COVID-19 vs. GFC: A Firm-level Trade Margins Analysis Using Kenyan Data

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Abstract

This study describes trade margins (intensive and extensive) and establishes determinants of the mid-point export and import growth during the global financial crisis (GFC) and COVID-19 pandemic by relying on Kenya's monthly customs transaction data (at 6-digit level of Harmonized System) for the period January 2006–June 2020. Exports fell during the two crises, of which the intensive margin was responsible for the drop during GFC while the extensive margin dominated the COVID-19 era. Imports are mainly driven by the extensive margin which grew during GFC but declined during the pandemic. However, the fall in the intensive and extensive margins was near symmetrical during the pandemic. Estimates from the fixed-effects regression model reveal that the decrease in export and import mid-point growth was larger during the COVID-19 pandemic than GFC and it was determined by several factors: firm-, product- and partner-country characteristics. Overall, addressing both supply- and demand-side shocks can help countries adjust better to future crises.

JEL Classification: F02, F14, F23, F60, G01

Keywords: Trade margins, mid-point growth, GFC, COVID-19, Kenya

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1. Introduction

Referred to as catalysts of the great trade collapse, the global financial crisis (GFC) and Coronavirus (COVID-19) are different in some respects. GFC is a financial shock that emanated from the housing and banking sectors of the US and some European countries while COVID-19 started as a health crisis in China and later blossomed into an economic crisis. GFC disrupted international trade, mainly through demand-side shocks as corporate investment and consumption of durables contracted (Chen et al., 2021; WTO, 2021). Supply-side factors – access to credit and protectionism – had minor effects on trade (WTO, 2021). On the other hand, COVID-19 has disrupted bilateral trade flows in fourfold – trade financing, demand-side shocks, supply-side shocks, and substitution and contagion effects – as countries imposed protectionist measures to avert the spread of the virus (Hayakawa and Mukunoki, 2021a; 2021b, WTO, 2021). Lastly, the trade effect of GFC, specifically on developing countries, was indirect as high income and emerging markets were more affected (Aryeetey and Ackah 2011; Allen and Giovannetti, 2011; WTO, 2021) while the COVID-19 recession is deemed to have had a more direct effect on exports and imports of developing countries due to its synchronous spread across the globe (Banga et al., 2020; Kassa, 2020).

This paper is among the first to compare the two recessions at a firm-level from an international trade perspective[1]. We first examine the contribution of the intensive and extensive margins on the monthly mid-point export and import growth rates for the two crises. In our context, the intensive margin entails sales of continuing firms, continuing products and continuing partner countries. The extensive margin captures sales of new firms, new products and new partner countries[2]. Next, we estimate regression models to establish determinants of the mid-point export and import growth during the two crises.

Our decomposition results show that exports fell during the two crises of which the intensive margin was responsible for the drop during GFC while the extensive margin dominated the COVID-19 era. Imports are mainly driven by the extensive margin which grew during GFC but

[1] A similar exercise has been conducted by Büchel et al. (2020) in Switzerland, Du and Shepotylo (2022) in the United Kingdom (UK) and Minondo (2021) in Spain but they are largely descriptive and use macro-data.
[2] The definitions of trade margins varies depending on whether the analysis is at macro or micro level (see Creusen et al., 2011).

declined during the pandemic. Nonetheless, the fall in the intensive and extensive margins was almost symmetrical during the pandemic. Estimates from the fixed-effects regression model reveal that the decrease in export and import mid-point growth was larger during the COVID-19 pandemic than GFC and it was determined by several firm-, product- and partner-country characteristics.

A number of studies have employed firm-level data to examine the effect of GFC on trade margins (see Bricongne et al., 2012; Behrens et al.,2013; Bellas and Vicard,2014; Wagner,2014; Paravisini et al.,2015; Manova et al.,2015; Ariu,2016; Matthee et al.,2016; Eppinger et al.,2018; Abreha et al.,2020; Douch et al.,2021; Chen et al.,2021; Munasib et al.,2021). Nonetheless, to our knowledge, only Behrens et al. (2013) has incorporated both exports and imports in their analysis. Thus, the inclusion of imports in our analysis is our first contribution to literature. Less attention has previously been devoted to imports irrespective of their vast contribution to inputs of manufacturing sectors of developing countries (Wagner, 2016; Edwards et al., 2018, 2020).

Firm-level analysis for COVID-19 is sparse as most studies are at the macro and product levels, often describing trade flows (volumes and value chains) and the impact of lockdown measures on them during the pandemic (see Espitia et al., 2022; Barbero et al.,2021; Hayakawa and Mukunoki,2021a, 2021b; Arenas et al.,2022). Some examples of empirical micro papers are Amador et al. (2021), Benguria (2021) and Bricongne et al. (2021). Amador et al. (2021) study the impact of COVID-19, proxied by stringency index and number of cases, on exports and imports of Portuguese firms. However, they neither study trade margins nor compare GFC to COVID-19. Benguria (2021) studies the impact of the pandemic on the trade margins of Colombia's exporters but they do not consider importers. Bricongne et al. (2021) study the effect of COVID-19 on the intensive and extensive margins of French exporters but they are mainly descriptive and do not compare GFC with COVID-19. Hence, our second contribution is expanding this thin literature on COVID-19 and micro-level import and export trade.

Our third contribution is expanding the literature on the effect of economic crises on trade in developing countries – particularly that of COVID-19 in Kenya. A few studies have assessed the impact of the virus on Kenya's international trade. For instance, Mold and Mveyange (2020), Were

and Ngoka (2022) who use macroeconomic data and Majune (2020) and Chacha et al. (2021), who use firm-level data. Nonetheless, these studies do not assess trade margins as done in our paper. Overall, besides the access to a novel customs transactions dataset, Kenya is fit for this kind of study because it is among the top ten economies by Gross Domestic Product (GDP) and trade in Africa (Mold and Mveyange, 2020) and it was largely effected by both crises (Majune, 2020).

The rest of this paper is organized as follows. Section 2 describes some stylized facts on international trade during major economic crises. Section 3 describes our data while section 4 presents results, starting with trade margins and then determinants of mid-point trade growth. Finally, section 5 concludes the study.

2. Some stylized facts

This study relates to three strands of literature. First, it relates to literature that compares trade performance under GFC and COVID-19 (Büchel et al., 2020; Du and Shepotylo, 2022; Simola, 2021; Minondo, 2021; WTO, 2021). Second, it relates to literature that empirically analyses the role of trade margins on export and import growth at the firm level during major crises such as the GFC (Matthee et al., 2016; Douch et al., 2021), the Asian financial crisis (Bernard et al., 2009), the Argentine crisis of 2001–2002 (Gopinath and Neiman, 2014) and COVID-19 (Bricongne et al., 2021; Benguria, 2021). Third, this study is related to papers that establish determinants of trade growth during recessions (Bricongne et al., 2012; Behrens et al., 2013; Bellas and Vicard, 2014; Manova et al., 2015; Paravisini et al., 2015; Douch et al., 2021; Chen et al., 2021; Munasib et al., 2021; Benguria, 2021; Espitia et al., 2022). Drawing on the review of these studies, we outline the following stylized facts, which we benchmark with our results.

