

1 Trade Liberalization and Inflation: Econometric Analysis to 2 Ethiopian Economy

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6

7 **Abstract**

8 Of the most commonly celebrated propositions in international trade is the hypothesis that
9 trade liberalization is associated with declining prices, so that protectionism is inflationary.
10 The New Growth Theory is strongly in favor of this view. However, the ?"Cost-push
11 advocates?" claim for the existence of positive correlations between trade openness and
12 inflation variables. Moreover, empirical studies have been confirming inconclusive results
13 regarding the nature of relationships between the two variables. These theoretical and
14 empirical departures are the principal motivations to the current study. This study is aimed
15 to test the relationship between inflation and trade openness variables in Ethiopia, using the
16 time series data set for the period serially ranging from 1976/77 to 2016/77. Augmented
17 Dickey Fuller and Phillips Perron approaches will be employed for testing the stationarity
18 properties of individual variables in the model and the Johnson? maximum likely-hood
19 approach will be employed for cointegration tests. Finally, Vector Error Correction will be
20 estimated in order to determine the relationships among variables entered the inflation model
21 adopted, both in the short and the long run periods.

22

23 **Index terms**— cointegration, ethiopia, inflation, openness, vector error correction model.
24 or the significantly celebrated benefit of international economic integration, no country can afford to isolate
25 itself from the global economy. The highly significant role of this economic integration goes to developing
26 economies as well. The possible economic gains from outward-looking development strategies have been
27 extensively discussed in theoretical and empirical literatures in the world of economics. The benefits of outward-
28 looking policies have been believed to be realized from international trade and capital flows. Following these
29 hypothetical integration-growth ties, a great deal of world economies has resorted to opening up their gates and,
30 a considerable shift has been observed from a closed to open and more flexible economic structure at around
31 1990s.

32 The celebrated benefit of openness is that it boosts the level of real output. The associated hypothesis has been
33 also been that, through its positive effect on output higher openness has a reducing effect on the rate of inflation.
34 But, the issue follows that, "has globalization really changed inflation in the way expected?" The issue remained
35 a subject of debate for long in economic literatures. In most countries, even though the relationship between
36 openness and output operates as expected, but takes different forms with inflation due to various structural and
37 country specific factors. However, there is no unique agreement on the interaction between higher trade openness
38 and inflation. Rogoff argues that "globalization has played strong supporting role in the past decade's process
39 of disinflation" (Rogoff, 2003). He evidenced the realized inverse correlation between openness and inflation.
40 However, contrary to Rogoff, Ball (2006) claimed for the existence of only little, probably insignificant impact
41 of openness on inflation. While continuing his argued for the probable existence of only the modest and little
42 relationship between the two macroeconomic variables. Despite the existence of varying views on these links, the
43 pronounced phenomenon in economic theories has been to regard inflation and openness the negatively varying

44 variables. Surprisingly, but not impressive, this theoretical link between the openness and inflation remained a
45 bench mark in national policy setting in for a considerable number of economies even today. Ethiopia is not an
46 exception to this.

47 Though regarded to serve positive role in rare case, inflation creates obvious costs to economic, social, political
48 and other aspects of the country. The higher rate of inflation has commonly recognized negative effects in any
49 typical economy. It could lead to poor resource utilization by forcing inefficient transactions and speculations,
50 dampens the scope for rational economic decisions, and moreover creating a horrible situation by which the
51 government policies loss credibility. When monetary economy to the largest extent losses power in dealing with
52 macro wise economic aspects, good conditions are created to welcome hyper inflationary situations (see ??rugman,
53 1991). Moreover, with higher inflation rates the economic growth process is also distorted via its reducing effect
54 on domestic propensity to save. That means since inflation is meant to evaporate the purchasing power of money
55 income, people's tendency to save part of their income for future consumption, of course it forms part of domestic
56 investments, diminishes; and hence, economic activities as well.

57 Whatever the relationship between openness and inflation is, stability in macroeconomic variables is a key for a
58 sustainable and real economic growth to take place. Inflation, hence, is among the main concern. Fischer (1993)
59 supports the view that a stable macroeconomic environment is conducive element to sustained economic growth.
60 From his empirical observations we see that countries with low inflation have grown faster and vice versa. An
61 important issue for the present analysis could be that stable and moderate growth rate of inflation is inevitable.

