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Research Article

The Demand for Imports and Exports in Africa: A Survey

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ABSTRACT

To drive economic development, it is important for policy makers to have a good understanding of the linkages between imports, exports, and the rest of the economy. This is particularly true for Africa. The continent depends on exports of commodities to finance imports of manufactured goods for consumption and investment purposes. The importance of trade to African economies is underscored by one fact: the region has one of the highest ratios of imports and exports to gross domestic product. In this paper, we survey the literature on import and export demand elasticities and present a broad set of estimates for the countries of Africa. These estimates collected in our survey can support both academic research and policy making on the continent. They also provide a road map for future research on the determinants of trade flows on the continent. The results reveal large gaps in our understanding of the determinants of trade flows in the region—those gaps serve as pointers for future research.

1. INTRODUCTION

The estimation of import and export demand elasticities has a long tradition dating back to the 1950s. By the mid-1970s, the literature was sufficiently large to warrant the publication of the classic survey of the literature by Stern et al. (1976). This survey was updated in the 1990s by Sawyer and Sprinkle (1999). The literature also had become large enough to warrant designated surveys for high-income countries and regions (e.g., Sawyer and Sprinkle, 1996,1997; Hooper et al., 1998). Surveys of trade elasticities for developing countries in general can be found in Santos-Paulino (2002) and Marquez (2013). The organization of surveys by region is important, as the literature now shows that trade elasticities tend to vary with the level of economic development (Lo et al., 2007). Of particular interest in this context is the survey of Latin American trade elasticities by Fullerton et al. (1999).

A survey of trade elasticities for a region composed primarily of developing countries, such as Africa, will therefore be more informative than usual. In the case of Africa, there has been no comprehensive survey of the literature on import and export demand elasticities for the continent. The purpose of the paper is to present a comprehensive listing of the entire literature on this subject. The resulting data clearly show that our knowledge of these elasticities is deficient in many areas. This lack of information adversely affects both future academic research and the implementation of sound economic policy.

The structure of the paper is as follows. In the next section, we discuss import and export demand elasticities in an African context. Section 3 provides a brief description of the technical details involved in the estimation of import and export demand elasticities. Sections 4 and 5 present the data derived from the literature on import and export demand, respectively. The final section summarizes the literature and provides suggestions for future research.

2. TRADE ELASTICITIES IN AN AFRICAN CONTEXT

For any country or region, the more open it is to trade, the more important its trade elasticities are to policy makers. Africa as a region is an excellent example. The economies of the region are more open to trade than the global average—as measured by the ratio of Gross Domestic Product (GDP) to the sum of imports and exports. The region's already high trade openness is increasing over time. In 1995, exports as a share of global GDP was 21% for the world economy. In Africa, this ratio—as a standard measure of trade openness—was 27%. By 2017, the global ratio had increased to nearly 30%. In Africa, it had risen to almost a third of GDP. With the exception of the large economies of Nigeria and South Africa, these percentages are not surprising for a region composed primarily of relatively small, open economies. Other standard measures of openness are consistent with this pattern.

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This means that studying the demand for imports and exports is more important for Africa than for most regions of the world. In this situation, it becomes crucial to have a good understanding of the underlying determinants of both imports and exports, in order to make meaningful economic policy. In both cases, the basic determinants are income, relative prices, and exchange rates. These determinants are slightly different for the two forms of trade flows. They will each be covered in turn with and put into an African context. In any country, the demand for imports is most importantly a function of income. Without the income to purchase the imports, relative prices and/or exchange rates are of little consequence. Fortunately, economic growth in Africa since the mid-1990s has been faster than the global average. This is reflected in the rising ratio of imports to GDP in the region. Part of the increasing openness of Africa is a reflection of rising incomes and standards of living which includes a greater capacity to satisfy consumer needs via imports. However, for developing countries this rapid growth is normally accompanied by a substantial amount of macroeconomic volatility. Further, this natural volatility may be exacerbated by cyclical movements in commodity prices. Such volatility translates into potentially large changes in the quantity of imports. The extent to which changes in GDP translate into changes in imports is expressed by the income elasticity of import demand.

Imports are heavily influenced by changes in relative prices. As will be seen in the next section, this is usually seen as a ratio of domestic prices to the price of imports. Because either the numerator or the denominator can change, the demand for imports can change in response. It is common in developing countries for overall prices to be more heavily influenced by inflation. A reflection of this is the common inflation target of 5% which would be something closer to 2% in developed countries. This could well lead to larger changes in relative prices for the developing economies of Africa. Further, discretionary policies such as price controls, exchange controls, or industrial policy may have noticeable impacts on the prices of domestic goods. Finally, much of what Africa imports are manufactured consumer and industrial goods from developed countries. Many of these imports lack few good substitutes and changes in import prices may have important effects on the domestic price level as well as the standard of living. The instability described above would make relative prices in African countries inherently unstable. In a floating exchange-rate regime, the nominal exchange rate likewise would tend to be unstable. Even in a fixed exchange-rate regime, the real exchange rate would tend to be unstable as relative prices change. At this point it is simply important to note that changes in real exchange rates can have a substantial impact on imports. This is particularly true if the change is large and occurs in a short period, that is, an exchange rate shock.