Fact 1: The collapse in trade was greater during the GFC than the COVID-19 period

Evidence from the world and countries shows that trade collapsed more during the GFC than the COVID-19 pandemic (Büchel et al., 2020; Du and Shepotylo, 2022; Simola, 2021; Minondo, 2021; WTO, 2021). For instance, global exports shrunk by 21.5% during the GFC and 9.64% during the pandemic. US and UK exports grew by -18.7% and -25.4%, respectively, during the GFC, and -13% and -14.7% , respectively, under COVID-19. In addition, the fall and recovery in trade under COVID-19 were faster than under GFC. For instance, Swiss imports and exports

started recovering after nine and seven months during the GFC, respectively, while recovery under COVID-19 started in the third month (Büchel et al., 2020).

Fact 2: The intensive margin plays a bigger role in the variation of trade than the extensive margin during crises

This fact is supported by evidence from the US (Bernard et al., 2009), Belgium (Behrens et al., 2013; Ariu, 2016), France (Bricongne et al., 2012; Bellas and Vicard, 2014; Bricongne et al., 2021), Peru (Paravisini et al., 2015), Denmark (Abreha et al., 2020), South Africa (Matthee et al., 2016), China (Manova et al., 2015; Chen et al., 2021), Spain (Eppinger et al., 2018; Minondo, 2021) and Colombia (Benguria, 2021). Thus, implying that incumbent firms, products and partners mainly drive the collapse in trade during crises instead of new partners, firms and products.

Fact 3: Determinants of trade growth vary by firm, product and partner-country characteristics during crises

Using Belgian microdata, Behrens et al. (2013) find that large firms had a positive and significant effect on the growth of exports and imports during GFC. Neither multinational nor foreign-owned firms affected the export and import growth. As for country characteristics, fluctuations in the exchange rate affected both export and import growth while the GDP only had a significant effect on exports. The export and import growth of intermediate, capital and consumer durable goods fell during the GFC but differentiated goods experienced a smaller fall.

Munasib et al. (2021) use Chinese customs data for the period 2003-2011 and find that exports of foreign-invested firms were more affected by GFC than those of private domestic firms. In addition, exports of durable and non-durable products, and energy and raw materials of foreign-invested firms declined during GFC. The authors also find that the exports of homogenous products were less affected by GFC than differentiated products while the trade margins of intermediate, capital and consumer goods declined under GFC.

The GDP and exchange rate were key determinants of French firms' exports growth during GFC (Bellas and Vicard, 2014). However, the authors find no evidence of the effect of currency unions and regional trade agreements (RTAs) on export performance. Recently, Benguria (2021) found

that the growth of exports by Colombian firms during the COVID-19 pandemic was determined by their multinational affiliation status and product characteristics. Multinational affiliates had a substantially better performance while intermediate and capital goods exports fell by 10% and 15.9% respectively. Firm size and level of indebtedness did not significantly affect export growth.

3. Data

We explore exporters and importers in Kenya using the updated Exporter Dynamics Database (EDD) by the World Bank (Fernandes et al., 2016)[3]. This data records customs transactions for export and import flows by product (at 8-digit level of the Harmonized System,HS), destination/origin, date of transaction and value of a transaction in Kenya shillings. The first step of the data cleaning process entails re-classifying products into HS-6 digit level which is more internationally comparable (Bellert and Fauceglia, 2019). This is done in line with Cebeci (2012). The second step is converting transactions to monthly levels (January 2006-June 2020) since the final analysis is at the monthly level. Trade values are then converted to US$ using monthly exchange rate values from the Central Bank of Kenya.

We then create indicators for GFC and COVID-19. The severity of GFC on economies started with the demise of the Lehman Brothers in September 2008, and lasted up to the end of the third quarter of 2009 (Allen and Giovannetti, 2011; Bricongne et al., 2012; WTO, 2021). For this reason, we define September 2008-August 2009 as the active window for GFC. We define the period from January 2020-June 2020, when the virus had spread to most countries, as the active window for COVID-19.

4. Results

4.1. Trade margins under GFC and COVID-19 in Kenya

To characterize the trade margins of exports and imports during the two recessions, we calculate the mid-point growth rate – at the firm, product and partner-country levels - following Davis and Haltiwanger (1992) and Bricongne et al. (2012). The mid-point growth rate establishes trade performance over a high frequency, say a year, instead of a low frequency like a month. This is to

[3] We thank Ana Fernandes who oversees the EDD database at the World Bank for granting us access to this updated database which is yet to appear online.

avoid the necessity of controlling for seasonality and the over-estimation of firm entries and exits associated with low-frequency data. The algebraical presentation of the mid-point growth rate is as follows:

$$g_{icpt} = \frac{y_{icpt} - y_{icp(t-12)}}{\frac{1}{2}(y_{icpt} + y_{icp(t-12)})} \quad (1)$$

Where g is the mid-point growth rate of a monthly (t) export/import (y) flow of product (p) from firm (i) to/from a partner-country (c). Each flow, g_{icpt}, is weighted as the relative share in total exports by the population of exporters (importers) in Kenya as follows:

$$S_{icpt} = \frac{y_{icpt} + y_{icp(t-12)}}{(\sum_c \sum_i \sum_p y_{icpt} + \sum_c \sum_i \sum_p y_{icp(t-12)})} \quad (2)$$

The year-on-year growth rate of the total value of export or import trade is given by summing each individual flow g_{icpt} weighted by S_{icpt} as follows:

$$G_t = \left(\sum_c \sum_i \sum_p S_{icpt} * g_{icpt}\right) \quad (3)$$

G_t can be classified into four types: intensive positive (rise in existing flows), intensive negative (fall in existing flows), extensive positive (entry) and extensive negative (exit). The net intensive margin is the difference between the intensive positive and intensive negative while the net extensive margin is the difference between extensive positive and extensive negative. Tables 1 presents a breakdown of these margins for the entire period of the study (January 2006-June 2020) and periods under GFC (September 2008-August 2009) and COVID-19 (January 2020-June 2020).

Column 1 of Table 1 shows that the total growth rate of exports for the entire period of our study (January 2006-June 2020) is 3.59%, out of which the net intensive margin accounts for 55% (1.97 of 3.59) while 45% is from the net extensive margin (1.62 of 3.59). The dominance of the intensive margin conforms to expectations in developing countries (Besedeš and Prusa, 2011), where continuing firms, products and markets largely drive the variations in exports. The entry of new

firms and products was responsible for the growth in the net extensive margin of exports during our study period.

Exports contracted by 5.04% during GFC as shown in column 2. Both the intensive and extensive trade margins declined, indicating the sensitivity of the two margins to external demand shocks. However, 60% (3.19 of 5.04) of the fall in exports in Kenya during the GFC was at the intensive margin, affirming the stylized fact that the intensive margin was responsible for the drop in trade during GFC. The extensive margin was hit harder by the exit of firms and markets. The net product extensive margin mildly improved by 3%, indicating more product entry than exit during GFC.

The third column shows that exports contracted by 3.73% within the first six months of COVID-19 in the world. Compared to the fall in exports under GFC (5.04%), we infer that the drop in exports was less severe during the pandemic than the GFC in line with the first stylized fact. The net intensive margin improved but the net extensive margin dropped. All the metrics -firm, product and country - of the net extensive margin declined, led by firm exit followed by country exit and lastly product exit. Chacha et al. (2021), who study the reaction of domestic and international trade flows during the COVID-19 pandemic in Kenya, also find that the fall in the number of new firm-to-firm relationships was massive at the onset of the lockdown.