62 The present study is aimed to test the empirical correlation between inflation and openness in Ethiopia.

63 Once the significant role of stable inflation is recognized, there is a need to determine its link with other
64 macroeconomic variables; one is the trade openness variable. Hence, it is intended to test whether the two
65 variables are operating in line with the theoretical claims. From the past experience in the literatures of inflation,
66 inflation has been thought to be influenced by various monetary, fiscal and structural phenomenons; with an
67 economies exposure to international economic and political integration other factors with a potential of affecting
68 home inflation could be introduced. Hence, efforts will be made to incorporate the effects of both the internal
69 and external influences on the domestic price level.

70 The hypothetical claim with the New Growth Theory on the link between inflation and openness has been an
71 important point of macroeconomic debates. The claim with the theory is that higher openness reduces the rate
72 of inflation. In line with this theory (Romer, 1993) investigated a negative relationship between trade openness
73 and inflation, using a large cross-section of 114 countries over the period 1973 to 1988. However, other views
74 and empirical findings exist in contrast to the above cases. For instance, the "Costpush myth" holds for inflation
75 to vary positively with the degree of openness (Mayer, 2003). The argument is that, an opened up economy
76 is highly subject to imported inflation and weekend domestic macroeconomic policies (particularly of monetary
77 and fiscal policies) with the introduction of external shocks (like exchange rate conditions and other unfavorable
78 happenings in trading partners), see ??ron and Muellbaur (2007). Heavy reliance on import of manufactured and
79 industrial goods and intermediate inputs by emerging economies will have higher possibility of importing foreign
80 inflation simultaneously, which can be reflected directly on domestic prices. Hence, given all these possibilities,
81 the 'Cost-Push' advocates claimed that, it is the net effect that determines the level of output and, hence price
82 level; but not only the justified benefits of trade openness.

83 Apart from this theoretical departure, there are also empirical contradictions on the nature of correlations
84 among the two variables. For instance, a study by Sanginabadi et al (2011) and Zakaria (2010) have confirmed
85 a positive and significant effect of trade openness on inflation in the respective economies of Iran and Pakistan.
86 Induced primarily by these theoretical and empirical contradictions regarding the link between inflation and
87 trade openness variables, the present study will be directed to determine the empirical relationship between the
88 two variables; given that no previous empirical study has been undertaken in the country in the spirit at hand.
89 Hence, the motivation could be to which of the hypothetical claim explains the case in Ethiopia; that is; "the
90 New Growth Theory or the Cost Push Myth".

91 The notion that there are no or little previous studies in the country somewhere in this paper suggests for the
92 desirability of the present study. Therefore, the present study is expected to contribute significantly by adding
93 value to the countries inflation literatures, with the specific reference to openness to trade. In fact, one could
94 find similar previous works in Ethiopia, though are limited too in concerning availability as well as statistical
95 requirements. The only considerable study in the country in exactly similar issue could be a work of Meseret
96 (2014), which is unpublished graduate study. Her control variables include the money supply, gross fixed capital
97 formation as a share of GDP, per capita income and the government's consumption expenditure together with the
98 openness variable (the principal element in the model). The study, even though, related is found to be limited
99 on a number of grounds. In the first place, the government expenditure takes many forms, not only consumption.
100 Government expenditure can be made for consumption of public goods and services, public investment activities
101 and transfer payments. In all the cases, currency is being injected in to the economy thereby creating respective
102 effects on the economy. Hence, the current study will try to incorporate the full effect of government expenditure
103 on inflation model, which is to be discussed latter in this paper. Moreover, her analysis was limited to home
104 side factors except the openness variable, which is the principal variable in the model. Yet, with higher exposure
105 to international trade there could be a possibility that other external factors could have significant role in the
106 domestic economy. For instance, in an opened up economies variables like imported inflation, exchange rates,

107 balance of payments and possibly foreign interest rates affect domestic economy but ignored due consideration
108 in the study by Meseret. Therefore, it will be tried to investigate the monetary, fiscal, structural and external
109 variables in a relation to inflation in the present study.

110 Moreover, previous studies in Ethiopia have been focusing on the general cause-effect aspects of inflation
111 with no particular attention to money supply and inflation; as opposed to their share in inflation theories and
112 literatures. Even though, a little work has been done, they all commonly share serious limitations: variables
113 employed as well as the number of observations were of limited size. Besides, not a little of them were concerned
114 with food inflation alone. For example, a study by Josef et al (2008) has considered only the short run issues.
115 Demirew (1998) for example used only agricultural and money supply variables in a relation to inflation as
116 cited by ; and Josef et al (2008) controlled only money supply, exchange rate, agricultural production shocks
117 and foreign price. This study is limited basically on three grounds; by employing small number of variables,
118 observations and considering the short run issue only. Other recent studies are also not out of this limitation:
119 study by (Tsegay, 2014; Meseret, 2014) might exemplify it. Moreover, majority of them used only small size of
120 observations. For instance; Carrying out analysis in such a way leads to defective conclusions. The present study
121 differs from the previous once on a number of grounds. First, both the size of observations and variables are
122 extended as appropriate as the econometric models employed.