Analogously, exports also are influenced by changes in GDP, relative prices, and exchange rates but with some important differences. As imports are influenced by domestic income, exports are influenced by changes in GDP in the destination markets. For convenience, changes in foreign income are usually proxied by changes in world GDP. In the case of Africa, global economic instability may have an outsized effect on the region in two ways. First, changes in world GDP may have a large effect on the absolute volume of commodity exports. The commodity cycle is highly correlated with global economic activity with predictable effects on African exports. Second, such movements may have a substantial effect on commodity prices. This conveniently leads to the effects of relative prices on exports. The demand for exports is related to the prices of exports relative to prices in the world economy. African exports are dominated by commodities. Commodity prices are inherently volatile which makes the relative price of African exports likewise volatile. While the overall elasticity for exports may be relatively stable, the underlying relative prices may be quite unstable. Many, if not most, of the commodities that the region exports can be obtained from other developing or developed countries. In this environment, any misalignment of relative prices can have potentially large effects on trade flows. Domestic policies with respect to inflation or distortionary price controls may have large consequences for the volume of exports. A similar situation is the effect of exchange rates on exports. Any significant overvaluation of the currency has the potential to cripple exports of commodities, a development that most of the countries of the region can ill afford. Further, extreme exchange-rate volatility has the tendency to dampen exports. The combination of volatility in relative prices and exchange-rate volatility could seriously weaken the competitive position of the countries of the region relative to commodity exporters in more stable regions.

A final note is that the gravity model of trade would predict that the countries of Africa would tend to trade relatively more intensively with one another. Thus, instabilities in GDP growth, relative prices, and exchange rates become more problematical in a region where such instabilities are common. This coupled with internal trade barriers and weak transportation systems makes African trade with the rest of the world more important than would otherwise be the case. The openness alluded to at the start of the section is an openness that is skewed toward the world economy. In a sense, there is less regional trade and more truly international trade. Given this, a knowledge of how trade responds to its underlying determinants becomes relatively more important, as African trade, especially exports, may well be subject to relatively more competition than the exports from other developing regions where internal trade is more easily facilitated.

Estimates of import and export demand elasticities are important for policy makers for a number of reasons. The income elasticity of import demand becomes an important macroeconomic parameter to gauge the response of imports to changes in GDP. This is particularly true for developing countries where GDP growth is more volatile. This volatility may be quite important in an African context. Fajgelbaum and Khandelwal (2016) show that income elasticities are positively correlated with income. This leads to the conclusion that low-income households benefit most from trade. Thus, volatility in income may have a disproportionate impact on household income in Africa. In the same vein, the income elasticity of export demand is important. Given the importance of exports to the countries of the region, changes in world income that lead to changes in exports have important macroeconomic consequences. The tendency for domestic prices to be more volatile in developing countries makes an understanding of the price elasticities of import demand important. Changes in domestic prices relative to import prices can have a large effect on imports. A monetary policy that fosters low and less volatile rates of inflation would tend to promote stability in the relative prices of both imports and exports. As we will see later, different specifications used for the estimation of trade elasticities account for changes in the exchange rate in different ways. At this point, it is simply important to note that changes in exchange rates can have a substantial impact on imports particularly if the change is large and occurs in a short period (i.e. an exchange-rate shock). For the countries of Africa, maintaining a reasonable level of exchange rate stability may be an important policy consideration. In formulating

macroeconomic policy, a good working knowledge of the various trade elasticities that go into the formulation of these models obviously is important. A similar situation comes up with respect to exchange rate policy. In a floating exchange-rate environment, an exchange-rate elasticity becomes important in forecasting changes in trade flows. These elasticities can become critical if the exchange rate has been fixed and a major devaluation is being considered.

The same sort of considerations come into play when formulating general equilibrium (GE) models for longer-run economic policy. These models are quite useful for studying the evolution of the balance of payments and determining if policies are sustainable in the long run. These models require information on the magnitude of income and price elasticities. Without empirical evidence on this, the elasticities must be assumed to be a certain value. Finally, the price elasticities become critical in the formulation of trade policy for two reasons. First, it is a reality that some tariffs in developing countries still are revenue tariffs. A knowledge of the price elasticities is critical in setting the optimum tariff in these situations. Second, the region is in the process of liberalizing internal trade. In the bargaining that occurs in trade negotiations, the price elasticity of demand becomes an important consideration in valuing the offers and counteroffers that inevitably occur.

3. ESTIMATING TRADE ELASTICITIES

The traditional approach to estimating import demand functions utilizes a specification containing income and relative prices. Imports are assumed to be positively related to income (Y). It is assumed that imports will be negatively correlated to this ratio. The ratio assumes that imports and domestic production are, in general, substitutes. The general formulation is shown in Equation (1).

$$M = f\left(+Y, -\frac{\mathrm{PM}}{\mathrm{PD}}\right) \tag{1}$$

Empirically, M is the real value of imports. Typically, income is measured as real GDP. In the case of imports, relative prices are measured by the ratio of import prices (PM) to domestic prices (PD). In this case, PD usually is measured by a version of the wholesale or producer price index.[1] The function is normally estimated in logs so that the resulting coefficients can be interpreted as elasticities.

While the specification given above is not unrealistic, it is not optimal in two senses. First, following Murray and Ginman (1976), it assumes that changes in prices are homogenous meaning that the imports respond in a similar manner to both changes in PM and PD. As will be seen from the tables, there is reason to believe this may not be the case. If so, this may lead to a second issue. If imports respond differently to changes in foreign and domestic prices, then estimates using Equation (1) are less useful in a policy sense. For the small, open economies that characterize Africa, changes in PM are exogenous and may be large. A similar problem could emerge for countries struggling with inflation.

This leads to the second specification of import demand given in Equation (2).

$$M = f(+Y, -\mathrm{PM}, +\mathrm{PD}) \tag{2}$$

In this specification, separate elasticities are generated for the effects of import prices and domestic prices on imports. This is an obvious advantage as it allows a policy maker to more clearly distinguish the effects of changes in foreign prices as opposed to changes in domestic prices. For example, the effects of domestic inflation on imports may be somewhat different from the effects of a change in the exchange rate.