The multifaceted nature of COVID-19 could have caused the collapse in the extensive margin of trade. Containment measures such as social distancing that hinder interactions among people might have reduced the potential of businesses to create new relationships and launch new products in foreign markets. Supply shocks could also have played a role in the exit of firms, destinations and products as the closure and slow clearance of goods at Kenya's border points also decreased the rate of cross-border supply. The production of exportables could also have been affected by measures such as the closure of workplaces and curfews which affected firm productivity during the pandemic. Exports from Kenya could also have been affected by demand shocks in destination markets. The demand for essential products such as food and medical supplies has increased during the pandemic period while that of durables has reduced (Hayakawa and Mukunoki, 2021a).

Column 4 displays results for mid-point growth rates for import trade margins. The overall growth rate of imports for our study period is 6.44% (column 1) of which 69% was at the extensive margin and 31% at the intensive margin. Import performance in Kenya is primarily driven by the entry of new firms and new partner countries as net firm and net country extensive margins dominated the net extensive margin and grew by 2.84% and 2.03% respectively.

Unlike exports, only the net intensive margin of imports declined (-6.21%) during the GFC as per column 5. However, the decline did not offset the positive net extensive margin (10.10%), leading to an overall positive growth rate (3.89%). The growth in entries of firms and partner countries was the source of the positive net extensive margin. Nonetheless, more new products exited than entered Kenya's market during the GFC.

Table 1: Contributions to mid-point growth rates, Kenya monthly exports and imports

	Export			Import		
	Sample	GFC	COVID-19	Sample	GFC	COVID-19
Net intensive margin	1.97	-3.19	3.16	1.99	-6.21	-8.68
Intensive positive	22.62	21.83	23.99	17.15	12.98	14.72
Intensive negative	-20.65	-25.02	-20.83	-15.15	-19.19	-23.41
Net extensive margin	1.62	-1.84	-6.89	4.45	10.10	-9.27
Net firm	1.53	-1.38	-4.93	2.84	5.78	-0.80
Firm entry	11.42	7.76	8.44	17.83	18.01	14.92
Firm exit	-9.90	-9.14	-13.37	-14.99	-12.23	-15.72
Net country	-0.49	-0.50	-0.13	2.03	6.32	-5.27
Country entry	14.58	13.39	10.81	25.31	30.77	17.64
Country exit	-15.07	-13.89	-10.94	-23.28	-24.45	-22.91
Net product	0.59	0.03	-1.83	-0.42	-2.00	-3.20
Product entry	6.32	7.36	4.68	14.78	11.90	12.44
Product exit	-5.73	-7.33	-6.51	-15.20	-13.90	-15.64
Total growth	3.59	-5.04	-3.73	6.44	3.89	-17.96

Note: Sample period runs from January 2006 to June 2020. GFC is set between September 2008 to August 2009, while COVID-19 spans from January 2020 to June 2020.

Column 6 indicates that imports declined by 17.96% during the COVID-19 pandemic. The net intensive and net extensive margins were symmetrically responsible for this effect as each

contributed to almost a half of the fall in imports. This indicates that existing import flows not only declined during the pandemic but also the rate of firm exit, product churning and partner country exit escalated during the pandemic. This can be attributed to the fall in demand for most imported goods as the aggregate demand for customers in Kenya declined due to high unemployment rates and closure of businesses (KNBS, 2021). Border closure, which was active by the end period of our data (June 2020), also imposed adverse supply shocks, disrupting import value chains and the distribution of foreign products in Kenya. The virus also interrupted the ability of foreign firms to find new partners and introduce new products in Kenya[4].

Table 2 shows the mid-point growth rates of exports and imports by firm size, region and product type for the overall study period (January 2006-June 2020), GFC (September 2008-August 2009) and COVID-19 (January 2020-June 2020). Firms are ranked by size – large (top 1%), medium (top 2%-20%) and small (the rest 80%) - based on their export/import value relative to other firms in a specific month. Regions are classified into Africa, Europe and Asia, and the rest of the world (RoW). Products are grouped into intermediate, final, capital and other following the Broad Economic Categories (BEC) classification (United Nations, 2018).

Percentage estimates in Table 2 indicate that 72% and 86% of variations in export and import growth, respectively, for the whole sample was driven by large firms. However, medium-size firms were responsible for the collapse of exports during GFC and COVID-19. Results show that exports from large and small firms grew by 0.8% and 0.13%, respectively, during the pandemic. Imports from large firms grew by 4.3% during the GFC, thereby offsetting the slump in imports of medium and small firms to lead to overall positive growth in imports. As for the COVID-19 pandemic, Table 2 shows that large firms were responsible for 94% of the drop in imports. Imports from medium and small firms also declined, suggesting that containment measures by the government of Kenya and that partner countries imposed negative demand and supply shocks.

Almost a half of Kenya's exports are final goods while 50% of imports are intermediate goods when the whole study period is considered. The dominance of intermediate goods in imports and

[4] Further analysis of the trend of export and import margins around GFC and the pandemic periods is displayed in Figures A.1a to A.1d.

their mild contribution in exports (28% of export growth) implies that Kenya's backward global value chain (GVC) participation is stronger than the forward participation[5]. The collapse of exports under GFC was mainly influenced by exports of final, intermediate, and other goods which fell by 2.8%, 0.3% and 2.6% respectively. Exports of capital goods grew by 0.4%, indicating that exports of capital-intensive goods improved during the financial crisis. Exports of final goods improved during the pandemic, but they did not offset the drop in intermediate, capital, and other goods. This result implies that exports of final goods such as food commodities improved during the pandemic, as Majune (2020) found. Only imports of other products plunged during the GFC. Intermediate goods imports grew by 3.6% while final and capital imports grew by 0.6% and 1.7% respectively. Conversely, imports of all commodities declined during the pandemic: 54% of the fall was from other goods, 25% from capital goods, 14% from intermediate goods, and 8% from final goods.

Kenya's exports to the rest of the world experienced the highest growth during the study period. The rest of the world also drove Kenya's imports alongside Asia during the study period. Asia's effect is due to countries such as China, which was Kenya's top import partner in 2020 (Majune, 2020). The decline in export growth during GFC is attributed to the drop in exports to Europe and the rest of the world which declined by 2.6% and 1.9% respectively. Exports to Africa also dropped while those to Asia mildly increased during the financial crisis. Exports to Africa showed a greater decline than other regions (Asia and the rest of the world) during the pandemic. Imports from all regions increased except the rest of the world during GFC. However, imports from all regions declined during the pandemic, signaling supply-chain disruptions arising from lockdown measures in Kenya and partner countries.

[5] Forward GVC participation means a country mainly exports intermediate commodities that are used in other countries' exports. Backward linkages is when a country's exports are mainly composed of imported intermediate inputs. Definitions are from Johnson (2018) and Antràs and Chor (2020).

Table 2: Contributions to mid-point growth rates by firm size, region and product type, Kenya monthly exports and imports

	Export			Import		
	Sample	GFC	COVID-19	Sample	GFC	COVID-19
Firm						
Large	2.58	-1.70	0.84	5.52	4.32	-16.89
Medium	0.99	-3.31	-4.70	0.87	-0.4	-0.85
Small	0.02	-0.03	0.13	0.04	-0.03	-0.21
Product						
Intermediate	1.02	-0.13	-0.51	3.21	3.56	-2.46
Final	1.72	-2.77	2.44	0.72	0.55	-1.39
Capital	0.13	0.41	-1.65	0.83	1.67	-4.43
Other	0.73	-2.55	-4.00	1.69	-1.89	-9.69
Country						
Africa	0.90	-0.63	-3.50	0.57	2.45	-3.44
Europe	0.68	-2.57	0.59	0.85	3.22	-1.82
Asia	0.36	0.09	-0.35	2.62	0.03	-3.88
RoW	1.65	-1.86	-0.47	2.41	-1.8	-8.83
Total growth	3.59	-5.04	-3.73	6.44	3.89	-17.96

Note: Sample period runs from January 2006 to June 2020. GFC is set between September 2008 to August 2009, while COVID-19 spans from January 2020 to June 2020.

