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Firm Level Analysis of Global Value Chain Participation in Kenya

Kevin Wanjala and Muhamed Abdulahi

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Kenya Institute for Public Policy
Research and Analysis

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Abstract

Over the last three decades since the 1990s, global value chain (GVC) participation has played an integral role in growing trade earnings for both developed and developing countries and is a vital framework for addressing trade benefits and economic transformation in developing countries. This study constructed Kenya's global value chain participation index at firm level to inform policy. The key findings from the study indicate that Kenya's global value chain participation index at firm-level is low and was estimated at 18.65 per cent. This implies that only 2 in every 10 Kenyan firms are integrated into the global value chains. Global value chain participation is driven by productivity, firm certification, size of firms, and research and development spending and uptake. Global value chains are often adversely affected by financial constraints and this is more pronounced among small and medium size firms compared to larger firms. To enhance participation of firms in the global value chain, the following is recommended. First, it is important to increase firm productivity through investment in human capital development, including on-job training programmes, and investment in efficient technology use. Secondly, there is need to conduct awareness of firms on the importance of international certifications on business, and sensitization in participating in global value chains. This can be done through close collaboration between the government agencies concerned with product quality assurance among firms and bolster firm registration in business membership organizations (BMOs). Thirdly, to increase access to finance, there is need to create credit information infrastructure for firms that look at the credit score or rating. Finally, investment in research and development through creation of business hubs and innovation centres and creating acceleration programmes will improve firms' capability when participating in global value chains.

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1.   Introduction

The emergence of Global Value Chains (GVCs), a procedure that involves a wider range of activities required to get products to the intended consumer, right from the production design to the processing and distribution stages, is closely related to the widespread developments in developing countries that have occurred over the past 20 years. GVCs is essentially the vertical fragmentation of the stages of production: components are produced in several countries and then assembled either sequentially throughout the value chain or at the final location (Del Prete and Rungi, 2015). The intricate industrial networks at play encompass a variety of services, including manufacturing, shipping, and port clearance (Baldwin and Venables, 2013).

As a result, countries are now better equipped to take advantage of their comparative advantages and frequently identify lucrative specialization niches. Each nation has had to rely on its own resources in the past, maybe even creating complete domestic supply networks. However, in a world where competition is escalating, it is especially harder for poorer nations to produce an entire product from the initial stages. Currently, a nation can generate a percentage of the value added for the commodities by specializing in a certain supply chain task or segment. By supporting the value chain as suppliers of intermediate inputs and acting as sub-contractors, even several layers down from the final consumer, several nations and businesses have been able to join a global production chain without having to offer all the upstream capabilities (Humphrey and Schmitz, 2002). For instance, since the 1990s, China has upgraded its involvement in GVCs by creating a competitive supply base of intermediate items and improving the quality of its exports. China first specialized in the assembly operations (Marvasi, 2013).

Participation in GVCs has been demonstrated to aid developing nations in undergoing structural change (Stllinger, 2016; Norbu et al., 2021). The creation of new jobs and increased export capacity are the major engines of economic transformation (Lectard and Abidjan, 2017; Bali'e et al., 2019; Lim, 2021). Participating in a supply chain and working together in a network of upstream and downstream partners can also improve information flow and learning opportunities, introduce new business practices, and use of more sophisticated technology, all of which can boost growth. As a result, it is essential to promote competitiveness by reallocating resources from older, less profitable activities to more recent, connected ones. This calls for an adequate level of absorptive capacity, which can be produced by intersectoral linkages (Kummritz, 2015).

The potential of African countries to establish their presence in the global world stage has not yet been fully realized. Minerals and primary agriculture continue to account for most global trade participation (World Bank, 2019). Kenya is one of the nations that participate on the global value chain to a lesser extent compared to its capacity. Despite having a favourable geographic and logistical location, most Kenyan businesses, particularly Small and Medium Enterprises (SME), have largely stayed "local," producing for the local market. Their participation in GVCs is currently minimal, focusing mostly on low value-added phases. However, as China and other Asian nations advance up the value chain, other nations must

develop into the next centre (suppliers) of labour-intensive productions and broaden their technology sectors. Kenya stands to benefit from this, especially now that the AFCFTA is allowing for increased intra-African trade, thus providing a significant potential.

By creating a robust, diverse, and globally competitive manufacturing sector, Kenya hopes to increase its regional market share for manufactured goods from 7.2 per cent to 15 per cent (Kenya Vision 2030). Since the government is aware that Kenya's competitiveness in manufacturing depends on agro-industrial exports, it seeks to increase the capacity for value addition in agro-based firms. Despite the efforts made so far, Kenya's performance in the global industrial network is still low, characterized by poor performance in both upstream and downstream productions.