While this "split price" specification is superior to the price ratio shown in Equation (1), there is one more improvement that can be seen in Equation (3).

$$M = f(+Y, -\mathrm{PM}, +\mathrm{PD}, \mp \mathrm{XR}) \tag{3}$$

In this case, PM has been redefined as the price of the imported product in the local currency of the exporting country. This allows one to separate the effects on imports of changes in the price in the exporting country from changes in the exchange rate (XR). If the exchange rate is defined as units of local currency per units of foreign currency, then the sign on the coefficient will be negative or vice versa. In a floating exchange-rate world, this specification has clear advantages for policy makers. It allows one to see how changes in the exchange rate affect imports in a more clear way.

The estimation of export demand occurs in an analogous fashion. The basic equation for the demand for imports is shown in Equation (5).

$$X = f\left(+\mathrm{YW}, -\frac{\mathrm{PX}}{\mathrm{PF}}\right) \tag{5}$$

In this case, the real value of exports is positively related to world GDP, YW.[2] In Equation (5), PX is an index of export prices and PF is the foreign currency price of competing goods, defined as the foreign wholesale or producer price index. The ratio PX/PF should carry a

[1]Wholesale or producer price indexes are preferred to the consumer price index or GDP deflator, as the market basket contains a smaller number of tradeable goods. For more detail on the estimation of import and export demand, see Sawyer and Sprinkle (1999).

[2]In some cases, YW is defined as the weighted average of the country's major export destinations. For an example, see Deyak et al. (1990).

negative sign as increases in the ratio would tend to depress exports and the reverse would be true. As before, the use of a price ratio is making an assumption that may be violated in practice. Exports may react in a different manner to changes in export prices as opposed to changes in foreign prices. In this case, a different specification such as Equation (6) is more informative.

$$X = f(+\mathrm{YW}, -\mathrm{PX}, +\mathrm{PF}) \tag{6}$$

As before, a further refinement can be added with respect to the exchange rate. In Equation (6), changes in the exchange rate are embedded in PX. Equation (7) provides a specification where these effects can be separately estimated.

$$X = f(+\mathrm{YW}, +\mathrm{PF}, -\mathrm{PX}, \mp \mathrm{XR}) \tag{7}$$

In Equation (7), YW and PF are defined as before. However, PX is now defined in terms of local currency. An appreciation or depreciation of the local currency would contribute to a decrease or increase in exports, respectively.[3]

In whatever form, these equations typically are estimated using a log specification. This conveniently allows one to interpret the coefficients of the regressions that will be reported later in the paper as elasticities. The most common specifications are those shown in Equations (1) and (5) with a price ratio. A smaller subset of results utilizing Equations (2) and (6) reports the outcomes obtained from splitting the price ratio into two separate components. A relatively small number of results are shown where the effect of exchange rate changes as in Equations (3) and (7). The data for these results are almost uniformly obtained from *International Financial Statistics* produced by the International Monetary Fund. As a result, variations in the estimates are more closely tied to actual differences among countries than any differences in the source data. The other source of differences in the estimates concerns the time series utilized. An advantage of the results in the next two sections is the comprehensive set of results presented. The disadvantage is that a number of studies date back to the 1980s. The trade-off is that the study of trade elasticities for the region has not been a very active area of research. The exclusion of older studies would leave far fewer estimates which creates its own problems of a relatively small sample and would also have excluded a number of countries from the data. The result is that we have chosen to take a comprehensive approach and allow users of the data to choose any subsample of the complete data set that best fits their needs.

Finally, some of the estimates presented for the demand for imports are derived from a methodology that is not the usual time-series econometrics approach. Following Kohil (1991), it is possible to derive estimates for the price elasticity of import demand from domestic GDP data.[4] In general, the econometric approach is preferred as it yields both income and one or more measures of the sensitivity of imports or exports to different changes in prices or the exchange rate. No technique is without its drawbacks. This is particularly true when estimating these equations for developing countries. Imprecision in the measurement of income (GDP), domestic prices, or import prices can lead to insignificant results. Partially, this is what leads to the preponderance of estimates using the price-ratio specification shown above. The GDP approach to estimating the determinants of import demand in many cases can yield a price elasticity where a time-series estimation strategy may not yield satisfactory results. The drawback of the technique is twofold. First, estimates are made with annual data so the reported results may be sensitive to the year(s) being used. Normally the number of years being used in a GDP approach is smaller than the typical time series used for an econometric estimation. Second, one only obtains a single price elasticity. Thus, there are a number of policy questions that the results are not designed to answer. In a similar vein, Soderbery (2015) formulated another method for estimating price elasticities which also only yields price elasticities. The advantage of this technique is that it can be used to obtain estimates for very narrowly defined product categories. Again, the problem is that valuable information other than the price elasticity is not provided. However, for low-income countries this is truly a case where some information is preferable to no information. As Tables 1–3 show, the state of knowledge of how trade flows in Africa respond to changes in income, relative prices, and exchange rates is quite low.

4. IMPORT DEMAND ELASTICITIES

In this section we report estimates of import demand elasticities that we have been able to identify for countries in Africa. The search procedure for finding the estimates involved several steps. The first step was searching EconLit using standard keywords such as Africa, import, export, demand, and the names of individual countries. We replicated this search using Google Scholar. The final part of the process was the older, but still effective, process of searching the references of all of the papers examined for further useful references. We accept the reality that, even under the best of circumstances, such a search will miss some estimates. Primarily, this occurs due to estimates being in studies with a larger purpose or focus, where the trade elasticities simply are part of a larger piece of research. We are confident that our search covered the lion's share of available elasticity estimates, even if a few were missed, as described. The variety of specifications given above limits the level of analysis of the data. This precludes the use of a standard meta-analysis due to the small number of estimates for the price ratio, its two components, and the exchange rate. As such, we have chosen to report only the raw data as the total number of estimates is still rather small.