4.2 Determinants of export and import growth during GFC and COVID-19 in Kenya

This section identifies the determinants of export and import growth and their respective trade margins during GFC and COVID-19. Following Behrens et al. (2013) and Benguria (2021), we use a linear regression model of the form:

$$g_{icpt} = \alpha_{ipc} + \gamma_{it} + \delta_{pt} + \varphi_{ct} + \beta \,.\, Crisis \,.\, X_{icpt} + \varepsilon_{icpt} \quad (4)$$

where the dependent variable, g_{ipct} represents the overall mid-point growth rate of firm $i's$ export/import growth at time t for product p with partner-country c. Note that mid-point growth rates are calculated as changes in the values of exports/imports between two time periods (defined with a 12 month lag). For instance, to calculate mid-point growth rate for the September of 2008 period, we use the data for trade values in September 2008 and September 2007. The computed mid-point growth rate is bounded between -2 and 2. It takes the maximum value of 2 when trade flows are considered to be positive extensive margin and minimum value of -2 when they are considered to be negative extensive margin. g_{ipct} also ranges from 0 to 2 when the trade flows are classified as positive intensive margin and -2 to 0 when the flows are classified as negative intensive margin.

$Crisis$ is a dummy variable that captures the effect of either GFC or COVID-19 on the growth rates. This regression model is estimated separately for the effects of the GFC and COVID-19 on the mid-point growth rates (exports or imports). For each analysis, the sample period is divided into two sub-periods: pre-crisis period and in-crisis period. In the case of the GFC analysis, we consider two sub-periods: September 2007 to August 2008 and September 2008 to August 2009. The September 2007 to August 2008 represents the pre-GFC period whereas the September 2008 to August 2009 refers to the GFC period. The dummy takes the value of one in the GFC period and zero in the pre-GFC period. For the COVID-19 analysis, we define the pre-COVID-19 period as from January 2019 to June 2019, while the COVID-19 period as from January 2020 to June 2020. Accordingly, the dummy variable equals to one from January to June 2020, and zero otherwise.

Given that we are interested in the trade behaviours of firms during the normal and crisis periods, we interact these dummy variables with a set of firm-, product- and country-specific variables (X_{icpt}). The coefficients of these interaction terms capture the crisis effects of the firm-, product- and country-specific variables on growth rates relative to the normal period. The regression model also includes firm-product-country fixed effects (α_{ipc}) that capture all the observable and unobservable characteristics that are correlated with trade flows. In addition to these dummies, we include firm-month fixed effects (γ_{it}), product-month fixed effects (δ_{pt}), and country-month fixed effects (φ_{pt}) to absorb time-varying firm-, product- and country-specific shocks. Finally, ε_{icpt} is a stochastic, idiosyncratic error term. Since the mid-point growth rate are at firm-product-country level, we have clustered standard errors with multiway clustering accordingly following the methodology described by Cameron et al. (2011).

Firm characteristics

Firm size is one of the most commonly analysed characteristics in the trade literature (Behrens et al., 2013; Bricongne et al., 2021). It is well-established that larger firms have a greater ability to respond to crisis than smaller firms and hence have a more stable stream of export revenues during the crisis period. We construct three size dummy variables ($Large$, $Medium$, $Small$) at time t based on Kenyan total exports (imports): the variable $Large$ takes the value of firm's share in a

given year belongs to a top 1 percentile of total exports (imports) and the variable $Medium$ takes the value of one if firm's export share is between 1 and 20 percentile of total exports (imports). The variable $Small$ includes the remaining all exporters (importers) and is used as the reference category. These dummy variables equal to zero otherwise.

Product characteristics

We also investigate the differential impact of the various product characteristics on mid-point growth rates during the crisis period. Previous studies have related product characteristics such as product types and product differentiation to midpoint growth rates during the crisis period. For example, Benguria (2021) finds some evidence that intermediate and capital goods exports experienced a larger fall relative to the final goods. Following Behrens et al. (2013) and Benguria (2021), we include several dummies that take the value of one if the product is $Intermediate$, $Final$ (consumption), $Capital$ and $Other$. We employ the BEC classification scheme to divide all products into intermediate, final, capital and other. The last category is used as a reference category in the analysis. Degree of product differentiation is one of the important aspects of the product that may affect the growth rate during the crisis period. Differentiated goods may have a higher elasticity of demand than undifferentiated goods, probably due to the fact that they are not necessary for subsistence and are usually high-value products, which makes them less resilient to the crisis. The negative effect of the crisis on trade, therefore, is expected to be stronger for differentiated goods. To account for this, a dummy variable for product differentiation is built based on the Rauch (1999) product classification. This dummy variable $Differentiated$ equals to one if a product is classified by Rauch as differentiated, and zero otherwise.

Country characteristics

This study also assess how country-specific variables can weaken or strengthen the effect of the crisis on mid-point growth rates. These include regional dummy variables ($Africa, Europe, Asia, RoW$), trade aggreement dummy between Kenya and its trade partner (EIA), the natural log of distance between Kenya and its trading partner ($Distance$), percentage change in the log of exchange rate between Kenya and its trading partner partners ($ER\ Change$), and the natural log of net imports/exports with each partner ($Net\ Import\ or\ Net\ Export$).

Regional dummy variables are included in the analysis to capture geographic differences in mid-point growth rates caused by the crisis. These dummy variables take the value one when the partner's location is in the above-mentioned regions, else its value is zero. The variable RoW serve as the reference category. The contraction in the mid-point growth rates due to the crisis is expected to be larger when the trade partner is in distant regions such as Asia or America since a greater distance indicates higher transport costs and thus a larger decline in bilateral trade.

This study also attempts to gain insights on how Kenya's trade has evolved with its trade agreement partner countries relative to the normal period. Sharing an agreement with a trading partner is expected to lower the cost of entry and operation in the foreign market (Yotov et al., 2017), thus mitigating the crisis's negative effects on the trade volumes. The variable EIA is a dummy variable, which takes the value of one if Kenya and its trading partner belong to the same Free Trade Agreement (FTA) or Customs Union (CU), and zero otherwise.

In times of crisis, countries tend to concentrate their trade flows with nearby trade partners in which trade-related costs are likely lower compared to distant partners. Accordingly, we expect that the variable $Distance$ will increase the magnitude of the crisis on the mid-point growth rates. Following Behrens et al. (2013), we also included the change in the bilateral exchange rate ($ER\ Change$) in the models. Based on the rationale, changes in exchange rates may differently influence a firm's exporting or importing behaviours in times of crisis. We assume that an appreciation of the partner's currency increases their chance of importing from Kenya and reduces the likelihood of exporting to Kenya (Yotov et al., 2017). In this study, the variable is defined such that an increase in the exchange rate is an appreciation of the partner's currency. Accordingly, it is expected to weaken the negative effects of the crisis on export growth while increase the negative effects on import growth.

