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Determinants of smallholders wheat commercialization: The case of Gololcha district of Bale zone, Ethiopia

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Abstract

Even though, agriculture plays a crucial role in Ethiopian economy, it suffers from low productivity and high man to land ratio. Food security and improved welfare of society was a main target of Ethiopian government. The Ethiopian government used commercialization of agriculture as a means of achieving food security and welfare of rural poor of countries. This study was aimed at analyzing determinants of smallholder wheat commercialization in Gololcha district of Bale zone. The objectives of the study aimed to identify the level of commercialization and analyze major determinants of the volume of wheat marketed/ commercialized/ in the study area. The data were collected both from primary and secondary sources. The primary data sources for this study were collected from 146 producers and 40 traders. The descriptive was based on the level of commercialization of sample respondents and it showed that in 2016, 13.7% were subsistence, 56.2% were semi-commercial and 30.1% were commercial farmers during the survey period. The result of the multiple linear regressions indicates that among 14 variables, five variables had shown significant relationship with volume of wheat sold/commercialized/ in the study area. Accordingly, cash expenditure for farming, access to credit and total wheat produced were found to influence the volume of wheat sold/commercialized/ positively and significantly and education status and oxen owned had shown negative and significant relationship with volume of wheat sold/commercialized/. Therefore, emphasis has to be given on identifying new technology, advice on the use of modern agricultural inputs, a need for strengthening the existing credit institution and increasing their number, and there is a need for improvement of market and marketing system.

***Keywords**: Commercialization, Wheat, Smallholders, Multiple linear regressions*

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1. INTRODUCTION

Afework and Endrias, (2016) noted that "meeting the challenge of improving rural incomes in Africa required some form of transformation out of the semi-subsistence, low income and low productivity farming systems that currently characterize much of rural Africa".

In the past decade, the government of Ethiopia had set plans and strategies to build on the agricultural led-industrialization policy framework through commercialization of agriculture and development of the private sector, both within and outside agriculture. However, the current reality shows that commercialization of smallholder farming is not yet high enough to enable farmers benefit from increased income and the farmers are not yet out of the subsistence-oriented agriculture Berhanu and Moti (2010).

In Ethiopia agricultural sector is largely characterized by small-scale subsistence farming and low productivity Thijssen et al. (2008). Thus, the poverty-reduction strategy adopted by Ethiopia seeks to achieve growth through further commercialization of smallholder agriculture. To deal with this, the ongoing Growth and Transformation Plan (GTP) of Ethiopia is also intending to increase production of major crops through increasing crop productivity by applying good agricultural practices MoFED (2010).

Commercialization of agriculture is also a core research theme of the Future Agricultures Consortium. Future Agricultures thematic work on agricultural commercialization has observed that, in various countries, different modes of commercialization co-exist and interact with each other Leavy and Poulton (2007). Consistent to this definition Samuel and Sharp (2007) put forth four categories that represent four potentially complementary "pathways" for commercialization policy in Ethiopia. These pathways categorize farmers under subsistent oriented smallholder farms, market oriented smallholder farms, Small investor-farmers and Large-scale agri-business. Majority of Ethiopian farmers (approximately 11.5 million) are categorized under the first two categories which assemble smallholder household farms ownership.

The driving forces generally behind commercialization include population growth and demographic change; urbanization; development of infrastructure and market institutions; development of the nonfarm sector and broader economy; rising labor costs; and macroeconomic, trade, and sectoral policies affecting these forces (Berhanu and Moti, 2010).

Commercialization is also affected by many factor markets; laws and institutions; and cultural and social factors affecting consumption preferences, production, and market opportunities and constraints. These factors influence commercialization by affecting the conditions of commodity supply and demand, output and input price, and transaction costs and risks faced by farmers, traders, and others in the agricultural production and marketing system Pender and Dawit (2007).

Wheat was selected because it was primarily grown and marketed by majority of the smallholder farmers in the study area and it is both food and cash crop. Moreover, wheat is also one of the most commonly consumed crops across Ethiopia with significant part of the annual consumption being supplied through imports. What is more, supply of wheat in the study area is yet subjected to seasonal variation where

surplus supply at harvest is the main feature and it cannot still satisfy the demand of the nearby markets.

As mentioned above, wheat is one of the main food and cash crops of the study area. Following this, to know the strong potentials and favorable impacts of wheat commercialization on productivity, poverty reduction and food and nutrition security; factors affecting commercialization of wheat produced are indispensable. However, these have not been systematically studied and documented. Hence, the present study is initiated to fill the knowledge gap in the understanding of the determinants of commercialization of produce sold and marketing behavior of wheat market which is required in designing appropriate technological, policy, organizational and institutional strategies to ensure smallholders and the rural poor benefit from the process of commercialization.

The general objective of the present study is to analyze the determinants of commercialization of wheat among smallholder farmers in the Gololcha District of Bale zone. Particularly, the specific objectives of the study are the following:

1) To identify the level of commercialization of wheat in the study area.

2) To identify problems or challenges of wheat marketing in the study area.

3) To identify and analyze major determinant of volume of wheat marketed/commercialized/ in the study area.

2. LITERATURE REVIEW

2.1. Measuring agricultural commercialization

According to Govereh et al. (1999) "Commercialization can be measured along a continuum from zero (total subsistence-oriented production) to unity (100% production is sold)." Strasberg et al. (1999) suggested a measurement index called household Crop Commercialization Index (CCI) which is computed as the ratio of gross value of all crop sales over gross value of all crop production multiplied by hundred. The advantage of using this approach is that it "avoids the use of crude distinctions as commercialized and non-commercialized farms".

However, this index is not without its limitations. For instance, consider the case when a farmer growing one quintal of wheat sells that all and another farmer producing ten quintals of wheat sells only two quintals. The CCI was told us that the first farmer is fully commercialized (100%) while the second is subsistence (20%). This interpretation does not make sense in such circumstances. Even though this limitation of using CCI is worth noting, there is still some room to use it in practice especially in the context of developing countries where it is less likely to get smallholders selling all of their output and very large farms selling none of their output Govereh et al. (1999).

2.2. Factors affecting Commercialization of Smallholder Farming

Leavy and Poulton (2007) have identified three critical conditions that need to be in place if agricultural commercialization is to be a success for the smallholder. These are market access, access to staple foods and asset accumulation.

The success and failure of smallholder commercialization is influenced by many enabling and constraining factors which can be physical, political, economic, socio-cultural, technological and individual Louw et al. (2008). Moreover, lack of supportive institutions; poor access to productive resources, markets, market information, public services, technology and skills; high transaction costs; poor agro-ecological conditions, prevalence of diseases; limited commercial mindsets and negative beliefs are other major constraints to smallholder commercialization Rukuni et al. (2006); Hazell et al. (2007); Louw et al. (2008); Poulton et al. (2008); Kirsten et al. (2012).

Similarly, in Ethiopia, Pender and Dawit (2007) developed a long list of factors that affect commercialization at local level based on the findings of different researchers. To them, commercialization is affected by agro-climatic conditions and risks; access to market and infrastructure; community and household resources and endowments; development of local commodity, input and factor markets; laws and institutions; and cultural and social factors affecting consumption preference, production, and market opportunities and constraints. From a different perspective but in the same vein, Mahelet, (2007) assessed the literature and found several factors that can either facilitate or constrain the commercialization of smallholder farming in the context of developing countries in general and Ethiopia in particular. Accordingly, these factors include, among others, distance to the market, transport access and road access; availability of credit, extension services and market information; output, input and factor prices; land size, access to modern inputs and storage facilities; and integration into the output market.

2.3. Review of Empirical Evidences

There are a number of empirical studies on factors affecting the marketable supply of agricultural commodities. For instance, Kinde (2007) identified factors affecting the marketable surplus of sesame by using OLS regressions. He found that sesame marketable supply was affected by; time of sale, use of improved production inputs, membership in local organization, extension contact and distance to market. Abay (2007) analyze the determinants of vegetables market supply by applying OLS regressions. Accordingly, the study found out that marketable supply of vegetables were significantly affected by family size, distance from main road, number of oxen owned, extension service and lagged price.

IFPRI (2015) Analysis of determinants of marketed surplus of wheat identify that the age of the household head has a negative coefficient while age squared has a positive coefficient, implying a U-shaped relationship between marketed share and age. Farm size is also positively and significantly related to the marketed surplus ratio for wheat though the effect is rather small: each additional hectare is associated with a two %age-point increase in marketed share. Ownership of livestock and farm implements both contribute to a higher share of marketed wheat. This may be because the assets contribute to a higher yield or because these households are less vulnerable to market-related risks. Households that are located far from a cooperative or an all-weather road tend to sell a smaller share of their wheat output, presumably because of the higher costs of obtaining inputs and transporting crops to market.

Moreover, Solomon and Ludi (2010) showed that likelihood to generate cash income improves consistently as the size of farm increases. Large farmers in general and especially those who cultivate above 5 ha of land generate substantially large cash income. Keeping the effect of other factors constant,

the result implies the positive effect of operation at higher level in coping with the risk of higher variance of returns in cash crop production.

Abafita et al. (2016) survey conducted on "smallholder commercialization in Ethiopia", fertilizer use and ownership of traction power (oxen) found to significantly and positively influence amount of crops sold. On the other hand available land size had significant positive effect on values of crops sold and among institutional services and infrastructure, access to credit and access to all whether road significantly enhanced volume of crops sold.

Asfaw et al. (2010) results also showed that, the effect of value of crop production and livestock endowment in determining the market position of households are apparently reflected in the estimation results. On the average, an additional crop production with a value of ETB10,000 increases the likelihood of being a net seller in crop market by 11%.Households with larger livestock endowments are less likely to be net buyers in crop market. The availability of larger family labor for agriculture affects the likelihood of being a net seller (buyer) in crop markets positively (negatively). This might be due to the inefficiency of labor market where households with more family labor could produce more outputs Berhanu and Moti. (2012).

Berhanu and Dirk (2008) in their study of the determinants of market participation using household level regression model found that population density is positively associated with proportion of Teff, chickpea and Niger seed produce sold indicates that given the decision to grow Teff, chickpea and Niger seed, households in high population density areas offer higher amount of their produce to market. Thus, it implies that both urban and rural population growth has positive impact for food and cash crops.

Alene et al. (2008) also noted that non-farm income contributes to more marketed output if the non-farm income is invested in farm technology and other farm improvements. Otherwise, marketed farm output drops if non-farm income triggers off-farm diversification. To meet both household consumption requirements and market demand, a household intuitively needs to generate surplus output. Key et al. (2000) and Makhura et al. (2001) found that distance to the market negatively influences both the decision to participate in markets and the proportion of output sold. Thus, the variable transport costs per unit of distance increases with the potential marketable load size.

Moreover, Mebrahatom et al. (2014) OLS econometric model was used to identify and analyze factors that determine the extent of smallholder participation in output market. Accordingly, ownership of equine, cash expenses for farming, specialization in Teff (land allocated to Teff), ownership of oxen were those explaining the variation of Teff output sale positively as evidenced by the OLS model while distance from homestead to the nearest market place and distance from homestead to all weather road found to affect negatively. Similarly, road and market infrastructure as well as ownership of oxen and equine are the other critical issues that need intervention emphasis to increase the level of commercialization of Teff production.

According to Asfaw et al. (2010) on their research entitled "Does technology adoption promote commercialization" conducted at Debrezeit, by using double-Hurdle model they found that farmers who knew more number of varieties during preceding year probably have better information about the advantages of the varieties and hence increase cash expenditure for new varieties and are likely to adopt

and allocate more land for the commodity during the year.

Furthermore, Shiferaw et al. (2008) found the same result on their studies for pigeon pea varieties, for cowpea varieties and for maize varieties respectively that to farmers technology awareness have a positive effect on adoption of these high yielding varieties. Moreover, the authors found that the level of adoption of improved chickpea varieties were strongly related to a range of household wealth indicator variables. Thus, adoption of high yielding varieties was lead to high allocation of land for that commodity and increase of cash expenditure for farming and hence marketing surplus. Here, knowledge of improved varieties increases the cash expenditure for production of a given crops and lies as an advantage to increase production, productivity and volume of crops sold.

3. Research Methodology

3.1. Description of the Study Area

Bale zone is one of the zones in Oromia National Regional State which is surrounded by one National regional state and five neighboring zones. It is bounded with Somali National Regional State in the East, East Hararghe zone in the North East, West Hararghe zone and Arsi zone in the North, West Arsi zone in the West and Guji zone in the South.

The study was conducted in Gololcha District. Available information suggested that the name of the District might have derived from Gololcha River. The District town is called Jara. The name Jara implies "century" in Afan Oromo. From 1996-1998 Gololcha and Gasera District were merged together and form Gololcha Gasera District by assigning Jara as a capital of the District. But from 1998 onward, the two Districts split each other and form their own administrative District. Gololcha District has endowed by numerous historical places and tourist attraction like Dire Sheik Hussein, Dire Dadala, Sofoumer hammara, Arab lij and Qachama sare GDOA, (2016).

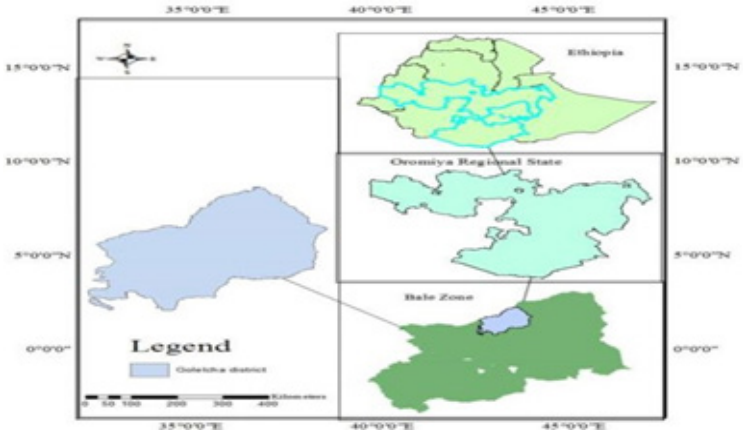

Figure 2. Map of the District Source: - GDOA, (2016)

Astronomically, Gololcha District lies between 7oN-71/2o N latitude and 4o E-4 1/2o E longitude. It is located in the Northern extreme parts of the Bale zone. It is bounded by Gasera District in the East, Legahidha and Sawena Districts in the West, Ginir District in the North and Arsi zone in the South. Gololcha District is one of the administrative territories of Bale zone with an area of 2,392 km2 (239,200ha)

which is ranked 10th among the Districts in the zone. The area of the District leads the District to have a share of 3.16 % from the total area of the zone (69,661km2). It is located at a distance of 122 km from zonal capital called Robe and 550km from capital city of the country GDOA, (2016). The location map of the District is presented below.

The total District population is 114,274.Out of which 58,345(51.06%) are male and 55,929 (48.94%) are female. Population is unevenly distributed in the District. Since the majority of the population is engaged in agricultural activity, the rural population has 93.99 % share out of the total population of the District. Thus, there are high concentrations of the population in rural areas of the District than urban areas. The average density of the population for Gololcha District (2013-2015) varies between 44-53.7 person/km2 BZFEDB (2016).

3.2. Data Sources and Methods of Data Collection

The study used both primary and secondary data. The secondary data on commercialization, trends in agricultural production, wheat marketing and other secondary data relevant for data analysis was collected from District and zonal planning offices, District office of Agriculture, and Disaster Prevention and Preparedness Office of the District.

Primary data was collected through a household survey. The household survey focused on collecting quantitative data on production and marketing of farm produce, as well as demographics, resource ownership, and non/off-farm activities using pre-tested questionnaire.

3.3. Sample Size and Sampling Procedures

Formally sample size was a function of the variability of population characteristics, the desired degree of precision and the degree or level of confidence desired in the estimate Mendoza, (1995). Moreover, the sample size depends on the number of wheat market participant, and traders on the basis of their size. For the primary data collection, a multi stage sampling technique was used to draw the sample.

In the first stage, in consultation with agriculture office of the District, three kebeles selected purposively based on their wheat production potentials. These kebeles are namely: Dire Gudo having wheat producers of 853, Dinsa having wheat producers of 782 households and Kenjila having wheat producers of 500 and total wheat producers of 2135 GDOA, (2016).

In the second stage, based on the population number of sample kebeles, representative wheat sellers/ producers/ were selected using probability proportional to size sampling technique from each sample kebeles. The maximum number of respondents was determined by using a formula developed by Yamane, (1967). See the table below

$$n = \frac{2135}{(1+2135\,0.08)^2}$$

$$= 145.6 \sim 146$$

Where: n= is the sample size (146); N is the population size (2135) and e is the level of precision (0.08).

Table 1. Number of sample respondents

Name of kebeles Administrations	Total number of Wheat producers	%	Sample size drawn	Sample traders	Total	sample size drawn
Dire Gudo	853	40	58	Wholesalers	45	15
Dinsa	782	37	54	District retailers	50	15
Kenjila	500	23	34	Rural assemblers	10	10
Total	2135	100	146		95	40

Source:-Survey result, 2017

For this study, data from traders was also collected. The sites for the trader surveys were market towns in which a good sample of wheat traders existed. The list of traders (wholesalers and retailers) were obtained from Gololcha District office of trade and industry and for other traders there is no recorded list (unlicensed traders). Both licensed (23 traders) and unlicensed (17 traders) were included in the traders survey. 15 wholesalers, 15 retailers and 10 rural assemblers were randomly selected constituting 40 traders from Dire Gudo, Dinsa and Kenjila markets.

3.4. Methods of Data Analysis

3.4.1. Descriptive statistics analysis

Descriptive statistics such as measures of averages, %ages and standard deviation was employed to assess the current level of commercialization of wheat production in the study area, and in the process of explain variation in the level of commercialization of wheat among households. The degree of commercialization of the sample households categorized in to three (subsistence, semi- commercial and commercial) based on the proportion of wheat they sold; defining as those who sold greater or equal to 60% of their production as most commercialized, and those who sold less than 30% as subsistence and between 30%-60% are semi-commercialized Degye (2015). To analyze the commercialization level of sample respondents, household commercialization index was determined for all respondents by using the following formula.

Household commerciliazation index (HCI) = (Amount of wheat sold)/(Amount of wheat produced)

3.4.2. Econometric analysis

3.4.2.1. Model for volume of wheat sold

In this study, multiple linear regression was used to analyze factors affecting the volume of wheat sold in the study area because dependent variable is continuous. This model is also selected for its simplicity and practical applicability Greene (2000). Econometric model specification of supply function in matrix notation is the following.

$$Y = XB + \varepsilon$$

Where: Y captures volume of wheat marketed; X denotes a vector of explanatory variables; B indicates

a vector of parameters to be estimated and ε is the vector of disturbance term.

Multicollinearity test

Multicollinearity is a situation whereby there exist strong linear relationships among independent variables is more than 75 % Gujarati (2004). If two variables are highly collinear, then this will result in inefficient estimates. In this study, before running multiple linear regression analysis,

multicollinearity was checked by using a variance inflation factor for continuous variable and contingency coefficient for dummy variable.

VIF is used to assess the degree of association among continuous explanatory variables. As a rule of thumb, if the VIF is greater than 10 the variable is said to be highly collinear. According to Gujarati, (2004), the Variance Inflation Factor (VIF) is calculated as follows:

$$VIF = \frac{1}{1 - R_j^2}$$

Where, VIF is variance inflation factor; R-squared is the multiple correlation coefficients between explanatory variables, the larger the value of the R^2 higher the value of VIF (Xi) causing higher collinearity between the variables. Contingency correlation (CC) is used to detect the degree of association among dummy explanatory variables (Healy, 1984). It measures the relationship between the raw and column variables of a cross tabulation. The value ranges between 0-1, with 0 indicating no association between the raw and column variables and value close to 1 indicating a high degree of association between variables. The decision criterion, if the contingency coefficient value is (CC >0.75) the dummy variables are said to be collinear and is computed as follow:

$$CC = \sqrt{\frac{\chi^2}{\chi^2 + N}}$$

Where χ^2 is chi-square and N is total sample size (146 in this case).

3.5. Hypotheses and Definition of variables

3.5.1. Dependent variable

To deal with smallholders' commercialization of wheat, which is the main issue explained in the present study, the volume of wheat produce sold was used as a dependent variable to measure commercialization level of wheat production.

Table 2. Summary of explanatory variables used in the multiple regression analysis

Explanatory variables	Type	Measurement	Expected effect
Sex of household head	Dummy	Male=1,Female=0	+ve
Age of household head	Continuous	Year	+ve
Education of household head	Continuous	Number of grades	+ve
Oxen owned	Continuous	TLU	+ve
Equine owned	Continuous	TLU	+ve
Access to credit	Dummy	1=yes 0=no	+ve
Distance to the market center	Continuous	Km	-ve
Off and non-farm income	Continuous	Birr	-ve
Wheat plot size	Continuous	Hectare	+ve
Available family labor	Continuous	Man Equivalent	+ve
Cash expenses for farming	Continuous	Birr	+ve
Frequency of extension contact	Continuous	Number of contacts	+ve
Access to market information	Dummy	1=yes	0=No
Quantity produced	Continuous	Quintals	+ve

3.5.2. Explanatory variables

The overall explanatory variables used in multiple linear regressions are summarized in table 2 below. These variables were selected based on the current practice in the literature on the standard determinants of smallholder agricultural crop commercialization. A total of 14 predictors are included of which eleven are continuous explanatory variables while the remaining three are categorical or qualitative predictors.

4. RESULTS AND DISCUSSIONS

4.1. Descriptive results

4.1.1. Demographic and socio economic characteristics of sample households

Table 3 and 4 present demographic and socio-economic characteristics of the sample respondents with their respective statistical tests. For instance, as shown in Table 3, the average age of the sample household heads was 39.04 years with minimum and maximum ages of 22 and 75 years, respectively. Similarly, of the total interviewed sample respondents 27.4% were members of farmer primary cooperatives while 72.6% were not members of farmer primary cooperatives (Table 4).

Table 3. T-tests for demographic and socio economic characteristics for continuous variables

Variable	Below Mean (Mean)	Above Mean (Mean)	overall	Std.dev	t-value	Sig.
Age (years)	37.01	42.21	39.04	9.85	-3.21	0.0016***
Family Size	6.76	6.70	6.74	1.912	0.19	0.849
Family labor	5.16	6.70	5.37	0.2353	-1.13	0.261
Oxen	2.61	2.59	2.60	0.9133	0.066	0.948
Equines	1.36	1.59	1.45	0.725	-1.904	0.059*
Total land	2.47	3.24	2.77	1.65	-2.79	0.006***
Cultivated land	2.31	3.11	2.62	1.59	-3.06	0.0026***
Land for wheat	1.46	2.19	1.80	0.84	-4.83	0.0000***
Fallow land	0.16	0.12	1.45	0.34	0.69	0.4928
Distance to market	1.94	1.77	1.87	1.21	0.85	0.398
Cash expenditure	19519.65	20807.28	20022.36	6698.171	-1.134	0.259
Off/Non-farm income	235.96	649.12	397.26	2445.21	-0.956	0.321
Educational status	2.44	2.84	2.60	2.08	-1.146	0.2537
Quantity produced	37.13	85.54	56.03	33.35	-12.12	0.0000***

*and *** showed that statistically significant at 10%, and 1% respectively. Source:-Survey result, 2017

Table 4. Chi² for demographic and socio economic characteristics for categorical variables

Variable	Below Average(n)	Above Average(n)	Overall (n)	%	Std dev	chi2-value	Sig.
Sex							
Male	62	50	112	76.7	0.035	6.3414	0.012**
Female	27	7	34	23.3	0.035		
Marital Status							
Married	82	49	131	89.7	0.025	1.515	0.469
Divorced	4	4	8	5.5	0.019		
Widowed	3	4	7	4.8	0.018		
Religion							
Muslim	84	54	138	94.5	0.018	0.008	0.927
Christian	5	3	8	5.5	0.018		
Nonfarm/income							
Yes	2	3	5	3.4	0.015	0.9556	0.328
No	87	54	141	96.6	0.015		
Cooperative Member							

Yes	22	18	40	27.4	0.8220	0.037	0.365
No	67	39	106	72.6	0.037		
Market Information							
Yes	46	22	68	46.6	0.041	2.3923	0.122
No	43	35	78	53.4	0.041		
Extension Contact							
Yes	61	42	103	70.5	0.038	0.4427	0.506
No	28	15	43	29.5	0.038		
Access to Credit							
Yes	21	22	43	29.5	0.038	3.7632	0.052*
No	68	35	103	70.5	0.038		
Mobile Ownership							
Yes	75	49	124	84.9	0.029	0.0780	0.780
No	14	8	22	15.1	0.029		

*, ** was statistically significant at 10% and 5% significance level Source:-Survey result, 2017

4.1.2 Level of commercialization

Table 5 reveals that the level of commercialization of sample respondents from 2013 to 2016.

Table 5. Level of Commercialization of Sample Households

Level of Commercialization	%	Std.dev
In 2013		
Non-Producers	8.9	0.236
Subsistence	6.2	0.019
Semi-Commercial	68.5	0.038
Commercial	16.4	0.308
In 2014		
Subsistence	7.53	0.022
Semi-Commercial	73.97	0.036
Commercial	18.5	0.322
In 2015		
Subsistence	22.6	0.038
Semi-Commercial	52.7	0.041
Commercial	24.7	0.036
In 2016		
Subsistence	13.7	0.028
Semi-Commercial	56.2	0.041
Commercial	30.1	0.381

Source: Survey result, 2017

According to survey result, in 2016, 13.7% of households were subsistent, 56.2% were semi commercial and 30.1% of the households were commercialized farmers. Most of the sample households were semi commercial i.e. they sold 30%-60% of their wheat produce.

Moreover, the level of commercialization of sample respondents increased over past four years. In 2013 only 16.4% were commercial farmers but, in 2014 and 2015; 18.5% and 24.7% were commercial farmers respectively. Therefore, to settle appropriate food security policy and poverty reduction strategy adopted by Ethiopian government seeks to achieve growth through commercialization of smallholder agriculture, the government should more focus on subsistent and semi-commercial households‟ and ways of increasing their commercialization level to join them on commercialized categories. Moreover, the study revealed that, the awareness of households about commercialization was increased over years.

4.1.3. Marketing Problem of Traders

Table 6 summarized the basic problems identified by sample traders. The major marketing problems sample traders face in the study area were capital shortage, credit access, poor quality of the commodity, infrastructure, lack of demand, price setting problem, government policy.

Table 6. Marketing problems of sample traders

Marketing problem	%
Capital shortage	40
Capital shortage, infrastructure	2.5
Credit access	15
Credit access, quality problem	2.5
Government policy	7.5
Infrastructure	12.5
Lack of demand	2.5
Price setting	7.5
Quality problem	10

Source: Survey result, 2017

4.2. Econometric Results

4.2.1. Determinants of households volume of wheat sold

The econometric analysis was intended to examine determinants of volume of wheat sold. There are a number of determinants that influence producers‟ wheat commercialization. Multiple linear regression analysis was performed to identify those factors that determine the volume of wheat sold of smallholder farm households. The level of total crops sold vary from household to household; some with as high as 140 quintals of crops sold and others with as low as 3 quintals of crops sold. Ahead of moving to the

multiple linear regressions, multicollinearity, heteroscedasticity and specification tests were conducted.

