



INTERNATIONAL JOURNAL OF RESEARCH SCIENCE & MANAGEMENT  
ESTIMATING INFORMAL TRADE STATISTICS USING RATIO ESTIMATION  
METHOD: A CASE STUDY OF KENYA

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**Keywords:** Informal Cross Border Trade (ICBT), Macroeconomic statistics, External trade statistics, Ratio estimation, Up-rating, Auxiliary information

### Abstract

Informal Cross Border Trade (ICBT), macroeconomic statistics in nature, forms bulk of the unrecorded economy. Unrecorded ICBT statistics leads to incomplete macroeconomic statistics despite the international best practices recommendations that compilation of macroeconomic statistics should be comprehensive and complete. ICBT has a positive social impact such as job creation and poverty alleviation especially to the rural population and has the potential to support Africa's on-going efforts of poverty eradication, if properly harnessed. This study aimed at determining the magnitude of unrecorded trade between Kenya and her neighbours, in a bid to derive an estimator which will be able to estimate informal trade statistics. These estimates will be used to adjust the formal external trade statistics resulting to a comprehensive, reliable, consistent and complete external trade statistics. A series of cross border surveys conducted by Kenya National Bureau of Statistics on selected border station for the years 2011 to 2016 informed our data source. Preliminary results showed that most of Kenya's informal exports were destined to Tanzania and Ethiopia through Isebania, Mandera and Moyale border stations. These commodities were mainly industrial in nature such as cooking fats and oils, wheat flour, cement and paraffin. Informal imports on the other hand were sourced from Uganda and Tanzania through Busia, Isebania and Malaba. These were mainly agricultural such as dry maize, bananas, beans, fish and fruits. All these were mainly transported by bicycles, push/hand carts and motor cycles. The ratio estimator of formal and informal trade between the Kenya and her neighbours was computed. Since a positive correlation exists between the two trade types and given the reliability and consistency of the formal trade, the value of informal export or import can be estimated as a function of the estimator and the respective formal trade at any given period. This estimation method will have minimized the seasonality effects and the inclusion of these estimates will narrow the completeness and comprehensiveness gap of the country's economy.

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### Introduction

#### Background of the study

Comprehensive coverage of a country's economy, often hindered by gaps in the recording of economic activity of the so called unrecorded economy, is one of the significant requirements in compilation of macroeconomic statistics according to the international best practices. Informal Cross Border Trade (ICBT), which is macroeconomic in nature, forms bulk of the unrecorded economy. The evolution of formal cross-border trade is a reflection of trade and economic integration policies, whereas informal cross-border trade reflects longstanding relationships between neighbouring countries and communities at the border points. The dynamics in trade patterns often explain economic situations and trade facilitation among trading partners during a particular period.

#### Review of previous studies on the subject of study

According to Nyatanga et al., (2000), ICBT provides an opportunity for the unemployed to earn a living which is considerably higher than the lowest income earned by an individual working in the formal sector. The study also found out that by engaging in informal cross border activities, unemployed persons get their livelihood by providing services such as transportation and other related services at across the border stations. Many families, especially single parent families also depend on these ICBT activities to meet their parental obligation such as school fees and other such related expenses thus empowering these single women who would otherwise engage in immoral activities such as prostitution. On his study on "The Impact of Informal Cross Border Trade on Regional Integration in SADC and Implication for Wealth Creation" in 1998, Mwaniki observed that many people were engaging in informal trading in order to earn a living. This makes traders to travel frequently across the borders in search of market for their products and eventually return back home with consumable goods and others for sale; and money to meet the family needs. These activities have enabled the traders to raise income which have turned around their households from poverty, considering their incomes are over and above the poverty line. Kachere (2011) sought to study the Southern Africa Development Community, for the case of Zimbabwe. He found out that just as the formal sectors within the economy, informal trade which forms part of