The estimates for import demand elasticities are presented in Tables 1–3. In total, we were able to identify 199 estimates for 46 countries. The estimates were derived from a total of 32 papers. The vast majority of the papers are estimated using annual data. The nine papers employing

[3]A further refinement is possible. One could first estimate PX separately to obtain these effects. This is not common in the literature on import and export demand but is similar to what is estimated in the exchange-rate pass through.
[4]See Kohli (1978),(1991) or Kee et al. (2008) for more detail.

Table 1 | African trade elasticities: total imports[a]

Year	Author	Period	Y	PM/PD	PM	PD	MR
Algeria							
1998	Senhadji	**1960–1993**	0.83*	–0.08			
2008	Kee et al.	1988–2001		–1.24*			
Benin							
1998	Senhadji	**1960–1993**	4.91*	–6.74*			
2008	Kee et al.	1988–2001		–1.08*			
2014	Tokarick	2001–2004		–1.41*			
Botswana							
2008	Kee et al.	1988–2001		–1.04*			
2014	Tokarick	2001–2004		–1.15*			
Burkina Faso							
1987	Arize and Afifi	1960–1982	1.2*		–0.93*	1.14*	
2005	Harb	1969–1996	0.64*	–0.18*			
2008	Kee et al.	1988–2001		–1.06*			
2014	Tokarick	2001–2004		–1.41*			
Burundi							
1998	Senhadji	**1973:2–1999:1**	1.63*	–0.99			
2008	Kee et al.	1988–2001		–1.10*			
2014	Tokarick	2001–2004		–1.23*			
Cameroon							
1987	Arize and Afifi	1960–1982	1.49*	–1.05*			
1998	Senhadji	**1960–1993**	1.01*	–0.77*			
2008	Kee et al.	1988–2001		–1.25*			
2014	Tokarick	2001–2004		–1.35*			
Cape Verde							
2014	Tokarick	2001–2004		–1.41*			
Central African Republic							
1987	Arize and Afifi	1960–1982	0.44		–1.06*	0.87*	
2008	Kee et al.	1988–2001		–1.04*			
2014	Tokarick	2001–2004		–1.35*			
Chad							
2008	Kee et al.	1988–2001		–1.02*			
2014	Tokarick	2001–2004		–1.35*			
Congo							
1987	Arize and Afifi	1960–1982	0.77*	–0.63*	2.13*		
1987a	Arize	1960–1982	0.39		–0.78*	0.70	
1987	Arize and Afifi	1960–1982	1.26*		–0.78*	0.70*	
1992	Faini et al.	1964–1985	1.6*		–1.58*		
1998	Senhadji	**1960–1993**	0.03	–0.34			
2008	Kee et al.	1988–2001		–1.05*			
2014	Tokarick	2001–2004		–1.10*			
Cote d'Ivoire							
1998	Senhadji	**1960–1993**	0.96*	–1.04*			
2008	Kee et al.	1988–2001		–1.16*			
2014	Tokarick	2001–2004		–1.41*			
Egypt							
2008	Kee et al.	1988–2001		–1.31*			
2014	Tokarick	2001–2004		–1.00*			
Eritrea							
2014	Tokarick	2001–2004		–1.23*			
Ethiopia							
1981	Umo	1963–1977	1.61*	–3.05*			
1989	Tegene	1973:1–1985:4	0.19	–0.88*			0.28*
2008	Kee et al.	1988–2001		–1.15*			
2014	Tokarick	2001–2004		–1.09*			
Gabon							
1987	Arize and Afifi	1960–1982	0.87*	–0.90*			
1988	Faini et al.	1964–1980	1.53*	–1.33*			
1998	Senhadji	**1960–1993**	1.45*	–0.62*			
2008	Kee et al.	1988–2001		–1.16*			
2014	Tokarick	2001–2004		–1.35*			

(*Continued*)

Table 1 | African trade elasticities: total imports[a]—*Continued*

Year	Author	Period	Y	PM/PD	PM	PD	MR
Gambia							
1987	Arize and Afifi	1960–1982	1.45*		−1.38*	1.26*	
1990	Clavijo and Faini	1967–1987	1.283*	−1.034*			
1998	Senhadji	**1960–1993**	1.51*	−1.57*			
2008	Kee et al.	1988–2001		−1.07*			
2014	Tokarick	2001–2004		−1.41*			
Ghana							
2008	Kee et al.	1988–2001		−1.09*			
2014	Tokarick	2001–2004		−1.41*			
Guinea							
2008	Kee et al.	1988–2001		−1.10*			
2014	Tokarick	2001–2004		−1.41*			
Guinea Bissau							
2014	Tokarick	2001–2004		−1.41*			
Kenya							
1988	Faini et al.	1964–1980	1.37*	−1.48*			
1988	Sarmad	1960–1981		0.885*	−0.848*		
1989	Tegene	1973:1–1985:4	2.03*	−2.12*			0.13*
1998	Senhadji	1960–1993	1.14*	−1.66*			
2005	Harb	1971–1998	0.40*	−1.37*			
2008	Kee et al.	1988–2001		−1.14*			
2014	Tokarick	2001–2004		−1.23*			
Lesotho							
2008	Kee et al.	1988–2001		−1.02*			
2014	Tokarick	2001–2004		−0.68*			
Liberia							
1987	Arize and Afifi	1960–1982	0.96*	−0.57*			
Libya							
1988	Faini et al.	1961–1985	0.64*	−1.21*			
1990	Clavijo and Faini	1967–1987	1.004*	−1.194*			
2014	Tokarick	2001–2004		−1.31*			
Madagascar							
1998	Senhadji	1960–1993	0.52	−0.71*			
1998	Senhadji	1960–1993	1.14*	−1.65*			
2005	Razafimahefa and Hamori	1960–2000	0.855*	−0.487			
2008	Kee et al.	1988–2001		−1.17*			
2014	Tokarick	2001–2004		−1.27*			
Malawi							
1987	Arize and Afifi	1960–1982	0.32	−0.51*			
1998	Senhadji	1960–1993	1.14*	−1.65*			
2014	Tokarick	2001–2004		−0.93*			
Mali							
1987	Arize and Afifi	1960–1982	0.06		−0.63*	1.18*	
2008	Kee et al.	1988–2001		−1.08*			
2014	Tokarick	2001–2004		−1.41*			
Mauritania							
1998	Senhadji	1960–1993	2.83*	−3.61			
2014	Tokarick	2001–2004		−1.41*			
Mauritius							
1987a	Arize	1960–1982	1.2*		−1.07*	1.12*	
1989	Tegene	1973:1–1985:4	0.93*	−1.39*			0.37*
1998	Senhadji	1960–1993	2.25	−2.78			
1998	Bahmani-Oskooee and Niroomand	1960–1992	1.05*	−0.93*			
2005	Harb	1971–1998	1.19*	−1.02			
2005	Razafimahefa and Hamori	1960–2000	0.671*	−0.644*			
2008	Kee et al.	1988–2001		−1.08*			