Table 10. Multiple linear regression results for determinants of volume of wheat marketed

Volume of wheat sold	Coef.	Std. Err.	t	P>t
Age HHs	.075	0.09	0.83	0.408
Sex HHs	-1.96	2.05	-0.96	0.341
Education status	-.727	0.38	-1.88	0.062*
Land for wheat	-1.64	1.01	-1.63	0.105
Cash expenditure	.0005	0.0002	2.99	0.003***
Family labor	.104	0.29	0.35	0.729
Market price information	1.35	1.59	0.85	0.399
Distance to market center	0.36	0.65	0.56	0.574
Access to credit	3.71	1.83	2.03	0.045**
Extension contact	.013	0.03	0.52	0.603
Oxen owned	-3.86	1.13	-3.40	0.001***
Equine owned	.053	1.17	0.04	0.964
Total off-farm income	.0002	0.0003	0.63	0.530
Total wheat production	.624	0.029	20.99	0.000***
_cons	4.47	5.22	-0.86	0.393
N				146
R-squared				0.8512
Adjusted R-squared				0.8353
Multicollinearity test (VIF),				1.34
Test for omitted variables,			F	0.1654
Heteroscedasticity test,			b>Chi2	0.2425

*, ** and *** at 10%, 5% and 1% significance level respectively

Source: Survey result, 2017

The VIF values were ranging between 1.05 and 1.81 and the mean VIF value was 1.33 and contingency coefficient for categorical variables were not greater than 0.75. These results indicated the absence of serious multicollinearity and endogenity problems among the independent variables. Furthermore, the problem of heteroscedasticity is always common and expected when analyzing cross-sectional data Gujarati, (2004). However, this study tested the existence of heteroscedasticity by employing Breusch-Pagan test using STATA command estat hettest. Hence, tests showed that there was no heteroscedasticity problem. Correspondingly, detection of specification error for omitted variables test result also showed that there were no omitted variables and specification error.

The multiple linear regressions found that among 14 variables, five variables had shown significant

relationship with volume of wheat sold in the study area. Accordingly, cash expenditure for farming, access to credit and total wheat produced were found to influence volume of wheat sold positively and significantly as expected. Contrary to this, Education status of household head and oxen owned had shown negative and significant relationship with volume of wheat sold. Hence, these variables require special attention if commercialization level is to be increased thereby increase income of producers.

Cash expenditure for farming: As expected, this variable had positive and significant influence on volume of wheat sold at 1% significance level. The regression coefficient showed that one ETB increase in cash expenditure for wheat production would result in a 0.00047 quintals increase in the amount of wheat sold; keeping the influences of other factors constant.

Access to credit: As expected, this variable also had positive and significant influence on volume of wheat sold at 5% significance level. The regression coefficient showed one times increase in credit utilization would result in a 3.712 quintals increase in amount of wheat sold.

Oxen owned: The impact of this variable on volume of wheat sold was found to be a contradiction to the previous hypothesis. The regression coefficient showed that a TLU increase in oxen owned by the household would result in 3.86 quintals decrease in the amount of wheat sold; ceteris paribus. The reason for the expected sign change of the effect of the variable was that in the study area, household‟s opted to cultivate their wheat land by tractor rather than cultivating by oxen.

Total wheat production: As expected, this variable also had positive and significant influence on volume of wheat sold at 1% significance level. The regression coefficient showed one quintal increase in wheat production would result in a 0.624 quintals increase in volume of wheat sold. This is in line with the findings of Rehima (2006), Aseffa (2009) and Ayelech (2011) who found that the amount produced by farmers/households influence quantity of supplied to the market for each commodity positively and significantly.

Educational status of household head: The impact of this variable on volume of wheat sold was found to be a contradiction to the previous hypothesis. The regression coefficient showed that a grade increase in educational status of the household head would result in 0.727 quintals decrease in the volume of wheat sold; ceteris paribus. The reason for the expected sign change of the effect of the variable was that when producers are getting educated they probably tend to shift to another business. The finding of this study is congruent with the findings of Gizachew (2006) and Almaz (2012) that found a negative relationship of household education with dairy supply and found negative relationship between educational status and supply of leafy vegetables respectively.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusion

This study was undertaken with the aim of analyzing the determinants of smallholders‟ wheat commercialization in Gololcha District of Bale zone. The specific objectives of the study include identifying the level of commercialization, assessing Structure Conduct Performance of wheat market and analyze major determinant of volume of wheat marketed/commercialized/ in the study area.

The data were generated from both primary and secondary sources. The primary data were generated from individual interview using pre-tested semi-structured questionnaire and checklist. The descriptive analysis of level of commercialization of sample respondents showed that 13.7% were subsistence, 56.2% were semi-commercial and 30.1% were commercial farmers in 2016 cropping year.

Multiple linear regressions were run to identify factors determining the volume of wheat sold. The result of the multiple linear regressions indicates that among 14 variables, five variables had shown significant relationship with volume of wheat sold in the study area. Accordingly, cash expenditure for farming, access to credit and total wheat produced were found to influence volume of wheat sold positively and significantly as expected .Education status of household head and oxen owned had shown negative and significant relationship with volume of wheat sold. Hence, these variables require special attention if commercialization is to be increased thereby increase income of producers.

5.2. Recommendations

Given the potential of the area for wheat production and its significant contribution to ensure food security and self-sufficiency as well as source of income for producers and meeting ever increasing demand of wheat processors, results of this study have implications for wheat commercialization development in the study area.

The results of econometric analysis indicated that volume of wheat sold is positively and significantly affected by utilization of credit access. Thus, viable credit market could be strengthened to encourage the producers to use more of the rightful inputs, to facilitate their market access. There is a need for policy and institutional arrangements to strengthen already established cooperatives and increasing number and availability of other credit services providers beside the cooperatives to improve access and availability of modern means of production and marketing.

Oxen owned also affected the volume of wheat sold by farmers negatively and significantly. Therefore, the volume of sold will be increased if households that have many oxen should cooperate with that have less oxen owned and support each other in farming, increase productivity, rather than selling their oxen to the market.

Cash Expenditure for farming also affected volume of wheat sold positively and significantly. Therefore, advice on the benefit of farm land management practices, use of recommended fertilizers and the benefit of crop rotation and improved varieties over local varieties etc should be given more concern by concerned body to increase the cash expenditure for farmers to use modern inputs thereby increase the production and productivity of wheat in order to increase volume of wheat sold by farmers.

Quantity of wheat produced influences the volume of wheat supplied to the market positively and significantly. Therefore, the public authorities should focus on increasing the production and productivity of wheat. This could be achieved through identifying new technologies and management systems that would boost the production and productivity of wheat.

Education of the household was associated with volume of wheat sold negatively. From the result of this study, it was realized that producers were not in a position to obtain better income as a result of exploitation

by traders and middlemen due to poor bargaining power and poor wheat market performance. As a result of this, they tend to shift to other business. Therefore, much emphasis has to be given to improvement of market and marketing system.

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Macroeconomic determinants of investment nexus: The application of Dynamic Panel Model in Eastern African Countries

By

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Abstract

Evidences show that developing countries' economies are inherent with structural and institutional rigidities and variations of basic economic variables like investment are explained beyond macroeconomic determinants. This paper analyzes the investment determinants beyond macroeconomic factors and tries to uncover the role of institutional factors on determining size and sign of investment function within neoclassical framework. The study is mainly dependent on secondary data obtained from WDI, EFW and PWT which covers panels of 6 East African countries from periods 2003-2020. Dynamic panel model is mainly chosen to estimate the investment function. Accordingly, AB- GMM estimation result shows that among Neoclassical's variables, economic size, economic growth and economic control variables are found to be significant. On the other hand, among institutional variables, business environment, financial development and political stability are found to be significant determinants of investment in the region. The simple insight for policy arising from this paper is that in addition to the traditional Macroeconomic policy areas, the investment climate in East Africa is characterized by the broader structural and institutional environment in which businesses operate. Therefore, development interventions should give emphasis to improvement of such institutional systems to increase the level of capital formation of the region.

Keywords: AB-GMM; economic size; institutional factors; investment

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1. Introduction

1.1. Background

The fundamental of macroeconomic theory starts with the preposition that "there exist a positive and strong relationship between capital formation and economic growth". Capital formation, theoretically and empirically, has proven to be critical for economic growth (Solow 1956, Levine 2005 and Zou 2006).

Investment is not only one of basic components of aggregate demands, by increasing productive capacity of an economy, investment also contribute to employment growth then reduce poverty and make an economy more resilient to external shocks (White, 2005). It is therefore worthwhile to investigate the factors that determine the level of domestic investment.

As far as macroeconomic factors of investment are concerned, the major theoretical formulations used to define investment behavior are; the accelerator theory which is postulated by Keynes (1936) which states that the main variable which determines an investment is GDP growth, the profit model which suggests that an increase in gross profits enhances internally created funds, which in turn boost investment activities, the neoclassical flexible accelerator model which is identifies output, availability of domestic credit, cost of external financing, depreciation, interest rates and tax structure as the main factors affecting investment (Eklund, 2013), the Tobin's "q" theory of investment which identifies interest rates as the major determinant of investment where interest rates affect investment in a negative manner in the sense that a rise in interest rates results in the increased user cost of capital and finally the neoliberal approach which is popularized by McKinnon (1973) which states that investment is positively determined by real rate of interest where the rise in interest rate is expected to increase the volume of financial savings through financial intermediaries and thereby raises investible funds which they call it "conduit effect".

In addition to the above macroeconomic determinants, studies by Lim (2014) and Bailey (2018) argues that institutional factors, such as democratic institutions, political stability, rule of law, corruption, tax policies and culture are important factors influencing foreign direct investment particularly and gross investment generally. Bailey (2018) further argues that institutional factors are more influential in attracting investment in developing countries compared to developed countries, and the effect of institutional factors is stronger in developing countries like Asia and Africa compared to those in North America and Europe.

On the other hand, this study tries to explain the roles of additional institutional and structural variables along with macroeconomic determinants on gross capital formation by selecting 6 East African countries as a case study. similarly, this study employs latest panel data of the period 2003-2020.

Given the close connection between the level of investment and the rate of economic growth, as documented in earlier studies (Khan &Reinhart, 1990, Barro and Lee, 2013), the decline in investment in African countries are a matter of concern. As far as the level of investment is considered, between 1985 and 2015, the rate of gross capital formation ranged between 1 and 90 percent of Gross domestic product worldwide while the Africa's status is among lowest one (Hycent et,al., 2014). This eventually, inhibits the potential for regional investment competitiveness and economic growth. Hence in order to facilitate efforts towards investment growth and regional integration in Africa, it is important to correctly identify the factors that are responsible for the investment lags in African economies.

Particularly this paper tries to answer the research questions such as what are the relative factors which determines investment activity in east African countries, what are the roles of structural and institutional factors like political instability, government quality, bureaucracy, quality of business environments, financial sector development, human capital development, legal system and property rights and etc… along with traditional macroeconomic determinants.

1.2. Objective of the study

The general objective of the study is to analyze macroeconomic determinants of investment with the application of dynamic panel model in the case of East African Countries.

Specific objectives

- To assess macroeconomic determinants of investment
- To analyze the role of institutional factors in explaining investment variation

2. Brief literature review

In the process of economic growth of countries, investment plays a crucial role to raise productivity through encouraging technological progress and promoting new techniques of production. It also plays an enormous role in the long run capital accumulation since investment increases productive capacity and creates new capitals. Hence, as investment rates increase the rate of accumulation of capital stock increases rapidly (Majeed and Khan 2011).

In light of this, giving sufficient emphasis and recognition to the development of investment sector become recent phenomena. Recently East African countries founded specific investment organization like Uganda investment authority, Kenya investment promotion center, Tanzania investment center and Ethiopia investment authority and etc…with an intention to give much emphasis and energy to attract investment believing that it will overcome constraints on economic growth through promoting technology transfer, creating employment opportunity and attracting investors in a more diversified economy. However, the level and the rate of investment activities in these countries are yet not satisfactory. Hence there is a need to analyze the determinants of investment beyond the traditional macro-economic factors.

Conventional models such as the flexible accelerator proved to be quite successful in explaining aggregate investment in industrial countries. However, these models assume an economy with perfect capital markets, absence of liquidity constraints, and no or minimal government intervention which is not consistent with the case of developing countries as these economies are inherited with institutional and structural rigidities. Romer et al. (1995), Ajide and Lawanson (2012). Specifically, East African countries are suffered from perennial institutional and structural constraints like political instability, high levels of corruption, feeble enforcement of law and order, ineffective governance and poor business environment for a long period. Hence there is a need to consider the analysis of the role of these factors and the level of their impacts on capital formation of the region.

There are evidences with regard to the role of institutional and structural factors in determining investment function. For example, study by Lim, 2014 shows the quality and structure of institutional mechanisms such as rule of law, contract enforcement, property right and judicial system influence aggregate

investment through altering incentive for new investment, or by increasing the sensitivity of investment to technological shocks at the macroeconomic level. Similarly study by Ucan, 2014 shows the role of financial development on investment expansion for G7 countries.

On the other hand, this study tries to analyze the determinants of investment activity by taking East African countries as a case study and by including institutional and structural indexes like governance indicators, human capital index, business environment, political stability and financial development along with basic neoclassical macroeconomic determinants of investment.

3. METHODOLOGY OF THE STUDY

3.1. Data Sources

This paper work is dependent on secondary data. Data of macroeconomic variables are obtained from data banks of World banks, world development indicators(WDI) and world governance indicators (WGI). Data of institutional and structural variables are obtained from the Economic Freedom of the World-index (EFW), Penn World table and World governance indicators (WGI). (The web sites are https://data.worldbank.org/country, www.govindicators.org and https://www.fraserinstitute.org for WDI, WGI and EFW respectively). The latest version of the indicators (2021 version) is obtained and the data set covers 6 East African countries; Ethiopia, Kenya, Uganda, Tanzania, Mozambique and Rwanda. Given the data of most of the indicators are not available in the case of African economy, the study covers 18 year's recent panel data from the period 2003-2020. Before using the data for analysis purpose, data cleaning and stationarity tests are conducted.

3.2. Model Framework

3.2.1. Theoretical model frame work

Following Lim, 2014 and Hycent et.al, 2016, the model framework of the paper is specified from the famous Cobb-Douglas's Neo-classical production function of constant returns to scale whose equation is given by

$$Q_{it} = A_t K_{it}^{\alpha} L_{it}^{\beta} \quad \ldots\ldots (1)$$

Where Qit is the level of national output in country i in period t, At is state of technology which is exogenous, Kit and Lit are the capital and labor used in production in country i in period t respectively and α and B are the share of capital and labor in production respectively. Then the capital formation (investment) equation is given by

$$K_{i,t} = K_{i,t-1} - \delta K_{i,t-1} + I_t \quad \ldots\ldots (2)$$

where δ is depreciation rate of capital. On the other hand, according to the neoclassical flexible accelerator model, the optimal capital stock of country i, in period t is given by the ratio of real output to rental cost of capital as represented by the following equation (3)

$$K_{it}^{*} = \frac{\gamma Q_{it}}{R_{it}^{\sigma}} \quad \ldots\ldots (3)$$

where σ is the elasticity of substitution of capital.

Substituting the optimal level of capital of equation (3) in to equation (2) and solving for investment at steady state yields

$$I_{it} = \frac{\gamma(\delta+\theta)Q_{it}}{R_{it}^{\sigma}} \quad \ldots\ldots (4)$$

Where θ is growth rate of capital which is also equal to growth rate of output and consumption in steady state.

Since, the above investment equation (4) is non-linear, it can be made linear by taking natural logarithm to both sides as follows

$$lnI_{it} = ln\gamma + ln(\delta+\theta) + lnQ_{it} - \sigma lnR_{it} \quad \ldots\ldots (5)$$

The term ln(δ+θ) is depreciation adjusted growth rate in country, i, lets denote it by letter 'g' and also lets express the ln terms with lower case, then the complete model of investment with inclusion of institutional variables is given by the next equation (6)

$$I_{it} = \beta_0 + \beta_1 g_{it} + \beta_2 q_{it} - \beta_3 r_{it} + \eta I_{it-1} + \varphi S_{it} + e_{it} \quad \ldots\ldots (6)$$

Where, Sit are a set of institutional variables included in the model over the neo classical specification, I(it-1) past year's investment which serve as investment smoothing term. The Empirical model of the study is specified as follows.

Empirical Model Specification

I. Differenced GMM (Arellano-Bond) estimator

Dynamic panel models are considered for the study where the chosen estimator is differenced GMM, also named Arellano-Bond (1991) estimator after Manuel Arellano and Stephen Bond. The estimator is chosen for based on the fact that it corrects endogeneity problem by transforming all regressors through differencing and using them as instruments. In such away it provides sufficient supply of instruments and produces efficient result. On the other hand, the Arellano-Bover (also known as system GMM) uses the differenced lag of the endogenous variable and endogenous variable at level as instruments. For this study given that the number of panel unit is relatively small, Arellano-Bond estimator is chosen to overcome problems of over identification (excess instruments) and instrumental inconsistency in comparing with system GMM (after conducting Sargan test of over identifying restrictions and Arellano-Bond serial correlation test AR1, AR2.)

A few description of the model is made as follows

Starting point: the first difference (FD) estimator

$$\Delta y_i = \lambda \Delta y_{i-1} + \beta \Delta x'_{i-1} + \Delta e_{it} \quad (7)$$

Where

$$\Delta y_i = \begin{bmatrix} \Delta y_{i2} \\ \Delta y_{i3} \\ \vdots \\ \Delta y_{iT} \end{bmatrix}, \Delta y_{i-1} = \begin{bmatrix} \Delta y_{i1} \\ \Delta y_{i2} \\ \vdots \\ \Delta y_{iT} \end{bmatrix}, \Delta x_{i-1} = \begin{bmatrix} \Delta x_{i2} \\ \Delta x_{i3} \\ \vdots \\ \Delta x'_{iT} \end{bmatrix} \text{ and } \Delta e_i = \begin{bmatrix} \Delta e_{i2} \\ \Delta e_{i3} \\ \vdots \\ \Delta x'_{iT} \end{bmatrix}$$

Then valid instruments

- ✓ $[t = 2 \; or \; t = 1]$: No instruments
- ✓ $[t = 3]$: the valid instruments for $\Delta Y_{i2}=(Y_{i2} - Y_{i1})$ is Y_{i1},
- ✓ $[t = 4]$: the valid instruments for $\Delta Y_{i3}=(Y_{i3} - Y_{i2})$ is Y_{i2} as well as Y_{i1},
- ✓ $[t = T]$: the valid instruments for $\Delta Y_{iT-1}=(Y_{iT-1} - Y_{iT-2})$ is Y_{iT-2} as well as Y_{iT-3}, ...Y_{i1}.

Hence there is a total of (T-1) (T-2)/2 available instruments or moment conditions for ΔY_{iT-1}.

The corresponding matrix of instruments for the lagged difference is given by

$$\omega_i = \begin{bmatrix} y_{i1} & 0 & \cdots & & 0 & \\ 0 & y_{i1}, y_{i2} & \cdots & & 0 & \\ \vdots & \vdots & \ddots & & \vdots & \\ 0 & 0 & \cdots & y_{i1}, y_{i2} & \cdots & y_{iT-2} \end{bmatrix}$$

The moment conditions can be described as

$$E[\omega'_i \Delta e_i] = 0 \quad (8)$$

Finally, the GMM estimator that takes into account the formulated moment conditions is:

$$\hat{\lambda}^{GMM} = (G' Z S_N Z' G)^{-1} G' Z S_N Z' \Delta y \quad (9)$$

Where $G = (\Delta y_{i-I}, \Delta x)$, $Z = (\omega, \Delta x)$

$S_N = (\sum_{i=1}^{N} z_i' \hat{e}_i \hat{e}_i' z_i)^{-1}$ is the optimal weighting matrix which is calculated from initial estimate.

Description of important variables included in the model and their expected sign is made as follows

II. Description of variables included in analysis

Dependent variable

investment: represents gross capital formation, where natural logarithm form is taken to reduce dimension. The gross capital formation which is taken as indicator of investment is the value of acquisitions of new or existing fixed assets by the business sector, governments and households and also inventory accumulation.

Independent variables

Last year's investment: last year's investment is included as investment smoothing variable and also impact on current investment is expected to be positive. (Eberly et.al, 2012)

Real GDP: is an indicator of economic size. In the model natural logarithm of Real GDP is taken to reduce dimension.

Real GDP growth rate: is considered as an indicator of economic growth.

Both real GDP and real GDP growth rate are expected to have positive effect on investment which follows from the flexible accelerator model that assumes there is a fixed relationship in the production function between the desired capital stock and the level of output as well as output growth rate (Fry, 1980).

Real Interest rate: interest rate is cost of capital and from Tobin's "q" theory of investment and from neoclassical hypothesis, it impacts is generally hypothesized to be negative.

Inflation rate: denotes the percentage annual growth rate in general price level (GDP deflator) of the economy. It is one of economic management/control variable. The impact of inflation is ambiguous as on one hand, inflation reduces real wage rate which raises employment capability of the firms and then investment, on the other hand, inflation creates macroeconomic uncertainties which may hurt investment decision. (Romer et. al, 1995)

The share of government spending in national GDP: - is another economic control variable. The impact of government spending on investment activity is theoretically ambiguous. Early empirical evidence (Blejer &Khan, 1984) shows that on one hand overwhelming government expenditure creates crowd out effect, which is partial displacement of private investment activities by creating high fiscal deficits, high interest rates and high tax burdens. On the other hand, government spending which is targeted toward infrastructural expansion and social development may complement private investment and may boost general investment activities.

Human capital index: - The index is constructed based on composite indexes of years of schooling and returns to education which lies between range of 1 (low) to 4(high) which is retrieved from Penn World Table Version 10. It is hypothesized to have positive impact on investment following Barro and Lee (2013)

Financial development: in the model, financial development is indexed with domestic credit to private sector share of GDP. It is hypothesized to be have a positive impact on investment activity. Its effect on investments works directly through the stock of credit available to firms. This positive impact has been found in many studies for developing economies (Levine, 2005; Fry, 1980)

Quality of business environment: the index is constructed from scores of property rights, credit market regulation, ownership of banks, interest rate controls, labor market regulations, administrative requirements to start business, regulatory burden, extra payments (bribes or favoritism), licensing restrictions and cost of tax compliance. Each component takes score of the range from 0 (low) to 10(high). This business environment index is retrieved from EFW which is the weighted of score of the listed components. Improvements in quality of business environment promotes of ease of doing business and hypothesized to have positive effect on capital formation. (Lim, 2014)

Political instability: Denotes indexes of the extent of political stability and Absence of Violence/Terrorism/ war in countries of the region. The index ranges from -2.5 (poor performance) to 2.5 (best performance) and obtained from world governance indicators (WGI). Following Uddin et al, 2018, the presence of war, instability and violence (the smaller the stability index) are expected to negatively affect investment function.

Table 1: Summary of Description of explanatory variables included in the model

Variable	**Symbol**	**Nature of the variable**	**Expected sign**
Last Year investment	investt-1	Continuous ~natural logarithm of one period lag in investment	+
Real GDP	lnRGDP	Continuous ~ natural logarithm of real GDP of the countries	+
Real GDP growth rate	RGDPgrowth	Continuous ~ the rate of growth of real GDP of economies of the countries	+
Real interest rate	interest	Continuous ~ the rate of interest	(-)
Inflation rate	inflation	Continuous ~the percentage growth in general price level, GDP deflator	+ or (-)
The share of government spending in national GDP	govspending	Continuous ~ the percentage share of government spending in GDP of the economies of the countries	+ or (-)
Human capital index	HCI	Scale~ composite index of health and education which lies from 1 (low) to 4 (high) which is constructed by PWT	+
Financial development	Financedevt	Continuous ~ measured by the percentage of domestic credit provided to private sector as a share of GDP	+
Quality of business environment	Businessenvt	Scale ~ composite index of several proxy of business environment which ranges from 0 (low performance) to 10 (high performance) which is constructed by PWT	+
Political instability	politicalinst	Scale ~ composite index of several proxy of instability and ethnic violence which ranges from -2.5 (high instability) to 2.5 (high stability) which is retrieved from PWT	(-)

III. Stationarity test; Levin, Lin, Chu (LLC) approach

Before employing the variables for analysis purpose, panel unit root tests are conducted for each variable. One of the first panel unit root tests formulated by Levin et al. (2002) suggests the following hypotheses for testing stationarity in panel data. Under null hypothesis, LLC test shows that each time series contains a unit root,

i.e., $H_0: \rho_i = 0 \; \forall i,$ and

for alternative hypothesis, each time series is stationary,

i.e., $H_1: \rho_i = \rho < 0 \; \forall i.$

The LLC approach assumes that the individual processes in each cross section are independent.

The test is mainly based on the estimation of the equation;

$$\Delta y_{i,t} = \alpha_i + \delta_{it} + \theta_t + \rho_i y_{i,t-1} + e_{i,t} \quad \text{..... (10)}$$

Where $i=1, 2, \ldots, 6$ *and* $t=1,2,\ldots,18$

Then the parameter up on which we conduct stationarity test is ρ_i.

IV. Sargan test of over identifying restrictions

This test verifies the validity of the instruments used in the analysis (Roodman,2009). This test is used for One Step estimations and in samples where there is not a risk of overestimation. The statistics reported is $\chi 2$. The number close to the $\chi 2$ in parentheses, correspond to the quantity of instruments over the instruments needed. The difference between the total instruments and the instruments leftover, is the optimal number of instrument for the model.

The interpretation of the Sargan test will be as follow:

Null hypothesis

Ho: All the restrictions of over identification are valid.

Criteria of rejection or acceptation:

Prob>$\chi 2 \geq 0.05(5\%)$

i.e. If the probability obtained is equal or higher to 0.05, the used instruments in the estimation are valid, and therefore over identification doesn't exit. Therefore, there is no evidence to reject the null hypothesis.

V. Arellano and Bond Autocorrelation Test

Dynamic panel data introduces the condition of correlation in the error terms (Cameron & Trivedi 2009). For testing that, the Arellano and Bond test is employed in the paper.

We should expect that the probability of AR(2) (pr > z) will be not significant at 5%. This will confirm

the absence of autocorrelation in the errors. Usually, AR(1) should be significant at 5% or 10%.

The interpretation of this test will be as follow:

Null hypothesis:

Ho: Autocorrelation doesn't exit.

Criteria of rejection/acceptation

To reject that null hypothesis, we will use AR (2). This rejection implies the probability pr > z is higher than 0.05, that is to say, the errors terms are not serially correlated.

4. RESULTS AND DISCUSSIONS

This section presents and discusses several findings of the study. Several descriptive statistics and Econometrics analysis of panel data are made and presented as follows. The statistics are computed with STATA v.16 software package.

4.1. Stationarity test

For panel stationarity test, the result of the Levin, Lin and Chu (2002) is presented as follows and variables which retained their stationarity are included in the regressions at level. Table 2 shows that All variables are stationary at level except financial development which became trend stationary process. For financial development, the cyclical component is removed and the deterministic part is included in the regression.