the informal sector, strengthens regional integration and relationships. Despite the economic benefits reaped from ICBT such as poverty eradication, Nyatanga et al., (2000) also observed that ICBT contributes to increased cases of prostitution, divorce and single parent families. In their study, Mupedziswa and Gumbo (2001) found that informal cross border activities strengthened family relations as traders' extended financial assistance to their relatives and spouses. Study by Nyatanga et al., (2000) acknowledged the role of ICBT especially to the rural Africa population in providing employment, supplementing other incomes and on improving food security. This is despite the worsening macro-economic environment in Zimbabwe, which just like other developing countries in Africa, face a huge unemployment rate. Gaidzanwa (1997) study on "Cross Border Trade in Southern Africa: "A Gendered perspective", the author argues about the hypothesis that ICBT cannot be secluded from the gender roles. Her study revealed that women traders are so creative in trading and the formal traders have a lot to learn from the operations of their female counterparts.

#### Statement of the problem

Trade information is useful for monitoring performance of the trade sector to inform formulation of sound trade policies necessary for economic development and regional economic integration. Lack of data on informal trade implies incomplete external trade statistics to inform these policies. Preliminary analysis of the data collected for the first four cycles of ICBT shows that there exists a lot of cross-border trade between Kenya and her neighbours which remains largely unrecorded. Therefore, the need for comprehensive, reliable, consistent and complete trade statistics cannot be overemphasized.

#### Significance of the Study

The study will generate reliable adjustment ratios on informal trade transactions which will be appropriate in improving the coverage and completeness of external trade statistics. The study will highlight the economic interdependence between the regional states, help review export performance of the country in terms of the product basket, growth of leading informal export products and the dynamics of international demand for these products.

### Objectives

#### Overall objective

Determine the magnitude of unrecorded trade between Kenya and her neighbours in a bid to derive an estimator which will be able to estimate yearly informal trade statistics.

#### Specific objectives

- Estimate the magnitude of unrecorded trade
- Determine the composition and direction of unrecorded trade
- Provide a comparative analysis of recorded and unrecorded trade
- Derive a ratio estimator which will be able to estimate yearly informal trade statistics given the formal trade statistics

#### Study limitations

Estimation depends on data collected for two weeks instead of four weeks in a month which affects the proper estimation of total trade as business activities may not be homogeneous for the entire month. Thus the estimates derived from this sample may be affected by sampling and non-sampling errors.

Not all trade activities were captured due to the open stretch and time at which the cross border transactions took place. Moreover, data may have coverage errors due to security and logistical challenges of some border points such as Liboi and Lamu. Consequently, the data might not be included despite its significant contribution in the estimation of the total trade.

### Methodology

#### Introduction

This chapter highlights an overview of the ratio estimation theory, the up-rating model and how the model will apply the ratio estimation to estimate the informal trade given the formal trade.

#### Ratio estimation theory

The ratio between two population values is a population parameter. If  $y_i$  is the value of the  $i^{th}$  unit in the sample and  $x_i$  is the auxiliary information for the  $i^{th}$  unit in the sample, then, the ratio between the two can be used to estimate the total value of the  $i^{th}$  unit in the population once the auxiliary information for the  $i^{th}$  unit in the population is known. Thus,

$$r_i = \frac{y_i}{x_i} (1)$$



$$\bar{r} = \frac{1}{n} \sum_{i=1}^n r_i = \frac{1}{n} \sum_{i=1}^n \frac{y_i}{x_i}$$

$$\hat{R}_n = \frac{\sum_{i=1}^n y_i}{\sum_{i=1}^n x_i}$$

$$Y = \hat{R}_n X(2)$$

$\hat{R}_n$  is the Ratio estimator of the population value and the product of  $\hat{R}_n$  and  $X$  provides an estimation of the population value  $Y$ . One of the significance of using the ratio estimation method is to increase the precision of the estimated population value, especially, if there exist a positive correlation between  $X$  and  $Y$ . Moreover, it corrects possible variances introduced through sampling (sampling errors) if  $X$  is known.

**Estimation of the total Informal Trade using ratio estimation method**

**Up-rating model**

Up-rating of the results will be necessary in order to generate yearly estimates from the two weeks of data collection.