123 The present study is principally intended to empirically investigate the relationship between trade openness
124 and inflation variables in Ethiopia using the time series data set for the period ranging from 1976 to 2016.

125 Towards attaining the set broad objective, the following specific objectives to be addressed in this study include;
126 ? Empirically investigating the direction of causality between inflation and openness variables; ? Examining both
127 the short and long run effects of trade openness on inflation and;

128 ? Determining the relative magnitude of each exogenous variable employed in explaining the process of inflation
129 in Ethiopia.

130 1 a) Theoretical Literature i. New Growth Theory versus Cost- 131 push Myth

132 The relationship between inflation and openness has been a subject of research, theoretical as well as empirical.
133 However, the literature on the subject is relatively scant. According to 'new growth theory', openness is likely
134 to affect inflation through its likely effect on output ??Jin, 2000). This link could be operating through: a)
135 increased efficiency which is likely to reduce cost through changes in composition of inputs procured domestically
136 and internationally, b) better allocation of resources, c) increased capacity utilization, d) rise in foreign investment
137 which can stimulate output growth and ease pressures on prices (Ashra, 2002). Okun ??1981) postulates that
138 the shocks to the domestic price level due to domestic output fluctuation are likely to ease as the economy opens
139 up. However, the "Costpush advocates" put the case differently. The "Costpush myth" holds for inflation to
140 vary positively with the degree of openness (Mayer, 2003). The argument is that, an opened up economy is
141 highly subject to imported inflation and weekend domestic macroeconomic policies (particularly of monetary
142 and fiscal policies) with the introduction of external shocks (like exchange rate conditions and other unfavorable
143 happenings in trading partners), see Aron and Muellbaur (2007). Heavy reliance on import of manufactured and
144 industrial goods and intermediate inputs by emerging economies will have higher possibility of importing foreign
145 inflation simultaneously, which can be reflected directly on domestic prices. Hence, given all these possibilities,
146 the 'Cost-Push' advocates claimed that, it is the net effect that determines the level of output and, hence price
147 level; but not only the justified benefits of trade openness.

148 2 ii. The Classical Quantity Theory

149 The theory bases its analysis on the Fishers (1911) quantity equation given by ($MV = PY$): where, M (money
150 supply); V (Velocity of money); P (general price) and Y (real GDP). Assuming V and Y to be constants in the
151 model, the theory claims that ($\%M = \%P$), implying the existence of equi-proportional relationships between
152 monetary growth and the rate of inflation. Therefore, inflation is always and everywhere a monetary phenomenon
153 and in that no other factor could have a role as money plays in the determination of inflation process; see (Johnson
154 et al, 2000; ??etzel, 2007; Milton, 1971; ??elson, 2007 and ??ay and ??nderson, 2011).

155 iii

156 3 . Keynesian Theories of Inflation

157 In contrast to the case with classical economists, money creates real impact where idle capacities are present
158 for Keynes. He claimed in such an economy that, any additional money balance reduces the rate of interest,
159 increases investment and, hence, output. As a result the initial rise in price could be completely offset by the
160 latter reduced price, hence, no way for it to directly transmit to the general price level (Keynes, 1936). Keynes
161 identified three basic reasons why an economic agents demand money balance; the transaction demand (in line
162 with the traditional economists), the precautionary demand (for emergency cases) and the speculative demand
163 (money even as store of value); with the latter being the key tool in his attack against the QTM (Keynes, 1936).
164 He contained these three motives together in his money demand Where; M is the nominal stock of exogenously