(*Continued*)

Table 1 | African trade elasticities: total imports[a]—*Continued*

Year	Author	Period	Y	PM/PD	PM	PD	MR
2010	Narayan and Narayan	1960–2005	1.2721*	−0.7316*			
2014	Tokarick	2001–2004		−1.31*			
Morocco							
1998	Senhadji	1960–1993	1.23*	−0.78			
2005	Harb	1972–1999	0.66*	−1.23			
2008	Kee et al.	1988–2001		−1.21*			
2014	Tokarick	2001–2004		−1.32*			
Mozambique							
2014	Tokarick	2001–2004		−0.78*			
Namibia							
2008	Kee et al.	1988–2001		−1.06*			
2014	Tokarick	2001–2004		−0.69*			
Niger							
1987	Arize and Afifi	1960–1982	1.18*		−1.40*	2.07*	
2008	Kee et al.	1988–2001		−1.09*			
2014	Tokarick	2001–2004		−1.41*			
Nigeria							
1975	Ajayi	1960–1970	0.257*	2.718*			
1987b	Arize	1960–1974	1.07*	−0.36			
1989	Salehi-Isfahani	1963–1979	0.69*	−1.15*			
1991	Umo	1960–1985	0.722*	−0.175*			
1994	Nyatepe-Coo	1960–1990	0.1344*				−0.250*
1998	Senhadji	1960–1993	1.81*	−0.90*			
2008	Kee et al.	1988–2001		−1.32*			
2010	Omotor	1970–2005		1.048*	−0.233*		
2014	Tokarick	2001–2004		−1.22*			
Rwanda							
1998	Senhadji	1960–1993	1.63*	−0.07			
2008	Kee et al.	1988–2001		−1.07*			
2014	Tokarick	2001–2004		−1.23*			
Senegal							
1990	Clavijo and Faini	1967–1987	1.307*	−0.282			
1992	Faini et al.	1961–1985	2.43*	−0.35			
2008	Kee et al.	1988–2001		−1.09*			
2014	Tokarick	2001–2004		−1.30*			
Sierra Leone							
1987	Arize and Afifi	1960–1982	1.29*		−0.47*	0.48*	
2014	Tokarick	2001–2004		−1.41*			
Somalia							
1987	Arize and Afifi	1960–1982	1.15*		−0.26	0.72*	
South Africa							
1978	Erasmus	1965:1–1976:4	0.886*	−1.525*			
1984	Bahmani-Oskooee	1975:4–1978:4	1.889	0.467			
1986	Bahmani-Oskooee	1973:1–1980:4	2.499*	−2.46*		−0.1092*	
1998	Senhadji	1960–1993	0.67*	−1.00*			
1998	Bahmani-Oskooee and Niroomand	1960–1992	1.29	−0.83			
2005	Harb	1969–1996	0.75*	−0.47*			
2008	Ziramba	1970–2005	2.04*	−1.43			
2008	Kee et al.	1988–2001		−1.43*			
2010	Narayan and Narayan	1960–2005	1.6464*	−0.9973*			
2014	Tokarick	2001–2004		−0.93*			
Sudan							
2008	Kee et al.	1988–2001		−1.39*			
2014	Tokarick	2001–2004		−1.23*			
Swaziland							
2008	Kee et al.	1988–2001		−1.05*			
2014	Tokarick	2001–2004		−0.68*			

(*Continued*)

Table 1 | African trade elasticities: total imports[a]—*Continued*

Year	Author	Period	Y	PM/PD	PM	PD	MR
Tanzania							
2008	Kee et al.	1988–2001		−1.31*			
2014	Tokarick	2001–2004		−0.92*			
Togo							
1987	Arize and Afifi	1960–1982	1.58*	−2.2*			
2008	Kee et al.	1988–2001		−1.09*			
2014	Tokarick	2001–2004		−1.41*			
Tunisia							
1987	Arize and Afifi	1960–1982	0.46*	−0.35			
1988	Faini et al.	1964–1980	1.43*	−0.25			
1989	Tegene	1973:1–1985:4	2.61*	−0.13*			0.33*
1998	Bahmani-Oskooee and Niroomand	1960–1992	1.52*	−0.63*			
2008	Kee et al.	1988–2001		−1.11*			
2014	Tokarick	2001–2004		−1.68*			
Uganda							
1987	Arize and Afifi	1960–1982	1.7*		−1.3*	2.04*	
2008	Kee et al.	1988–2001		−1.26*			
2014	Tokarick	2001–2004		−0.76*			
Zambia							
1987	Arize and Afifi	1960–1982	0.58*		−0.64*	0.36	
1988	Faini et al.	1964–1980	0.78*	−1.14*			
1989	Tegene	1973:1–1985:4	0.17	−0.87*			0.046*
1998	Senhadji	1960–1993	0.34*	−1.17*			
2008	Kee et al.	1988–2001		−1.11*			

[a]A total of 8 papers estimated for both goods and services. *Indicates statistical significance at the 0.05 level or higher.