The model will be based on the following assumptions:

- Informal trade data was collected for two weeks for each of the selected border on randomly selected months for each year.
- The supply and demand of trade commodities from either side of the border remain the same for that particular month of data collection.
- The informal trade assumes the trend of the formal trade throughout the year.

Under assumption (ii) above, if  $N$  is the number of all commodities traded informally in all border points and  $\omega_{ij}$  is the daily value of the  $i^{th}$  commodity traded during the  $j^{th}$  day of data collection period, then the total value of all products traded in the  $j^{th}$  day of the survey period can be expressed as:

$$\mu_j = \sum_{i=1}^N \omega_{ij}, \text{ for } j = 1, 2, \dots, 14(3)$$

The total value of informal trade  $\alpha_t$  up-rated for all the products in a particular month  $t$  of data collection can be expressed as;

$$\alpha_t = \delta \sum_{j=1}^{14} \mu_j(4)$$

$$\text{Where } \delta = \begin{cases} 2.21, & \text{if the month has 31 days} \\ 2.14, & \text{if the month has 30 days} \\ 2.07, & \text{if the month has 29 days} \\ 2.00, & \text{if the month has 28 days} \end{cases}$$

This will be the up-rating factor from the value recorded in the two weeks of data collection to the total estimate value of informal trade for that particular month.

To get the estimated value of informal trade  $\theta$  for the year under assumption (iii), the up-rated monthly informal trade data for each border station  $\alpha_t$  is summed up to the country level  $\alpha_T$ . Formal trade data for that particular month by particular border stations  $\pi_t$  is similarly summed up to the country level  $\pi_T$  and the two values are compared to generate a ratio as follows:

$$r_t = \frac{\sum_t \alpha_t}{\sum_t \pi_t} = \frac{\alpha_T}{\pi_T} = r_T(5)$$

$$\text{Where } E(r_T) = \hat{R}_T$$

The computed ratio  $r_T$ , which is an unbiased estimator of  $\hat{R}_T$  is an estimate ratio which estimates the total informal trade data  $\hat{\theta}$  by partner country for the respective year given total formal trade data  $\varphi$ .



$$\hat{\theta} = \hat{R}_T \varphi(6)$$

The estimated value of informal trade will be used to adjust the formal external trade statistics resulting to comprehensive, reliable, consistent and complete external trade statistics.

## Results and discussion

### Introduction

This chapter highlights the source of data used in the study, sample size used and the results, and discussions of the study.

### Data source

The study used secondary data derived from a series of Informal Cross Border Trade surveys conducted by Kenya National Bureau of Statistics on selected border stations between Kenya and her neighbours for the years 2011 to 2016. However, the study was not conducted in 2013 and as a result an estimate was imputed.

### Study design

Data from 12 sampled border stations was used; 3 along Kenya-Uganda border, 6 along Kenya-Tanzania border, 1 along Kenya-South Sudan border, 1 along Kenya-Ethiopia border and 1 along Kenya-Ethiopia and Somalia.