Finally, the variable $Net\ Import$ is included in the analysis as country-specific variables to capture the response of trade to the demand shock induced by either GFC or COVID-19 crisis, following Bricongne et al. (2012). It is calculated by subtracting Kenya's exports to a specific destination from the destination's total imports while the variable $Net\ Export$ is Kenya's total imports less Kenya's trade partner's bilateral exports to Kenya. This procedure allows us to avoid

endogeneity problems and it shows the level of external and domestic demand for commodities (Bricongne et al., 2012). A detailed description of the variables and data sources is given in Table A.1 in the Appendix.

Table 3 presents regression results on the impact of the GFC crisis on the firms' export growth rates using the ordinary least squares method with fixed effects. The dependent variable was firms' mid-point export growth rates and it was regressed on a set of firm-, product-, and country-specific variables, along with appropriate fixed effects. To explore the impacts of the GFC crisis on export growth, the analysis began with the estimation of model, which only includes the variable $Crisis$ (Model 1). Then, we re-run three more regressions, where the interaction terms between crisis dummy and firm-, product- and country-specific variables were entered separately (Models 2-4).

The estimated coefficients reported in Model 1 of Table 3 show that the GFC crisis reduces the mid-point growth rate of exports by 1.58 percentage points. Having established that the GFC crisis reduced firm's export growth in Kenya, we next want to evaluate whether firm size heterogeneity has implications for export growth by employing two interaction terms between the crisis dummy and size dummies: $Crisis\ x\ Large$ and $Crisis\ x\ Medium$. Model 2 indicates that large and medium-sized firms experienced a smaller drop in their exports during the GFC crisis. The attenuated effects are also found to be large and highly significant. This result is consistent with the view expressed earlier that large firms have easier access to external finance, and therefore less prone to the financial crisis (Bricongne et al. 2012).

In Model 3 of Table 3, we examine the differential impact of the GFC crisis on export growth, depending on product characteristics. Specifically, we interact the crisis dummy with several product type indicators including intermediate, final, and capital, as well as product differentiation. We find that intermediate, final and capital goods experienced a significantly larger fall in exports compared to the base category, namely others. This aligns with the findings of previous studies, such as those by Behrens et al. (2013). As expected, the export growth of the differentiated goods is also more negatively affected by the GFC crisis. The result, however, is inconsistent with Behrens et al. (2013), who found that Belgian differentiated goods exports were less affected by the GFC crisis. The conflicting result could be due to the fact that developing countries such as

Kenya are relatively more involved in the trade of homogenous goods than developed countries (Majune et al., 2020).

We further investigate the impact of country-specific variables interacted with the crisis dummy on export growth. In Model 4, we can see that exports destined to Europe experienced a greater fall during the crisis. The coefficient on the interaction term between the crisis dummy and economic integration agreement, $Crisis\ x\ EIA$, on the other hand is positive and statistically significant. The result is consistent with the notion that exports destined to a country that shares a trade agreement suffer less during a financial crisis because of the reduction in trade costs. The coefficient estimate on the interaction between distance and the crisis dummy ($Crisis\ x\ Distance$) implies that exports to faraway locations suffer more during the crisis, as expected. Again this is intuitive, as firms relocate their exports to nearby countries given the increasing trade costs in bad times.

In addition, the coefficient of the interaction term ($Crisis\ x\ ER\ Change$) in Model 3 of Table 3 is negative and statistically significant, meaning that the positive effect of exchange rate changes on the export growth is eliminated during the GFC period. This result is not in line with prior expectation that exports destined to a country in which Kenya has favorable exchange rate changes is more resilient to the crisis. As expected, the responsiveness of Kenyan exports to changes in log import values of the destination country ($Crisis\ x\ Net\ Import$) is much larger during the crisis period, illustrating the key role that external demand plays. This result is consistent with previous research (Behrens et al, 2013; Bellas and Vicard, 2014).

Table 3: Effect of GFC on firm-level export growth: Firm, product and country determinants

Variable	(1)	(2)	(3)	(4)
Crisis	-1.582***			
	(0.011)			
Crisis x Large		1.672***		
		(0.038)		
Crisis x Medium		1.239***		
		(0.030)		
Crisis x Intermediate			-0.226***	
			(0.034)	
Crisis x Final			-0.234***	
			(0.034)	
Crisis x Capital			-0.277***	
			(0.044)	
Crisis x Differentiated			-0.073**	
			(0.025)	
Crisis x Africa				0.135
				(0.175)
Crisis x Europe				-0.248*
				(0.109)
Crisis x Asia				-0.130
				(0.140)
Crisis x EIA				0.282**
				(0.108)
Crisis x Distance				-0.233*
				(0.109)
Crisis x ER Change				-0.038*
				(0.017)
Crisis x Net Import				0.073*
				(0.030)
Firm x Product x Destination F.E.	Yes	Yes	Yes	Yes
Firm x Month F.E.			Yes	Yes
Product x Month F.E.		Yes		Yes
Destination x Month F.E.		Yes	Yes	
Obs.	291,581	272,788	269,471	57,035
R-squared	0.37	0.52	0.60	0.74

Note: Column 1 presents the results where we include only crisis dummy. Columns 2-4 display the results where we interact the crisis dummy with firm, product and country characteristics, respectively. Standard errors clustered at a firm-exporter-product-destination level using multiway clustering are given in parenthesis. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

In Table 4, we report similar results for import growth. The first column shows that the overall mid-point growth rate of imports declined by 1.657 percentage points during the financial crisis. The results also reveal that the magnitudes of the crisis dummy coefficient is larger for the import growth than for exporter growth presented in Model 1 of Table 3. This indicates that Kenyan imports fell more than exports in during the financial crisis. One of the key factors in explaining the disproportionately large fall in imports relative to exports is the product composition of Kenyan imports, which mainly consists of consumer durable and capital goods (Were and Ngoka, 2022). Firms in developing countries that import those products are usually more sensitive to the cost of external finance than exporting firms, and this sensitivity increases during financial crises.

Model 2 of Table 4 reports the estimated coefficients of the interaction term between firm size dummies and crisis dummy. The estimates are quite similar to those in Table 3, implying that large and medium-sized firms (exporters and importers) are more resilient in the face of major financial crisis. This finding, coupled with the above result, confirms that small-sized firms are more sensitive to external finance and are much more vulnerable to external shocks. As shown in Model 3 of Table 4, imports of consumption, capital and differentiated goods experienced a larger decline, consistent with our earlier findings for export growth. However, the intermediate goods no longer play a role in explaining the fall in imports.

Furthermore, the import growth was dampened by trading with partners located in Europe and Asia. In contrast, trading with Africa weakens the negative effects of the GFC crisis on imports. This finding is quite plausible given the fact that firms usually cope with financial shocks by switching to suppliers located in neighbouring countries. As in the case of export growth, we find evidence that the negative effect of the GFC crisis on imports was mitigated by trade agreements and exchange rate fluctuations. The estimated coefficient of the interaction variable ($Crisis\ x\ Net\ Export$) is negative and statistically significant, suggesting that imports have been less affected by domestic demand conditions during the GFC crisis. This is quite surprising given the fact that firms in developing countries usually depend more on imported intermediate and capital goods for production. This finding implies that Kenyan firms switched from imported to locally produced intermediate and capital goods in times of crisis because domestically produced inputs provide cost advantages during the crisis period.