165 determined money supply; D, the demand for money and P is the general price level (Keynes, 1936). With the
166 nominal interest rate included in his money demand function, Keynes stressed that, changes in the quantity
167 of money affect price level only after impacting the level of interest rate, and hence investment, output and
168 employment (Humphrey, 1974). So that, the transmission mechanism between money and the price level is
169 indirect. The immediate impact of change in the quantity of money rests on the interest rate but not on price.
170 It implies that when interest rate decreases (following positive shock in the quantity of money), the level of
171 investment responds by increasing. Hence, the levels of output, income and employment increase also as well.
172 The additional level of employment, in fact, imposes additional pressure on aggregate demand, and that the rising
173 wage and other costs together induce the price level to rise. Here, the transmission of monetary impact on price
174 is not only indirect, but the effect is not complete, since part of the money balance is held by the speculators (see
175 Krusell P., 2004; ??elson, 2007) Both versions of the quantity are, however, similar for an economy operating at
176 its full capacity. For Keynes money could impose even a higher than full inflationary effect in the long run being
177 aggravated by inflationary expectations. The Keynes's version reveals that the elasticity of price with respect to
178 any monetary shock be equal to zero ($e_p = 0$) in an economy with idle resources to utilize. According to him, in
179 such an economy, monetary injections would enable utilize idle resources and employment which increases output
180 in a proportion to changing aggregate demand, hence there would be no impact on prices in the short run(see
181 ??enneth and Anthony, 2015). The elasticity becomes one, given the level of output and employment fixed at full
182 capacity and is 'True inflation' for Keynes. Any monetary growth while the economy is operating at full capacity
183 induces proportional change on price.

184 Secondly, the constant assumption of velocity was no more guaranteed in Keynes's version of QTM. In his
185 Tract, he claimed that velocity of money is rather procyclical (subjected to shocks)by considering the impact of
186 interest rate on demand for money.

187 4 Capturing velocity by ($V =$

188 5 $\frac{M}{P} = \frac{V}{P} \times \frac{P}{M}$

189), Keynes argued that velocity is a positive function of interest rate. It works like this; when interest rate
190 increases, money demand decreases and, as a result velocity of money increases.

191 The implication is that, increased interest rate induces cash holders to save more to gain extra benefit from
192 rising rates. So that, they put more of their balance at bank and remain with few and since the amount of balance
193 available in the economy is now less, it frequently changes hands to serve the remaining unsatisfied motives for
194 money. With unstable velocity, no way for money to directly transmit to price and vice versa; i.e. any change
195 in price or income would also be absorbed by the same process as a result no increasing response from money
196 supply (Snowdon and Vane, 2005).

197 6 iv. Demand-Pull Theory of Inflation

198 As the name implies this type of inflation is the result of excess demand in the economy. From the Keynesians
199 traditional national income identity ($Y = C + I + G$), aggregate demand is a function of aggregate consumption
200 (C), investment (I) and government expenditure (G). The demand pull inflation occurs when this sum exceeds
201 the total level of supplies in the economy. Any factor causing aggregate demand to increase above its potential
202 level would result in inflation. According to Oludele et al (2002), Keynesians' had a simple and direct tool to deal
203 with this type of inflation. Their advice is to absorb money back from the public sufficient enough in reducing
204 the extra effective demand imposing adverse shock on the price level.

205 v. The Cost-Push Fallacy These types of inflation emerge from any negative shocks in the supply side of the
206 economy. Following Lahari (2011), the supply side of the general economy explains output, inflation and the
207 economy's adjustment to equilibrium at the potential level of output. The argument here is that, any factors
208 contributing negatively to the production side of the economy are all inflationary. For example, increasing raw
209 material costs, rising labor costs and indirect taxes could direct reflect in the form of increased prices or induce
210 price to increase thereby reducing outputs. It is frequently stated in theoretical literatures like, Batten (1981)
211 and ??umphrey (1976), for this type of inflation to take place in the following manner: to cope up with the
212 rising living costs in a condition of rising aggregate prices, employees may bargain and form a union demanding
213 additional wage income; rising wages in turn can help drive inflation. This type of price surge also is regarded
214 to spread in other sectors of the economy. It implies that, if a given production sector involves the input use of
215 goods and services produced in another sector for which the production costs are increasing; then the prices of
216 the goods produced in the first sector also increases.