### Preliminary analysis

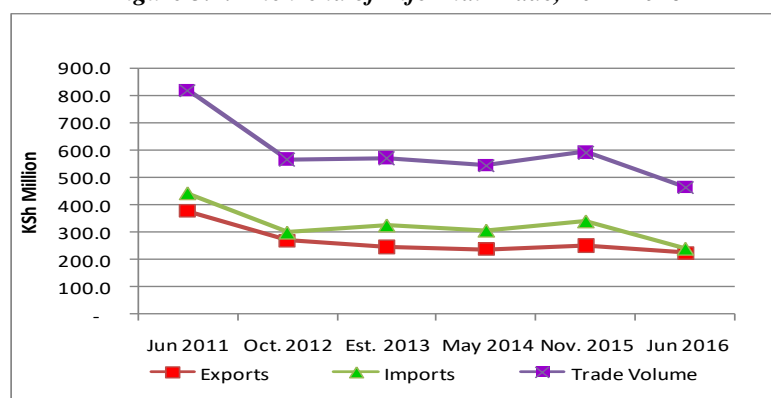
#### Magnitude informal trade

Table 3.1: Summary of Informal Trade, 2011-2016

KSh Million	Jun 2011	Oct. 2012	Est. 2013	May 2014	Nov. 2015	Jun 2016
Exports	375.67	268.52	246.94	238.13	252.70	225.79
Imports	442.41	298.04	324.44	305.34	339.29	238.96
Trade Volume	818.08	566.56	571.38	543.47	591.99	464.75
Trade Balance	(66.75)	(29.53)	(77.50)	(67.21)	(86.60)	(13.17)
Cover Ratio	84.91	90.09	76.11	77.99	74.48	94.49

The trend of informal trade has been on the decline, with the highest volume of informal trade recorded during the periods 2011 to 2016 being in June 2011, with informal imports accounting for 54.1 per cent of total informal trade. During the review period, Kenya recorded an informal trade balance deficit, with the highest deficit of KSh 86.6 million being recorded in November 2015 following the high demand of agricultural informal imports.

Figure 3.1: The trend of Informal Trade, 2011-2016



#### Direction of Informal Trade



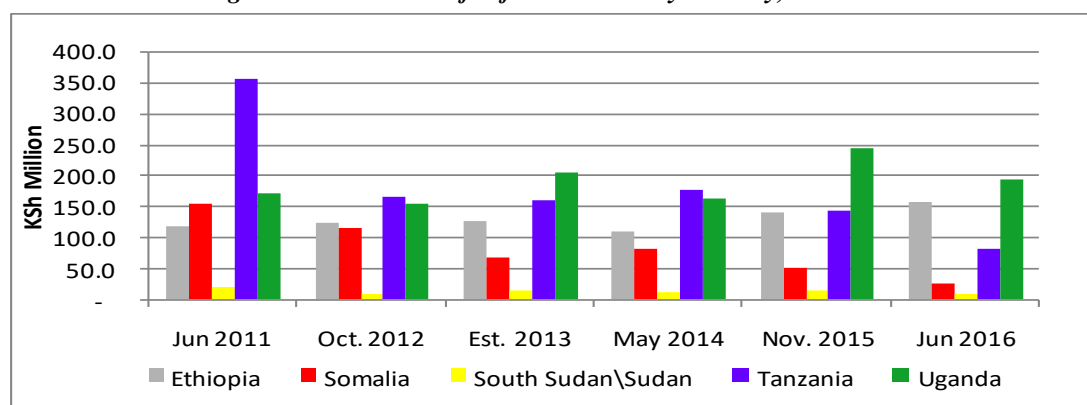
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**Table 3.2: Informal Trade Flow by Country, 2011-2016**

	KSh Million											
	Jun 2011		Oct. 2012		Est. 2013		May 2014		Nov. 2015		Jun 2016	
	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports
Ethiopia	65.14	52.64	73.17	51.25	78.18	47.58	84.11	25.58	71.56	68.34	105.79	51.04
Somalia	43.36	111.26	25.22	88.59	5.57	61.53	5.78	76.57	5.31	46.29	25.20	0.12
South Sudan	18.42	0.04	7.39	0.09	12.67	0.66	11.43	0.26	13.72	1.03	7.09	0.15
Tanzania	175.97	180.40	109.22	57.14	75.67	84.30	75.06	101.86	75.41	66.36	51.99	30.24
Uganda	72.76	98.08	53.52	100.98	74.85	130.37	61.75	101.06	86.69	157.27	35.72	157.40
<b>Total</b>	<b>375.67</b>	<b>442.41</b>	<b>268.52</b>	<b>298.04</b>	<b>246.94</b>	<b>324.44</b>	<b>238.13</b>	<b>305.34</b>	<b>252.70</b>	<b>339.29</b>	<b>225.79</b>	<b>238.96</b>

There seems to exist a shift of destination of the country’s informal exports from Tanzania in June 2011 and October 2012 to Uganda in November 2015 and to Ethiopia in June 2016, respectively. For instance, Ethiopia was the single largest destination of informal exports valued at KSh 105.8 million, representing 46.9 per cent of total informal exports. In June 2011, Tanzania and Somalia were the major sources of informal imports, with the value of informal imports from Tanzania standing at KSh 180.4 million, whereas, the value of the informal imports from Somalia was KSh 111.3 million. Similarly, in November 2015 and June 2016 the highest value of imports was from Uganda at KSh 157.3 million and KSh 157.4 million, respectively.