Table 4: Effect of GFC on firm-level import growth: Firm, product and country determinants

Variable	(1)	(2)	(3)	(4)
Crisis	-1.657***			
	(0.006)			
Crisis x Large		2.265***		
		(0.020)		
Crisis x Medium		1.501***		
		(0.018)		
Crisis x Intermediate			0.027	
			(0.018)	
Crisis x Final			-0.060**	
			(0.019)	
Crisis x Capital			-0.042*	
			(0.020)	
Crisis x Differentiated			-0.224***	
			(0.017)	
Crisis x Africa				0.551***
				(0.106)
Crisis x Europe				-0.319***
				(0.049)
Crisis x Asia				-0.355***
				(0.054)
Crisis x EIA				0.110*
				(0.054)
Crisis x Distance				0.110
				(0.073)
Crisis x ER Change				-0.049***
				(0.009)
Crisis x Net Export				-4.476***
				(0.466)
Firm x Product x Destination F.E.	Yes	Yes	Yes	Yes
Firm x Month F.E.			Yes	Yes
Product x Month F.E.		Yes		Yes
Destination x Month F.E.		Yes	Yes	
Obs.	825,393	805,488	726,757	381,568
R-squared	0.33	0.44	0.60	0.69

Note: Column 1 presents the results where we include only crisis dummy. Columns 2-4 display the results where we interact the crisis dummy with firm, product and country characteristics, respectively. Standard errors clustered at a firm-exporter-product-destination level using multiway clustering are given in parenthesis. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

We also explore the impact of the COVID-19 on Kenya's export and import growth. The results for export and import growth are shown in Tables 5 and 6, respectively. Model 1 of Table 5 shows that the effect of the COVID-19 on export growth is negative and significant. The COVID-19 reduced the mid-point growth rate of exports by 1.803 percentage points, which is higher in magnitude than that presented in Model 1 of Table 3. The finding of a negative effect on export growth is broadly consistent with the results reported in Bricongne et al. (2021) and Benguria (2021). This finding also implies a greater elasticity of exports to the COVID-19 than those of the GFC crisis. Border closures, supply chains disruptions and bottlenecks in transport and logistics networks caused by the COVID-19 have been widely seen as the main contributors of the relatively larger fall in exports compared to the GFC crisis.

The estimated coefficients for firm- and product-specific variables are quite similar to those provided in Models 2 and 3 of Table 3. The evidence suggests that the negative effect of the COVID-19 crisis on export growth was weakened by large and medium firms, whereas it was increased by the trade in intermediate, final, and capital goods. Differentiated goods were also responsible for a relatively larger fall in exports during COVID-19. As the fourth column of Table 5 demonstrates, the firms that ship their products to Africa and Europe were less negatively affected by the COVID-19 pandemic. It seems that Africa and Europe's supply chains and transport and logistics systems have been relatively less disrupted by the COVID-19 pandemic, making it much easier to export goods to those regions compared to other regions, like Asia or RoW. Furthermore, in contrast to the GFC crisis, an appreciation of the importer's currency seems to offset the decline in exports caused by the COVID-19 pandemic. Meanwhile, results with the interaction term between crisis dummy and external demand conditions ($Crisis\ x\ Net\ Import$) show that exports to countries that fared relatively better during the crisis were less negatively affected by the pandemic, as expected. Other remaining interaction terms with country-specific variables had no significant effect on export growth during the COVID-19 pandemic.

Table 5: Effect of COVID-19 on firm-level export growth: Firm, product and country determinants

Variable	(1)	(2)	(3)	(4)
Crisis	-1.803***			
	(0.013)			
Crisis x Large		1.851***		
		(0.043)		
Crisis x Medium		1.112***		
		(0.032)		
Crisis x Intermediate			-0.219***	
			(0.045)	
Crisis x Final			-0.224***	
			(0.044)	
Crisis x Capital			-0.356***	
			(0.059)	
Crisis x Differentiated			-0.148***	
			(0.035)	
Crisis x Africa				0.747*
				(0.328)
Crisis x Europe				0.468**
				(0.171)
Crisis x Asia				0.143
				(0.216)
Crisis x EIA				-0.234
				(0.163)
Crisis x Distance				-0.340
				(0.226)
Crisis x ER Change				0.088*
				(0.035)
Crisis x Net Import				0.090*
				(0.046)
Firm x Product x Destination F.E.	Yes	Yes	Yes	Yes
Firm x Month F.E.			Yes	Yes
Product x Month F.E.		Yes		Yes
Destination x Month F.E.		Yes	Yes	
Obs.	159,065	149,898	142,056	19,240
R-squared	0.45	0.58	0.70	0.78

Note: Column 1 presents the results where we include only crisis dummy. Columns 2-4 display the results where we interact the crisis dummy with firm, product and country characteristics, respectively. Standard errors clustered at a firm-exporter-product-destination level using multiway clustering are given in parenthesis. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

Moving to the import side, the negative and statistically significant coefficient reported in Model 1 of Table 6 indicates that the mid-point growth rate declined during the COVID-19 crisis by 2.091 perecentage points. The estimated magnitude is relatively larger compared to those reported in Table 4. This evidence once again suggests that the COVID-19 had more detrimental effects on Kenyan trade (both exports and imports) than the GFC crisis. The rest of the estimated coefficients of the interaction terms between the crisis dummy and firm-and product-specific variables are very similar to those reported in Models 2 and 3 of Table 4, except that the interaction variable between crisis dummy and intermediate goods ($Crisis\ x\ Intermediate$) become statistically significant and the variable ($Crisis\ x\ Final$) was not significant anymore and its sign was changed. It seems that capital goods imports were hardest hit by the COVID-19 pandemic. In contrast, the impact of the pandemic was less severe on the imports of intermediate goods which are used in furthering Kenya's manufacturing sector.

In the last column of Table 6, we investigate the impact of the COVID-19 pandemic on import growth using country characteristics. The interaction variable between crisis dummy and Africa ($Crisis\ x\ Africa$) is significantly and positively associated with the import growth, as to be expected. This suggests that imports sourced from Africa are less affected by the COVID-19 pandemic compared to other regions. The lesser decrease in the imports of Kenya from Africa can be explained by the fact that border closures and disruptions in transportation for Africa caused by the pandemic is less severe than the global average. However, the interaction variable between the crisis dummy and distance ($Crisis\ x\ Distance$) carries an unexpected and statistically significant positive sign in the case of import growth. The remaining variables did not have any significant impact on the mid-point growth rate, indicating that country-characteristics play marginal role in explaining the adverse effects of the COVID-19 on Kenya's imports.

Table 6: Effect of COVID-19 on firm-level import growth: Firm, product and country determinants

Variable	(1)	(2)	(3)	(4)
Crisis	-2.091***			
	(0.006)			
Crisis x Large		2.288***		
		(0.016)		
Crisis x Medium		1.339***		
		(0.015)		
Crisis x Intermediate			0.043*	
			(0.018)	
Crisis x Final			0.011	
			(0.019)	
Crisis x Capital			-0.067***	
			(0.020)	
Crisis x Differentiated			-0.208***	
			(0.016)	
Crisis x Africa				1.880***
				(0.532)
Crisis x Europe				-0.059
				(0.154)
Crisis x Asia				0.173
				(0.152)
Crisis x EIA				0.086
				(0.124)
Crisis x Distance				0.388*
				(0.156)
Crisis x ER Change				0.040
				(0.030)
Crisis x Net Export				-1.442
				(0.905)
Firm x Product x Destination F.E.	Yes	Yes	Yes	Yes
Firm x Month F.E.			Yes	Yes
Product x Month F.E.		Yes		Yes
Destination x Month F.E.		Yes	Yes	
Obs.	669,608	661,233	608,959	100,597
R-squared	0.44	0.52	0.65	0.76

Note: Column 1 presents the results where we include only crisis dummy. Columns 2-4 display the results where we interact the crisis dummy with firm, product and country characteristics, respectively. Standard errors clustered at a firm-exporter-product-destination level using multiway clustering are given in parenthesis. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% level, respectively.