Table 2 | African import demand elasticities by country—broad commodities

Year	Author	Period	Y	PM/PD	PM	PD	XR
Egypt							
Wheat							
1987	Wilde	1960–1981	0.671*	−0.046			
Ghana							
Manufacturing and capital goods							
1991	Quarcoo	1967–1983	1.0929*				−0.1293*
Raw materials and intermediate goods							
1991	Quarcoo	1967–1983	1.1969*				−0.2451*
Libya							
Coarse grains							
1987	Wilde	1960–1981	0.140	−0.917*			
Morocco							
Wheat							
1987	Wilde	1960–1981	2.123	−0.231			
Nigeria							
Capital goods							
1989	Salehi-Isfahani	1963–1979	0.79*	−1.75*			
Chemicals							
1991	Umo	1960–1985	0.743*	−0.450			
Crude materials							
1991	Umo	1960–1985	0.158	−0.004			
Cycles							
1975	Ajayi	1960–1970	3.024	−5.734			
Food							
1989	Salehi-Isfahani	1963–1979	0.05	−1.00*			

(*Continued*)

Table 2 | African import demand elasticities by country—broad commodities—*Continued*

Year	Author	Period	Y	PM/PD	PM	PD	XR
Food and live animals							
1991	Umo	1960–1985	0.717*	−0.256*			
Intermediate goods							
1989	Salehi-Isfahani	1963–1979	0.69*	−1.33*			
Machinery and transport							
1991	Umo	1960–1985	0.752*	−0.168			
Mineral fuels							
1991	Umo	1960–1985	0.471*	−0.151*			
Raw materials							
1991	Umo	1960–1985	0.652*	−0.139*			
Wheat							
1987	Wilde	1960–1989	0.512*	−0.107			
South Africa							
Agriculture							
1987	Kahn	1974:1–1985:2	0.19*	−0.79*			
Chemicals							
1987	Kahn	1974:1–1985:2	0.70*	−1.37*			
Machinery and transport							
1987	Kahn	1974:1–1985:2	2.96*	−0.14			
Manufacturing							
1987	Kahn	1974:1–1986:1	0.72*	−0.55*			
1999	Hong	1980–1997	1.06*	−0.8*			
Tunisia							
Grains							
1987	Wilde	1960–1981	2.451*	−1.572*			
Wheat							
1987	Wilde	1960–1981	1.904*	−0.068			

*Indicates statistical significance at the 0.05 level or higher.

Table 3 | African import demand elasticities by country/region

Year	Author	Period	Y	PM/PD	PM	PD	XR
Egypt							
Imports from Eurozone							
2007	Harb	1976–2003	0.63*	−0.77*			
Fish from the United States							
2014	Bahmani-Oskooee and Hosny	1994:1–2007:4	1.92*	−1.41*			
Fruit and vegetables from the United States							
2014	Bahmani-Oskooee and Hosny	1973:1–1998:4	0.15	−1.82*			
2014	Bahmani-Oskooee and Hosny	1973:1–1998:4	0.89*	−2.54*			
Coffee and tea from the United States							
2014	Bahmani-Oskooee and Hosny	1973:1–1998:4	0.02	−1.75*			
Oil seeds from the United States							
2014	Bahmani-Oskooee and Hosny	1973:1–1998:4	2.87	−1.33*			
Cork and wood from the United States							
2014	Bahmani-Oskooee and Hosny	1973:1–1998:4	0.46	−1.21*			
2014	Bahmani-Oskooee and Hosny	1973:1–1998:4	0.91*	−0.66			

(*Continued*)

Table 3 | African import demand elasticities by country/region—*Continued*

Year	Author	Period	Y	PM/PD	PM	PD	XR
Inorganic chemicals from the United States							
2014	Bahmani-Oskooee and Hosny	1973:1–1998:4	0.06	−1.02*			
Essential oils and perfumes from the United States							
2014	Bahmani-Oskooee and Hosny	1973:1–1998:4	1.03*	−0.77*			
Fertilizer from the United States							
2014	Bahmani-Oskooee and Hosny	1973:1–1998:4	0.25	−1.24*			
Cork and wood from the United States							
2014	Bahmani-Oskooee and Hosny	1973:1–1998:4	0.42	−0.98*			
Paper and pulp from the United States							
2014	Bahmani-Oskooee and Hosny	1973:1–1998:4	0.63	−2.65			
Iron and steel from the United States							
2014	Bahmani-Oskooee and Hosny	1973:1–1998:4	0.05	−1.55*			
Office machines from the United States							
2014	Bahmani-Oskooee and Hosny	1973:1–1998:4	0.35*	−0.99*			
Furniture from the United States							
2014	Bahmani-Oskooee and Hosny	1973:1–1998:4	0.21	−1.21*			
Miscellaneous manufactures from the United States							
2014	Bahmani-Oskooee and Hosny	1973:1–1998:4	0.32	−0.81			
Libya							
Imports from Eurozone							
2007	Harb	1976–2003	0.90*	−1.03			
Morocco							
Imports from Eurozone							
2007	Harb	1976–2003	0.62	−0.28			
Sudan							
Imports from Eurozone							
2007	Harb	1976–2003	0.48*	−0.86*			
Tunisia							
Imports from Eurozone							
2007	Harb	1976–2003	1.04*	−0.22			