**Figure 3.2: The trend of Informal Trade by Country, 2011-2016**



### Composition of informal trade

Industrial products constituted the bulk of total informal exports for the periods 2011 to 2016, with the highest value of industrial commodities exported through informal trade being recorded in June 2016, with a share of 74.2 per cent of total informal exports as shown in Table 3.3 and Figure 3.3. Agricultural products dominated informal imports accounting for 84.8 per cent of total informal imports recorded in June 2016. Most of the industrial products exported included fertilizer, wheat flour and cooking oil, while the agricultural informal imports were mainly maize, beans, fish, ground nuts and oranges. Other commodities included charcoal, firewood and water.

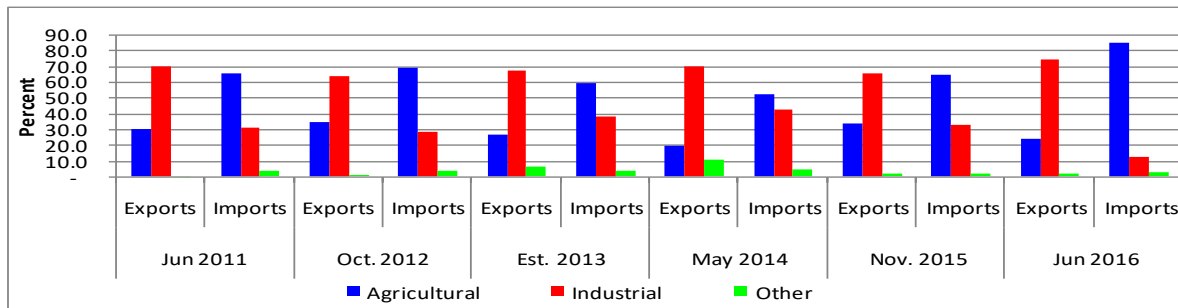
**Table 3.3: Percentage of Informal Trade Flow by Product, 2011-2016**

Commodity	Jun 2011		Oct. 2012		Est. 2013		May 2014		Nov. 2015		Jun 2016	
	Export	Import	Export	Import	Export	Import	Export	Import	Export	Import	Export	Imports
Agricultural	30.0	64.9	34.8	68.6	26.5	58.8	19.3	52.1	33.1	64.7	24.0	84.8
Industrial	69.6	30.8	63.7	27.8	67.3	37.5	69.9	42.7	65.0	33.0	74.2	12.1
Other	0.4	4.3	1.6	3.5	6.1	3.6	10.8	5.2	1.9	2.3	1.7	3.1
<b>Total</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>



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Figure 3.3: The trend of Informal Trade Flow by Products, 2011-2016



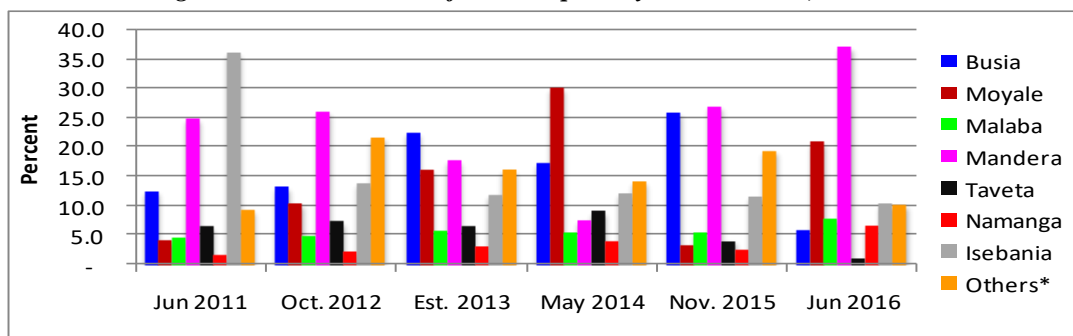
### Composition, direction and magnitude of informal trade