5. Conclusion

Using monthly customs transaction data (at the 6-digit level of HS) from Kenya for the period January 2006–June 2020, this study describes trade margins and establishes determinants of the mid-point export and import growth during the GFC and COVID-19 pandemic.

We find that the fall in exports during the GFC was at the intensive margin while the extensive margin was responsible for the decline of exports during the COVID-19 pandemic. Imports are mainly driven by the extensive margin which grew during GFC but declined during the pandemic. Nonetheless, the fall in the intensive and extensive margins was almost symmetrical during the pandemic. Estimates from the fixed-effects regression model reveal that the decrease in export and import mid-point growth was larger during the COVID-19 pandemic than GFC. Varied factors determined this growth: firm characteristics (large and medium-size), product characteristics (intermediate, final, capital and differentiated) and partner country characteristics (location (Africa, Europe, Asia), trade agreements, distance, exchange rate appreciation and net import/export (foreign/domestic demand)).

Generally, COVID-19 containment measures, like social distancing that hinder interactions among people, have escalated the exit of the incumbent and new exporters and importers as they struggle to create new relationships and launch new products in Kenya and foreign markets. Domestic and external demand shocks arising from unemployment and business closures have also impacted export and import mid-point growth in Kenya. Therefore, addressing these supply and demand shocks can help firms and countries improve their export performance during major economic crises. Nonetheless, some of these recommendations might change when updated data is used.

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Appendix

Table A.1: Variable definitions and data sources

Variable	Definition	Source
Large	Takes a value of one if the firm is considered as large firms, zero otherwise	Customs Transaction Data
Medium	Takes a value of one if the firm is considered as medium firms, zero otherwise	Customs Transaction Data
Intermediate	Takes a value of one if the 6-digit products are considered as intermediate goods, zero otherwise	Customs Transaction Data
Final	Takes a value of one if the 6-digit products are considered as final goods, zero otherwise	Customs Transaction Data
Capital	Takes a value of one if the 6-digit products are considered as capital goods, zero otherwise	Customs Transaction Data
Africa	Takes a value of one if Kenya's trade partner is located in Africa, zero otherwise	USITC's Dynamic Gravity Dataset
Europe	Takes a value of one if Kenya's trade partner is located in Europe, zero otherwise	USITC's Dynamic Gravity Dataset
Asia	Takes a value of one if Kenya's trade partner is located in Asia, zero otherwise	USITC's Dynamic Gravity Dataset
EIA	Takes the value of one if Kenya and its partner have an FTA or CU aggreement at time t, and zero otherwise.	Baier and Bergstrand's website:www.nd.edu/jbergstr and WTO's RTA-IS database
Distance	Log of geographical distance in Kms between the capital city of Kenya (Nairobi) and those of partners	CEPII's GeoDist database
ER Change	Monthly percent change in the log of the bilateral Exchange rate between Kenya and its trading partner	International Monetary Fund (IMF)
Net Import	Log of partner country's total imports minus Kenya's exports to that specific location	International Monetary Fund's (IMF) Direction of Trade Statistics database
Net Export	Log of Kenya's total imports minus its partner country's exports to Kenya	International Monetary Fund's (IMF) Direction of Trade Statistics database

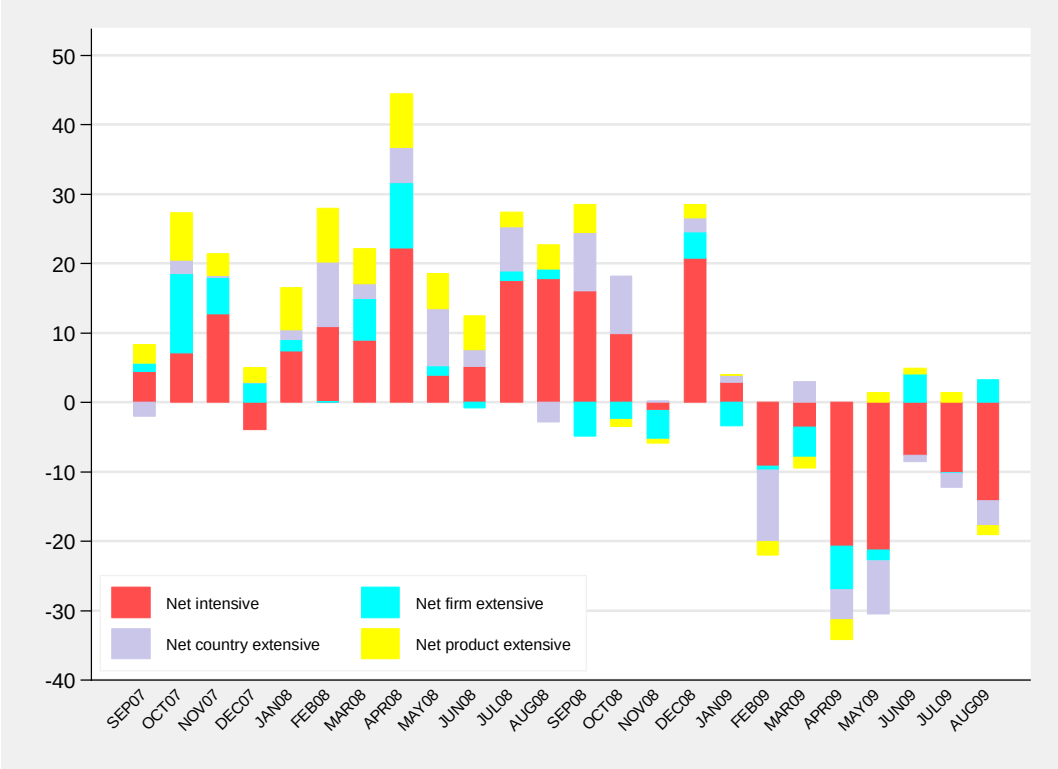


Figure A.1a: Net margins' contributions to mid-point growth rates during the 2008-2009 financial crisis period, Kenyan monthly exports (percent), January 2008-December 2009