Table 2: panel stationarity test, LLC approach

Variable	t* Statistics	p-value	Remark
investt-1	-4.9740	0.0000	Stationary at level
Lnrgdp	-6.4170	0.0000	Stationary at level
RGDPgrowth	-4.1434	0.0000	Stationary at level
Interest	-4.0906	0.0000	Stationary at level
inflation	-2.8622	0.0021	Stationary at level
govspending	-1.3976	0.0811	Not stationary at P-value 5%
govspending with trend term	-2.3238	0.0101	Stationary at p5% after including trend term
HCI	-1.8214	0.0343	Stationary at level
financedevt	-6.1691	0.0000	Stationary at level
businessenvt	-5.0297	0.0000	Stationary at level
politicalinst	-2.3231	0.0101	Stationary at level

4.2. Descriptive statistics

I. Summary of descriptive statistics

a. Aggregate summary

Table 3: Summary of descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Lninvestment	108	22.41491	1.03008	19.456	24.2444
Lnrgdp	108	23.80056	.7587081	21.9745	24.936
RGDPgrowth	108	6.520116	2.936982	-3.35547	13.5726
Interest	108	7.785073	2.738586	2.67365	12.8627
Inflation	108	8.449025	9.480367	-3.62143	84.5574
govspending	108	13.50962	4.272079	6.61373	26.4707
HCI	108	1.676489	.387585	1.14748	2.5179
financedevt	108	18.04515	7.363786	6.18238	34.9907
businessenvt	108	6.960463	.9575098	4.75	8.62
politicalinst	108	-.7593518	.6194122	-1.8	.63

On table 3 above, the standard deviation statistics show that among macroeconomic variables, inflation is the one with highest volatility (9.48) while among institutional variables, financial development is the one with highest volatility (7.36). Institutional variables like financial development and business environment exhibits higher standard deviation than some macroeconomic variables like real GDP, which is preliminary indication of how institutional variables and may matter in determining investment.

b. Across country summary; mean statistics

Table 4: Across country mean statistics of the variables

Countries	variables (mean)									
	lninestment	ln RGDP	RGDP growth	interest	inflation	gov spending	HCI	fina devt	b u s envt	political inst
Ethiopia	23.11	24.15	9.13*	3.13	12.79*	11.05	1.32	18.04	6.29	-1.55
Kenya	22.85	24.5*	4.93	8.01	8.52	14.59	2.18*	30.19*	7.36	-1.22
Uganda	22.38	24.05	6.19	10.48*	9.64	10.35	2.07	12.28	7.9*	-0.95
Tanzania	23.15*	24.28	6.16	7.98	7.39	10.24	1.62	11.56	6.79	-0.36
Mozambique	22.11	23.20	5.93	8.53	5.45	20.3*	1.18	20.05	5.51	-0.13*
Rwanda	20.91	22.61	6.75	8.54	6.87	14.5	1.66	16.12	7.9*	-0.33

*: - denotes maximum figure

The across country mean statistics of the table 4, (the details which includes other statistics are reported on Appendix III) shows that over the periods covered by the study, on average, Tanzania has highest investment level which is 11.32 billion$ (antilog of 23.15) per year, Ethiopia has highest GDP growth rate and highest inflation rate which are 9.13% per year and 12.79% per year respectively, Kenya has highest real GDP size, 43.67 billion$ (anti ln of 24.5) per year and Mozambique has highest government size as a % of GDP which is 20.3% per year.

Similarly, in the case of institutional variables over the periods covered by the study, in comparing with the other countries, on average Kenya has highest human capital index and highest financial development index which are 2.18 and 30.19 per year respectively. In terms of creating good business environment Uganda's and Rwanda's average figure are higher (7.9). On the other hand, in terms of political stability and no violence score, Mozambique's figure is relatively better (-0.33) while Ethiopia's figure is the worst (-1.55).

II. Pairwise Correlation analysis

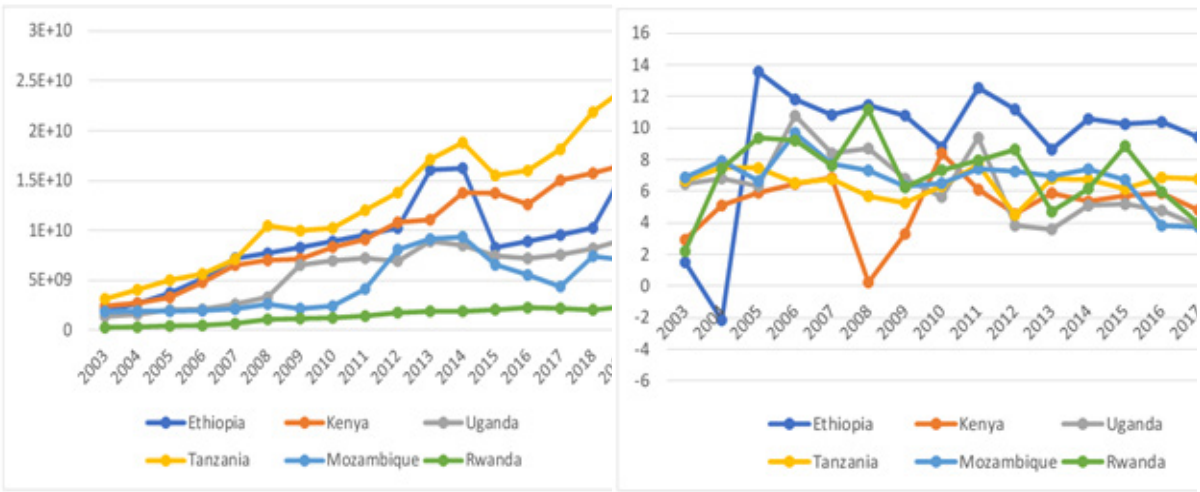
Table 5:Pairwise correlation table

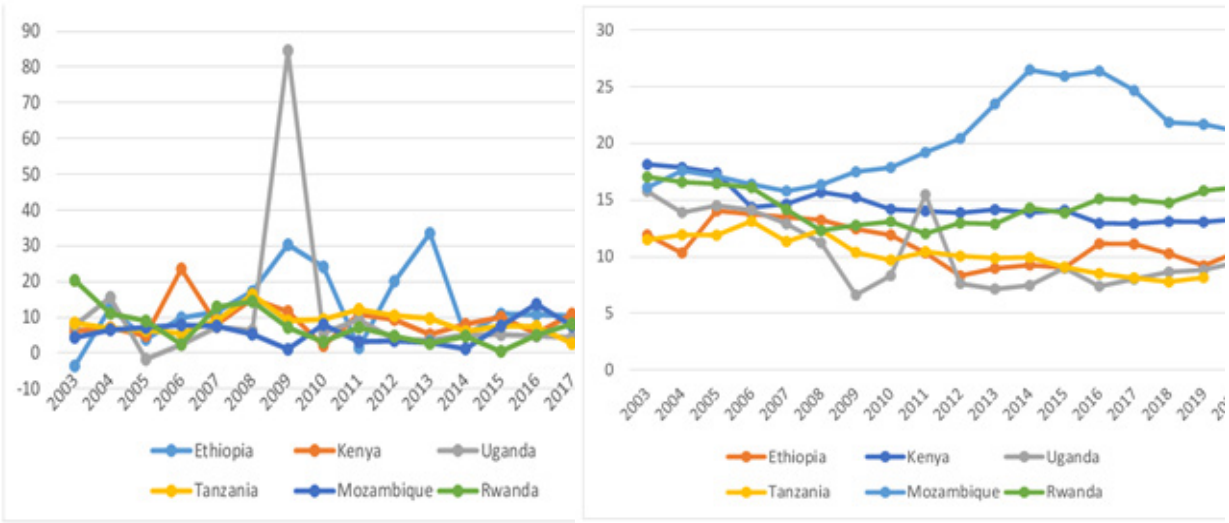
	Lninve	Lnrgdp	RGDPgr	Interest	Inflation	govspe	HCI	finan	Buss	politi
Lninvest	1.0000									
Lnrgdp	0.9046*	1.0000								
RGDPgro	-0.0199	-0.0963	1.0000							
Interest	-0.3653*	-0.2246*	-0.3388*	1.0000						
Inflation	0.0569	0.0568	0.0919	-0.1166	1.0000					
govspend	-0.3635*	-0.4611*	-0.1229	0.1090	-0.1756	1.0000				
HCI	0.2054*	0.4825*	-0.3093*	0.3628*	-0.0518	-0.3761*	1.0000			
finan	0.3184*	0.3279*	-0.2556*	-0.215*	-0.0729	0.3971*	0.305*	1.0000		
busine	-0.1252	0.0610	-0.0747	0.3006*	0.0274	-0.4481*	0.713*	-0.056	1.000	
politic	-0.2753*	-0.4436*	-0.1106	0.3376*	-0.242*	0.1764	-0.184	-0.262*	-0.055	1.000

*: - correlation is significant at 5% significance level.

The significant simple pairwise correlation tests show that among macroeconomic variables real GDP is highly and positively correlated with investment while interest rate and government spending are highly and negatively correlated with it. In the case of institutional variables, investment has high positive significant correlation with financial development and high negative significant correlation with political instability.

III. Trend Analysis





Source: own computation from WB data

The above figures show the trends of selected macroeconomic variables. For example, Figure 1 shows the trends of investment or cumulative capital formation in the sample of East African countries. When we observe the trend of each country, Tanzania has the highest investment levels than the other countries in the sample and it shows that there is a high increasing trend followed by Kenya and Ethiopia. Ethiopia's investment trend shows large fluctuation specifically 2011 G.C. onwards. On the other hand the figure shows investment trends in Rwanda and Mozambique is relatively smaller.

4.3 Econometrics Estimation Result

This section presents the results from econometrics' model estimation of the differenced GMM for the Investment equation (6). The results from the alternative linear panel models are presented for the purpose of checking robustness and consistency of the results. Before presenting the results of AB estimator, the test of over identifying restrictions and the test of serial correlation are conducted with Sargan test and AB test for zero autocorrelation in first-differenced errors respectively. (see appendix I) Accordingly, model results presented in the paper passes the tests of instrumental validity (no over identification) and consistency (no serial correlation). In addition, based on Wald χ^2 criteria model results presented in the paper, satisfies the overall model significance.

4.3.1 Determinants of Investment; Arellano-Bond GMM Estimator

This section presents the results from econometrics' model estimation of the differenced GMM for the Investment equation (6). The results from the alternative linear panel models are presented for the purpose of comparing robustness and consistency of the results. Before presenting the results of AB estimator, the test of over identifying restrictions and the test of serial correlation are conducted with Sargan test and AB test for zero autocorrelation in first-differenced errors respectively. (see appendix I) Accordingly, model results presented in the paper passes the tests of instrumental validity (no over identification) and consistency (no serial correlation). In addition, based on Wald χ^2 criteria model results presented in the paper, satisfies the overall model significance.

Table 6: Macroeconomic determinants of investment; Arellano bond estimator

Arellano-Bond dynamic panel-data estimation						Number of obs = 108
Group variable: panel id						Number of groups = 6
Time variable: year						
						Obs per group:
						min = 16
						avg = 16
						max = 16
Number of instruments = 97						Wald chi2(5) = 3622.55
						Prob > chi2 = 0.0000
One-step results						(Std.Err. adjusted for clustering on panelid)
Lninvestment		Robust Std. Err.	Z	P>z	[95% Conf.	Interval]
investt-1	.6563343	.0326673	20.09	0.000	.5923076	.720361
Businessenvt	.1243525	.0609499	2.04	0.041	.004893	.243812
Politicalinst	-.0382348	.0124633	-3.07	0.002	-.0626624	-.0138073
HCI	.0584874	.0683473	0.86	0.392	-.075471	.1924457
Financedevt	.016456	.0034494	4.77	0.000	.0096952	.0232167
Lnrgdp	.3107794	.0864953	3.59	0.000	.1412518	.480307
RGDPgrowth	.0078825	.0022544	3.50	0.000	.003464	.0123009
Interest	-.0049185	.0059219	-0.83	0.406	-.0165252	.0066883
Inflation	.0046429	.0007868	5.90	0.000	.0031008	.006185
Govspending	-.0167116	.0026158	-6.39	0.000	-.0218385	-.0115848
_cons	-.7275316	1.260149	-0.58	0.564	-3.197379	1.742316

The above AB-GMM estimation results (table 6) shows that most of macroeconomic variables are statistically significant and most of the sign of coefficients of the variables are inline with expected priori criteria. the last year investment and the economic size (RGDP) are among the variables having strong positive effect on investment with the coefficients of 0.65 and 0.31 respectively. Among economic control variables, inflation is found to be positively affecting investment while government spending found to be negatively affecting it. A percent increase in general price level raises investment by 0.46%. The result for inflation may not be very surprising as the economy of most East African countries are inherent with inflation problem. Even if the result seems against priori, it has some implication for East African countries. On one hand stable inflation reduces the real wages which inturn enables firms to hire large

amounts of labor with cheap wage and expand productivity or investment. On the other hand inflation reduces real interest rate and then promotes investment activity in the region which is consistent with Philiphs curve consensus. This result is consistent with Hycent's finding for central African countries' investment function, where they found the positive impacts of inflation. (Hycent et, al., 2014).

Expansion of government spending found to have significant negative impact on investment in the region. One percent rise in percentage share of government spending in GDP results in about 3.2% decline in investment. As the share of government spending in GDP increases, this may create partial displacement of private sector investment and may raise costs of capital which may inturn negatively affect the gross capital formation of the region. However contrary to this one Lim (2014) and Bailey (2018) found the positive impacts of government spending on investment activities.

One interesting point of the finding of the study is even if its sign is negative, the impacts of interest rate on investment is found to be negative as postulated by neo-classical's theory. One percent increase in interest rate entails 2.48% reduction in investment.

Analyzing the role institutional factors included in the model, the result on table 6 shows that except for human capital, the impacts on investment of all institutional variables included in the model are statistically significant and their magnitude of effects are in accordance with expected priori. The impacts of business environment and financial development on investment is found to be positive. The positive impact of improvement in quality of business environment on investment is strongest one. One percent improvement in quality of business environment promotes investment in the region by 12.4%. The improvement in business environment includes improvements in credit market regulation, labor market regulations, administrative requirements to start business, the property rights, participation of private banks in business, degree of combatting corruption, relaxing licensing restrictions and reducing cost of tax compliance. Similarly, one percent improvement in financial development increases investment by 1.6%.

Even though it is statistically insignificant, the coefficient of human capital index shows that the human capital development has positive effect on investment.

On the other hand, the impact of political instability like presence of war, violence, internal conflict and terrorism on investment of the region is found to be negative and significant. This is because as shown in table 2 the political stability index of the region is low which is even below average. The decline in political stability index by 1% (the rise in political instability by 1%) reduces investment in the region by 3.8%. A research by Abdelkarim Jabri in Middle east and north Africa (MENA) region reveals the same result on the role of institutional factors where institutional indicators like government stability, investment profile, rule of law, internal and external conflict, are found to have a long-run effect on attracting investment in general and foreign direct investment in particular (Jabri, 2015).

Overall, the regressions presented on table 6 affirms the quantitative and qualitative results obtained in the descriptive parts which then provides some evidence on the effects of institutional variables in addition to the neoclassical determinants of investment.

For the purpose of comparison of consistency and robustness of the obtained result, the estimations of the linear panel models are presented on the following table 7. However, the linear panel models are

non-instrumented model and their results are not expected to be as efficient as GMM estimator presented above.

Table 7: Linear panel models' estimation results

Independent variables	**Dependent variable: investment**		
	POLS	Fixed Effects	ML-Random Effects
Lnrgdp	1.527*** (.0629734)	1.4300*** (.13113)	1.5012*** (.12298)
Gdpgrowthrate	.0051112 (.0115254)	.01771** (.00844)	.01596** (.008134)
Interestrate	.0023985 (.0157117)	-.005748 (.01457)	-.00435 (.01391)
Inflation	.0017071 (.002098)	.00488** (.00232)	.004531** (.002234)
Govspendingshare	-.018039 (.0178674)	-.0197067 (.012655)	-.02011* (.012018)
Hci	-1.2762*** (.1613727)	.3458709 (.336806)	.05214 (.33688)
Financialdev't	.027213*** (.0068295)	.022854** (.009267)	.02425*** (.00879)
businessenvironment	.1465*** (.0512169)	.19841*** (.0614514)	.16450*** (.05893)
Politicalinstability	.3495423*** (.063045)	-.04059 (.08504)	.01635** (.08502)
Constant	-12.86*** (1.890929)	-13.8709*** (2.5921)	-14.809** (2.434)
Observation	108	108	108
R2	0.929	Within R2 =0.91 Overall=0.68	
Adjusted R2	0.92		
F stat.	513.84***	Wald χ^2=114.03***	LR χ2=255.65***

Note: The statistics in the parenthesis are standard errors of the estimators. The *,** and *** indicates statistically significant coefficients at 10%, 5% and 1% level of significance.

5. CONCLUSIONS AND RECOMMENDATIONS

The existing and earlier research papers conducted on determinants of investment mainly focuses on macroeconomic variables like size of an economy, growth rate of an economy, interest rate, inflation rate, trade openness and size of a government. However, given that there are structural and institutional rigidities inherited to an economy of developing world, there is a need to focus on additional institutional determinants of investment along with macroeconomic variables.

In this paper the researcher tries to analyze the impacts of institutional and structural variables on investment dynamics along with macroeconomic determinants by taking 6 East African countries as a case study. The data covers 18 years' panel and the study employs differenced GMM model as a benchmark estimator. There are two main findings of the study. The first one is the neoclassical's determinants of investment function still work for East African economies as well. Among the neoclassical's macroeconomic determinants economic size highly matter in determining investment function. Other macroeconomic determinants like interest rate, government spending, inflation rate and economy's growth rate are also significantly matter in determining the size and the sign of investment. Another main finding of the study is beyond traditional macroeconomic determinants, there are institutional and structural variables which matters in

capital formation of East African countries. The simple insight for policy arising from this paper is that in addition to the traditional Macroeconomic policy areas such as a stable macroeconomic environment, the investment climate in East Africa is characterized by the broader structural and institutional environment in which firms and businesses operate. These includes, financial openness, financial development, government size and the governance frameworks such as rule of law and the extent of control of corruption.

Specifically based on the findings of the study, here it is recommended that for investment expansion, in addition prescribing appropriate macroeconomic policies, the policy maker and concerned bodies should target toward improving quality of business environment like improving ease of doing business, private sector participation into investment activities, improvement on property rights and business regulation, relaxing administrative requirement and bureaucracy to start business, proper labor market regulation, relaxing licensing restrictions and revising tax structure, providing subsidy and setting attractive interest rates. Similarly improving access to credit and financial sector expansion are better for financial development which in turn is necessary to boost investment activity and capital formation in the region. In addition, structural transformation of existing social and political institutions, government strength, protection of human rights, democracy, reduction of war, political instability and terrorism are equally recommended for investment expansion and capital formation of the region.

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The Nexus between Economic Growth and Environmental Quality in Ethiopia; an Implication of Environmental Kuznets Curve

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Abstract

The interdependency between the environment and development are crucial. The interdependency will continuously exist because of natural activities in human life cycle and the struggle to satisfy human wants, there is no single readymade solution for this problem. However, there are limited recent studies on exploring the link between quality environment and economic growth in Ethiopia. This study seeks to examine the applicability of Environmental KuznetCurve (EKC) in Ethiopia and the impact of Economic activities on the Environment. Secondary data was collected from various sources ranging from the period 1980 to 2018.Both descriptive and econometrics methods of analysis were deployed for this study. The results of the ARDL model from the econometrics analysis revealed thatin the long run, economic growth was the first largest contributor to ecological foot print per capita in Ethiopia, with a coefficient of -1237.784. It is statistically significant at 1% level of significance. This indicates that a 1% increase in real GDP results in 1237.8% decrease in ecological foot print per capita. Meanwhile, a square GDP has a positive coefficient and which is not as priori expected sign. This result implied that the applicability of the EKC in Ethiopia cannot be confirmed. Therefore, this study contributes to the debate on the existence and policy relevance of the EKC Ethiopia. The study recommends that policy makers should focus on environment friendly development instead of expecting that economic growth will automatically lead to a cleaner environment.

Keywords: Ecological Foot Print, Economic Growth, Environmental Kuznets Curve, and Environmental Quality

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1. Introduction and Rationality of the Study

For both developing and developed countries, economic growth is critical. This can have an impact on people's health, education, employment, and quality of life. It can also have an impact on the government's stability, affecting everything from social and food security to political stability (Mak, 2010)

Growth in the economy necessitates more capital and natural resources, resulting in more waste and CO2 emissions to the environment. The accumulation of trash and pollutants as a result of resource depletion may result in environmental degradation and a decline in human well-being. The accumulation of pollution as a result of continued resource consumption and economic expansion may exceed the environment's carrying capacity, putting the entire economic activity at risk (Everet et al., 2010). In opposition to this viewpoint, there is a case to be made that higher levels of environmental improvement go hand in hand with economic advancement because higher levels of economic growth may lead to an increase in demand for less material intensive goods and services, as well as a demand for improved environments, both of which are expected to improve the environment further (TP, 1993).

The production processes, which take raw materials from the environment and then return a variety of types of pollution (such as solid waste, air and water pollution, and so on) to the environment as a result of the production, consumption, and utilization processes, have a cyclic relationship with the environment. A large number of empirical researches have looked at the existence of an inverted U-shape link between economic activity and environmental quality, which is usually quantified in terms of per capita income. Environmental degradation rises as per capita income rises in the early stages of economic growth, but begins to decline when per capita income rises past a tipping point (Kuznet, 1995).

According to the Environmental Kuznets hypothesis, pollution rises throughout the early stages of development and continues to rise until a particular level of economic growth is reached, at which point pollution begins to decline. The inference is that, in the long run, economic growth is beneficial to environmental improvements since countries may eventually "grow themselves out" of their difficulties. This implies that wealthy nations are cleaner and greener than poor nations. However, the trajectory of global GDP per capita and global ecological footprint calls into question the validity of this argument (Akpan, 2011).

Developing countries and the poorest populations, particularly in Sub-Saharan Africa, South Asia, Southeast Asia, and Latin America, have impacted negatively on the environment. Air pollution, drought, and water scarcity have all exacerbated the dangers to people, assets, economies, and ecosystems in metropolitan areas. Water availability and supply, food security, infrastructure, and agricultural revenues are all key influences in rural areas. In fact, the poor are disproportionately affected by the deterioration of ecosystem services, which contributes to growing gaps between groups of people and is sometimes the primary cause of poverty and social unrest.

The obvious environmental concerns in Ethiopia pose a significant challenge, and the focus is shifting away from politics and poverty and toward environmental issues. Pollution has severely harmed the quality and fertility of Ethiopia's earth, freshwater, and marine environments, which has resulted in a decline in the establishment of industrial and manufacturing sectors (FRDE, 2011). Rapid population increase, urbanization, energy use, overgrazing, and land cultivation have all exacerbated the problem.

As a result, the economic impact of environmental degradation in Ethiopia has grown to become a serious obstacle to economic progress and stability. As a result, Ethiopia's next task will be to maintain economic growth while also maintaining its natural resource base.

Ethiopia is classified as a developing country since it has one of the worst poverty rates in the world. Due to drought-related lower agricultural production, it witnessed an average economic growth of roughly 10.3% in 2015, which dropped to 8% in 2016. Despite this impressive growth, the country's poverty rate has remained high (DFID, 2016). According (WB, 2016), 29.6% of Ethiopians live in poverty, and food security is in jeopardy, along with environmental degradation.

Many academics attempted to study the existence of the inverted U shaped relationship after Kuznet's discovery. The majority of articles indicated a non-inverted Kuznet U curve link between economic growth and environmental quality. Some scholars discovered the validity of EKC as a link between economic growth and environmental quality, while others looked into its non-validity.

The findings of (Kamande, 2007), (Shahbaz, et al., 2010) for several countries revealed that there is an inverted U-shaped link between environmental deterioration and economic growth. In contrast to these findings, research on the relevance of EKC in Africa have been undertaken, such as (Lin , 2015) and Wai and Mulali,2015) for lower middle income and low-income nations, and they have determined that the EKC is not relevant in Africa and hence is not a sound basis for environmental policy in the region.

(Faridul, 2013) tested the inverted U hypothesis and discovered that the Kuznet hypothesis is correct for Bangladesh's economy. The existence of the inverted U hypothesis in Bangladesh, according to the author, is due to the economy's structural adjustments.

As a result, the debates appear to be ongoing, and no general agreement has been reached thus far. The econometric method used, the nations examined in the analysis, the study period (time variation), and the environmental quality metrics used appear to have a significant impact on the findings and conclusions reached by various studies. The majority of the research cited above focused on specific economic/geographic regions, while others looked at individual countries using time series data, which can be related to the various econometric methodologies utilized and diverse means of quantifying environmental quality.

It is not enough to refer to Ethiopian research papers on the relationship between economic expansion and environmental quality. The majority of Ethiopian studies centered on the causal relationship between energy usage and economic growth. For example, (Ramakrishna, 2015) looked into the causal association between Ethiopia's energy use, CO2 emissions, and GDP growth from 1981 to 2011. The findings revealed that energy is a force for both immediate and long-term economic growth. Furthermore, (Nyasha et al., 2018) used Ethiopian time-series data from 1971 to 2013 to investigate the causal link between energy use and economic growth. The findings of this study revealed that in Ethiopia, there is a clear unidirectional causal flow from economic growth to energy consumption. It meant that, both in the short and long run, economic expansion promotes energy consumption.

Thus, the majority of Ethiopian scientific research has focused on determining the causal relationship between economic growth and energy consumption, with CO2 emissions as the dependent variable and GDP, trade openness, urbanization, energy structure, and energy use as the independent variables.

As a result, the purpose of this paper was to investigate the influence of economic activities on the environment in Ethiopia and to determine if economic expansion is harmful or good to the ecosystem.

2. Objectives of the Study

The general objective of this study is to evaluate the nexus between Economic growthand environmentalquality in Ethiopia over a period of 1980-2018. Specifically,

 To examine whether the relationship between environmental quality and economic growth follow a Kuznet curve in Ethiopian economy.

 To analyze the impact of Economic growth over environmental degradation.

 To analyze the impact of environmental degradation over economic growth.

3. Data and Methods

3.1. Sources and Types of Data

The empirical analysis of this study considered is secondary or time series data for all variables ranging from the year 1980 to 2018. The energy use and GDP, trade openness, population and ecological footprint data was obtained from world population prospect, MOFED and Global Footprint Network.

3.2. Analytical Framework of the Study

The STIRPAT identification, which is a variation of the IPAT identity, is used in this study. The IPAT model was proposed for the first time by (Holdren, 1974). It investigates the environmental repercussions of human activity. It claims that population, wealth, and technology all have an impact on the environment. That is,

$$I = P * A * T \quad [1]$$

Where I is impact, A is affluence and T is technology. The specification of the model indicates that the driving forces do not independently influence the environment. When one factor changes, it affects the impacts directly, and the other factors affect the impact through the scale effects (York, 2003).