Generally, Ethiopia and Tanzania were the leading destinations of Kenya's industrial products, collectively accounting for 76.9 per cent of the country's total value of industrial products, during the month of June 2016. Uganda was the main source of agricultural products during the review period, with the value of informal agricultural imports from Uganda amounting to KSh 143.7 million, representing 70.9 per cent of total informal agricultural imports.

### Composition, direction and magnitude of informal trade by border station

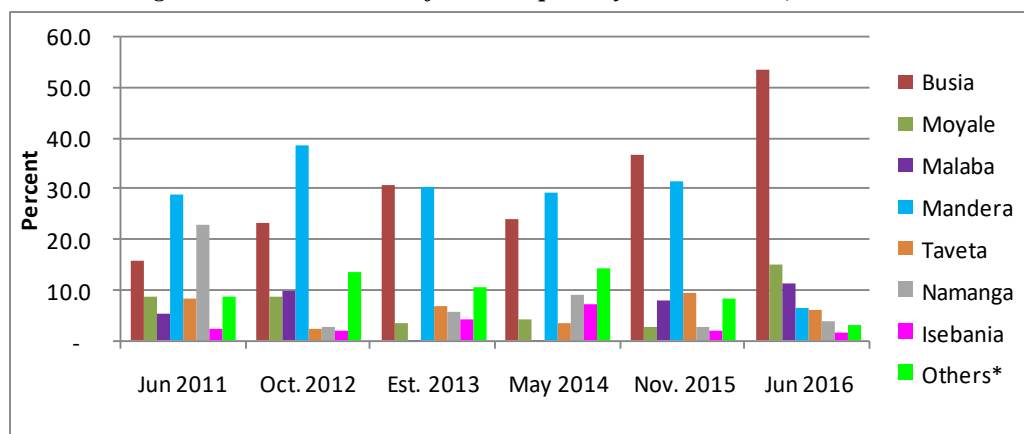
The highest transactions of informal trade were recorded in Busia, Mandera, Moyale and Isebania, jointly accounting for more than 69 per cent of the total informal trade volume in June 2016. Most of informal exports were through Mandera and Isebania accounting for 23.5 per cent and 17.7 per cent of the total informal exports on average during the entire period under study.

Figure 3.4: The trend in Informal Exports by border station, 2011-2016



On the other hand, during the review period, value of informal imports through Mandera and Busia jointly accounted for 57.0 per cent of the total informal import bill on average. The main informal exports through Mandera border were khat (miraa), tea leaves and spices, while wheat flour and sugar were the leading informal imports. Busia border was a major point of entry of fish, beans and oranges.

Figure 3.5: The trend in Informal Imports by border station, 2011-2016



### Magnitude of informal trade by mode of transport





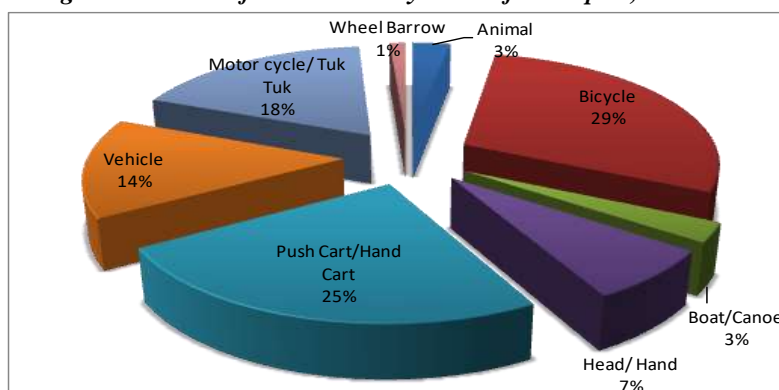
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Bicycles, push/hand cart and motorcycles were the most preferred mode of transportation for the informal trade. In June 2016, 53.7 per cent of the total volume of informal trade was transported using bicycles and push/hand carts, as presented in Table 3.4 and Figure 3.6.