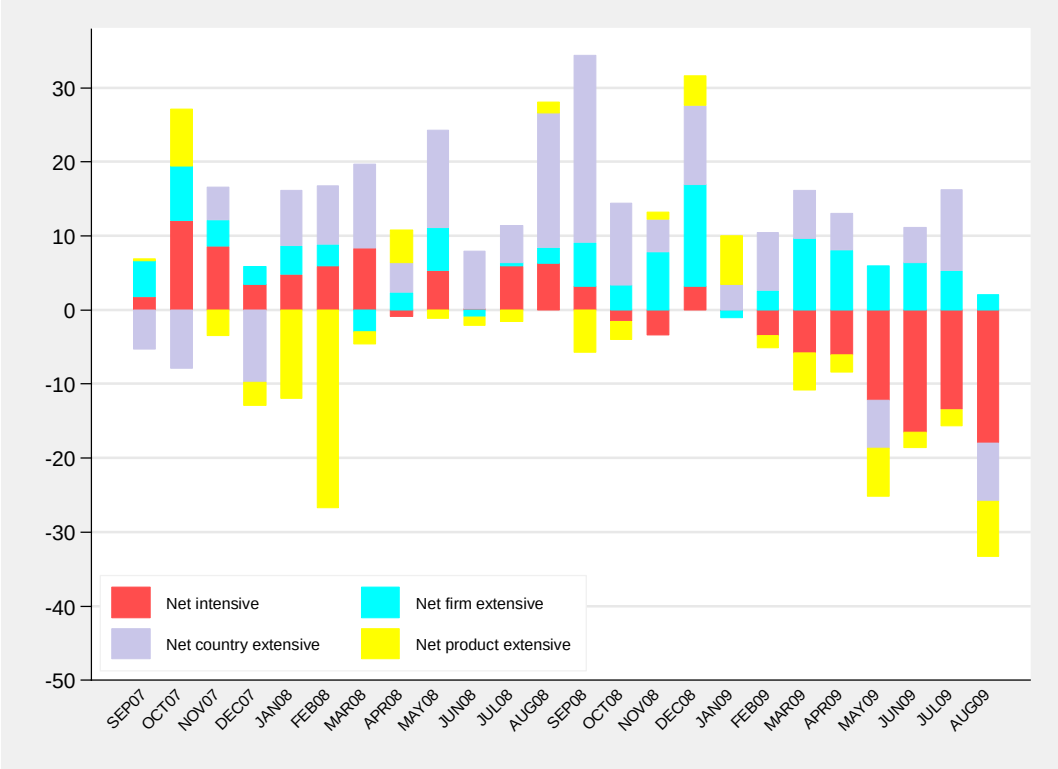


Figure A.1b: Net margins' contributions to mid-point growth rates during the 2008-2009 financial crisis period, Kenyan monthly imports (percent), January 2008-December 2009

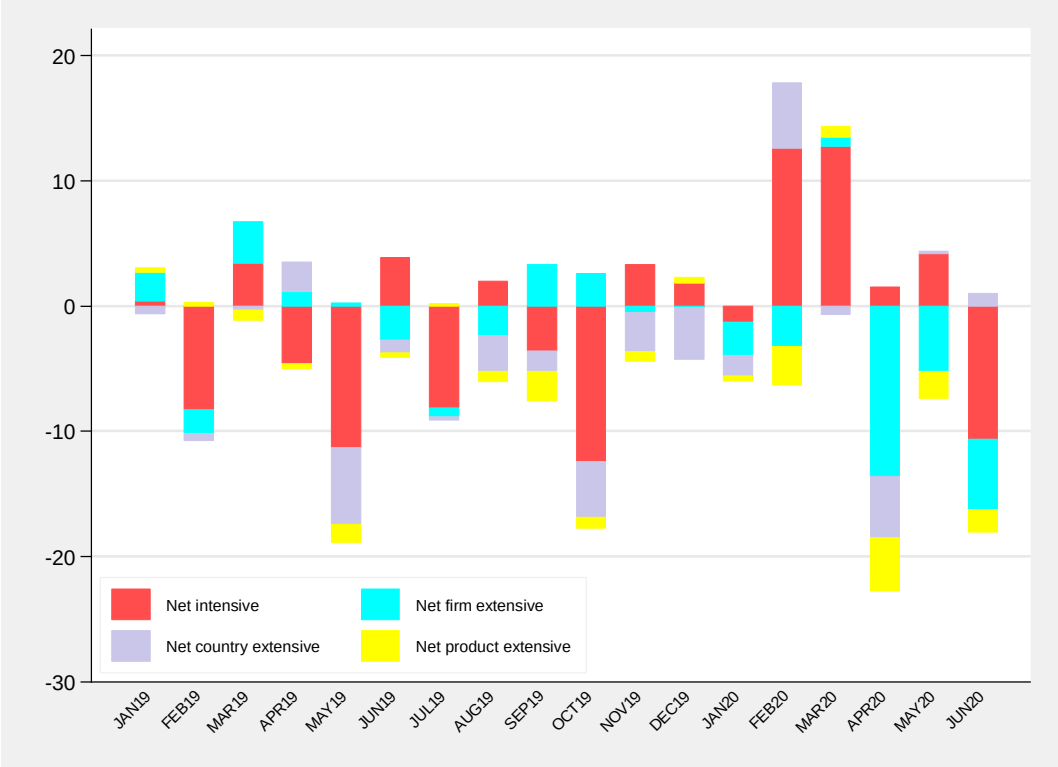


Figure A.1c: Net margins' contributions to mid-point growth rates during the COVID-19 crisis period, Kenyan monthly exports (percent), January 2019-June 2020

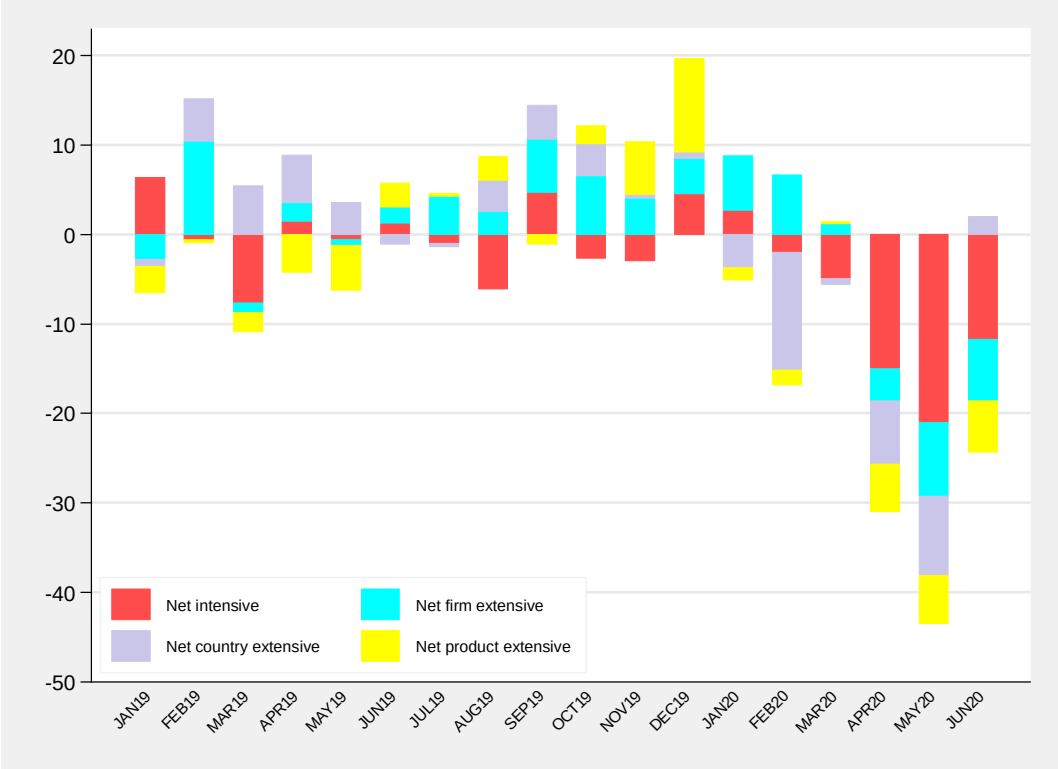


Figure A.1d: Net margins' contributions to mid-point growth rates during the COVID-19 crisis period, Kenyan monthly imports (percent), January 2019-June 2020