The Stochastic Impacts by Regression on Population, Affluence and Technology (STIRPAT) will be developed to overcome the shortcomings of the IPAT model. It was put forward by Dietz and Rosa (1994). It is specified as a Cobb-Douglas function.

$$I = ap^b A^c T^d \quad (2)$$

Where; I, P, A and T is Impact, Population, Affluence and Technology respectively. b, c and d are ecological elasticity of population, affluence and technology respectively. The IPAT identity assumes that b=c=d=1 which may not always be the case. Taking logs of equation 2 yields,

$$LogI = loga + blogP + clogA + dlogT \quad (3)$$

This paper adopts the STIRPAT model with a slight modification to include other variables

thataffectenvironmentalquality.Accordingto (York, 2003) other variables can be included to the STIRPAT model as long as they theoretically fit in the multiplicative specification of the model.

3.3. Specification of the Econometric Models

The following empirical model would be considered to analyze the nexus betweeneconomic growth and environmental quality

Model 1: $LEFPC = \beta_0 + \beta_1 LRGDPPC + \beta_2 LRDPPC^2 + \beta 3LUBN + \beta 4LTO + \beta 5LPOP + \beta LEU6$ [4]

Mode 2: $LEFPC = \beta_0 + \beta_1 LRGDPPC + \beta 2LUBN + \beta 3LTO + \beta 4LPOP + \beta LEU5$ [5]

Where, EFPC is ecological footprint per-capita, environmental quality, which is the dependent variable, is proxied by the ecological footprint. It is basically the area of land and ocean (in hectares), that is needed to support a country's consumption. And RGDPPC is the real gross domestic product per capita at market prices, UBN is urbanization rate,is measured as a proportion of total population that stays in the urban areas and population were considered as controlled variables. TO is trade openness, trade intensity is calculated by dividing the sum of imports and exports by real GDP per capita, EU is energy use measured as kilogram of oil equivalent, POP is total population (in annual thousands). All variables are in US dollars.

Equation [4] is the conventional model for estimating the EKC, employing both income and square of income as exogenous variables. This model provides us with several possible functional forms of income environmental quality relationships. Wecompare β2and β1 in model 4 such that if$\beta 1 > 0$ and $\beta 2 < 0$, then we conclude that environmental Kuznets curve is applicable. Equation [5], however, is the alternative approach to evaluate the EKC relationships, as suggested by (19). In this model, the EKC relationship is evaluated by comparing short run and long run income elasticity are compared and if the long run coefficient is less than the short run, we conclude that the EKC is applicable (Narayan, 2010).

Table 3.1: Summary of Variables Descriptions and Priori Expectations

Variables	**Description**	**Expected Sign**
Dependent Variable		
Environmental Quality	Ecological footprint	
Independent Variables		
Population	TotalPopulation (in annual thousands)	Positive
Trade openness	Trade intensity (Sum of imports and exports divided by real GDP per capita)	Positive
Energy Use	Kilo gram of oil equivalent.	Positive
Urbanization	Proportion of population living in urban areas.	Positive
GDP Per Capita	Real GDP Per Capita	Positive
GDP per capitasquared	Real GDP Per Capita	Negative

3.4. Methods of Data Analysis and Estimation Techniques

In the econometrics model the methodology based on secondary data analysis and it employee ARDL model in the analysis. Because it uses for both non stationary and stationaryat I(0) integrated at level and I(1) integrated at first differencetime series as well as for time series with mixed order of integration.

Augmented Dickey–Fuller (ADF) Test

The study employed Augmented Dickey fuller Test (ADF) and Philip Perron test to check the variables are stationary or not. The ADF test is an improvement of the Dickey-Fuller test which assumes that the error term is uncorrelated. The ADF test addresses this shortcoming by correcting for autocorrelation. Given a variable X, then the equation of the ADF test is given as

$$\Delta X\, t = \beta_0 + \beta_1 t + \beta_2 X_{t-1} + \sum_{i=1}^{n} \alpha_i \Delta X_{t-i} + \varepsilon_t \qquad (6)$$

Where n is the optimal lag length, Xt is the number of lagged difference and εtis pure white noise error term. The Akaikeinformation criterion and Schwarz information is used to determine the optimal lag length. The null hypothesis under this test is that β2 is equal to zero, that is, the variable is non-stationary or there is a unit root.

When performing a regression analysis, non-stationary variables can result in erroneous and inconsistent results. To avoid this, the analysis in this study begins by looking for non-stationary or the presence of a unit root. Co-integration is defined as the presence of outcomes that are not false. The presence of co integration indicates that the variables have a long-term link. According to the co-integration theory, if the order of integration is one, that is, their series are stable at the first difference, there may be a co-integration relationship between ecological footprint, total population, trade openness, energy utilized, GDP per capita, and GDP per capita square.

Looking at the coefficient of the error correction term in the ARDL results can also reveal the presence of co-integration. There is co-integration if it is negative and significant. However, if there is no co-integration, the VAR model is advised.In this research, we employ the Autoregressive Distributed Lag (ARDL) framework, which was newly created and introduced by (Pesaran, 1998) Compared to its predecessors, this framework features a number of advantages. The first is that it looks for a short-term and long-term link between variables of interest without requiring the underlying explanatory variables to be purely integrated of order 0 (I(0)), integrated of order 1 (I(1)), or mutually co-integrated (Pesaran and Smith, 2001).

Second, unlike the traditional models mentioned above, the ARDL technique permits distinct variables to have varied amounts of optimal lags. Furthermore, if the data is accessible annually, the ARDL technique is more suitable for small sample sizes, typically for time series data of less than 80 years (Narayan and Smyth, 2009). The time span covered by our sample size is 38 years in our situation. ARDL pound test equation given as follow;

$$\Delta LnEFPt=\beta 0+\sum_{i=1}^{n} \beta 1i\Delta LnEFP_{t-1}+\sum_{i=0}^{n} \beta 2i\Delta GDP_{t-1}+\sum_{i=0}^{n} \beta 3i\Delta GDP2_{t-1}+\sum_{i=0}^{n} \beta 4i\Delta URt-1+\sum_{i=0}^{n} \beta 5i\Delta TO_{t-1}+\sum_{i=0}^{n} \beta 6i\Delta POPt-1+\sum_{i=0}^{n} \beta 7i\Delta EUt-1+\theta ECTt-1+\pi 1Ln EFPt-1+\pi 2LnGDPt-1+\pi 3Ln GDP2_{t-1}+\pi 4Ln URt-1+\pi 5Ln TOt-1+\pi 6LnPOPt-1+\pi 7LnEUt-1+Et$$

[7]

The parameter B is the short run coefficient; □is the long run multiplier in the ARDL model. Where; □is the speed of adjustment parameter and ECTt-1 is the error correction term with the lag. The lagged error-correction term measures the speed of adjustment of the endogenous variable when there is a shock in equilibrium. The coefficient of the lagged error correction term is expected to be negative and statistically significant. All the analysis in the study conducted using EVIEWS 10 version software. Post-estimation diagnostic tests such as, normality, heteroskedasticity tests are conducted to ensure the strength of the model. In addition, we also conduct the stability test, i.e., cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ), to confirm the model's stability.

4. Results and Discussions

4.1. Descriptive Statistics

This section presents empirical results and discussions in an effort to examine the applicability of the environmental Kuznets curve in Ethiopia. Before going to the econometric results appropriate diagnostic tests such as normality (Skewness and Kurtosis), unit root and others, have been performed.The table below indicated L-EFPPC and L-URB are skewed to the left (means that mean and median is greater than the mode and L-GDPPC, L-OPP, L-ENU and L-POP are skewed to the right (l.e mean and median less than the mode value). But, the degree of skewness of most variables approaches to zero and smaller.

Further, most of the variables have a kurtosis around to threerefers that standard normal distribution. Yet, L-URB and L-OPP have light tails since their kurtosis is 1.7 and 1.8 respectively. Looking at the mean and median, we can conclude that the data employed is not extremely skewed since the mean and median are almost approaches. This means the data is well behaved for regression. Skewed data would affect the reliability of the findings.

Table 4.1: Descriptive Statistics

Variable	Mean	Median	No	Max	Min	Sd	Kurtosis	Skewness
DPPC	281.53	224.63	39	772.31	111.93	186.35	4.1101	1.4663
L-GDPSQ	563.057	449.29	39	1544.62	223.86	372.698	4.11017	1.4664
L-OPP	0.3462	0.352	39	0.5587	0.1271	0.1225	1.8281	0.0279
L-EFPC	0.9935	1.010	39	1.090	0.790	0.0643	5.2080	-1.5203
L-ENU	481.959	478.90	39	496.120	472.510	6.9118	2.1988	0.6291
L-URB	4.7766	4.950	39	5.590	3.780	0.5182	1.6962	-0.3353
L-POP	669348	647513	39	1.09	351.4171		1.8803	0.2905

Source: Authors Computation from Time Series data, 2019

To this end two conventional unit root tests;(Fuller, 1979) and (Philips and Perron, 1988) test were employed for stationary because it corrects for autocorrelation (Gujirati, 2014). The Akaike Information Criterion and Schwarz information criterion is employed to obtain the optimum lag length for each variable before running the test. Results of the ADF test, PP test and AIC test statistic with and without trend at level and at first difference are presented in table 4.2 and 4.3 respectively.The result shows that in case of ADF, ecological foot print is stationary at level, whereas, the rest variables are become stationary at first difference at 5% significance level except population.

Table 4.2: Augmented Dickey Fuller Test for Stationary

Variable	ADF Test						Order of integration
	With intercept		Intercept and Trend		None		
	ADF Test statistics	Prob*	ADF Test statistics	Prob*	ADF Test statistics	Prob*	
L- EFPC	-2.1606	0.2234	-2.3217	0.4127	-2.2544*	0.0251	
D(L-EFPC)	-5.7498**	0.0000	-5.6902**	0.0002	-5.7945**	0.0000	I(1)
L- GDPPC	-0.3133	0.9133	-0.9997	0.9318	0.9045	0.8988	
D(L -GDPPC)	-3.5054**	0.0134	-3.8198**	0.0266	-3.3827**	0.0013	I(1)
L-OPN	-1.4612	0.5418	-0.7718	0.9595	-0.6435	0.4318	
D(L-OPN)	-4.7931**	0.0004	-4.8484**	0.0020	-4.8534**	0.0000	I(1)
L- ENU	0.4559	0.9828	-2.1344	0.5108	2.1182	0.9906	
D(L- ENU)	-6.0849**	0.0000	-6.3422**	0.0000	-5.5469	0.0000	I(1)
L-URB	-2.1857	0.2146	-2.3362	0.4053	0.5949	0.8405	
D(L- URB)	-4.2557**	0.0019	-4.1671**	0.0116	-4.3358**	0.0001	I(1)
L- POP	-2.7380	0.0783	-0.4048	0.9830	1.0480	0.9191	
D(L- POP)	-1.3751	0.5819	-3.1059	0.1221	-1.2562	0.1879	I(1)

Note; ‘D’ Means 1ST Difference , ‘*’ and‘**’denotes statistical significant at 1% and 5% level respectively

Source: Authors Computation from Time Series data, 2019

For our observation, a stationary test has been used to determine the order of integration of each variable. The Phillip Perron (PP) test for stationary has been applied as it corrects for serial correlation and heteroskedasticity in errors by modifying the Dicky Fuller test statics (Philips and Perron, 1988). So by applying this method, we have solved the problem in case of Dicky Fuller test that the variable has not been stationary.

The result shows that in case of PP test same variables such as EFPC and POP are stationary at level whereas, the rest variables are not stationary at level but, become stationary variables at their first difference at 5% significance level or less. Thus, we further note that log of ecological footprint per capita, log population are integrated of order zero since they are stationery at level. log real GDP per

capita, log trade intensity and log energy use are stationary at first difference and therefore, it is integrated of order1

Table 4. 3: Phillips-perron Test for stationary

Variable	ADF Test						Order of integration
	With intercept		Intercept and Trend		None		
	ADF Test statistics	Prob*	ADF Test statistics	Prob*	ADF Test statistics	Prob*	
L-EFPC	-1.8907	0.3330	-2.0455	0.5584	-2.0512*	0.0400	
D(L-EFPC)	-6.1009**	0.0000	-6.3360**	0.0000	-6.0182**	0.0000	I(1)
L- GDPPC	0.2157	0.9701	-05646	0.9755	1.2215	0.9405	
D(L- GDPPC)	-3.4467**	0.0155	-3.7613**	0.0304	-3.3168**	0.0015	I(1)
L-OPN	-1.2173	0.6569	-0.7718	0.9595	-0.6512	0.4285	
D(L- OPN)	-4.7500**	0.0005	-4.7812**	0.0024	-4.8154**	0.0000	I(1)
L-ENU	1.4911	0.9990	-1.8611	0.6547	2.9686	0.9989	
D(L- ENU)	-6.4175**	0.0000		0.0000	-5.5469**	0.0000	I(1)
L-URB	-2.5358	0.1153	-2.5543	0.3021	0.3919	0.7921	
D(L-URB)	-4.2165**	0.0021	-4.1671**	0.0116	-4.3008**	0.0001	I(1)
L-POP	-3.2596*	0.0241	0.0463	0.9955	29.1708	0.9999	
D(L-POP)	-4.8822**	0.0032	-5.8732**	0.0001	0.5419	0.4754	I(1)

Note; ‘D ‘Means 1ST Difference,‘*’ and‘**’denotes statistical significant at 1% and 5% level respectively

Source: Authors Computation from Time Series data, 2019

4.2. Econometric Results

Before we move on with co-integration analysis, we need to determine the optimal lag length to be used in the ARDL model. For this determination, we have deployed the AIC and SC information criteria. The results suggested the same model specifications, so we preferred to use the model a tlag one to order to avoid oversimplifying the model. Moreover, in order to test the impact of GDPP, GDPSQ, UR, TO, POP and EU on environmental quality which is proxied by ecological footprint per capita in Ethiopia, this study used Autoregressive Distributed Lag (ARDL) bounds test approach of (Pesaran and Smith, 2001).

The coefficient of the error correction term is negative and significant at 1% level of significance in the model (Table 4.4). The implication is that the short run shocks converge to a long run stable equilibrium at a speed of 0.98 percent. This further indicated the existence of long run relationship between environmental quality and explanatory variables such as energy use, GDP, trade openness, population, and urbanization. This is the alternative evidence for the existence of co integration among the variables under consideration. In addition, the results in model two from table4.4indicated that the coefficient of GDP in the long run is less in the short run as expected. But, it is not statically significant. Therefore, we focused on model one to interpret it. The effect of urbanization on ecological foot print

per capita is positive in the long run and statistically significant. A one percent increase in urbanization increases ecological foot print per capita by 0.25%. However, its effect is negative in the short run indeed, statically insignificant.

Trade openness is the third largest contributor to affect environmental quality with a coefficient of -0.092806 which is not as expected. This implies that a one percent increment in trade openness leads to a 0.09% decrease in ecological foot print in the long run. This finding supports (Wai and Mulali,2015) and (Al-Mulali, 2016) results. This result confirm the pollution haven hypothesis for Ethiopia because relatively low-income developing countries will be made dirty with trade due to the fact that pollution intensive manufacturing relocates from developed to developing countries where environmental regulations are assumed to be less strict. Under this situation developed countries create demand for environment protection. Trade liberalization leads to move more rapid growth of dirty industries from developed economies to developing world, thereby deteriorating environmental quality. The effect is however, positive in the short run where a one percent increase in trade openness increase ecological footprint per capita by 0.10%. This finding suggests that opening up allows countries to share information and green technologies, hence improving the environment over time.

In the long run, economic growth is the first largest contributor to ecological foot print per capita in Ethiopia, with a coefficient of -1237.784 which is not as priory expected. However, it is statistically significant at 1% level of significance. This indicates that a one percent increase in real GDP results in a 1237.8% decrease in ecological foot print per capita. Contrary, a square of GDP has a positive coefficient and which is not as priory expectation. This result implied that based on the (Narayan, 2010) approach, the applicability of the environmental Kuznets curve in Ethiopia cannot be confirmed which corroborates with the findings of (Lin, 2015), (Shahbaz, 2010) and (Wai and Al-Mulali, 2015) for lower middle income and low-income countries. They found out that the EKC is not applicable in Africa and therefore it's not a sound basis for environmental policy in the region. This means the country has not reached the turning point, means that still now we are pre-industrial economies. More than 80% of the Ethiopian population which is growing at a very rapid rate of about 3 percent annually depends on agriculture for their livelihood. This resulted in land degradation and main causes for increasing numbers of people to remain in poverty, suffer from shortage of food and deteriorating living conditions. Due to this fact the population has been cutting forests and vegetation to satisfy its increasing necessities of food and energy which results in environmental degradation.

Looking at the result of energy use, it is positive in the short run while it is negative in the long run however, statistically insignificant. The effect on population on ecological foot print per capita in the long run is positive however statistically in significant. Whereas, in the short run it is negative effect on ecological foot print per capita and statistically significant. Thus, a 1% increases in population decreases ecological footprints per capita by 2.44% which in line with the finding of (Nagdeve, 2007), that is rapid population growth has an impact on economic growth, energy consumption and environmental degradation in developing countries.

Table 4.6: Results of ARDL Models

Long run result				
Model 1			Model 2	
Variable	Coefficient	Std. Error	Coefficient	Std. Error
L_ENUPC	-1.719675	2.127827	1.121231	8.211256
L_GDPPC	-1237.784*	339.0257	0.074106	0.083052
L_GDPSQ	1237.778*	339.0413	-	-
L_OPPNE	-0.092806*	0.035702	0.140420	0.5187
L_POPUL	0.174605	0.081419	-0.277056	0.602431
L_URBAN	0.251270**	0.099935	0.273659	0.24892
ECM(-1)*	-0.989335*	0.104055	-0.692138*	0.063906

SHORT RUN RESULT				
Model 1			Model 2	
Variable	Coefficient	Std. Error	Coefficient	Std. Error
D(L_ENUPC)	2.440603	1.307996	2.905486	2.133983
D(L_GDPPC)	-628.4148*	168.3316	0.133462	0.063974
D(L_GDPSQ)	628.5013*	168.3301		
D(L_OPPNE)	0.103867*	0.045062	0.293593*	0.109742
D(L_POPUL)	-2.442638**	1.006497	-3.522190**	1.179281
D(L_URBAN)	-0.012696	0.089990	-144566	0.109229

Note: * = Significant at1%; **=Significant at 5%;

Source: Authors Computation from Time Series data, 2019

The post-diagnostic tests of our models indicated that there is no evidence of non-normality and heteroskedasticity in all cases. The variance of the residual in the regression models is constant, does not vary as the value of the predictor variable changes. In addition, test of the stability of the estimated models, the CUSUM and CUSUMSQ were employed and the results indicated that the estimated parameters in all cases were stable over the periods within the 5% critical bounds.

5. Conclusion and Recommendations

Today, the world is watching the technological advancements but on the other hand suffering the problem of environmental degradation due to different human activities in various forms. This includes rapid growth of population, excessive use of energy source that contaminates the environment and rapid urbanization and industrialization which is also contributing significantly to degrade our environment. The main objective of this paper is to examining the relevance of Environmental Kuznets Curve hypothesis in Ethiopia ranging from 1980 up to 2018 and to examine the impact of economic activities on the environment. This area motivates the authors because of deteriorating environmental quality. Primary data was collected from various sources to achieve the objectives. Unit root tests were conducted using

conventional ADF and PPtest methods. The result revealed that some variables are integrated at level, others are integrated at first difference and while some of them are integrated of mixed. For this reason, ARDL approach to co-integration was applied to establish the long-run relationship of the variables and to obtain the estimates for both long-run and short-run effects.

Diagnostic tests were also used to check the overall significance of the model and results showed that the model is overall significant. There was no Heteroskedasticity problem in the model and the model is normally distributed with joint hypothesis of skewness approach to zero and excess kurtosis being around to three. Stability of model is checked through CUSUM and CUSUM SQURES test which also showed significant result.

Results from the econometrics part revealed that both in short run and long run, GDP per-capita has a negative impact on the quality of the environment. Whereas, GDP per capita square was positively related to our interest variable and statistically significant at1% level of significant.This finding showed that no evidence for the validity of EKC hypothesis in Ethiopia. Therefore, increases real GDP per capita causes increase environmental degradation both in the short and long run. More specifically, in the short run a one percent increase in GDP per capita, GDP per capita square, and population affect the ecological foot print per capita by -628.4148, 628.5013, and -2.4426 % respectively. In the long run, a one percent increase in GDP per capita, GDP per capita square, trade openness and urbanizationaffect the ecological foot print per capita by -1237.784, 1237.778, and -0.0928%respectively.

Given that the Environmental Kuznets hypothesis is not valid for Ethiopia, then it means that it is not a sound basis of environmental policy of the country. Policy makers try to achieve all-inclusive economic growth and sustainable development simultaneously instead of expecting that growth will automatically lead to a better environment. A strong emphasis should be given to appropriate growth as this will help in reducing environmental degradation. Trade policy makers are encouraged to open up morein order to boost free flow of greener and cleaner technologies and prevent more polluted industry to the country. So we don't compromise our environmental standards so as to attract foreign direct investments. Moreover, research and development activities regarding environmental degradation which are important to achieve sustainable development are still remaining unbearable in Ethiopia. Therefore, to minimize the negative impact of environmental degradation, there is a need to implement environment taxes such as green tax.

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The impact of monetary policy shock on Ethiopian trade balance: Structural Vector Auto-Regressive Model, evidence from Ethiopia

By

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Abstract

In developed and developing countries including east Africa Ethiopia, trade balance is affected by monetary policy. Expansionary as well as contractionary monetary policies affects trade balance both positively and negatively. Therefore monetary policy shocks have great impact on trade balance, thus this paper amid to be examined the impact of monetary policy shock on Ethiopian trade balance. Trade balance is the most significant macroeconomic variable in every country due to its importance for economic growth and influenced by monetary policy shocks. It was inspected to identify the macro variables that affected trade balance. The researcher constructed a structural vector autoregressive model for a time series data from the period of 1980 up to 2020. The variables included under the study were money supply, government expenditure, real effective exchange rate, and inflation. For the testing of Stationarity of a time series data both ADF for without structural break and Zivot-Andrews for structural break were implemented. The impulse response result shows that money supply represents cyclical effect on trade balance and does not support j-curve effect theory while real effective exchange rate worsens trade balance in case of Contractionary monetary policy and improve in the expansionary monetary policy which also supports the j-curve theory. Generally expansionary monetary policy shock affects trade balance negatively while Contractionary monetary policy in the short run increases trade balance.

Keywords: Deficit, J-curve, monetary policy, surplus, and trade balance

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1. Introduction

Nations of the world involve in an international market to make trade relations with other countries (Devereux, 2013). The engagement of nations in the international trade is depending on the terms of trade advantage of their productions of goods and services (Nibret, 2018). Know particularly fiscal and monetary policy implication of macro activities are mandatory for macroeconomic stability and trade relation of countries (Metaket, 2014). Monetary policy plays a vital role for the administration of countries economy by adjusting money supply, interest rate, exchange rate, and to preserve trade balance (Monacelli, 2005).

Therefore, countries give attention to the existence of sound monetary policy laid a fertile ground to attract domestic and foreign investors (Thematic thinking, 2012). These policies are implemented through different tools, including the adjustment of the money supply, interest rate, purchase or sale of government securities, and changing the amount of cash circulating in the economy(Michele Lenza, Huw Pill, 2008). So that monetary policy determines the countries trade balance and economic growth. Then trade balance is most researchable area in macroeconomics.

Rachman (2018) settled that the monetary approach in the direction of trade balance and itemized that the balance of trade is really a monetary phenomenon. Currency devaluation has an influence on the balance of trade via its impact on the real money supply (Nnamdi, 2021). This means that, when there is currency devaluation, domestic prices increase and real money supply decline which will followed by lower imports (Ojeaga & Ogundipe, 2013). However, if devaluation of currency is followed by further increases in the nominal money supply, the initial disequilibrium will reconstruct and the positive effect of devaluation will be annulled. Then, according to the monetary theory of trade balance, devaluation leads to increment in trade balance of a nation via its demand channel by decreasing imports as long as the money supply remains unchanged (Acar, 2000). Therefore, the monetary policy has great influence on trade balance both in developed and developing countries including Africans specifically east African countries.

The monetary policy shock of trade balance in small European countries in France, Italy, and UK has a great impact. The monetary expansion leads a nominal exchange rate depreciation and appreciation of trade balance (Kim, 2001). The evidence from Indonesian also indicates that contractionary monetary policy worsened trade balance, and the commodity price takes a crucial source in explaining the trade balance fluctuations (Lestano, 2005).

The contractionary monetary policy and exchange rate appreciation shocks affect trade balance, evidence from South African countries. The shock of monetary policy worsens trade balance through imports than exports and finally contractionary monetary policy deteriorates trade balance (Ncube et al., 2013). Other empirical evidence that done in east Africa especially in Sudan's economy indicates that monetary policy shock is the case of exchange rate fluctuations, the increments of money supply leads to the decrement of interest and exchange rate. Finally the depreciation of exchange rate affects trade balance positively (Andersson, 2010).

When came to the empirical evidence of our country Ethiopia contractionary monetary policy and appreciation of exchange rate affects Ethiopian trade balance negatively, this disclosed that there is a long

run relationship between the variables which means trade balance with money supply and exchange rate. Money supply increase exchange rate decreases then imports of the country decrease exports improve therefore trade balance must be improve or surplus (Gzaw, 2021). Therefore, the monetary policy has great influence on Ethiopian trade balance both contractionary and expansionary monetary policy affects the variable trade balance in Ethiopia. Depreciation (appreciation) of the domestic currency against foreign currencies improves (deteriorates) the trade balance.

However, it worsens (improve) within the short run and generating the J-curve effects (Ncube et al., 2013). Know this paper came to investigate the impact of monetary policy shock on trade balance by constructing the structural vector auto-regressive model evidence from east Africa Ethiopia.

1.1. Statement of the problem

Trade balance is the most essential macroeconomic variable in every country due to its importance for economic growth, and it is the main component of balance of payment (Ali et al., 2015). Therefore, policymakers are interested on trade balance whether the country's trade balance is deficit or surplus and how to reduce the deficit because it is one component of measuring economic growth (Ilan, 2007).

Nizamani (2016) found that Contractionary as well as expansionary monetary policy affects the trade balance through expenditure switching rather than income channel.

Even if some literatures exit on monetary policy shocks, the monetary policy shock on Ethiopian trade balance is still a series problem and all the previous papers are not matched with monetary policy shock on trade balance in Ethiopia. Now a time monetary policy shocks on trade balance is a series problem because of the increment of inflation, the trade balance of the country is seriously affected, so this paper is completely different from all the previous papers. All the previous papers like (Abnet, 2014), Ncube et al.(2013), Nizamani (2016), and Lestano (2005) are yet recent as well as differ from one another. Now almost all the papers were made partial part of monetary policy (i.e., means Contractionary monetary policy impact on trade deficit, price and economic growth in case of Ethiopia as well as in other countries). However, my paper is absolutely different from the previous papers due to the following reasons.

First, the previous papers made the impact of Contractionary monetary policy shock only, but in this paper the researcher was investigated both the impact of expansionary and Contractionary monetary policy on Ethiopian trade balance. Second, the previous studies used only differencing methods for the non-stationary data become stationary methods of data transformation however, in this study's the researcher used both differencing and Hodrick and Prescott (HP) filter to investigate the best way of data transformation system.