**Table 3.4: The Magnitude of Informal Trade by Mode of Transport, 2011-2016**

KSh Million		Jun 2011	Oct. 2012	Est. 2013	May 2014	Nov. 2015	Jun 2016
<b>Mode of Transport</b>							
Animal		55.89	0.78	36.24	65.89	1.84	13.18
Bicycle		218.52	223.57	184.79	142.10	229.97	135.68
Boat/Canoe		53.04	..	57.50	51.16	63.38	13.04
Head/ Hand		161.56	27.49	27.82	29.28	25.72	33.82
Push Cart/Hand Cart		169.75	77.73	111.03	120.53	97.63	113.73
Vehicle		56.93	105.76	58.18	48.99	67.54	66.85
Motor cycle/ TukTuk		78.38	130.13	93.39	81.65	105.17	82.94
Wheel Barrow		24.02	1.11	2.43	3.87	0.75	5.51
<b>Total</b>		<b>818.08</b>	<b>566.56</b>	<b>571.38</b>	<b>543.47</b>	<b>591.99</b>	<b>464.75</b>

**Figure 3.6: The Informal Trade by mode of Transport, June 2016**



### Comparative analysis of recorded and unrecorded trade

Both formal and informal exports between Kenya and her neighbours showed declining trend during the period under study, as shown in Table 3.5. Formal imports showed mixed performances while informal imports showed an upward trend after a decline in October 2012.

**Table 3.5: A comparison Table of the Formal and Informal Trade, 2011 – 2016**

KSh Million		Jun 2011		Oct. 2012		May 2014		Nov. 2015		Jun 2016	
Trade Type		Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports	Imports	Exports
<b>Formal Trade</b>		3,920.81	14,012.94	2,695.95	13,410.02	2,576.48	12,250.76	3,741.59	11,029.73	2,996.48	10,795.70
<b>Informal Trade</b>		442.41	375.67	298.04	268.52	305.34	238.13	339.29	252.70	238.96	225.79
<b>Total Trade</b>		4,363.22	14,388.61	2,993.99	13,678.54	2,881.82	12,488.89	4,080.89	11,282.43	3,235.44	11,021.49
<b>Informal to Formal (%)</b>		11.28	2.68	11.06	2.00	11.85	1.94	9.07	2.29	7.97	2.09

Uganda was the main source of both Kenya’s formal and informal imports in November 2015 and June 2016. Informal imports from Uganda accounted for 65.9 per cent of the total informal imports in June 2016, while the share of formal imports from Uganda to total formal imports was 56.6 per cent during the same period. Ethiopia and Uganda were the largest markets of Kenya’s formal exports accounting for 46.9 per cent and 43.2 per cent of the country’s formal exports, respectively, in June 2016. Similarly, Uganda was the main destination of



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Kenya's informal exports accounting for 43.1 per cent of the country's informal exports in November 2015, as presented in Table 3.6.

**Table 3.6: Share of Formal and Informal Trade by Country, 2011-2016**

		Imports				Exports					
		Jun 2011	Oct. 2012	May 2014	Nov. 2015	Jun 2016	Jun 2011	Oct. 2012	May 2014	Nov. 2015	Jun 2016
Ethiopia	Formal	1.2	1.2	1.3	1.1	0.9	3.8	2.1	6.1	4.9	6.5
	Informal	11.9	17.2	8.4	20.1	21.4	17.3	27.2	35.3	28.3	46.9
Somalia	Formal	0.0	0.0	0.2	0.1	0.0	9.0	13.1	8.4	11.2	12.0
	Informal	25.1	29.7	25.1	13.6	0.1	11.5	9.4	2.4	2.1	11.2
South Sudan	Formal	0.0	0.0	0.0	0.0	0.0	15.7	11.4	10.9	9.9	12.7
	Informal	0.0	0.0	0.1	0.3	0.1	4.9	2.8	4.8	5.4	3.1
Tanzania	Formal	68.0	44.2	70.8	23.3	42.4	23.1	32.4	34.9	30.9	25.6
	Informal	40.8	19.2	33.4	19.6	12.7	46.8	40.7	31.5	29.8	23.0
Uganda	Formal	30.9	54.6	27.6	75.5	56.6	48.3	41.0	39.7	43.1	43.2
	Informal	22.2	33.9	33.1	46.4	65.9	19.4	19.9	25.9	34.3	15.8