217 7 vi. The Structuralist's Explanation

218 This theory briefs the causes of inflation particularly in less developed economies by identifying structural rigidities
219 commonly underlying these economies. For instance, Ray and Anderson (2011) have identified three structural
220 factors commonly explaining inflation in under developed economies. These are inelastic supply of agricultural
221 products, insufficient national resource (government budget constraint) and foreign exchange bottlenecks. The
222 implication with the first case is that, the unbalanced growth trends in agricultural sector and urbanization

223 could result in higher rate of inflation in most LDCs. That means agricultural productivity is insufficient to
224 meet its growing demand as urbanization is going ahead. Besides, due to weak domestic capacity complemented
225 with loss of trust by external lenders, most LDCs resort to monetization of their deficits which is inflationary
226 in practice in line with the traditional QTM. The structuralists' maintain that factors forcing monetization of
227 deficits in LDCs are accounted for this type of inflation but not money supply as it is induced by those structural
228 rigidities. Moreover, Donath and Dima (2000) and Jema and Fekadu (2012) also highly stress the case in line
229 with Olson (2010). Foreign exchange limitations and huge price differentials in the international trade are also
230 among the main headaches of underdeveloped economies. Finally, structuralists' have a message to LDCs at
231 least to minimize the effect of inflation resulting from structural rigidities. That is to develop any optimum
232 measure as well as capable institutions enough to avoid structural rigidness and imbalances in various sectors of
233 the developing economies and bring these changes in the economy.

234 **8 vii. Theoretical Link between Deficits and Inflation**

235 Budget deficit is the second important variable in this study (next to money supply variable) because of its
236 theoretical link to monetary growth. Via the QTM approach, the monetarists argue that monetization of budget
237 deficit is inflationary. There are three ways to finance the public expenditures; borrowing from the public,
238 borrowing from the central bank (Seigniorages) and external borrowing (Sargent and Wallace, 1976; ??ebecca,
239 2014). Relative to the other two methods, the central bank financed deficits impose higher inflationary pressures.
240 That is when money is created to fill deficits, the quantity of money in the economy increases and could result
241 in inflation. Budget deficit affects price only after affecting the level of nominal money growth in an economy. It
242 means, as long as the deficit is not monetized, no link exists between deficits and the price level. ??argent and
243 Wallace (1981) postulate that, following exogenous government spending and taxes, monetization of the deficits
244 would lead to monetary variable induced inflation in the long run. According to them, deficit cause money growth
245 and which in turn causes inflation. Besides, they argue in such a condition, for the existence of feedback effect
246 from inflation to budget deficits in the manner that inflation reduces the value of real revenue to the government,
247 leading to fiscal deficit in the long run. Sargent and Wallace maintain that if monetization of deficits could
248 result in growth of money supply and hence inflation, the situation would be termed as 'fiscal dominance,' due
249 to the fact that the whole process is forced by the initial shocks in the fiscal policy. Lags in the collection of
250 government's tax revenue adversely affect the government's fiscal position thereby reducing the real value of the
251 public's tax revenue; this might further induce monetary creation.

252 viii. Empirical Evidences From early empirical discoveries, Triffin and Grudel (1962) tested the hypothesis
253 that openness boosts productivity and hence leads to cheaper availability of goods that are costly in the country
254 otherwise and confirmed an inverse relationship between openness and inflation variables in sample of 5 countries
255 in European Economic Community. It, hence, is in line with the claim of New Growth Theory and the Romer's
256 hypothesis. Romer (1993) finds that closed economies tend to have higher inflation. He argues that central banks
257 in economies more open to trade find currency fluctuations caused by money surprises more painful and therefore
258 exercise more restraint than their closed economy counterparts. Empirical findings by Lane (1997)

259 argues that tariffs do not necessarily cause inflation, at least in the US. ??ruben and Mcleod (2004) show that
260 there does not exist any significant opennessinflation relationship among OECD economies. ??im and Beladi
261 (2004) have estimated a positive relationship between price level and trade openness for some advanced economies,
262 such as the US, Belgium, and Ireland, while for other countries, both developed and developing, their finding
263 is in line with Romer's (1993) argument. Finally, it is interesting to note that Romer (1993) himself finds no
264 significant openness-inflation relationship among OECD economies.

265 The country specific case is concerned; a study by Meseret (2014) could be primarily mentioned. She estimated
266 the negative but insignificant impact of trade openness on inflation in contrast to the theoretical claims. Minyahil
267 (2016) has also estimated the dynamics of inflation in a relation with other macroeconomic variables by controlling
268 the openness variable. His finding indicates that the relationship between the two variables is positive and highly
269 significant both in the short and long run. He justified the case to the country specific conditions like rigid
270 economic policies, the prolonged internal and external conflicts with a potential of blocking the suspected benefits
271 of large openness.