*Indicates statistical significance at the 0.05 level or higher.

quarterly data are indicated by the notation of the quarter used at the beginning and the end of the time series. Estimates using quarterly data have the obvious advantage of having more observations which potentially improves the quality of the estimates. In addition, most of the papers are estimated for the demand for merchandise imports. However, there are 8 papers estimated for both goods and services. These papers are identified by the use of bold for the period. In terms of the type of specification, the results are dominated by the price-ratio specification. A total of 176 papers used this specification, whereas only 14 estimates used the split-price specification. Finally, there were only nine reported elasticities for the exchange rate. This initial information alerts one to a serious problem. Relative to the importance of international trade to the region, the responsiveness of imports to their determinants has not been widely studied. On average, there are less than four studies per country. As can be seen from the tables, the estimates are skewed toward the larger economies and even less is known about import demand for the smaller countries.

Table 2 presents import demand estimates for broad product categories for a small selection of countries in the region. As is usually the case, there are far fewer estimates of import demand for disaggregated product categories. In total, there are only 22 estimates for seven countries. Further, there are only 16 different broad categories with a substantial amount of overlap among the categories. The limited nature of the

estimates is a result of the existence of only seven papers focused on import demand for the region for disaggregated product categories. With one exception, all of the studies use annual data. All of the studies employ the price-ratio specification while none utilize the split-price specification. Only one paper reports exchange-rate elasticity for two different product categories. The paucity of the data on trade elasticities for the region is now becoming more apparent.

Table 3 presents what little is known about imports into the region disaggregated by the source or by both the source and the product category. As one would expect, the coverage is narrower. There are estimates for only five countries and these estimates are derived from only two papers; 17 of the estimates are derived using quarterly data with the rest employing annual data. In this case, all of the estimates are derived from the price-ratio specification. Furthermore, neither of the two studies presents estimates of the exchange-rate elasticity. One of the papers reports estimates for five countries concerning their imports from the Eurozone countries. The other paper reports estimates for one country, Egypt. The estimates are for 13 different categories of imports from the United States. While the estimates are both interesting and useful, note that both the country and product category coverage is small.

5. EXPORT DEMAND ELASTICITIES

As we saw in the third section of the paper, the demand for exports is determined in a way that is analogous to the demand for imports. The dependent variable in this case is the demand for merchandise exports or the demand for a product category. In the case of the aggregate demand for exports, there are no estimates of the demand for both goods and services. This is an early indicator of a more general problem. While the region is critically dependent on exports to the rest of the world, the overall state of knowledge of their determinants is not large. The estimates presented in Tables 4 and 5 were found using the same procedure that was used to locate the estimates for import demand. The only real difference is that these estimates are considerably less common in the literature. However, this is not something that is just specific to Africa. In general, it is not uncommon in these surveys for import demand estimates to outnumber export demand estimates by something on the order of 2 to 1. This is a bit of a puzzle in the literature on trade elasticities. The main point is that the discrepancy shown in this paper is a common problem in the overall literature.

Overall, there are only 60 available estimates of the demand for exports. Because there are estimates available for only 24 countries, it is a sad reality that there are a number of countries where information on the demand for exports is a null set. The estimates of the determinants of the demand for merchandise imports are shown in Table 4. There are estimates for 22 countries which were derived from 14 different papers. The total number of estimates presented in the table is 55. To reiterate, the vast majority of the papers used annual data; 38 of the papers relied on annual data with the remainder using quarterly data. As was the case with the demand for imports, the use of the price-ratio specification dominates the estimates. A total of 41 of the estimates utilize this specification, nine of the estimates use a split-price

Table 4 | African trade elasticities: total exports

Year	Author	Period	YF	PX/PF	PX	PF	XR
Algeria							
1999	Senhadji and Montenegro	1960–1993	1.15*	–3.08*			
Benin							
1999	Senhadji and Montenegro	1960–1993	1.55*	–1.32*			
Burundi							
1999	Senhadji and Montenegro	1960–1993	1.03*	–0.26			
Burkina Faso							
1987a	Arize	1960–1982	0.13	–0.90*			
1987b	Arize	1960–1982	0.30	–2.1*			
Cameroon							
1999	Senhadji and Montenegro	1960–1993	2.29*	–0.24			
Cote d'Ivoire							
1987b	Arize	1960–1982	0.37		–0.82	0.64*	
1988a	Arize	1960–1982	0.37		–0.82	0.64*	
1989	Tegene	1973:1–1985:4	0.24*	–0.60*		–0.99*	
1990	Tegene	1973:1–1985:4	0.15*	–0.44*			
1999	Senhadji and Montenegro	1960–1993	1.52*	–0.16			
Egypt							
1999	Senhadji and Montenegro	1960–1993	1.12*	–1.44*			
Ethiopia							
1989	Tegene	1973:1–1985:4	0.13	–0.87*			–0.46
1990	Tegene	1973:1–1985:4	0.16	–0.53*			
Gambia							
1999	Senhadji and Montenegro	1960–1993	0.84*	–0.79*			

(*Continued*)