Third, the previous papers used only US currency (single exchange rate) for imports and exports, but Ethiopia's trade relation with US is very small it is not more than 10%. Beyond this, Ethiopia has a trade relation with Asia, Europe and Africa(National Bank of Ethiopia, 2019). Therefore, used US currency as a benchmark is inappropriate, but this paper used real effective exchange rate to analysis trade balance of Ethiopia.

General objective

The general objective of this paper was to identified the impact of monetary policy shock on Ethiopian trade balance from the period of 1980 to 2020 and have the following specific objectives

 To identify the impact of expansionary monetary policy shock on Ethiopian trade balance

 To investigate the impact of Contractionary monetary policy shock on Ethiopian trade balance

 To investigate whether the monetary policy shock on Ethiopian trade balance support the J-curve effect.

2. Brief literature review

Policymakers today are taking the responsiveness of trade flows to relative price changes under consideration when to construct an exchange rate policy or a commercial policy (Bahmani-Oskooee & Kara, 2005). The sum of the elasticity's for the demand of imports and exports would want to be sufficiently larger than one so the supply and demand curves of the foreign exchange rate are elastic enough and depreciation will so create its potential to correct a balance of payment deficit. This can be the rationale why it's vital to calculate the important world price of the price elasticity's of demand for imports and exports (Salvatore et al., 2019).

2.1. Trade balance theory

Mundell et al. (2013) developed the monetary approach towards the balance of trade and stated that the balance of trade is essentially a monetary phenomenon. Currency devaluation has an impact on the balance of trade side. According to the monetary theory of trade balance, devaluation leads to improvement in trade balance of a nation via its demand channel by decreasing imports as long as the money supply remains unchanged (Fassil, 2017). According to the monetary theory

$$DM + F = M \quad \ldots\ldots(1)$$

Where M, DM and F indicates that the nation's total money supply, domestic components of the nation's monetary base and the foreign components of the nation's monetary base, respectively. This money supply equation can be written as

$$\Delta M - \Delta DM = \Delta HFA \quad \ldots\ldots(2)$$

The above equation states that the changes in the central bank's holding of foreign assets is equal to changes in the stock of high-power money minus the change in the domestic credit. The crucial point that understands from the above equation is that ΔHFA is the balance of payment. The domestic component of the nation's monetary base (DM) is the domestic credit created by the nation's monetary authority. Know the external balance is given by

$$M - X = FS - \Delta IR \quad \ldots\ldots(3)$$

But ΔIR is a change in international reserve and the same as ΔHFA. Thus, shows that import minus export is equal to foreign saving (FS) less than the change in international reserve (ΔIR). Therefore, the relationship between trade balance and monetary account can be written as follows from the equation 2 and 3

$(X-M) = (\Delta M-\Delta FS)$……(4)

This last equation or equation four showed that how the trade balances or external account and the monetary accounts are related and monetary theory of trade balance states that the change in domestic money supply is negatively related with trade balance of a country. This means excess stock of money supply will lead to an out flow of reserves (increases import) or a balance of trade deficit. It is clear from equation (4) that devaluation improves the trade balance of nation in line with the monetary theory. This implies that when the money market is in equilibrium, so does the balance of payments. Therefore, the nation's balance of payments surplus/deficit is a temporary and self-correcting phenomenon (Oladipupo, 2011).

2.2. Empirical literature

Koray & McMillin(2004)examined that the response of the exchange rate and the trade balance to monetary policy innovations for the US economy during the period 1973:01–1993:12. Exchange rate appreciations cause Contractionary monetary policy and correlated with a short-lived enhancement in the trade balance, which is then followed by deterioration, giving funding to the J-curve hypothesis.

Kim (2001)Investigated that the effect of monetary policy shocks of trade balance was examined in small open European countries in France, Italy and UK by used SVAR model with monthly time series a period from 1981:6 to 1996:12 for Italy, 1979:1 to 1996:12 for UK and 1976:9 to 1996:6 for France. A monetary expansion leads a nominal exchange rate depreciation and trade balance increase.

Authors name (year)	Methodology	Coverage	Key findings
Hooy (2008)	ARDL co-integration	Monthly data 1990-2008 Malaysia	Deprcaitation of domestic currency improve trade balance and supports J-curve effect theory
Nizamani (2016)	VECM	Pakistan	It has positive effect in the short and negative effect in the long run on trade balance
Lestano (2005)	SVAR	Monthly data 1980-2005 Indonesia	Contractionary monetary policy worsens trade balance
Xuan (2012)	SVAR	Yearly data 2003-2012 Vietnam	Monetary policy shock affects trade balance negatively
Haile (2008)	OLS	Annually data 1980-2003 Ethiopia	Devaluation of Ethiopian currency may not improve Ethiopian trade balance. The increased export after devaluation was not sufficient to overcome the increase in imports.
Yeshineh(2017)	ARDL	Annually data 1971-2011 Ethiopia	Money supply has strong effect than exchange rate on trade balance, and monetary policy negative impact on trade balance.

Yemataw Gizaw(2015)	ARDL	Annually data 1980-2013 Ethiopia	Monetary policy shock has negative effect on trade balance.
Fassil(2017)	VECM	Yearly data 1970-2014 Ethiopia	Birr devolution worsen trade balance in the short run, the reverse is true in the long run and J-curve theory hold in Ethiopia policy

In the above empirical literatures, the researchers used different methods or methodology of researches and they analyzed the impact of monetary policy shock on trade balance both in developing and developed countries. The results of the papers showed that the impact of monetary (specifically contractionary monetary) policy shock affect trade balance. But in this paper the impact of monetary policy shock on Ethiopian trade balance that means both expansionary and contractionary monetary policy were investigated.

3. Research Methodology

3.1 Methods and source of data

In this study secondary time series data was employed and collected from annually report as well as publication of national bank of Ethiopia (NBE) and burgle database. And also time series data employed for the analysis of monetary policy shocks on trade balance in Ethiopia from the period of 1980 up to 2020. The money supply, government expenditure, real effective exchange rate, and general inflation rate are mostly used variables in developing countries in order to analyze the effect of monetary policies shocks on trade balance. Based on this money supply, government expenditure, real effective exchange rate, and general inflation rate are very important and significant variables to analysis Ethiopian trade balance.

3.2 Methods of data analysis

Both the descriptive and econometric methods were employed to test and analyze the issue of the paper. Within the descriptive analysis statistical and time series properties such as means, standard deviations, and maximum, and minimum was discussed

3.3. Unit root tests

When working with time series data, it is always essential to make sure that all the variables included in the estimation process are stationary. The use of non-stationary series in econometric analysis generates spurious regressions. In normal circumstance, autoregressive based methods was implemented to test the null hypothesis that each series contains unit root against the alternative of stationary process(Diebold, 2019). Despite their widespread application, these tests have been shown to have low power to distinguish unit root processes from structural breaks. As a result, the researcher was used the method proposed by Zivot and Andrews Baum (2004) that accounts for possible break in intercept, slope or both. The potential break points are determined exogenously recursive estimation of test regressions

3.4. Structural VAR model and model specifications

The structural VAR model which introduced by sim (Kilian, 2013) becomes important to handle various issues and problems concerning the identification of the cotemporaneous and dynamic relationship between macroeconomic variable and the policy instrument. The structural shocks, by definition should be uncorrelated with one another. In line with this it is possible to provide a brief description of the SVAR model here with

$$BY_t = \beta + B_1 Y_{t-1} + B_2 Y_{t-2} + --- + B_p Y_{t-p} + \varepsilon_t ----------(1)$$

Where, B is $K \times K$ coefficient matrix of endogenous variable.

β are $k \times k$ vectors of fixed constant terms.

Y_t Is $K \times 1$ coefficient matrix of lagged endogenous variables, where $i = 1-------P$

ε_t Is $K \times 1$ vector of endogenous variables at a time t (k is number of variables)

Is vector of innovations which are uncorrelated each other, have constant variance, and zero mean, with the following properties. Matrix that described in equation is normalized across the main diagonal so that each equation in the SVAR system has a designed dependent variable. But the parameter estimation of the SVAR using OLS result will be inconsistent therefore; to solve this problem the researcher was written the SVAR model in to a reduced VAR model form. To obtain the reduced form multiplying both sides of equation by B^{-1} and we get the following VAR model.

$$B^{-1}BY_t = B^{-1}\beta + B^{-1}B_1 Y_{t-1} + B^{-1}B_2 Y_{t-2} + --- + B^{-1}B_p Y_{t-p} + B^{-1}\varepsilon_t -----(2)$$

$$Y_t = \alpha + A_1 Y_{t-1} + A_2 Y_{t-2} + --- + A_p Y_{t-p} + u_t --------(3)$$

$$Y_t = \alpha + A(L)Y_t + u_t ----------(4)$$

Where $\alpha = B^{-1}\beta$, $u_t = B^{-1}\varepsilon_t$ and

$A_i = B^{-1}B_i$, i=1, 2……p

u_t is the innovation corresponding to the reduced form and has zero mean with constant variance i.e., $u_t \sim (0, \delta)$ or $E(u_t) = 0$

Model specification

This section of the SVAR model using the above-described structural model equation (1) with lag operator becomes;

$$BY_t = \beta + B(L)Y_t + \varepsilon_t \text{----------(5)}$$

$$BY_t = \begin{pmatrix} 1 & \gamma_{12} & \gamma_{13} & \gamma_{14} & \gamma_{15} \\ \gamma_{21} & 1 & \gamma_{23} & \gamma_{24} & \gamma_{15} \\ \gamma_{31} & \gamma_{32} & 1 & \gamma_{34} & \gamma_{35} \\ \gamma_{41} & \gamma_{42} & \gamma_{43} & 1 & \gamma_{45} \\ \gamma_{51} & \gamma_{52} & \gamma_{53} & \gamma_{54} & 1 \end{pmatrix} \begin{pmatrix} MS_t \\ GE_t \\ REER_T \\ IR_t \\ TB_t \end{pmatrix}$$

$$B(LY_t) = \begin{pmatrix} a_{11}(L) & a_{12}(L) & a_{13}(L) & a_{14}(L) & a_{15}(L) \\ a_{21}(L) & a_{22}(L) & a_{23}(L) & a_{24}(L) & a_{25}(L) \\ a_{31}(L) & a_{32}(L) & a_{33}(L) & a_{34}(L) & a_{35}(L) \\ a_{41}(L) & a_{42}(L) & a_{43}(L) & a_{44}(L) & a_{45}(L) \\ a_{51}(L) & a_{52}(L) & a_{53}(L) & a_{54}(L) & a_{55}(L) \end{pmatrix} \quad \varepsilon_t = \begin{pmatrix} \varepsilon_t^{MS_t} \\ \varepsilon_t^{GE_t} \\ \varepsilon_t^{REER_t} \\ \varepsilon_t^{IR_t} \\ \varepsilon_t^{TB_t} \end{pmatrix} \text{and} \quad \beta = \begin{pmatrix} \gamma_{10} \\ \gamma_{20} \\ \gamma_{30} \\ \gamma_{40} \\ \gamma_{50} \end{pmatrix}$$

And

$L = 1, 2, ...P$, p is lag length and the variable MS, GE, REER, IR and TB represent money supply, government expenditure, real effective exchange rate, inflation rate and trade balance respectively at a period t. and also $\varepsilon_t^{MS_t}$, $\varepsilon_t^{GE_t}$, $\varepsilon_t^{REER_t}$, $\varepsilon_t^{IR_t}$ and $\varepsilon_t^{TB_t}$ money supply, government spending, real effective exchange rate, inflation rate, and trade balance shock respectively. And β contains fixed constant.

3.2. SVAR identification

The standard reduced vector autoregressive model is a symmetric simultaneous equation setup and can be expressed to the following.

In this study, there are five variables in the model, normalizations of the diagonal elements of B to be unity leaves $n \times (n-1)/2$ or 10 additional restrictions to be impose on the system. Hence based on economic theories, it is possible to imposed short run restriction on some of the elements of B to satisfy the necessary conditions of identifications.

According to the above restrictions imposed, the new matrix structure B becomes as follows;

$$Bu_t = \varepsilon_t \equiv \begin{pmatrix} 1 & 0 & 0 & 0 & 0 \\ \gamma_{21} & 1 & 0 & 0 & 0 \\ \gamma_{31} & \gamma_{32} & 1 & 0 & 0 \\ \gamma_{41} & \gamma_{42} & \gamma_{43} & 1 & 0 \\ \gamma_{51} & \gamma_{52} & \gamma_{53} & \gamma_{54} & 1 \end{pmatrix} \begin{pmatrix} \bigcup_t^{MS_t} \\ \bigcup_t^{GE_t} \\ \bigcup_t^{REER_t} \\ \bigcup_t^{IR_t} \\ \bigcup_t^{TB_t} \end{pmatrix} = \begin{pmatrix} \varepsilon_t^{MS_t} \\ \varepsilon_t^{GE_t} \\ \varepsilon_t^{REER_t} \\ \varepsilon^{IR_t} \\ \varepsilon_t^{TB_t} \end{pmatrix} \quad \text{---------- (6)}$$

Following Wray (2016) and desalegn(2014a) this paper must place the restrictions [1] on matrix B in order to do impulse response and forecast error variance decomposition analysis of SVAR framework. Theoretical guidance and empirical judgments could help formalize some kind of causal relationships among variables within the model which in turn facilitates the identification process.

In the Cholesky decomposition for the trade balance model shown in equation [6] money supply is assumed to be most exogenous and is ordered first. This is because in developing countries like Ethiopia money supply is the macro variables and it affects other variables in the system for equation [6], but should not respond readily to it other macroeconomic variables shock contemporaneously. Government expenditure (GE) is ordered second and suggests that government expenditure affects all variables coming to it in the model. But not reacts other variables on it. In developing countries government expenditure cannot remain isolate from the macroeconomic variables.

Similar ordering was used for real effective exchange rate (REER) and ordered third. It affects the remaining variables next to it but not affected by other variables coming after it. According to Abinet (2014) inflation rate (IR) does not affect real effective exchange rate contemporaneously but it affects real effective exchange rate and other macro variables through time lags, therefore inflation rate ordered fourth it is less exogenous variable it affects the coming variables only. The variable trade balance (TB) ordered last. It is the most endogenous variable and contemporaneously affected by all other variables coming before it of the above model.

3.3. Impulse response function and variance decomposition

3.3.1. Impulse response function

The impulse response function is derived and used to examine the dynamic response of the variables to various shocks with the SVAR system. A shock on the j^{th} variable not only affects the j^{th} variable rather it affects all endogenous variables through the dynamic (lag) structure of the VAR. The impulse response function derived from VMA traces the path of the response for the i^{th} variable over time following an innovation from the j^{th} variable.

The VMA representation of the above reduced from of VAR model is written as follows by first in lag operator from; equation four can be expressed as in terms of MA

$$\left(I-A(L)\right)Y_t=\alpha+u_t$$

$$Y_t = \mu + \delta(L)u_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (7)$$

Where $\mu=\left(I-A(L)\right)^{-1}\alpha$ and $\delta(L)=\left(I-A(L)\right)^{-1}$

From the reduced VAR moving average representation we can write structural moving average (SMA) substituting $u_t=B^{-1}\varepsilon_t$

$$Y_t = \mu + \delta(L)B^{-1}\varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (8)$$

Equation seven also written as the following forms

$$Y_t = \phi(L)\varepsilon_t = \phi_1\varepsilon_{t-1} + \phi_2\varepsilon_{t-2} + \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (9)$$

The element of matrix ϕ_t matrices generate the dynamic multiplier of impulse response of Y_t to the structural shock ε_t

3.3.2. Variance decompositions

Fundamentally the impulse response functions (IRFs) show the response of each concerned variable in the linear system to shock from system variable. But variance decomposition (VDCs) shows the portion of the variance in the forecast error for each variable due to innovations to all variables in the system. Forecast error variance decomposition for this study determine the proportion of the variability of the errors in forecasting MS, GE, REER, IR and TB at time t + s based on information available at time t that is due to variability in the structural shocks $\varepsilon^{MS},\varepsilon^{GS},\varepsilon^{REER},\varepsilon^{IR} and \varepsilon^{TB}$ between times t and t + s. The s period ahead forecast error expressed as;

$$Y_{t+s}=\mu+u_{t+s}+\delta_1 u_{t+s-1}+....+\delta_{s-1}u_{t+1}+\delta_s u_t+\delta_{s+1}u_{t-1}$$

The best linear forecast of Y_{t+s} based on information available at time t is

$Y_{t+s/t}=\mu+\delta_s u_t+\delta_{s+1}u_{t-1}$ And forecast error is written as follow

$$Y_{t+s} - Y_{t+\frac{s}{t}} = U_{t+s} + \delta_1 U_{t+s-1} + \ldots + \delta_{s-1} U_{t+1} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (10)$$

The forecast error in terms of structural shock is representing by

$$u_t = B^{-1}\varepsilon_t \;,\; \phi(L) = \delta(L)A^{-1}$$

$$Y_{t+s} - Y_{t+\frac{s}{t}} = \phi_0\varepsilon_{t+s} + \phi_1\varepsilon_{t+s-1} + \cdots + \phi_{s-1}\varepsilon_{t+1} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (11)$$

4. RESULT AND DISCUSSIONS

4.1. Descriptive results

The descriptive statistics of the variable money supply have 1627325 birr and 2053 birrs relative higher and lower value respectively. While the government expenditure has 238157 birr and 1462 birr larger and smaller value respectively. Real effective exchange rate revealed considerable appreciation until 1992 relatively and followed by substantial depreciation in some period and fluctuate in recent year (increase indicate appreciation). Real effective exchange rate has 356.76 higher appreciations and 39.91 relatively lower depreciation.

General inflation rate had been increasing consistently with a maximum of 55.2% from general inflation rate of 2.400% over time. The variable trade balance is strictly decreasing for most recent decades from a large value of (-532725) birr to the smallest value of birr (-349819923) the standard deviation of trade balance, money supply, and government expenditure are high as compared to real effective exchange rate and general inflation rate.

Table 4.1 descriptive statistics or analysis

	MS	GE	REER	IR	TB
Minimum	2053	1462	39.91	11.800	-349819923
1stQU	6708	3419	78.38	2.400	-82840966
Median	22178	10533	130.75	7.400	-8064744
Mean	151637	33559	157.98	9.402	-68603082
3rd QU	104432	27176	243.38	14.800	-1501009
Maximum	1627325	238157	356.76	55.200	-532725
Std .Dev	313907.2	58137.79	98.66143	13.15309	118759089
Skewness	3.155864	2.327126	0.608941	1.515154	-1.401122
Kurtosis	13.74072	7.464278	2.187035	6.258232	3.346402
Observations	41	41	41	41	41

Sources own computations 2021

4.2. Stationarity tests

The result of ADF tests indicated that the null hypothesis that the series in level contains unit root could be fail to accept for all the series except real effective exchange rate and trade balance.

As it evident the real effective exchange rate and trade balance tests is fail to reject the null hypothesis a unit root in time series data at 5% level of significant, implying that this variable is non-stationary by ADF tests.

Table 4.2. ADF unit root tests

Variable	ADF tests	
	With intercept	With trend
In level		
MS	10.1747**	10.6581**
GE	4.0667**	3.4129**
IR	-4.3661**	-4.763**
First difference		
ΔREER	-3.7453**	-3.6659**
ΔTB	-3.1997**	-4.3983**
critical value at 5%	-2.93	-3.50

Source(s) own computations 2021

The Zivot-Andrews unit root test results where the test accounts for potential structural breaks in each time series variables. The real effective exchange rate and general inflation rate are definitely stationary at level under the three cases, while money supply is found second difference stationary. The remaining variable's government expenditure and trade balance are difference stationary.

Table 4.3. Unit root ziovt-Andrews unit root tests

Variables	Zivot and Andrews unit root tests			Break point
	Intercept	Trend	Both intercept and trend	
At level				
REER	-7,5564**	-3.9452	-7.2371**	1992
IR	-6.3822**	-5.8493**	-6.6088**	2008
First difference				
ΔGE	-7.1951**	-8.1422**	-7.9587**	2012
ΔTB	-5.9367**	-5.4463**	-7.2621**	2003
Second difference				
ΔΔMS	-13.3348**	-9.8805**	-9.2403**	2014
Critical value at 5%	-4.8	-4.42	-5,08	

Source(s) own computations 2021

The result of ADF unit root tests strictly contradicts with the results of Zivot Andrews tests except inflation rate and trade balance. Then in the presence of structural break in time series data Zivot Andrews is a good testing method for differentiating the unit root. Know all variables in the model do not have the same level of integration, and then the possibility of long run relationship will not be considered here.

4.3. Lag length determination

Lag length determination is a vital issue in modeling VAR since choosing incorrect length has strong implication for following modeling choice. This study chose or used three optimal lag length based on the results suggested by the Akaike information criteria (AIC) and (HQ). Therefore the optimal lag length of this paper is three which satisfies all diagnostic tests.

4.4. SVAR model estimation

The contemporaneous matrix B defined in section3 is estimated using the set of restrictions given equation 2. Since the SVAR estimation result are presented on appendix-1 shows the signs of coefficients are consistent to theoretical relationship among variables.

4.4. Post-estimation Diagnostic tests

After running VAR model, there are some diagnostic tests which are vital for ensuring that the result obtained from VAR estimation can be used for forecasting or policy analysis. Important post-estimation tests which are mostly performed on the residual of VAR model are portmanteau tests for residual serial correlation tests, ARCH for Hetroscedasticity, Jarque Berea test for residual multivariate normality and model stability tests.

The null hypothesis of normality in Skewness, homoscedasticity and absence of serial correlation are accepted at optimal lag length three. The estimated probability values are larger than the standard probability critical value of 0.05. Since the model is stable and has no serial correlation see appendix-2, it is possible to proceed impulse response and variance decomposing to investigate the impact of monetary policy shock on Ethiopian trade balance.

4.5. Impulse response functions and variance decomposition

4.5.1. Impulse response functions

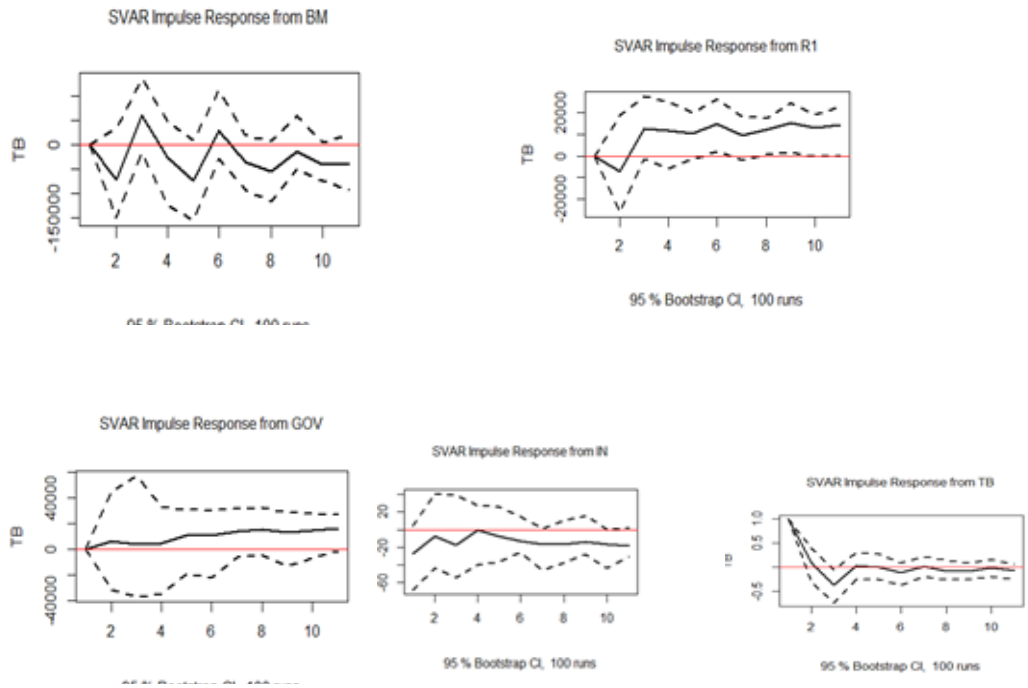
Fig 4.1 shows that the effect of broad money supply on trade balance is not uniform. On the impact the effect of broad money supply on trade balance is zero. After the third horizon period the effect of broad money supply on trade balance is negative and it shows cyclical effects. Know the relationship between broad money supply and trade balance is negative averagically (see fig 4.1). This negative effect of money supply is consistent with Contractionary monetary policy theory which supports the findings of (Kimbrough, 2004).

The effect of government expenditure on trade balance is uniform. The relationship between government expenditure and trade balance is positive. This might be because the larger part of the government

expenditure was channeled to subsidizing the manufacturing sector to produce cheap goods hence the effect were improving net-exports and discouraging imports which supports the findings of (Tatenda., 2013)(see fig 4.1).

The effect of real effective exchange rate on trade balance is relatively uniform. From on the impact to two horizon periods, one standard deviation increase(increase indicates appreciation) in real effective exchange rate decrease trade balance by about 0.2 unit, which means in the short run real effective exchange appreciation worsen trade balance is Contractionary monetary policy. Generally real effective exchange rate in the short run indicate Contractionary monetary policy, while in the long run indicate expansionary monetary policy which supports the j-curve effects and the findings of (Soyoung, 2001) (see fig 4.1).

Fig 4.1 Impulse response graph



Source own computation 2021

4.6. Forecast error variance decomposition (FEVD) analysis

The forecast error variance decomposition (FEVD)is the percentage of the variance of the error made in forecasting the variable (Watson, 2007). In the first horizon period the broad money supply accounts 16.02% forecast variability of trade balance. Real effective exchange rate accounts 4.38% forecast error variability of trade balance and also inflation rate have a great contribution in the first period which accounts 72.33% the forecast variability of trade balance. In the second and third horizon period, broad money supply have more than 98% and 97% forecast error variability of trade balance while government expenditure and real effective exchange rate constitute the remaining 2% and 3%. Broad money supply

play significant roles for forecast error variability of trade balance across a period, while the contribution of inflation rate is negligible (see table 4.1). This finding is consistent with the impulse response analysis.