272 The quality of any macroeconomic analysis can be determined by the accuracy, consistency and availability of
273 any macroeconomic variables in question. The problem in Ethiopian case is the inconsistency of macroeconomic
274 data from different sources: to cope up with this problem, money sources will be referred as possible. The study
275 uses secondary time series data set for the period serially ranging from 1976/77 to 2016/17, which is for about
276 41 years. The data are to be sourced from both the domestic and external organizations. The potential domestic
277 sources include; Ministry of Finance and Economic Cooperation (MoFEC), National Bank of Ethiopia (NBE),
278 Central Statistics Agency (CSA) and the Ethiopian Economic Association (EEA). External sources include;
279 World Bank (WB) data base, International Monetary Fund (IMF) and the African Development Bank (AfDB).

280 **9 a) Econometric Model Specification**

281 The inflation variable can be measured in either of the following ways;

10 OPENNESS =

? GDP-Deflator: -computed as the ratio of nominal to real GDP. This ratio at any time (t) indicates the level of inflation. ? Producer Price Index (PPI):-It measures the positive change in the average price of inputs or raw materials used by producers. Its delinquency is that it considers only raw materials, not finished goods and services.

286 ? Consumer Price Index (CPI):-It is the change in the average price of consumable goods and services. It
287 measures the positive net change in the average price of consumer goods and services.

No doubt, higher proportion of income in Ethiopia is spent on consumption of final goods and services. According to the Ethiopian 2014/15 third quarter economic report of UNDP, more than 56% of households' expenditure was made on food, beverages and other final consumable goods and services. Therefore, to use CPI is more appropriate and contextual in case of Ethiopian economy. GDP-Deflator is inappropriate since it excludes the impact of imported inflation on domestic prices owing to the definition of Gross Domestic Product. On the other hand, Producer Price Index (PPI) is not effective in representing inflation in Ethiopia compared to CPI, since the proportion of income spent on consumption of final goods and services exceeds spending on the purchase of raw materials and other inputs. Hence, CPI is reasonably a good candidate to measure inflation in Ethiopia, so that, it is a proxy to inflation variable (a response variable) in this study. Hereafter, while using CPI anywhere in this paper, we are referring to the inflation variable in other way round.

Modeling inflation is among the complex phenomenon in Economies as it is subject to various influences. However, it can be possible to determine the key variables the process of inflation in the countries like Ethiopia. The most empirically popular way in examining the relationship between trade openness and inflation variables has been to employ the single equation model, treating openness as the exogenous variable and; obviously, inflation (CPI) is the endogenous variable the model setting.

303 Hence, based on Solomon (2004), Mukhtar (2010) and Aron and Muellbaur (2007), the dependent and
 304 independent variables employed in modeling inflation in the current study are functionally related as follows;
 305 $CPI_t = f(BD_t, GDP_t, RER_t, OT_t, M2_t, GCF_t) \dots (1)$

Where; CPI = Consumer Price Index which is a proxy to inflation variable; BD = Budget Deficit; It is the difference between government expenditure and receipts for a given fiscal time period; GDP is Gross Domestic Product and RER is Real Exchange Rate. OT is the openness to trade variable. It is equal to the sum of import and export values divided by nominal GDP; thereby all the exports, imports and the GDP are measured in current price and current exchange rates.

311 10 Openness =

312 ?????? ?????+?????? ????? ?????? ??? M2 = Stands for the broad money supply in Ethiopia. It forms
 313 the definition of money supply in the operational setting of National Bank of Ethiopia (the central banker of
 314 Ethiopia); and, GCF is Gross Capital Formation as a share of GDP; and t, captures any time trend in each case.

315 Just, the intention here is to determine the elasticity of each of the predictor variables with respect to inflation;
 316 and, due to the fact that, not everything is controlled in the model, we need to adopt the econometric model
 317 incorporating the identified variables and also considering the effect of other variables not included in the model.
 318 The model is set as follows; $\ln \text{CPI}_t = \beta_0 + \ln \text{BD}_t + \ln \text{GDP}_t + \ln \text{RER}_t + \ln \text{OT}_t + \ln \text{M2}_t + \ln \text{GCF}_t$
 319 $+ u_t$?(2)

330 But, the error term (u_t) is stationary at level, and may be heteroskedastic and serially correlated. However,
 331 the problems will be corrected in PP test by modifying the test statistics of $t^* = 0$ and $T^* = 1$ in the first regression.
 332 Based on Harry (2012); Sjo (2008), the new test statistics would be represented by Z_t and Z_{T^*} as; $Z_t = [(T^* - 1)^{1/2} t^*] / \sqrt{t^*}$ and; $Z_{T^*} = [T^* - 1] T^* \bar{u}_t / \sqrt{t^*}$; and $\bar{u}_t = \frac{1}{T^*} \sum_{t=1}^{T^*} u_t$.