Table 4 | African trade elasticities: total exports—*Continued*

Year	Author	Period	YF	PX/PF	PX	PF	XR
Ghana							
1988	Faini et al.	1964–1980	4.01*	−3.37*			
Kenya							
1989	Tegene	1973:1–1985:4	0.122	−3.08*			−0.055
1990	Tegene	1973:1–1985:4	0.62	−0.67*			
1999	Senhadji and Montenegro	1960–1993	0.17	−2.07			
Madagascar							
2005	Razafimahefa and Hamori	1960–2000	0.533*	−1.066			
Malawi							
1987b	Arize	1960–1982	1.99*		−0.48*	2.0*	
1988a	Arize	1960–1982	1.99*		−0.48*	2.08*	
1989	Tegene	1973:1–1985:4	0.021	−1.25*			−0.16*
1990	Tegene	1973:1–1985:4	0.13*	−0.82*			
1999	Senhadji and Montenegro	1960–1993	1.25*	−0.10			
2000	Arize et al.	1973:1–1996:4	1.10*	−0.84*			
Mauritius							
1990	Tegene	1973:1–1985:4	0.37*	−0.41*			
1998	Bahmani-Oskooee and Niroomand	1960–1992	3.53*	−0.86*			
1999	Senhadji and Montenegro	1960–1993	3.17	−1.92			
2000	Arize et al.	1973:1–1996:4	2.31*	−1.35*			
2005	Razafimahefa and Hamori	1960–2000	2.316*	0.621*			
2010	Narayan and Narayan	1960–2005	1.27*	−0.73*			
Morocco							
1988a	Arize	1960–1982	0.18		−0.583*		0.82*
1988a	Arize	1960–1982	0.18		−0.82*	1.12*	
1992	Faini et al.	1967–1983	1.0*	−1.17*			
1999	Senhadji and Montenegro	1960–1993	1.12*	−1.47			
2000	Arize et al.	1973:1–1996:4	2.14*	−0.70*			
Niger							
1999	Senhadji and Montenegro	1960–1993	0.38	−1.74			
Nigeria							
1988b	Arize	1953–1981	1.73*		−0.88*	0.75*	
1999	Senhadji and Montenegro	1960–1993	1.69*	−0.50			
Senegal							
1999	Senhadji and Montenegro	1960–1993	0.58*	−0.50*			
South Africa							
1986	Bahmani-Oskooee	1973:1–1980:4	0.458*	−1.1276*			0.02339
1991	Smit	1974–1988	0.51*	−0.63*			
1998	Bahmani-Oskooee and Niroomand	1960–1992	1.32*	−0.98*			
1999	Senhadji and Montenegro	1960–1993	0.66*	−0.51			
Togo							
1999	Senhadji and Montenegro	1960–1993	1.27	−0.33			
Tunisia							
1987b	Arize	1960–1982	1.54*		−0.11	1.58*	
1989	Tegene	1973:1–1985:4	0.034		−0.51*	0.086*	
1990	Tegene	1973:1–1985:4	0.71	−0.45*			
1992	Faini et al.	1967–1983	1.08*	−0.76*			
1998	Bahmani-Oskooee and Niroomand	1960–1992	1.02*	−1.14*			
1999	Senhadji and Montenegro	1960–1993	2.43*	−0.78			
2000	Arize et al.	1973:1–1996:4	1.53*	−0.42*			
Zambia							
1990	Tegene	1973:1–1985:4	0.31	−0.20*			
1992	Truett and Truett	1967–1987	0.774	−0.532			

*Indicates statistical significance at the 0.05 level or higher.

specification, and only nine estimates are available that yield an exchange-rate elasticity of export demand. Table 5 is a stark example of our state of knowledge on trade elasticities in the region. Once one goes below aggregate estimates, very little is known. There are disaggregated estimates of export demand for only three countries (Madagascar, Somalia, and South Africa). There are estimates for only five product categories: natural vanilla, bananas, travel services, natural resource products, and metal products. Three of the estimates are in price-ratio form, whereas the other two have a split-price specification. There is only one estimate that produces an exchange-rate elasticity.

Table 5 | African export demand elasticities by country—broad commodities

Year	Author	Period	Y	PM/PD	PM	PD	XR
Madagascar							
Natural vanilla							
2006	Cadot et al.	1964–1991	1.02*	−1.03*			
Somalia							
Bananas							
2002	Osman and Evans		0.62*	0.31			
Travel services							
1993	Moshirian	1972–1986	2.1*	−1.9*			
South Africa							
Natural resource products							
2006	Edwards and Alves	1980–1999	0.622*		−0.048	0.640*	0.797*
Metal products							
2006	Edwards and Alves	1980–1999	0.551*		−0.106*		1.066*

*Indicates statistical significance at the 0.05 level or higher.

6. CONCLUSION

The purpose of this paper was to create a comprehensive source of information on the responsiveness of imports and exports in Africa to the usual set of determinants. These estimates are important to academic researchers seeking to understand how changes in domestic and global economic conditions affect a region that is presumably less developed and more open than the rest of the world economy. For policy purposes, the estimates are even more important. The demand for imports and exports are critical to both short-run macroeconomic models and more long-run GE models. The reality is that the extant data are not very comprehensive, at least for the African context. Given the importance of the region and its relative openness, there is a clear opportunity to extend the literature to more African countries, to cover more products, and more recent years of African economic and trade data. Most of the literature focuses on the aggregate demand for imports and exports. Little is known about the determinants of trade flows for broad product categories, and much less for narrowly defined product categories. The absence of estimates for product categories creates a challenge for economic policy. The broader estimates are important as inputs for macroeconomic models of short-run overall economic activity. However, the narrow estimates have even greater potential as predictors of economic activity.

Without accurate and timely information on these elasticities, there is bound to be error in planning for how trade affects African economies. First, as growth produces structural change in the region, more narrowly defined elasticities are an important input when using GE models.[5] Second, some countries in the region are dependent on a very narrow range of product categories. Understanding trade elasticities for those products is essential for policy in those countries. The tables in this paper reveal clear gaps in our knowledge of these elasticities for particular products and particular countries. As such, what we present is a "road map" for opportunities in future research efforts on the demand for imports and exports in Africa.

CONFLICTS OF INTEREST

The authors declare they have no conflicts of interest.

AUTHORS' CONTRIBUTION

The authors contributed equally to the article.

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[5]For more details on structural change for the economies of Africa, see Clark et al. (2016).

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