The study showed that, the bulk of formal export was through Malaba accounting for more than 20 per cent of the total formal exports on average during the review period, while informal export was mainly through Mandera accounting for 27.0 per cent and 37.0 per cent of the total informal exports in November 2015 and June 2016, respectively. Busia and Namanga were the key entry stations of the country's formal imports jointly accounting for 50.5 per cent and 71.3 per cent of the total formal imports in November 2015 and June 2016, respectively. However, during the review period there was a shift in border station through which high volumes of informal imports entered the country. Mandera was leading in the first three study periods by 32.1 per cent on average and Busia leading in the last two research periods by 36.5 per cent and 53.1 per cent in November 2015 and June 2016, respectively.

Notably, informal trade through Mandera was more significant as compared to the formal trade mainly due to the movement of livestock across the border.

#### Informal trade statistics ratio estimator

The ratio between the formal and informal trade of Kenya and her neighbours was computed. During the period 2011 to 2016, formal exports were significantly higher as compared to the informal exports with the latter accounting for 2 per cent of the formal exports on average for the five countries.

**Table 3.7: Ratio Estimator of Informal to Formal Exports, 2011-2016**

	Jun 2011	Oct. 2012	May 2014	Nov 2015	Jun 2016
<b>Ethiopia</b>	12.3	25.8	11.2	13.3	15.0
<b>Somalia</b>	3.4	1.4	0.6	0.4	1.9
<b>South Sudan</b>	0.8	0.5	0.9	1.3	0.5
<b>Tanzania</b>	5.43	2.51	1.75	2.21	1.88
<b>Uganda</b>	1.07	0.97	1.27	1.83	0.77
<b>Total</b>	<b>2.68</b>	<b>2.00</b>	<b>1.94</b>	<b>2.29</b>	<b>2.09</b>

During the review period, both formal and informal trade exhibited mixed performance with either type of trade being higher than the other simultaneously for Ethiopia, Somalia and South Sudan. On average, informal imports could only account for 10.2 per cent of the formal imports taking into account the five neighbour countries.

**Table 3.8: Ratio of Informal to Formal Imports, 2011-2016**

	Jun 2011	Oct. 2012	May 2014	Nov 2015	Jun 2016
<b>Ethiopia</b>	116.1	164.6	77.3	167.6	190.2
<b>South Sudan</b>	34.1	38.5	21.7	..	34.0
<b>Tanzania</b>	6.77	4.79	5.58	7.62	2.38
<b>Uganda</b>	8.10	6.86	14.21	5.56	9.28
<b>Total</b>	<b>11.28</b>	<b>11.06</b>	<b>11.85</b>	<b>9.07</b>	<b>7.97</b>

Assuming the same trend as the formal trade which is more reliable and consistent throughout the year, at any point in time the value of informal export or import can be estimated as a function of the estimator and the





respective formal trade at a given period. This will have minimized the seasonality effects and the inclusion of these estimates will narrow the complete and comprehensive gap of the country's economy.

### Conclusion

From the analysis results, it is evident that informal cross border trade between Kenya and her neighbours is significant. However, seasonality effect due to rainfall patterns affects the constant flow in agricultural products. Ratio estimation of informal trade will minimize the seasonality effects and the inclusion of the informal trade estimates will narrow the completeness and comprehensiveness gap of the external trade statistics, Balance of Payment statistics and the country's economy. This will go a long way in policy formulation regarding regional economic integration and settling trade disputes among others.

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