336 Under the null of $\delta = 0$ (i.e. unit root exists), the Z_t and Z_{t-1} statistics in the Phillips-Perron (PP) procedure
 337 above, assume similar asymptotic distribution as with the conventional DF t-statistic. The PP procedure is
 338 advantageous over the ADF mechanism on at least two grounds; 1st, the PP is robust to general forms of
 339 heteroskedasticity in the error term; and, 2nd, and it does not need specification of lag length for regression as
 340 it is adjusted at length three by default in econometric and statistical software.

341 11 a) Lag Length Determination

342 It is also essential at the onset of cointegration analysis that the problem of determining optimal lag length should
343 be considered as multi-variate cointegration analysis is very sensitive to the lag length selection. The two most
344 common way used to determine the optimum lag length are the one where Akaike information criterion (AIC) is
345 minimum and one which is suggested by majority of the criteria.

346 12 b) The Cointegration Test

347 The econometric framework to be used for analysis in this study is the Johansson (1998) maximum likelihood
348 cointegration technique, which investigates both the existence and the number of cointegrating vectors. This
349 multivariate cointegration test can be modeled as: $Z_t = K_1 Z_{t-1} + K_2 Z_{t-2} + \dots + K_{k-1} Z_{t-k} + \epsilon_t$ (4)

350 Where; $Z_t = (BD, GDP, RER, OT, M2, GCF)$ i.e. a 5×1 vector of variables that are integrated of order
351 one [i.e. $I(1)$]. ϵ_t is a vector of constant and, ϵ_t is a vector of normally and independently distributed error
352 term. Equation (4) can be reformulated in a Vector Error Correction Model (VECM) as follows; $\Delta Z_t = \Gamma_1 \Delta Z_{t-1} + \Gamma_2 \Delta Z_{t-2} + \dots + \Gamma_{k-1} \Delta Z_{t-k} + \epsilon_t$ (5) Where; $\Gamma_i = (I - A_1 - A_2 - \dots - A_{k-1})$, $i = 1, 2, 3, \dots, k-1$ and $\Gamma = -(A_1 - A_2 - \dots - A_{k-1})$. The coefficient matrix Γ , provides information about the long-run relationships among the
353 variables in the model. Γ can be factored into $\Gamma = \Gamma_1 \Gamma_2 \dots \Gamma_{k-1}$, where Γ_1 will include the speed of adjustment to the equilibrium
354 coefficients while the Γ_{k-1} will be the long run matrix of coefficients. The presence of r cointegrating vectors between
355 the elements of Z implies that Γ is of the rank r , $(0 < r < 5)$. To determine the number of cointegrating vectors,
356 Johnson (1998) developed two likelihood ratio tests: the trace test (χ^2 trace) and the maximum Eigen value test
357 (χ^2_{max}). If there is any divergence of results between these two tests, it is advisable to rely on the evidence
358 from χ^2_{max} because it is more reliable in small samples (see Dutta and Ghosh, 1977, and Ghosh and Dhami, 2005
359 Where, χ^2_{max} and χ^2_{trace} are the consistent variance estimates of the following respectively;¹

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363 Global Journal of Human Social Science -