Table 4.4 Forecast error variance decomposition (FEVD) of trade balance

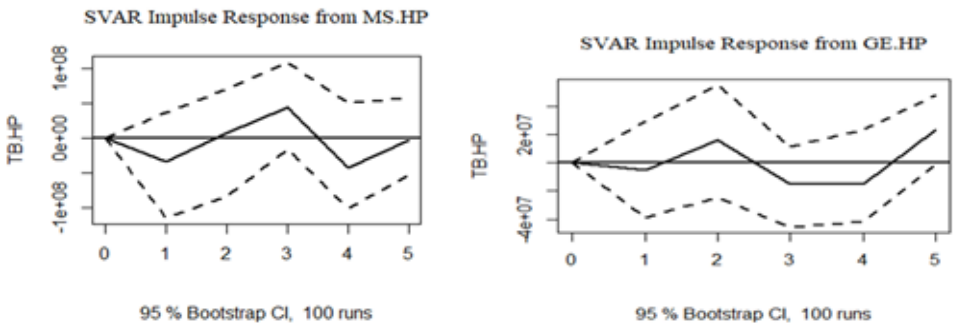
Horizon period	BM	GOV	REER	IN	TB
[1,]	0.1602442	0.043775064	0.071688290	7.233075e-01	9.848825e-04
[2,]	0.9833037	0.006748912	0.009947244	1.494767e-07	1.904745e-10
[3,]	0.9709500	0.005753865	0.023296050	1.196032e-07	1.248915e-10
[4,]	0.9577869	0.007204884	0.035008149	1.099895e-07	1.148995e-10
[5,]	0.9588618	0.011633428	0.029504723	7.353628e-08	7.332344e-11
[6,]	0.9413331	0.018026384	0.040640452	7.897067e-08	6.926034e-11
[7,]	0.9306276	0.027004390	0.042367945	8.777427e-08	6.328543e-11
[8,]	0.9232264	0.034043378	0.042730164	8.724102e-08	5.383453e-11
[9,]	0.9069430	0.040887746	0.052169165	9.407150e-08	5.273333e-11
[10,]	0.8991538	0.046186765	0.054659322	9.753887e-08	4.817829e-11

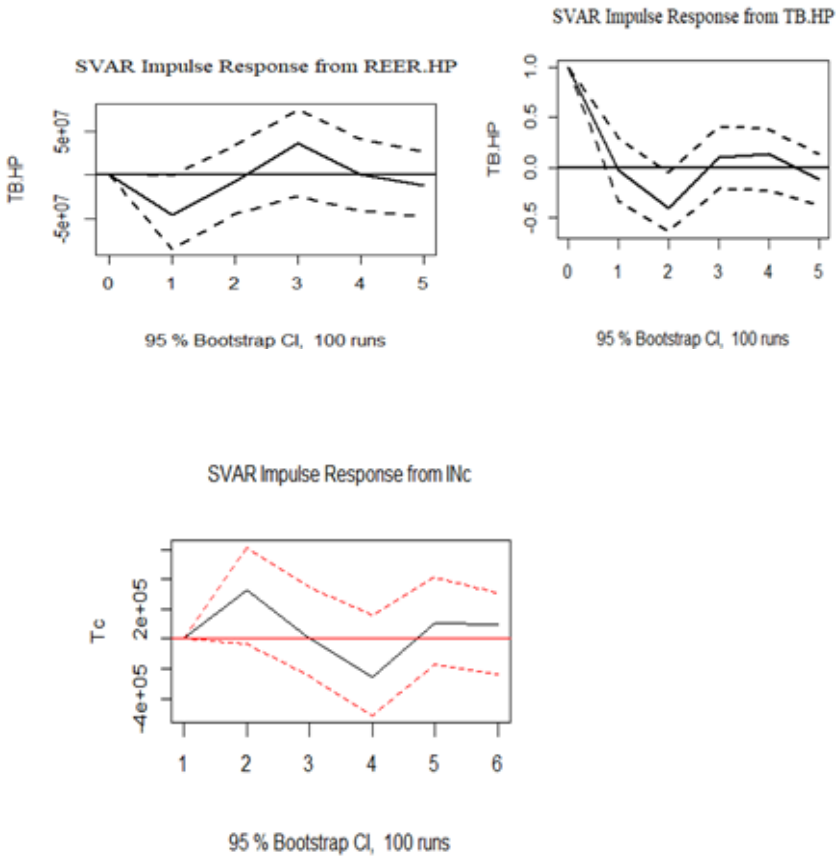
Source(s) own computations 2021

4. Hodrick and Prescott (HP) filter result

The alternative data transformation results with stationary processes are extracted from the cyclical component of the original series using hodrick Prescott filtering method. The alternative data transformation method or HP filter have similar result with stationary graph of baseline result, while the impulse response result of HP filter little difference with the baseline result both in magnitude and time horizon period. Generally the results shows that the slight difference between baseline result and HP filter both in the different stationary and impulse response graphs. The major implication of this particular observation is that macroeconomics business cycle studies that rely on different data filtering techniques and econometric results that exploit difference data could produce obvious difference in the strength of shock transmission on some endogenous variables.

Fig 4.2.1 HP filter graphs





4. Structural break results analysis

The results of Zivot-andrews tests suggest that each variable's in the data have breaks. The year 1992 is a year that the first break was happened. The result shows that one of the five series studied (real effective exchange rate) witness to the presence of a structural break in 1992; this year was the ending of the Drug regime and also the transitional government. Based on the Zivot-andrews result the first break was 1992 at REER, the next second break was 2003 at trade balance, third break was existed in 2008 at inflation rate, fourth in 2012 at government expenditure, and finally in 2014 at broad money supply. Therefore, each data have breaks with independent of each other.

If a time series data have breaks two types of dummy preparing is mandatory in order to incorporate the break time in the estimations (Waheed et al., 2006). The first one is coded one at the break time or year and otherwise zero, the second grouped the data into two groups which means coded one from the first time break up to the end and zero from the first break back to the starting time (Pfaff, 2009). The potential break point can also be located exogenously by the researcher (Perron, 1997).

Know in both causes which means case one coded one at break time and case two coded one after the first break the estimations results doesn't have any difference from the baseline results. In the estimation process the (t and p)-values of each variables included in the model are greater than 1.6 and less than 0.05 respectively which means significant these variables have a great influence on the result of the

studies. But in this study the estimation value of each exogenous variables that coded by the researcher are the t-value less than 1.6 and also the p-value is greater than 0.05, in short all exogenous variables are insignificant. Therefore the result is not different from the baseline estimations result.

5. Conclusion and recommendations

5.1. Conclusion

In this paper structural vector auto-regressive model was applied to annual time series data to study the impact of monetary policy shock on Ethiopian trade balance for the period 1980-2020. Both the impulse response and forecast error variance decomposition results confirm money supply and real effective exchange rate exerts the strongest influence on trade balance. In addition, own shock as well as inflation rate shocks are negligible.

Generally money supply affects trade balance negative, the increment of money supply which means an expansionary monetary policy have negative effect on trade balance and don't supports the j-curve effect theory hypothesis. While real effective exchange rate affects trade balance negatively in the short run and positively in the long run and also supports the j-curve hypothesis Contractionary monetary policy theory affects trade balance negatively in the short run and positively in the long run. These findings suggest the importance of paying consideration attention to money supply and real effective exchange rate in order to maintaining healthy trade balance consistence with the goals of monetary policy of Ethiopia.

In this study the alternative data transformation method HP filters, filter the data in to trend and cyclical components instead of doing difference stationary for non-stationary data. The results of this alternative data transformation method of HP filter have slight difference with the baseline or difference stationary result. The inclusion of exogenous structural break time in the model doesn't give different results from the baseline result.

5.2. RECOMMENDATIONS

Based on the empirical findings the researcher has drawn the following recommendations.

 As the finding indicate that in the short as well as long term the variability of trade balance output were more explained due to the shock to money supply, therefore the NBE should ensure that the balance of money supply in the market.

 Based on the evidence of the empirical finding real effective exchange rate have the second contribution for explained the variability of trade balance, therefore NBE should pay a great attention to depreciate in order to improve trade balance.

 As the finding indicate that the alternative data transformation method HP filter result different from the baseline result, therefore the NBE should be decide its own diction about the difference between the econometrics difference stationary result and the macroeconomic studies filter the data into trend and cyclical parts and cyclical estimation result.

Further studies should be needed to identify different the appropriate data transformation methods,

whether the econometrics based difference stationary or HP filter.

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Analysis of Urban Solid Waste Management Practices and Determinants

By

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Abstract

Environmental quality can be maintained in urban areas by improving solid waste disposal practices. This research was carried out with the aim of ensuring environmental quality by assessing the solid waste discharge practices of households and identifying the most significant variables of willingness to pay for urban solid waste management. The research was carried out applying the contingent valuation method to estimate cost recovery, logistic regression to determine powerful variables that affect willingness to pay, and descriptive statistics to reveal the household waste disposal practices. The result revealed that most households have a poor culture of discarding the collected waste. Although households have the willingness to pay for the improvement scheme; educational background, income, environmental awareness, age, marital status, and sex of the households are significant variables affecting willingness to pay for improved solid waste management. 70,537.30 USD can be saved if there is improvement in waste discharging.

Keywords: Environmental quality; logistic regression; Mizan-Aman; waste disposal; Willingness to pay.

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INTRODUCTION

An increasing amount of solid waste is generated as a result of the rapid rate of urbanization and economic growth. This, in turn, presents greater difficulties for waste disposal. The problem is more acute in developing countries where the pace of urbanization is faster. Urbanization introduces society to a new and modern way of life, an improved level of awareness, new skills, a learning process, and so on. With increased urbanization, mainly due to the increase in population growth and rapid economic expansion, there is a growing interest in waste management; one of which is solid waste management in urban areas. The management of solid waste involves storage at the source, collection, transportation, and final disposal of the refuse. The sources of these wastes are generators of solid wastes by industry, by households at home, along the streets by individuals, public, and private institutions (Lemma, 2007). It is important to study the interest of local communities, especially households, to contribute to improving solid waste management. In this regard, various researchers conducted research in different parts of the world to identify and analyze the determinants of household contribution or WTP to improve solid waste management in their respective countries. Some of the most important works are: Roy et al. (2013), Anjum (2013), Khattak and Amin (2013), Alhassan and Mohammed (2013), Ojo et al. (2015), Joel et al. (2014), Mary and Adelayo (2014), Adebo and Ajewole (2012), Adewuyi and Oyekale (2013), and Niringiye and Omortor (2010). In Ethiopia, there are also some studies on the determinants of WTP for improved solid waste management; Dagnew et al. (2013), Tewodros and Samson (2009) and Galgalo et al. (2012). From these studies, it is controversial whether which variable has an impact on the WTP of households to improve the solid waste management system. As demographic, social, economic, and environmental factors change, solid waste generation and management changes; this, in turn, affects the WTP of households for waste management.

Thousands of tons of solid waste are generated daily in Africa. Most of it ends up in open dumps and wetlands, contaminating surface and groundwater and posing major health hazards. Generation rates, available only for select cities and regions, are approximately 0.5 kilograms per person per day, in some cases reaching as high as 0.8 kilograms per person per day. Although this may seem modest compared to the 1–2 kg per person per day generated in developed countries, most waste in Africa is not collected by municipal collection systems due to poor management, fiscal irresponsibility or malfeasance, equipment failure, or inadequate waste management budgets. The separation and treatment of organic waste is very rare. Municipal composting programs exist in some South African cities, but the few large-scale composting facilities built elsewhere are no longer operating. Global concern about environmental impacts has no boundaries.

In Ethiopia, as an example, Bamlaku et al. (2019) argues that complications of waste management cover not only effects of the management approach itself, but also the mechanism within the system, such as those effects derived from transportation activities to final disposal sites from households or transfer stations. Waste management is a growing public concern in Ethiopia. In many cities of the country, waste management is poor and solid wastes are dumped along roadsides and into open areas, endangering health and attracting vermin (Tewedross et al., 2008). In Ethiopia, like in developing countries, the increase in solid waste generation is due to rapid urbanization and booming population. According to Lemma (2007), the amount of solid waste in Addis Ababa and other areas of the country that are growing rapidly have increased over time, largely attributed to the rapid growth rate of the population. The same authors indicated that of the total solid waste released by the population of the city, approximately 50-60

% were collected and the rest were unattended. Recently, the municipality has increased its coverage to about 85%.

In terms of the study area, the municipality of Mizan-Aman is responsible for disposing of urban solid waste discharged to the highways and the surrounding areas from different sources. For this purpose, the municipality establishes a business process owner mainly responsible for the management of solid wastes called urban cleaning & beautification department, and currently there are about five associations with a total member of 15 engaged in collecting the solid wastes dispensed by different bodies under the supervision of the core business process owner. They are responsible for collecting solid waste dumped in different parts of the town from about 9,610 households and the nearby community. There is a Sino track at the municipal level that transports the waste collected by the associations to the final destination called Gewaka a place 10 km far from Mizan Aman town. In a town where solid waste recycling and reuse is poorly practiced, such as the city of Mizan-Aman, good disposal practices are best treated. However, in a city where there is low budget for waste management practices and low habit for waste management, households mainly dispose their wastes in communal areas and to some extent burn, which is partly the cause of poor environmental quality. The practice of poor solid waste management in Mizan-Aman town could be manifested in; there are piles of rotting vegetables and other organic waste around the streets, river banks, and market areas. Files and rodents feed and breed in the piles. The raw and cooked foods displayed on the market are swarmed with files. Children play and scavenge among the rotting waste. Most of the time, refuses are scattered by dogs, goats, birds, and vultures. During rain storms, the debris is carried to water sources with the runoff. Residents of rural areas use such polluted water.

The practice of poor solid waste disposal is attributed to various reasons. Among the major factors responsible for this is the inadequate and/or complete absence of a public waste collection service. The problem arises from lack of identified disposal sites, lack of containers in different places, complete absence of waste collection by local authorities, and so on. The reason for lacking waste collection services is attributable to the fact that solid waste management is generally a public good that cannot be optimally provided under the market conditions (by private) since the service is characterized by non-competing consumption and non-excludability. In such kinds of goods, economists try to apply implicit market mechanisms that allow us to estimate the economic value of these non-marketable (environmental) goods simply by directly asking the willingness of the household to pay using a different mechanism if the services are to be provided.

According to the study by Awomeso et al. (2010), in developing urban areas massive waste generally consists of domestic garbage, organic litter, plant leaves, branches, logs, spoiled agricultural produce, crop residues, bad food materials, pieces of paper, polythene bags, rags, vehicle scraps, used tires, dusts, mire, plastics, glass, blood, bones, animal skins, hides, leather, urinary and fecal materials. When these wastes are improperly disposed-which is generally the case-they constitute threat to air, water, land, vegetable, wildlife, and man. Sickness and disease epidemics often occur when sewage, garbage waste, and unwanted substances are not properly disposed of and well managed. In developing nations, waste is characterized by vegetative matter (60%), tins and cans (<10%), metals (<10%), polythene, wood, and termites, among others. Fortunately, waste in the city is the remains of fruits, chats and other types of fund pollutants that can easily be converted to soil and non- polluting particles and at the same time cause serious health problems if not collected on time.

However, in the town of Mizan-Aman, observed from the storage site, waste is stored at its source for a long period of time. Uncontained generation and disposal of solid waste coupled with poor collection services pose a great threat to environmental quality and human health. Despite this, studies in the city of Mizan Aman that attempted to consider the demand of households for more and improved solid waste collection services are to our knowledge nonexistent. This article aims to fill this gap by attempting to estimate the willingness of households to pay for improved solid waste collection and disposal services. It is; therefore, aimed at making a significant contribution to analyze the household demand for more and better solid waste collection and disposal services and elicit the willingness to pay for obtaining the services. Although the municipality is trying to dispose of the solid waste to the nearby waste sink, there are many issues to consider for the overall cleaning and beautification of the town. Because improper solid waste management results in multiple problems, such as the closing of ditches, health problems and others due to suffocation, pollution and overcrowding of roads. The objective of the study is to estimate the monetary value of the willingness to pay for improved solid waste management. The study was carried out in the town of Mizan Aman, the town of Benchi Maji Zonal Administration in 2018.

The CVM was selected for the analysis. Compared with other economic techniques, it is considered very flexible and adaptable to some valuation tasks that alternative economic valuation techniques cannot handle. It is one of the most widely used and generally acceptable techniques for estimating the total economic value of many classes of public goods and services that other economic techniques cannot accommodate. Its results are relatively easy to interpret and to use for policy purposes (Fonta, et al 2008).

MATERIALS AND METHODS

Study Area

Mizan –Aman is the capital of the Bench-Maji Zone, one of the administrative zones in the Regional State of the South Nation and Nationalities in Ethiopia. The town is located 561 km from the country's capital Addis Ababa and 833 km from the region's capital Hawasa. The annual average temperature of the city ranges from 15 ° C in the coldest month (August) to 27 ° C in the hottest month (April). Average annual rainfall ranges between 1935 and 1935 mm. The city of Mizan-Aman has an altitude of 1000 -1500 meters above mean sea level. The projected population of the city based on the 2007 national census is 48,706 of which 26,052(53.5%) are men and 22,886 women (CSA, 2007).

Data Sources

The study relied mainly on primary data (questionnaires and interviews) surveyed from residents of the town of Mizan-Aman and direct personal observation. An interview was conducted for the town administrator to have general information about current solid waste management practices and associated problems, coverage, and the designed project. For survey questionnaires, the sampling frame (population) was the lists of all households in the city living for a year and more, and the sampling unit in the household survey was the household. The data consisted of socioeconomic conditions in households, respondents' awareness of the current situation with urban solid waste management availability of the town, problems, proposed improvement scheme and about respondents' WTP. In addition to the primary data survey, secondary data was also used to consolidate it.

Method of data collection, sample technique, and sample size

Data were collected for the contingent valuation technique to estimate the willingness to pay for solid waste management. The contingent valuation methods elicit consumer preferences and, therefore, the WTP. Despite a variety of validity and measurement issues Carson & Haneman (2006), the application of contingent valuation (CV) surveys are argued to be a viable method of collecting information on preferences for providing public goods and services in developing countries. There are numerous formats of elicitation questions; payment card, dichotomous choice, open-ended format, and stated choice experiments. These different formats, each with its own advantages and drawbacks, have been shown to yield statistically different responses (Welsh and Poe 1998; Brown et al. 1996). In this study, the researcher used a dichotomous choice that is pertinent to research objectives. The town of Mizan – Aman has five kebeles and 9610 households. The researcher used a stratified sampling technique based on kebeles to determine the total number of households to be surveyed. To determine the number of households that will be selected from each kebeles, proportionate random sampling was used. Since the dependent variable is a binary choice that uses the logistic regression sample size is determined based up on the formula n=N/(1+□Ne□^2) at 5% level of significance, the researcher determined household sample size to be 384 from all kebeles. According to Kothari (2006), the sample size should be determined by a researcher keeping in view the following key points: nature of units, size of the population, size of questionnaire, finance, availability of trained investigators, the conditions under which the sample is being conducted, the time available for completion of the study, etc.

Data collection instruments

The next chapter of the process was the collection of data from 384 randomly selected household respondents. The basic data collection instruments used in the data collection procedure were questionnaire, key informant interview, and focus group discussion.

The instrument was developed taking two alternative scenarios: the current scenario considers the existing solid waste management practices and the alternative one is by taking a hypothetical solid waste management improvement scheme to be adopted for a better waste discarding mechanism in the town.

Questionnaire: a household survey questionnaire was prepared and data collected from 384 sample respondents through 5 data enumerators. Here, the data enumerators were trained on how to collect the data briefing from the household survey questionnaires.

Key informant interview: To support and triangulate the household survey questionnaire, the researcher had conducted key informant assumed to give detail information about the issue under study.

Focus group discussion: A detailed discussion has been held with different community members to capture issues that may not be addressed through the household survey questionnaire and the key informant interview.

Method of data analysis

The method of data analysis of the collected data rely mainly on descriptive statistics tools like mean, percentage, tabulation, and graphing followed by interpretation and verbal explanation.

To determine the determinants of household WTP, an Econometric model was used. Data collected from 362 households were used in the analysis, where twenty-two were dropped due to invalid responses and refusal.

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The Econometric Model

How can we measure the welfare impact on a household if the quality of a public service increases or a new public service is introduced? If the existing quality level of the service, for example, waste management services, is given by q_0, then the improvement in waste management services from q_0 to q_i with no associated price changes produces a welfare gain of Eq. 1.

$$CV = E(P, q_0, U_0, Q) - E((P, q_i, U_0, Q) \quad (1)$$

Where, CV is the compensating variation that provides the true measure of the welfare effect of the waste management services that are being evaluated; p is the vector of prices for the marketed goods; q_i is the environmental quality being changed; U0 is the initial level or status quo of the utility to which the respondent is assumed to be entitled; Q is the vector of other public goods that are assumed not to change. E represents the consumer's expenditure function, and E(P, q0, U0, Q) represents initial income of respondents (Y0).The CV is the amount of money the consumer is willing to pay to see the service's quality improve from q0 to qi and is exactly the measure that the contingent valuation method aims to obtain from the respondents to the household survey. Let Yi is the level of income that solves for U0, given p, qi and Q, the value of the second expenditure function. Now, we can define WTP as the difference between Y0 and Yi. The Willing condition states that the equation can equivalently be expressed as an income compensation function. If WTP is the desired benefit measure, then the WTP function is used by Eq. 2.

$$WTP (qi) = f(P, q0, U0, Q) \quad (2)$$

Where q0 is now the baseline level of the public good of interest (waste management services, in this case). This equation forms the basis for estimating a valuation function that depicts the monetary value of a change in economic welfare that occurs for any change in qi (Freeman et al 2003). In this study, contingent valuation is widely used to estimate the benefits of improved waste management services.

Following equation two, it is necessary to identify the dependent variable and the independent variables incorporated in the study along with the expected sign of the coefficients a priori. These are discussed below.

Dependent Variable: willingness to pay (WTP) assumes the values 1 and 0 for yes and no responses

to the improvement program of solid waste management, respectively. Willingness to pay for waste management services from respondents will be obtained from single-bounded dichotomous followed by open ended questioner survey.

Independent variables

Income (Y): is a continuous variable in the literature on environmental economics that has a positive relationship with the demand for improvement in environmental quality. Therefore, we expect income to affect willingness to pay and its amount positively and significantly.

Sex (S): is a dummy variable that takes the value of 1 if the respondent is female; 0 otherwise. This study expects that women are more willing to pay for waste management than men, as traditionally it is the role of women to clean the house and dispose of waste.

The weekly generation of solid waste (HW) by households measured in sacks is expected to have a positive relationship with the amount of money households are willing to pay.

Age of the respondent (A): is a continuous variable expected to negatively affect willingness to pay for waste management. This is because old people may consider waste collection as a government responsibility and could be less willing to pay for it. The younger generation might be more familiar with cost sharing like for education and could be more willing to pay.

The level of education of the respondent (E): is taken to capture the level of understanding of the respondent about the desirability of proper management of solid waste. It is hypothesized that the higher the level of education, the more the respondent would appreciate the consequence of mishandling solid waste and the higher the value the individual would give in order to avoid the risk of being a victim of unclean environment. Education is measured as the number of years spent in school.

The marital status of the respondent (M): being single or not is expected to influence the value the individual attaches to a proposed change for solid waste management. Marital status is a dummy variable taking 1 if the respondent is married; 0 otherwise, and is expected to have a positive sign. This is due to the fact that married people are likely to be more responsible to keep the environment clean than single ones because married respondents are likely to have larger family size and hence face higher risks of hygiene associated diseases than those not married.

Perception (P): of the respondents for the current solid waste management level: households who perceive the current solid waste management system as good will be less willing to pay than households who perceive the current solid waste management system as bad. Perception of the respondent on current solid waste management takes 1 if the respondent perceives current solid waste management as fair and 0 otherwise.

The size of the household (SH): is expected to have a positive effect on willingness to pay. This is due to the fact that the more people in the household, the more willing the household will appreciate a clean environment. The amount of waste generated is measured in kilograms of waste that the household generates in a week. It is hypothesized to be positively related to the willingness to pay, since the higher

the generation, the more households face the challenges of waste disposal and the greater the willingness to pay.

Environmental Awareness (EA): Environmental awareness of the respondent, 0 for not aware, 1 for fairly aware. More awareness of the environment means that respondents know the benefit of the environment and it is likely to have more environmental demand. One of the objectives of the study is to assess the WTP of residents for improved solid waste management services and to suggest mechanisms for cost recovery. In this regard, the main objectives of the WTP survey are to calculate the mean WTP and estimate a parametric model that includes socioeconomic factors of respondents in the WTP function.

For simplicity, in the remainder of this section, we assume that the change is an improvement (C > 0) and we focus on the measurement of WTP (Richard et al. 2005). If the change is regarded as an improvement, C >0; in this case, C measures the maximum WTP of individuals to ensure the change, which implies C=WTP. Therefore, Eq. 2 can be rewritten as Eq. 3.

$$U(p, q1, y\text{-}WTP) = U(p, q0, y) \quad (3)$$

To generate household WTP to improve solid waste management; the contingent valuation (CV) technique was used. CV elicits the maximum WTP of an individual respondent to obtain improvement or avoid damages on environmental goods and services in a hypothetical market (Pek et al., 2010). Therefore, the WTP of the respondents for the management and improvement of urban solid waste management in the city of Mizan-Aman was determined by directly asking the respondents their preference. Following Albertini and Cooper (2000); cited in Asrat P. , Belay K. and Hamito D., 2004), in the compensating variation when a person purchases an improvement in environmental quality can be specified as Eq. 4.

$$v(y - WTP, p, q1; z) = v(y, p, q0; z) \quad (4)$$

Where;

v- denote the indirect utility function,

Y - Income

P - Vector of prices faced by the individual

q0, q1 alternative levels of the good or quality indexes (q1 > q0, indicating that q1 refers to improved environmental quality and q0 unimproved one).

WTP- willingness to pay

z - Respondent characteristics (such as age, education, etc.)

The theoretical foundation of the contingent valuation method is a well-developed area. For stated preferences, the welfare change is measured by a change in these functions. The WTP is the amount of income that compensates an individual for a welfare change. Solving Eq. 4 for WTP yields is given as Eq. 5.

$$WTP = f(y, p, z, q0, q1) \quad (5)$$

Eq. 5 is the model that is used to identify the main factors that affect the individual's maximum willingness to pay for better solid waste management in the study area.

As pointed out in (Fredrik C., Gunnar K., and Alemu M., 2004), in order to estimate the WTP from the closed-ended responses for individual i in household j can be modeled as Eq. 6.

$$WTP = \alpha + \beta 1\ Y + \beta 2\ S + \beta 3\ HW + \beta 4\ A + \beta 5\ E + \beta 6\ M + \beta 7\ P + \beta 8SH + \beta 9EA + \varepsilon i \quad (6)$$

RESULTS AND DISCUSSION

This part of the research presents the research output obtained from the survey data collected from 362 (94.27%) sample respondents whose responses were valid. Both descriptive statistics and econometric models were used for interpretation and analysis.

Socioeconomic and demographic characteristics of the respondents

The information obtained from the survey shows that 68.97% of the head of households were male and 31.03% were female. Regarding the distribution of the family size of the household, the minimum household size was 1 person and the maximum was 7 family sizes in a single house. The minimum age of the heads of the household considered was 19 years and the maximum was 72 years. The mean age was about 36 years. Regarding the marital status of the respondents, the majority of the respondents (67.24%) were married while the remaining 18.76% were single household heads and approximately 14.0% of the household heads were divorced or widowed. In terms of housing conditions, 69.54% lived in their own home, 29.02% rented from private individuals, while the remaining 1.44% rented from kebele (local government). The level of education of the respondent, the religion and the level of income were also considered for the analysis. Accordingly, of the total households accounted, about 73.5% were 12 complete, 13% of them are able to read and write and the remaining 13.5% of the respondents were illiterates. Similarly, the religion distributions of the respondents are 45.6%, 33.5% and 20.9% for Orthodox Christian, Protestant and Muslim fellows, respectively. The level income of the respondents ranges from a monthly income of 300-12500 Ethiopian birr. The average monthly income of the respondents is described in Table 1.