364 Figure 1:

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- 363 [Africa] , *Africa* Research Article in Department of Economics of Oxford University, England
- 364 [Milton ()] 'A Theoretical Frame Work for Monetary Analysis'. Milton . *National Bureau of Economic Research*
365 1971. p. .
- 366 [Dutta ()] *An Aggregate Import Demand Function for Bangladesh: A Cointegration Approach*, D Dutta , Ahmed
367 , N . 1997. Working Paper, University of Sydney
- 368 [Jin ()] 'Can Openness be an Engine of Sustained High Growth Rates and Inflation? Evidence from Japan and
369 Korea'. C J Jin . *International Review of Economics and Finance* 2006. 15 p. .
- 370 [Song ()] *China's Rapid Growth and Development: An Historical and International Context*, Song . 2010. Beijing,
371 China. p. . Conference Paper at Peking University
- 372 [Temesgen ()] *Determinants and Impacts of Dynamic Inflation in Ethiopia*, Temesgen . 2013. Norway. MA Thesis
373 in Economics, Norwegian University of Life Sciences
- 374 [Jema ()] 'Determinants of Recent Souring Food Inflation in Ethiopia'. Fekadu Jema . *Research Journals* /2277.
375 2012. 1 (8) p. .
- 376 [Sachsida et al. ()] 'Does Greater Trade Openness Reduce Inflation? Further Evidence Using Panel Data
377 Techniques'. A Sachsida , F Galrao , P R A Loureiro . *Economic Letters* 2003. 81 p. .
- 378 [Mukhtar ()] 'Does Openness Reduce Inflation? Empirical Evidence from Pakistan'. Mukhtar . *the Lahore Journal
379 of Economics* 2010. 15 (2) p. .
- 380 [Johnson ()] 'Dynamic Impact of Money Supply on Inflation: Evidence from ECOWAS Member States'. Ley
381 Johnson , Cate . *International Economic Conference Paper*, Anthony Kenneth (ed.) (Awka, Nigeria) 2000.
382 2015. 6 p. . Bemidji State University ; Nnamdi Azikiwe University (Keynes' Theory of Money and His Attack
383 on the Classical Model)
- 384 [Rogoff ()] *Globalization and the Global Disinflation*, K Rogoff . 2003. Jackson Hole Conference. (Paper presented
385 to the Federal Reserve Bank of Kansas)
- 386 [Ashra ()] *Inflation and Openness: A Case Study of Selected Developing Economies*, S Ashra . 2002. (Working
387 Paper 84, Indian Council of Research on International Economic Relations (ICRIER)
- 388 [Lane ()] 'Inflation in Open Economies'. P R Lane . *Journal of International Economics* 1997. 42 p. .
- 389 [Batten ()] 'Inflation: The Cost-Push Myth'. Batten . *Economic Quarterly Review* 1981. p. .
- 390 [Hideki ()] 'Inflationary Expectation in Ethiopia: Some Preliminary Results'. Rukmani Hideki , Josef . *Working
391 Paper* 2008. 8 (2) .
- 392 [Kim and Beladi ()] 'Is Free Trade Deflationary?'. M Kim , H Beladi . *Economic Letters* 2005. 89 p. .
- 393 [Krusell ()] P Krusell . *Macroeconomics I*, 2004. (Post Graduate Lecture Notes in Economics Department)
- 394 [Boo ()] 'Modern Macroeconomics: Its Origins, Development and Current State'. Sjo Boo . *South African Journal
395 of Economic and Management Sciences* 31. Solomon, M., and de Wet, W.A. (ed.) 2008. 2005. 2004. Edward
396 Elgar Publishing Inc. USA. 30 (1) p. . (Journal of Econometrics)
- 397 [Terra ()] 'Openness and Inflation: A New Assessment'. C T Terra . *Quarterly Journal of Economics* 1998. (113)
398 p. .
- 399 [Romer ()] 'Openness and Inflation: Theory and Evidence'. D Romer . *Quarterly Journal of Economics* 1993.
400 108 (4) p. .
- 401 [Sargent ()] 'Rational Expectations and the Theory of Economic Policy'. Wallace Sargent . *Journal of Monetary
402 Economics* 1976. North-Holland Publishing. p. .
- 403 [Kibrom ()] *Sources of Recent Inflationary Experience in Ethiopia*, Kibrom . 2008. Ethiopia. MA Research Paper
404 in Economics Department of Addis Ababa University
- 405 [Kibrom ()] *Sources of Recent Inflationary Experience in Ethiopia*, Kibrom . 2008. Ethiopia. MA Research Paper
406 in Economics Department of Addis Ababa University
- 407 [Johansen ()] 'Statistical Analysis of Cointegration Vectors'. S Johansen . *Journal of Economic Dynamics and
408 Control* 1988. 12 p. .
- 409 [Meseret ()] *The Effect of Trade Openness on Inflation in Ethiopia*, Meseret . 2014. Ethiopia. MA Research
410 Paper in Economics Department of Addis Ababa University
- 411 [Mayer ()] 'The Fallacy of Composition: A Review of the Literature'. Mayer . *Discussion Paper of the United
412 Nations Conference on Trade and Development*, 2003.
- 413 [Lahari ()] 'The General outline for PFTAC Central Bank Training'. Lahari . *The General outline for PFTAC
414 Central Bank Training*, (Suva) 2011. 2011. 19. (Test for Cointegration)
- 415 [Keynes ()] *The General Theory of Employment, Interest and Money*, Keynes . http://etext.library.adelaide.edu.au/k/keynes/john_maynard/k44g/k44g.html 1936.
- 416 [Humphrey ()] 'The Quantity Theory of Money: Its Historical Origin and Role in Policy Debates'. Humphrey .
418 *Economic Review* 1974. p. .