Table 1: Monthly income of sample respondents

Average monthly income (ETB)	Frequency	%
300-1000	40	11.05
1001-2000	120	33.15
2001-3000	57	15.75
3001-4000	66	18.23
4001-5000	43	11.88
More than 5000	36	9.94
Total	362	100

Concerning the employment level of the respondents, they were engaged in private business (33%),

government employee (49.4%), nongovernmental organizations (12%) and the remaining (6.6%) were leading their life being daily laborers.

Sources, type and location of waste dumping

This part of the paper addresses issues related to the place solid waste was disposed and the type of waste that was dumped at different corners of the town. This was done by organizing and interpreting the data collected from the distributed structural questionnaires and the personal observation at the time of data collection. In addition to residents, the community coming from around the town also disposes of waste in different segments of the town, which implies that the source of waste emanates from both households living within the territory of the town and the nearby community. As the data stated, the solid waste generated in Mizan-Aman is mainly composed of spoiled banana, leaf of banana, chat by products, plastic packages, dust, grasses, food waste, papers, and sugar cane waste, etc. These wastes were dumped on nearby roads, ditches, and open spaces randomly. In addition to the residents of the town, people from nearby towns also contribute to the disposal of waste in the city. They come to the town for the exchange of items in the market but after finishing their business, they simply through the waste they come with on the market place or on roads or on the drainage systems of the town.

Solid Waste Management Practices of Town Residents

The households in the sample were asked how they were managing the waste, how and where they were disposing the waste. The type of waste collected, the frequency of collection of waste, and the final destination of the waste to be discarded were analyzed. The respondents were asked to determine the daily practice of managing waste and the type of container used in the process. Consequently, some of the respondents (46.6%) of the respondents respond that they store solid waste from their home using sacks, (45%) store using plastics, and the remaining part of the respondents (8.4%) said that they have no culture of collecting waste in either of the materials, rather simply collect and throw in or outside their compound.

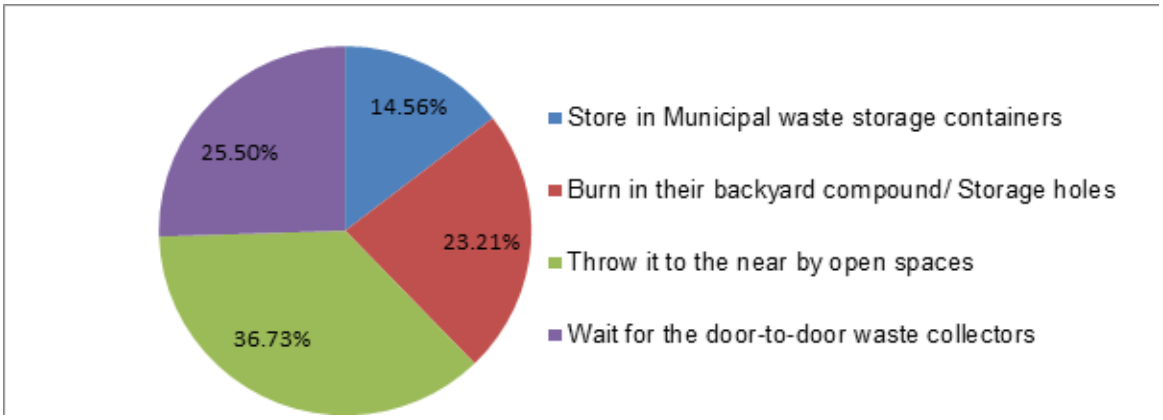

Fig. 1: The current situation of household solid waste disposal practices

Figure 1 tries to summarize the way households discard the collected waste. Accordingly, after the waste was collected and stored in bags or plastics, the respondents were asked to respond on the final destination where the waste was discarded. In this regard, 48.71% of the respondents (including those

who simply throw to anywhere and store in storage holes in their compound) said that because of awareness problem or the weakness of the municipality to collect the waste on time, the cost of the payment for the collection or the huge accumulation of the waste in their compound and many other problems, they supposed to dump the waste to the roads, the ditch (at time of rains) or the nearby free areas and try to burn or store in holes within their territory. This is a huge burden for the environment since this kind of waste disposal has multiple consequences, such as disease, and affects the amenity of the city. In addition to its burden on the environment, it poses a problem on the physical infrastructure of the city by blocking the drainage system and sharing roads with the movement of people and cars.

Reasons for poor solid waste management in the study area

There is a poor culture of urban solid waste management in the city mainly due to the reasons summarized in Table 2 below:

Table 2. Reasons for unplanned solid waste disposal

Reasons for inappropriate disposal of wastes	**Frequency**	**%**
Awareness problem/ negligent nature of households	40	11.05
Schedule of waste collection by the municipality/ interruption/ being delay/ extended time period	120	33.15
High payment for waste disposal	57	15.75
Believe that accumulation of waste in their compound is good	66	18.23
Inaccessibility of the resident's house for waste collection by the municipality	43	11.88
Inappropriate/ no waste loading site near their residence	36	9.94
Total	362	100

The table above tells us that the households in the study area discharged solid waste randomly, mainly due to the municipality's waste collection mechanism problem and the extended schedule on the one hand, the inappropriate location / site and the lack of containers arranged by the municipality for this purpose. In addition to these, some respondents (18.23%) perceived that accumulating waste in their compound is good for different purposes, such as composting and cooking food using it as firewood. But according to Muhdin et al. (2016) keeping household waste in the house for a week or longer has health implications, because it creates harmful microorganisms, rats, mosquitoes, air pollution, and others. Of course, there is an awareness problem explained by 11.05% of the respondents with respect to the advantage and risk of unplanned waste disposal. The topography of the city and the location where the house of some households is located affect the waste collection process. This is explained by 11.88 % of the respondents, whose residential house is inaccessible to the infrastructures to collect waste at home.

In the study area, there is a door-to-door waste collection practice, although collections are not practiced regularly and are open to complaints by clients. Respondents of door-to-door solid waste collection service users pay for the service in a minimum of 0.94 USD and a maximum of 2.82 USD in cash per month. But service providers were not collecting solid waste in a regular base of equal frequencies per month for all the service users, and the payment is not properly allotted per waste. The majority 40 (57.14%) of the respondents reported that their solid waste will stay at home up to 15 days after collection and storage, since service providers serve them only 2 times a month, 23 (32.66%) said that their solid

waste has been collected weekly (4 times a month) and 7(10.00%) reported that service provision is inconsistent. Absentee is common, and this creates inconvenience in the waste collection and disposal process. The waste collection process at the municipal level is not in the program. All collected waste was collected at the municipal level once a week and disposed at a place called Gewaka 10 km from the center of Mizan and 5 km from Aman. This extended schedule coupled with a single track and distance pave the way for residents to discard waste in all corners of the city.

Willingness to pay for responses to urban solid waste management

With the description of the scenario, improved waste management and current scenarios, the proposed solid waste collection and disposal project was presented to the respondents, as it benefits the whole community by creating a clean environment; it is safe for residents and work. If households are willing to participate and contribute to the project, since there is mutual benefit between households and service providers, the service will be sustainable and the community will always live in a clean environment. To determine the bid value that households expected to contribute to improving the solid waste collection mechanism, existing payment rates exercised in the town (the minimum was 0.94 USD and the maximum was 2.82 USD) were considered as the minimum and maximum bid values currently functioning at the municipal level. The willingness to pay of the respondents considered is summarized in Table 3.

Table 3: WTP of the respondents (Bid values)

Response	Minimum bid (0.94 USD)	Initial bid value (1.88 USD)	Maximum bid (2.82 USD)
Yes	334 (92.27 %)	287 (79.28 %)	236(65.19 %)
No	28 (7.73 %)	75(20.72%)	126(34.81%)
Total	362 (100%)	362 (100%)	362 (100%)

Table 3 shows the willingness of the respondents to contribute to improving urban solid waste management. Of the total respondents considered, 92.27% are willing to pay the minimum bid value, and the remaining 7.73% refuse this payment rate. Regarding the initial bid value, about 79.28% have the willingness to pay for the program and the reaming 20.72% have negative response. Finally, concerning the maximum bid value, 65.19 % agreed to pay for the program, but 34.81% say no for the stated value. Although the willingness to pay of the respondents decreases when the bid value increases (theoretically sound), most of the respondents are very willing to contribute to improve the solid waste management systems shown in each bid value. The following table (4) presents the mean value of minimum and maximum willingness to pay of the respondents for the purpose of improving waste management.

Table 4: The mean value of minimum and maximum WTP of the respondents

Variable	Observation	Mean	S.D.	Min.	Max.
Minimum Bid Value (MINBIDV)	362	51.60221 (1.62USD	16.23245	10 (0.31 USD)	60 (1.88 USD)
Maximum Bid Value (MAXBIDV)	362	71.04972 (2.23USD)	28.29656	0	90 (2.82 USD)

Table 4 briefs the mean willingness to pay of the households; it is 1.62 and 2.23 USD per month for

minimum and maximum bid values, respectively. At the time of the survey, the minimum amount that households perceived as fair is 0.31 USD and the maximum payable amount is 2.82 USD.

Cost Recovery of Solid Waste Management

The purpose here is to determine the amount of cost in USD that can be recovered due to the improvement in the current disgusting solid waste management systems in the study area.

Table 5: The average WTP of households

	Coefficient	S.E.	z	P>|z|	[95% Conf. Interval]
Willingness to pay for waste management (WTPWM)	19.51451 (0.612USD)	1.613121	12.10	0.000	16.35285 22.67617

Table 5 describes the average amount of dollars that households are willing to pay for improving urban solid waste management in the study area. Accordingly, on average, they are willing to pay an amount of 0.612 USD per month.

Table 6: Total WTP of households

Willingness to pay for waste management (WTPWM)	Coefficient	S.E.	z	P>|z|	[95% Conf. Interval]
Total Willingness to Pay (TWTP)	187534.5 (5,878.12 USD)	15502.1	12.10	0.000	157150.9 217918

Table 6 is about the total income that will be collected from households for the management of urban solid waste calculated from the average willingness to pay of the respondents ((0.612USD) and the total households living in the study area (9610). This collected income is the cost that can be saved through the proper management of solid waste. Consequently, the total amount of cost recovered is approximately 5,878.12 USD per month and annually it will be 70,537.30 USD considering the WTP of the household living in the study area. This is equivalent to the total cost saved due to the application of the proposed improved waste management system.

Household WTP for improved urban solid waste management

Improved solid waste management plays a key role in improving environmental quality in cities and then making these cities conducive to living. To have a record of improved solid waste management practice and system, households are expected to contribute their share to the program. But different factors are responsible for influencing the WTP of households for the improvement scheme. For this purpose in this study, the most pressing factors were determined with the application to the logistic regression model and the result is summarized in Table 7.

Table 7: Determinants of WTP, logistic regression result values)

Logistic regression Log likelihood = -96.642323				Number of obs = 362		
				LR chi2(9) = 32.26		
				Prob > chi2 = 0.0002		
				Pseudo R2 = 0.1430		
WTPWM	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
S	.9165562	.477294	1.92	0.055	-.0189228	1.852035
M	-1.009879	.4676302	-2.16	0.031	-1.926417	-.0933402
A	.0412256	.0194958	2.11	0.034	.0030145	.0794368
SH	-.0852487	.2149248	-0.40	0.692	-.5064936	.3359961
E	.3059958	.1818481	1.68	0.092	-.0504199	.6624115
Y	.0007467	.0002681	2.79	0.005	.0002213	.0012721
EA	2.487213	.8744467	2.84	0.004	.7733288	4.201097
HW	-.3732285	.3372426	-1.11	0.268	-1.034212	.2877549
P	-.3358099	.7050908	-0.48	0.634	-1.717762	1.046143
_cons	-1.94947	1.214992	-1.60	0.109	-4.330809	.4318701

Of the variables expected to determine the WTP of households for improved solid waste management in the study area, sex (S), marital status (M), age (A), educational level (E), income (Y) and environmental awareness (EA) are the most powerful variables to affect WTP significant at a 10% level of significance. From these significant variables, except marital status, the remaining five variables have positive coefficient, which implies they have positive influence. Age which is directly correlated with the experience of households living with environmental amenities and the aesthetic values enjoyed or the other way around, education status that paves the way to identify good and bad in the context of environmental quality and pollution, environmental awareness (the know how level of the households) about benefits and costs of the environment have a positive effect on the WTP of the households. Afroz et al. (2009) pointed out that holding all other factors constant, older people are willing to pay more than younger people. This suggests that older citizens make more mature decisions related to evaluating health and environmental issues, possibly due to their age , leading them to express a high WTP value. When we look at the sex and marital status, compared to the reference category, married and female are more sensitive toward the effect of wastes because most of the time the house (compound) management connected with waste management has a direct link with females as compared to their male counterparts and married are more careful than that of their counterparts in the process of solid waste management. This result confirms the analysis done by Afroz, Hanki & Hasegawa Kurisu (2009). In their analysis of the household's willingness of the household to pay for improved solid waste management in Daka city, Bangladesh maintained that age, household size and income maintain an increasing function with the willingness of consumers to pay for the improvement of the solid waste management system. However, they found that women have a positive influence on WTP consumers WTP and males to have a negative influence on WTP consumers. Aggrey and Douglason (2010) confirmed the findings of Afroz et al. (2009), stating that these variables and other variables like household expenditure

and consumer level of education also pose a significant influence on consumer WTP. The educational level and environmental awareness of the respondents are strongly positive for the amount of WTP and are significant variables that confirm this result as well with Dagnew et al. (2012).

CONCLUSION

Urban solid waste management, although crucial to environmental quality, management in the study area is still poor due to the commitment of the local government, the specific owner of the business process, and the involvement of the household. In the study area, solid wastes originate from different sources and the highest share is from the households that live there, and to discard these wastes, there is a problem of inaccessibility of waste sinks, poor collection practice of the collected wastes at municipal level, and the awareness of households about environmental improvement and the resulting outcomes of poor waste management are still poor. The topographic nature of the town also has its share in the waste collection process, making some residential houses difficult to reach. The type of waste discarded is composed of different products resulting from food processing to waste collected from their compound. The final destination of the waste varies according to the awareness and capabilities of the municipality, ranging from the waste dumping to the nearby roads, ditches, and open spaces to the area where the waste legality is disposed called Gewaka. Although households, with different socioeconomic status, are willing to participate in the improvement scheme, educational background, income, environmental awareness, age, marital status, and sex of households are the most significant variables that affect the willingness to pay for improved solid waste management. The rationale behind their significance is their correlation with exposure/experience/awareness to/for the problems and benefits of an environmental which is bad because of poor waste collection and management and environmental quality as a result of improvement in the process of waste discharging. Therefore, if there is an improvement program pertaining to solid waste management, the city in particular and the country in general can save a lot of money from the mismanagement of solid waste. In the study area, the total amount of cost recovered is about 5,878.12 USD per month and annually it will be 70,537.30 USD considering the WTP of the household living in the study area. But in doing so, an intervention and participation of different stakeholder plays a significant role in addressing the goal of environmental quality. To ensure the intended goal, i.e. environmental quality through improved waste management practices, the active engagement and participation of the households, the government and other stakeholders play pivotal role so that attention has to be given.

AUTHOR CONTRIBUTIONS

The whole process of the research work was contributed by the author, including the proposal writing, questionnaire development, data collection supervision, and management up to the research output writing. The manuscript is also prepared by the author.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest with respect to the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely observed by the authors.

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The socio-economic and institutional determinants of household's solid waste management in Debre Markos Town

By

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Abstract

This study examines the demographic, socio-economic and institutional determinants of household solid waste management in Debre Markos Town. A total of 270 questionnaires, which were selected through multi-stage sampling technique were analyzed by using descriptive and inferential statistics (i.e. ordered logistic regression analysis). The result of the study verified that households' monthly income, households' awareness, accessibility of private solid waste collectors, households' access of container and municipal support have a positive and statistically significant effect on households' solid waste management practices. Contrary to the above memo, households' family size, households' marital status and home to container distance have a negative and statistically significant effect on households' solid waste management practices. Therefore, on the backdrop of the above finding, this study suggests that entrepreneurs and innovators should be encouraged to ensure sustainable and efficient solid waste management program and to ease solid waste management problems.

Keywords: Solid Waste, Solid Waste Management, Ordered Logistic Model, Debre Markos

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1. Introduction

Univocally, we live in a century marked by hyper-consumerism, excessive urbanism and population overcrowding. These economic existences create problems for governments to meet the constant increases in demand for municipal services. One of them is solid waste management services which were mainly the responsibilities of municipalities in developing countries including Ethiopia, which culminated in inadequate service provision (Endalkachew, 2018). Therefore, in solid waste management orb the paradox creates a paradox: implies that the more the development and urbanization, the more waste we generate; the more the waste we generate, the less developed we are.

Waste is those materials generated in production and consumption activities that have not reached an economic value in the context in which they are produced but has consequences on health, the environment and the local economy if they are not properly managed (Yohanis and Genemo 2015). Historically, waste has existed since our planet has existed, about 4,000 million years ago. In the past, the disposal of solid waste did not pose a significant problem, as the population was small and the amount of land available for disposal of waste was large. The problem of solid waste begins with the development of the modern society, with the growth of the urban population, intensification of the industrial process and the increase in purchasing power of the population. Hence, one of the biggest challenges faced by modern society is solving the municipal solid waste problems (Nigatu et. al., 2011).

Currently the problem of waste is not only an issue of quantity; it is also a question of how this waste is composed and what is done with it to minimize its health and environmental risks (Getahun, 2011). Pronouncedly speaking, the waste generated by human groups has always existed, but its presence, as an environmental and health problem, is a recent phenomenon. While it is true that waste generators are similar anywhere in the world, the amount of waste, density and sources of waste vary considerably depending on income level, lifestyle, production and consumption patterns, culture, traditions, location and climate (UNEP, 2005). Rapid urbanization, population growth and economic development will cause the amount of waste globally to increase 70% in the next 30 years and reach a staggering 3.4 billion tons of waste generated annually. Regionally, Sub-Saharan Africa and South Asia are the fastest growing regions, where total waste generation is projected to triple and more than double by 2050, respectively, constituting 35% of global waste (GG Consultancy Service report, 2015).

In this memo, in Ethiopia the per capita amount of waste generated rate ranges from 0.28 to 0.83 kg/person/day and it lacks the financial resources and institutional capacity to provide the needed municipal infrastructure to adequate solid waste management. Not only this, the recycling rates in Ethiopia are also very low, so that 90% of the waste generated in the country ends up being wasted and ends up in landfills. This improper management of wastes has polluting the city oceans, clogging drains and causing floods, transmitting diseases, increasing respiratory diseases due to burning, harming animals that consume waste, and affecting its economic development in general. Connectively, all of this affects our quality of life (Samuel, 2006). Therefore, ensuring effective and proper solid waste management in Ethiopia is crucial to achieving its goal to become middle income country.

Like many other megacities in the country, most cities in Amahra region has followed the global trend of rising economic output and increasing in municipal solid waste generation, both in terms of aggregate and per capita. Contrarily to this memo, the expansion of new landfills or other MSW management

methods did not increase correspondingly in the region. The solid waste generation and disposal in selected Ethiopia cities is presented in table 1 in the appendix.

Based on the current practices of the community in Debre Markos Town, which is located in the Amhara region, solid waste which is generated from different sources has easily dumped in roadside, open space, ditch, and around fence due to lack of awareness, experience, financial and material support, infrastructure and coordination of stakeholder's participation. Having this form of solid waste disposal sites in turns become the sources of contamination by fabricating flies, mosquitoes, and rodents. These, in turn, are the means of disease that affect human health. Consequently, household's solid waste is one of the foremost doubts of the town because of inappropriate planning, inadequate governance, resource constraint and managerial inefficiency (Gebrie, 2009). Meanwhile, a lot of empirical studies have been documented on determinants of household's solid waste management across the country, but there seems to existed dearth of empirical studies on the socio-economic and institutional determinants of household solid waste management practices in East Gojjam Zone, specifically in Debre Markos Town. To contribute to the literature, this study is, therefore; examines the socio-economic and institutional factors that affect household's solid waste management practice in Debre Markos Town and the result will have paramount importance in providing relevant information that is basic to design appropriate solid waste management system in the town.

To address the above-stated research problems, the researcher develops the following research questions:

o What is the current trend of households' solid waste management practices in the town?

o How do the socio-economic and institutional factors affecting household's solid waste disposal practice in the town?

2. Methodology

2.1. Description of the study area

Debre Markos Town is one of the largest towns in Amahra regional state located in North Western part of Ethiopia. It is the capital of East Gojjam Zone, one of 12 zones of Amhara regional state, which is the second largest region in the federation of Ethiopia. Historically, Debre Markos Town has been the dominant political, economic, and historical center in North West Ethiopia. It is located at a distance of 300 km from Addis Ababa, and 265 km from Bahir dar the regional capital. Its astronomical location is 10º 21" North Latitude and 37º 43' East Longitude. Despite its proximity to the Equator, the climate of Debre Markos Town is subtropical highland; where March is the warmest month with 25.1 °C and July is the coldest month with 18.9 °C average monthly temperature. Based on the 2007 national census conducted by the Central Statistical Agency of Ethiopia, in 2012 Debre Markos Town has had an estimated population of 262,497, of whom 129,921 were men and 132,576 were women. Of this 97.03% of the residents were practiced Ethiopian Orthodox Christianity, while 1.7% of the residents were Muslim and, the remaining 1.1% were Protestants.

2.2. Target population and sampling unit

Permanent residents of the town, who are legally licensed on their respective administrative units, are considered as population of the study for this investigation. Hence, the sampling unit for this study was household heads.

2.3. Research Approach

There are three basic approaches in research, i.e. quantitative approach, qualitative approach and mixed. Quantitative approach involves the generation of data in quantitative form which can be subjected to rigorous quantitative analysis (Kothari, 2004: p. 5), while the qualitative approach concerned with subjective assessment of attitudes, opinions and behavior. To reach at a level of truth that enables the researcher to come up with complementary and convergence of facts, triangulating both qualitative and quantitative approach (i.e. mixed approach) is most appropriate. Thus, the study used mixed approach to achieving the stated research questions.

2.4. Type and Source of Data

Regarding to the type and sources of data, both primary and secondary sources of data was used to achieve all the necessary information on the area under which the research is conducted. The primary data were collected from respondents, key informants, government officials and focus group discussion by using semi-structured, unstructured, and open-ended types of questionnaires and interviews. Secondary data were collected from various documents like strategic plans, books, journals, manuscripts, and research and official reports of the municipality.

2.5. Sampling Design

The data in this study were collected using a Multi-stage sampling technique. In the first stage the researcher randomly selected one town from all towns in Amhara region i.e. Debre Markos. In the second stage the researcher purposively selected two manageable kebeles[1] (i.e. 02, 03) out of 11 kebeles in the town based on their relative population density, economic status, solid waste generation capacity and severity of the problem. In the third stage, from these two purposively selected kebeles, five villages were selected purposively which give a total of ten (10) sample units. In the fourth stage, from these ten purposively selected villages, twenty seven (27) households were randomly selected. Hence, a total of 270 households were used as the sample size for the study.

2.6. Methods of Data Collection

Data collection for this study was involved: questioner, a document review, interviews, FGD, and observation. Household interviews in this study were administered using a semi-structured questionnaire, while interviews with key informants were conducted using an unstructured, open-ended checklist. The observation is intended to see the practice of waste management process, thus it was carried out personally through transect walk in the field area. Lastly, document review was also used to collect secondary data from strategic plans, books, journals, manuscripts, and research and official reports of the municipality.

1 It refers to an administration units under sub-city or woreda, which is depending on the structure of the town

2.7. Methods of data analysis

Data compilation and processing was started immediately after field work. Data processing involved editing, coding, classifying and entering data by using the Statistical Package for Social Sciences (SPSS) and STATA. Quantitative and qualitative data were generated and presented via frequencies, and descriptive and multi-response statistics in STATA. To explain the observed variation in disposal practice, ordered logistic regression model in which the dependent variable household solid waste management experience is regressed as a function of the explanatory variables (i.e. social, economic, and institutional factors) were used.

2.8. Model specification

The choice of econometric model depends on the nature of the dependent variable, i.e. nominal, ordinal, interval, binary and/ratio scale. The dependent variable in this study (i.e. solid waste management frequency) is ordinal by its nature and has an intrinsic order in its responses (i.e. never, sometimes and always); as a result, ordered logit and probit model is the right econometric model than a multinomial logit model (Wooldridge, 2002). Explicitly speaking, unlikely to multinomial logit model, ordered logit or probit model is used when the dependent variable under investigation has more than two categories and the values of each category have a meaningful sequential order where a value is indeed 'higher' than the previous one. For example if we examine the variable V1 that has green, yellow and red as independent variable then V1 encodes as a multinomial variable but if V1 has represent some sort of increased urgency then they define an ordinal variable. If we are in the yellow level we are assumed that we have reached and exceed the green level, if we are in the red level we have reached the green and we are in the red level if we have reached the yellow level. Besides, if the ordinal model does not meet the parallel regression assumption, the multinomial one will still be an alternative. But the question is how does one differentiate logit models from the probit one? This question is answered by (Park, 2015); the core difference lies in the distribution of the error term. In the logit model, error term is assumed to follow the standard logistic distribution; whereas in probit model it is assumed to follow the standard normal distribution. With this minor difference, in this study ordered logistic model was modeled to analyze the socio-economic and institutional determinants of households' solid waste management practices. Based on its distributional assumption and following Wooldridge (2002), the ordered Logit Model of the study is specified as:

$$Pr(Y \leq j) = \ln((\sum Pr(Y \leq j/X))/(1-\sum Pr(Y \leq j/X))) = ß0+\beta 1X1+\beta 2X2+...+ \beta 14X14+\varepsilon i$$

Where, j takes a value of 0 if the respondents choose never, 1 if the respondents choose sometimes and 2 if the respondents choose always. X's are socio-economic and institutional determinants and ß's are coefficients of the model. All coefficients in the model are estimated by means of maximum likelihood methods. Based on review of previous empirical studies (i.e. Samuel, (2006), Melaku (2008), Gebrie (2009), Martin (2010), Solomon (2011), Getahun (2011), Yohanis &Genemo (2015), Teshiwal (2018) and Endalkachew (2018) fourteen socio-economic and institutional determinants were identified (i.e. sex, age, education, religion, year of residence, marital status, family size, income, households' awareness, accessibility of private solid waste collectors, access of container, municipality support, home to container distance and enforcement of rule and regulation. The definition, measurement and expected sign of each variable are presented in Table 2 in the appendix.

The interpretation of ordered logit coefficients cannot be read as regular OLS coefficients as they are in log-odds units. The signs of the parameter estimates and statistical significance indicate the direction of the response associated with a particular variable. However, the changes in the probabilities associated to the categories of the dependent variable are not reported. Thus, it is necessary to estimate the category specific marginal effects which show the influence of a variable across the categories of the dependent variable. Hence, each marginal probabilities measure the change in the probability of each solid waste management outcome with respect to a change in each explanatory variable.

3. Discussion and analysis

3.1. Demographic and Socio Economic Characteristics of respondents

The demographic and socioeconomic characteristics of the sample studied are illustrated in Table 3 in the appendix. The respondent gender profile indicates that among 270 survey samples, 98(36.3%) were men and 172(63.7%) were female. Concerning the age of the household head, the minimum and maximum age of the participants was 25 and 65 years, respectively and the average age of the respondents was 35 years.

Table 3: Demographic and Socio-economic characteristics of the respondents

variables	Freq	%	Cum	min	max	Mean
sex 0 = female 1 = male	172 98	63.70 36.30	63.70 100.00			
age				26	65	37
Education 0= primary completed 1= secondary completed 2= high school completed 3= college completed 4= university completed	 17 98 33 66 56	 6.30 36.30 12.22 24.44 20.74	 6.30 42.59 54.81 79.26 100.00			
Marital status 0=otherwise, 1=married and live with together	 213 57	 78.89 21.11	 78.89 100.00			
Years of residence				7	29	18
Family size				1	8	3
Income				1250	11305	5360
Religion 2= Muslim 1= orthodox 0= others	 21 243 6	 7.78 90.00 2.22	 7.78 97.78 100.00			
Total observation	270					

With regard to family size, the minimum and maximum family size that the participants had 1 and

8 members, respectively and the average family size of the respondents had 3 members. Concerning with the educational level of respondents, 17(6.30%) had primary education, 98(36.3%) had secondary education, 33(12.22%) had high school education, 66(24.4%) had college diploma and the remaining 56(20.7%) had completed university education. Regarding to marital status 57(21.11%) of the respondents were married and lived together, whereas 213(78.89%) of the respondents were others (i.e. single/divorced/widowed and/ lived loneliness). Concerning with years of residences, the minimum and maximum year of residences of the participants was 7 and 29 years, respectively and the average years of residences of the respondents were 18 years. With regard to monthly income, the minimum and maximum monthly income of the participants was 1,250 and 11,305 ETB, respectively and the average monthly income of the respondents was 5,360 ETB. Regarding with religion almost 243(90%) were the followers of orthodox Christianity, about 21(7.78%) of respondents were Muslim religion followers and the remaining 6(2.22%) of the respondents were other religion followers.

3.2. Solid Waste Management characteristics of the Respondents

The solid waste management characteristics of the respondents are presented in table 4 in the appendix. Regarding with respondents solid waste composition, 165 (64.81%) of the respondents were generate waste in their home the form of ash, dust, paper, plastic and old clothes, 94 (34.81%) of the respondents were generate waste in the form of kitchen and wood scrap, and the remaining 1 (0.38%) of the respondents was generate waste in the form of glass, cans, ceramics, cement, and metal. Concerning with access to storage container, 88 (32.59%) of respondents have a storage container in their home while the remaining about 182(67.41%) of respondents don't.

Table 4: Solid Waste Management characteristics of the Respondents

Variables	Freq	%	Min	Max	Mean
Types of waste					
1= food waste/left over	-	-			
2= ash, dust, paper, plastic, old cloths	175	64.81			
3= kitchen and wood scrap	94	34.81			
4= glass, cans, ceramics, cement, metal	1	0.38			
5= other	-	-			
Storage container					
1= yes	88	32.59			
2= no	182	67.41			
Door to door service					
1= yes	150	55.56			
2= no	107	39.63			
3= not sure	13	4.81			
Service per month					
1= once per month	162	60			
2= twice per month	104	38.52			
3= three times month	4	1.48			
4= four times per month	-	-			
5= other	-	-			

Willingness to pay per service			22.5	10	40
Municipality support					
0= very low	84	31.11			
1= low	-	-			
2= medium	1	0.37			
3= high	70	25.93			
4= very high	115	42.9			
Reason for poor municipality perform					
1= lack of infrastructure	128	47.41			
2= weak commitment & stakeholders	40	14.81			
3= shortage of logistics	102	37.7			
4= lack of human & financial resource	-	-			
HH waste disposal options					
1= open space around the village	114	42.22			
2= throw inside the compound	4	1.48			
3= store in temporary container	61	22.59			
4= burn to road side	84	31.11			
5= store in kitchen	7	2.59			
Environmental cleaning event					
1= yes	103	38.15			
2= no	167	61.85			
Participation duration					
1= once per year	132	48.89			
2= twice per year	122	45.19			
3= three times per year	12	4.44			
4= four times per year	4	1.48			
Reason for not participation					
1= work load	29	10.74			
2= not planned	127	47.04			
3= no such program at all	114	42.22			
Training and discussion about SWM					
1= yes	81	30			
2= no	189	70			
Who is responsible body for SWM					
1= household	36	13.3			
2= private waste collectors	45	16.6			
3= municipality	57	21			
4= all of them	133	49.1			
Is there private waste collector in the town					
1= yes	165	60.9			
2= no	83	30.6			
3= not sure	22	8.1			
Do you give value for the work & workers					
1= yes	112	41.3			
2= no	158	58.7			

Regarding to door to door services, 150(55.56%) of respondents had got a door to door solid waste disposal services, 107(39.63%) of respondents were not got a door to door solid waste disposal services and the remaining 13(4.81%) of respondents were not sure about the services. Concerning with the frequency of the service, 162(60%) of respondents mentioned that they got the services once per month, 154(38.52%) of respondents were got the service twice per month, and the remaining 4 (1.48%) of respondents were got the services three time per month. Regarding to respondents willingness to pay, in the study area the minimum and maximum willingness to pay per services was 10 and 40 ETB, respectively and the average willingness to pay per services was 22.5 ETB.

Regarding to the method of waste disposal, in the study area 114(42.22%) of the respondents were disposed their waste in open space around the village, 84(31.11%) of respondents claimed that they disposed of their solid waste by burning to road side, 61(22.59%) of the respondents were disposed their waste by storing in temporary container, 7(2.5%) of the respondents were disposed their waste by storing in kitchen and the remaining 4(1.48%) of the respondents were disposed their waste by throwing inside the compound. Concerning with the municipality performance to support households waste disposal service, 115(42.9%), 70(25.93%), 84(31.11%), and 1(0.37%) of respondents said it was very low, not satisfactory, satisfactory, and very good, respectively.

Regarding the reason for poor municipality support, 128(47.41%) of the respondents were replied it was due to lack of infrastructure, 102 (37.7%) of the respondents were respond it was due to shortage of logistics covered and the remaining 40(14.81%) of the respondents were said it was due to weak commitment from municipality and stakeholders. Pertaining to the environment cleaning event, 103(38.15%) of respondents said that there is environment cleaning program even 48.89%, 45.19% respondents were participated at the environment cleaning event once and twice per year respectively. The remaining 167(61.85%) of the respondents responded that there is no environmental cleaning event in the study area. The result of the study also prevail that 127(47.04%) of the respondents did not participated in environmental cleaning event due to they didn't have plan, 114(42.22%) of the respondents stated that there was no such program in their area and the remaining 29(10.74%) of the respondents were not participated because of work load.

The solid waste management characteristics of the respondents shows that 81(30%) of respondents said that they got solid waste management training, education and discussion forum, while the majority 189(70%) of the respondents replied that there was no suck kind of forum in their area. Concerning with the responsible body for solid waste management, 36(13.3%), 45(16.6%), 57(21%) and 133(49.1%) of the respondents in the study areas replied that it is households, private waste collectors, municipality and all are responsible bodies, respectively. Regarding to the existences of private waste collectors, 165(60.9%) of the respondents told that private waste collector was existed; 83(30.6%) of the respondents said that there was no private solid waste collectors exited in their area, whereas the remaining 22(8.1%) of the respondents were not sure about the existence of private waste collectors. Concerning with attitude towards to the work and workers 112(41.3%) of the respondents told that they gave value for the work and workers while 158(58.7%) of the respondents were not gave value for the work and workers.

3.3. Econometrics analysis

3.3.1. Diagnostic test

Before performing the econometric estimation, it is extremely important to test different econometric assumptions using appropriate statistical methods (i.e. test of parallel regression assumption, model specification test, heteroscedasticity test, multicolinearity test…). The result of the diagnostic test was discussed below.

3.3.1.1. Test of parallel regression assumption

One of the assumptions underlying ordered logistic (and ordered probit) regression is that the relationship between each pair of outcome groups is the same. In other words, ordered logistic regression assumes that the coefficients that describe the relationship between, say, the lowest versus all higher categories of the response variable are the same as those that describe the relationship between the next lowest category and all higher categories, etc. This is called the proportional odds assumption or the parallel regression assumption. Because the relationship between all pairs of groups is the same, there is only one set of coefficients (only one model). If this was not the case, we would need different models to describe the relationship between each pair of outcome groups. We need to test the proportional odds assumption, and hence the result of parallel regression assumption is reported in table 9 in the appendix. The result indicates that we fail to reject the null hypothesis as approximate likelihood-ratio test of proportionality of odds across response categories (0.2553) was insignificant.

3.3.1.2. Model specification test

Testing the model specification (ovtest) is very important to check out whether one or more relevant variables are omitted from the model or one or more irrelevant variables are included in the model. There are different methods to check specification error of the model. The Ramsey reset test for omitted variables are commonly used in the test. Table 8 in the appendix shows the result of ovtest. According to Ramsey reset test, a model specification is said to be fit if the p-values stated in P>F is greater than the chosen level of significances i.e. 1%, 5% and 10%. The Prop> F in the result is 33.36% which is greater than any of the significance levels of the specified model. Therefore, the model has no relevant omitted variable which means the model under consideration has no specification error.

3.3.1.3. Test of heteroscedasticity

In the classical linear regression model, one of the basic assumptions is that the probability distribution of the disturbance term remains same over all observations of X; i.e. the variance of each is the same for all the values of the explanatory variable. Symbolically,

$$\text{var}(u_i) = \text{E}\left[u_i - \text{E}(u_i)\right]^2 = \text{E}(u_i^2) = \sigma_u^2;$$

This feature of homogeneity of variance (or constant variance) is known as homoscedasticity. It may be the case, however, that all of the disturbance terms do not have the same variance. This condition of non-constant variance or non-homogeneity of variance is known as heteroscedasticity. Thus, we say that U's are heteroscedastic when:

$$\text{var}(u_i) = \sigma_u^2$$

Thus in order to test whether there is a heteroscedasticity or not, the study employed Breushpogan test. The result of Breushpogan test presented in table 7 in the appendix. The decision rule is, if the p-value

of the Breushpogan test is greater than any of the chosen significance levels i.e. 10%, 5% and 1% which indicates that there is no probable problem of heteroscedasticity. Therefore, as reported the p-value is greater than 0.05 (i.e. 0.2600>0.05) then the null hypothesis is accepted and there is significant evidence that there is no heteroscedasticity problem.

3.3.1.4. Test of Multicollinearity

Multicollinearity meant the existence of a "perfect" or exact, linear relationship among some or all explanatory variables of a regression model. For k-variable regression involving explanatory variables , an exact linear relationship is said to exist if the following condition is satisfied.

where are constants. To test the existence or not-existence of multicollinearity problem contingency correlation test was applied. The result of the contingency correlation presented in table 6 in the appendix. The result of the test indicates that there is no strong correlation among all or some explanatory variables; this is therefore, an indicator of nonexistence of multicollinearity problem.

3.4. Determinant of solid waste management practice

Twenty four explanatory variables were included into the ordered logistic regression model to predict factors affecting households' solid waste management practice. Table 5 in the appendix shows the sign, magnitude, statistical tests, marginal effects and significance level of each explanatory variable. Out of the 24 variables hypothesized to influence households' solid waste management practice in the study area, twenty variables were found to be statistically significant at 1%, 5% and 10% level of significance. These variables are sex, age, education categories, marital status, family size, income, accessibility of private waste collectors, municipality support categories, access to container, categories of households' awareness towards SWM, and home to container distance.

Table 5: The regression result of ordered logit model

Variables	Coefficient	Z value	Marginal Effect		
			Never (0)	Sometimes(1)	Always(2)
Sex	-1.23944* (0.2942967)	-4.21	0.241439* (0.01125)	-0.1734813* (0.00216)	-0.1680117* (0.002413)
Age	-0.4399384*** (0.2311318)	-1.90	0.0585851*** (0.00676)	-0.0290914*** (0.00967)	-0.0383063*** (0.04991)
Education1	0.0095544* (0.0399417)	0.24	-0.0532858* (0.04095)	0.0566729* (0.04718)	0.0644129* (0.06151)
Education2	0.0163144* (0.04675342)	0.35	-0.0600752* (0.01623)	0.0179165* (0.05393)	0.0712023* (0.06826)
Education3	0.0483696* (0.0978652)	4.94	-0.0046377* (0.01698)	0.0012506* (0.01075)	0.0064879* (0.00358)
Education4	0.0570111* (0.10654017)	0.54	-0.0132797* (0.02562)	0.0098926* (0.01942)	0.0021526* (0.00506)
Religion1	0.0417018 (0.2854389)	0.15	0.0016438 (0.07146)	0.0081959 (0.07023)	0.0012708 (0.01556)

Religion2	0.0330598 (0.2767969)	0.01	0.0008247 (0.06159)	0.0016806 (0.04481)	0.0073712 (0.00692)
Years of residence	-0.0626842 (0.1430585)	-0.44	0.0082049 (0.02824)	0.0039853 (0.01937)	0.005657 (0.00094)
Family size	-0.0930491* (0.13648405)	-0.68	0.0157723* (0.02661)	-0.0097862* (0.01817)	-0.0038912* (0.00131)
Income	0.6325005* (0.1205793)	5.25	-0.1501973* (0.02271)	0.1128419* (0.01811)	0.027479* (0.00031)
Marital status	-2.4315585* (1.03884)	-2.34	0.4058865* (0.07618)	-0.3446773* (0.06982)	-0.0513327* (0.00544)
Awareness to-SWM1	1.4278965** (0.3818396)	3.74	-0.32943** (0.07358)	0.252164** (0.05799)	0.0673891** (0.01369)
Awareness to-SWM2	1.4372052** (0.3911483)	3.67	-0.3387387** (0.07778)	0.2614731** (0.06219)	0.0766978** (0.01789)
Awareness to-SWM3	1.4364955** (0.3904861)	3.68	-0.3391831** (0.08222)	0.2619175** (0.06663)	0.0771422** (0.02233)
Awareness to-SWM4	1.4365385** (0.3793761)	3.79	-0.3269665** (0.08222)	0.2608064** (0.05552)	0.0760311** (0.01122)
Accessibility of SW-collectors	1.9284603** (0.3306068)	5.83	-0.4451741** (0.05318)	0.3292237** (0.04345)	0.1036042** (0.01423)
Access to container	1.1172504 *** (0.5812539)	1.92	-0.2691384*** (0.13516)	0.2034502*** (0.10386)	0.0533426 *** (0.0226)
Rule and regulation	-0.0182527 (0.310957)	-0.06	-0.0047193 (0.06825)	-0.0065047 (0.04933)	-0.0105602 (0.00658)
Municipality support1	0.6285596 * (0.1595085)	3.94	-0.1473615* (0.03062)	0.1100916 * (0.02288)	0.0249243 * (0.00074)
Municipality support2	0.6310287 * (0.08157959)	7.73	-0.0609417* (0.055805)	0.0236718 * (0.06354)	0.0614955 * (0.08716)
Municipality support3	0.60633731* (0.1372871)	4.42	-0.1251393* (0.00813)	0.08786931 * (0.00066)	0.0018688 * (0.02296)
Municipality support4	0.6365842* (0.1686441)	3.77	-0.1553861* (0.03864)	0.1170051 * (0.03201)	0.0318378* (0.00839)
Home-container-distance	-2.0131729 * (0.5416336)	-3.72	0.4519574 * (0.0969)	0.2712086* (0.04645)	0.1753167** (0.06973)
/cut1	4.469674	Log likelihood			-197.80445
/cut2	7.121283	LRchi2(24)			120.3232
Number of observation	270	Pseudo R2			0.6843

Notes: Standard errors are reported in parentheses and ***1%, **5%, and *10%

As the regression result in table 5 in the appendix shows sex of the respondents affects solid waste management practice negatively (-1.23944) and it was statistically significant at 1%. This finding is consistence with the findings of Solomon (2011), Melaku (2008), Martin (2010) and Gebrie (2009).

This implies that male respondents have low involvement in solid waste management than its female counterpart as females are more responsible for the process from collecting, cleaning and disposing of solid waste culturally. The marginal effect result of the model indicated that, holding all else constant, being male increase the probability of respondents who never clean their home by 24.14%; however decrease the probability of the respondents who sometimes and always clean their home by 17.34% and 16.8%, respectively.

As the model result indicates the age of the respondents affects solid waste management practices negatively (-0.4399384) and it is statistically significant at 10%. This finding is parallel with the findings of Teshiwal (2018), Solomon (2011) and Melaku (2008), but it is contrary with Martin (2010) and Gebrie (2009). This implies that old respondents are less likely to management their solid waste than its counterpart youth and adult respondents. Unlike them, youth and adult take responsibility to clean their own home and they are very eager to give a priority for clean living environment, fear the social criticism from others as a work force and raring to live than the elders. The marginal effect result of the model indicated that, holding all else constant, when the age of the respondents increases by one calendar year, the probability of the respondents who never clean their home increase by 5.8%, but the probability of the respondents who sometimes and always clean their home decrease by 2.9% and 3.8%, respectively.

Concerning with respondents educational level, as the regression result of the model shows it had a positive for all categories (i.e. .0095544 for secondary, .0163144 for high school, .0483696 for college and .0570111 for university) and significantly affect households' solid waste management practices. This finding is parallel with the findings of Teshiwal (2018), Solomon (2011) and Melaku (2008), but it is contrary with Martin (2010). This implies that as the respondents education level increases respondents become more and more aware about the importance of proper solid waste management practices, they are more likely disposed their own solid waste properly, hence these minimizes its environmental and health effect of improper solid waste disposals. The marginal effect results of the model shows, holding all else constant, compared with respondents who have primary education; completing secondary, high school, college and university education decreases the probability of the respondent who never clean their house by 5.32%, 6.01%, 0.46% and 1.32% respectively but increases the probability of respondents who clean their home sometimes and always by 5.67%, 1.79%, 0.13%, 0.99% and 6.44%, 7.12%, 0.65% and 0.22%, respectively.

Family size of the respondents was negatively correlated with households' solid waste management practice. As expected, the variable was statistically significant and negative (-0.0930491) effect on households' solid waste management practice. This finding is compatible with the finding of Teshiwal (2018), Melaku (2008), Martin (2010) and Gebrie (2009). This implies that when the respondents' family size increases, their waste disposals will also increases, this make solid waste management practice more and more challenging hence respondents solid waste management practices trim down. As the marginal effect result of the model indicates, when the family size of the household head increases by one member, holding all else constant, the probability of the respondents who never clean their home increase by 1.57%, while the probability of the respondents who sometimes and always clean their house decrease by 0.97% and by 0.38%, respectively.

Concerning with households' income, as expected the result of the regression shows it had a positive

(0.6325005) and significant effect on households' solid waste management practice. This finding is consistence with the findings of Teshiwal (2018), Solomon (2011), Melaku (2008), Martin (2010) and Gebrie (2009).This is due to the fact that households who have high income increases their willingness to pay for solid waste collecting and disposal service which creates clean house, clean living compound and safe environment. As the marginal effect regression result of the model shows, when the income of respondents' increase by one ETB, holding all ease constant, the probability of the respondents who never clean their home decrease by 15.01%; however the probability of the respondents who clean their home sometimes and always increase by 11.28% and 2.75%, respectively.

As expected marital status have a negative (-2.4315585) and significant effect on households' solid waste management practices in the study area. This finding is similar with the finding of Teshiwal (2018) and Solomon (2011) but it is contrary with the finding of Gebrie (2009).This is due the fact that those participants who are married and living together dispose more solid waste compared with its counterparts, these make households solid waste management practice more challenging, given the current solid waste disposal characteristics of the respondents. As the marginal effect results of the model indicates, being married and living together, holding all else constant, increase the probability of the respondents who never clean their home by 40.59%, but decrease the probability of the respondents who clean their home sometimes and always by 34.47 % and 5.13 %, respectively.

Regarding with the accessibility of private solid waste collectors in their area, the regression results of the model shows it was positively (1.9284603) and significantly correlated with households' solid waste management practice. This finding is parallel with the findings of Teshiwal (2018), Solomon (2011) and Melaku (2008), but it is contrary with Martin (2010) and Gebrie (2009). This means that when accessibility of private solid waste collectors enhance, households' home cleaning, waste collecting and disposal practice likely increases, these creates a comfortable living compound and mitigates the negative effect of poor solid waste management practice on human health and the environment. As the marginal effect results of the model shows, when private solid waste collectors are accessibility to the household head, holding all else constant, the probability of the respondents who never clean their home decrease by 44.51%, while the probability of the respondents who sometimes and always clean their house increase by 32.92% and 10.36%, respectively.

As the regression result shows households' awareness towards solid waste management was a positive for all categories (i.e. 0.6409052 for low, 1.4372052 for medium, 1.4364955 for high and 1.4365385 for very high) and significantly affect households' solid waste management practices. This finding is compatible with the findings of Teshiwal (2018) and Solomon (2011). This implies that as the respondents more and more aware about the importance of proper solid waste management practices, they are more likely disposed their own solid waste properly, hence these minimizes its environmental and health effect of improper solid waste disposals. The marginal effect results of the model shows, holding all else constant, compared with respondents who have a very low satisfaction on municipality support; having low, medium, high and very high satisfaction decreases the probability of the respondent who never clean their house by 32.94%, 33.87%, 33.91% and 32.69% respectively but increases the probability of respondents who clean their home sometimes and always by 25.21%, 26.14%, 26.19% and 26.08% and 6.73%, 7.66%, 7.71% and 7.60%, respectively.

As indicated in the regression table, households' access to container was positively (1.1172504) and

significantly affects the solid waste management practices of the respondents in the study area at 10% level of significance. This finding is parallel with the findings of Solomon (2011) and Melaku (2008), but it is contrary with Gebrie (2009). This is due to the fact that access of container near to their home motivates households to clean their home and compound frequently, which creates safe environment to live and mitigates the negative effects of improper solid waste management on human health. The marginal effect results of the regression indicates, other thing remain constant, accessed to container decrease the probability of the respondents who never clean their home by 26.91%; however increase the probability of the respondents who clean their home sometimes and always by 20.34% and 5.33%, respectively.

Concerning with the municipality support, as the regression result of the model shows it had a positive for all categories (i.e. 0.6285596 for low, 0.6310287 for medium, 0.60633731for high and 0.6365842 for very high) and significantly affect households' solid waste management practices. This finding is parallel with the findings of Teshiwal (2018), Solomon (2011) and Melaku (2008), but it is contrary with Martin (2010). This means that the support which has been given to households from municipality increases their commitment and effort of respondents' on solid waste management practice and hence mitigates the negative effect of poor solid waste management on environment and human health easily. The marginal effect results of the model shows, holding all else constant, compared with respondents who have a very low satisfaction on municipality support; having low, medium, high and very high satisfaction decreases the probability of the respondent who never clean their house by 14.73%, 6.09%, 12.51% and 15.53% respectively but increases the probability of respondents who clean their home sometimes and always by 11.01%, 2.37%, 8.79%, 11.70% and 2.49%, 6.15%, 0.19% and 3.18%, respectively.

As the regression result of the model indicates, regarding to households' home to container distance it had a negative (-2.0131729) and significant effect on households' solid waste management practices. This finding is parallel with the findings of Teshiwal (2018), Gebrie (2009), Martin (2010), Solomon (2011) and Melaku (2008). It implies that when households' home far apart from the container, households' throw their disposals in open space around their compound rather put it in the container. The marginal effect results of the model shows that, when the households' home to container distance far apart, holding all else constant, the probability of the respondents who never clean their house increase by 45.19%, whereas the probability of the respondents who clean their home sometimes and always decrease by 27.12% and17.53%,respectively.

4. Conclusion and Recommendation

4.1. Conclusions

This study conducted a survey to 270 households in Debre Markos Town, to examine the socio-economic and institutional determinants of households' solid waste management practices. The dependent variable of the study was households' solid waste management practices which was measured by the frequency of households' home cleaning practice. The study used ordered logistic regression model to examine how households' solid waste management practices is affected by different socio-economic and institutional determinants (i.e. sex, age, education, religion, year of residence, marital status, family size, income, households' awareness about solid waste management, accessibility of private solid waste collectors, access of container, municipality support, enforcement of rule and regulation and home to container

distance). Based on the findings, the following conclusions were drawn:

The gender profile of respondents indicates that among 270 survey samples, 63.7% of the respondents were female. The average age of the respondents was 35 years. 6.30% of respondents had primary education, 36.3% had secondary education, 12.22 had high school education, 24.4% had college diploma and the remaining 20.7% had completed university education. The average years of residences of the respondents in the study area were 18 years. 90% were the followers of orthodox Christianity. The average family size of the respondents was 3 members. 21.11% of the respondents were married and lived together. The average monthly income of the respondents was 5,360 ETB.

Concerning with the characteristics of households' solid waste management, the result of the study indicates that the type of waste that the respondents often generated in their own home was ash, dust and paper, plastic and old clothes which covered 64.81%. Despite the result of the study prevails 55.56% of respondents were got a door to door solid waste disposal service, about 60% of respondents were mentioned that they got this service once per month. The mean willingness to pay was 22.5 ETB for solid waste disposal service per services. The most common method of solid waste disposal in the study area was through open space around the village (42.22%). Regarding to households satisfaction on municipality support, 42.9% of respondents agreed that it was very low. Although 61.85% of respondents responded that there was no environmental cleaning event in the study area, 48.89% and 45.19% respondents from participated households even participated at the environment cleaning event once and twice per year respectively, this is too weak. On the existence of private solid waste collectors, 60.9% respondents were confirmed the existences of private waste collector enterprise in the study area even if 58.7% were not giving value for the work and workers.

The result of ordered logistic model shows that education, households' monthly income, households' awareness about solid waste management, accessibility of private solid waste collectors, households' access of container and municipal support of households' solid waste management were positively and significant affects respondents' solid waste management practices. Whereas, households' family size, households' marital status and home to container distance were negatively and significantly affects respondents' solid waste management practices in the study areas. Religion had a positive effect on households' solid waste management practices but it was not statistically significant. Respondents' year of residence and enforcement of rule and regulation were negatively affects respondents' solid waste management practices but they were not statistically significant.

4.2. Recommendations

Based on the findings of the study and the conclusion drawn, the researcher has suggested the following recommendations as the solution measures need to be taken by all stakeholders to solve the solid waste management problems in the study area.

 More efforts should be made by stakeholders to change the situation and improves households' solid waste management practices in the area in the form of technical and logistics facilities.

 The town administration, health office, NGOs, humanitarian organizations and civic associations should engage continuous on awareness creating campaign like training, education and discussion

forums for the community in planned and programed form. Each and every information about the effect of poor solid waste management on environment and health should be well communicate at schools, institutions, parks and business or market centers by using popular individuals via different mediums of communication.

 To reverse this worst scenario, the municipality itself should get its own enough budget from the town administration to build its own capacity by human power, financial, material, technological, technically that enables it to run its responsibility and assignment effectively and efficiently. Thus, it should develop high commitment and well organized effort to improve households' frequency of solid waste collection, and transportation by preparing regular programs.

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