According to statistics released by UNCTAD (2016), Kenya scored a GVC of 35 per cent in 2016, placing it at number 41 in Africa. With a foreign value-added component of 18 per cent, Kenya is ranked number 22 in Africa. With a domestic value-added export component of 19 per cent, Kenya is ranked number 45 in Africa. If this situation is not reversed, Kenya runs the risk of losing its competitiveness in the global market.

It is against the backdrop that this study sought to measure and establish the determinants of GVC participation in Kenya. To achieve this, firstly, the study computed the degree of GVC participation by firms in different sectors. Secondly, it investigated firm level drivers of GVC participation by Kenyan firms. The scope of the study is, however, limited to 1,001 firms obtained from the World Enterprise Survey. An alternative would be to obtain macroeconomic data from supply use table of the economy or data from multi-regional input-output tables. This would have provided an overall picture of the economy. There are ubiquity of studies that have used this approach. Therefore, the study saw it fit to conduct a microeconomic study as this would offer more insight on how the capacity of firms could be built to participate in GVC. In addition, firm-level studies are surprisingly scarce, a factor that warrants more investigation in this area.

The rest of the sections are organized as follows. Section 2 highlights the theoretical underpinning of the study. Section 3 describes the data and approach to construct GVC Index and analyze the determinants of GVC participation at the firm level. Section 4 discusses the findings of the study. Section 5 concludes the study.

2.   Literature Review

2.1   Theory of Heterogenous Firm

This study is anchored on the theory of heterogenous firms developed by Melitz (2003). It is an industry equilibrium model featuring a combination of heterogenous firm productivity (Javanovic, 1982), with a model of trade based on preference and increasing returns to scale (Krugman, 1980). The starting point of the model is that there are numerous countries in the world and each country trades with more than one country n≥1 countries. The model begins by considering symmetric countries and assumes that labour is the singular factor input with an inelastic supply and not mobile across the countries. The model further defines consumer preference over a range of horizontally differentiated products within an industry. The preferences are said to exhibit a Constant Elasticity of Substitution (CES) in the following form:

$$C=[\int_{\omega \epsilon \Omega}.q(\omega)^p d\omega^{1/p}, \qquad \qquad 0<p<1 \qquad \qquad 2.1$$

Where ω denotes indexes of products, Ω is the endogenous set of products, p is the price dual and can be expressed as:

$$P=\int_{\omega \epsilon \Omega}.q\omega^{1-\sigma}d\omega)]^{1/(1-\sigma)}, \qquad \qquad \sigma=1/(1-p)>1$$

σ relates to the elasticity of substitution between products.

The model captures an industry within an economy and the CES preference is predicated on the ideas that consumers have a greater desire for product and that the marginal benefit of consuming any one product is dwindling. Given these preferences, the revenue for a product offered on the domestic market is:

$$r_d(\omega)=R(Pd(\omega))/P)^{1-\sigma} \qquad \qquad 2.2$$

Where $pd(\omega)$ is the price of product ω in the domestic market; R denotes aggregate revenue, which equals aggregate income, which equals aggregate expenditure; the price index P summarizes the prices of competing products.

2.1.1   Production technology

The primary aspect of market entry is the sunk entry cost of f_e of units of labour, which can deter potential entrants. As a result, they have a hazy impression of what the industry produces. However, the member obtains productivity Φ from utilizing a fixed distribution g(Φ) after paying the sunk cost. The model predicts that productivity is often fixed after entry, but that firms experience a constant exogenous likelihood of dying, leading to steady-state entry and exit of firms.

Empirical evidence suggests that there is no correlation between a firm's output and its propensity to fail. However, the model still takes into consideration the actual findings that exiting firms are less productive than surviving firms since, among the cohort of entering firms each period, those that draw low productivity exit rapidly. Market structure is governed by monopolistic competition. Each product's manufacturing involves a set production cost of f_d units of labour and a

constant variable cost based on firm productivity. As a result, the labour required to produce q(Φ) units of a certain product is:

$$i(\Phi)=f_d+q(\Phi)/\Phi$$

With the CES preference, the fixed production cost is necessary to matching empirical findings that exiting firms are generally less productive than surviving enterprises because firms with sufficiently low productivity cannot generate enough variable revenues to cover the fixed production cost. Due to extremely variable trading costs and a fixed exporting cost of f_x units of labour, firms that opt to export must export ($\tau>1$) more than one unit of each type for one unit to arrive in a far-off country.

The fixed exporting cost is integral to CES preferences because only companies with high productive capacity can afford to cover the fixed export costs from the profits that they realize. Vast empirical research has pointed out that if firms were only faced with variables cost of exportation, there would have been no obstacles to export. The rationale behind this from the CES preference is that the utility derived from consuming an extra unit of product rises exponentially as the consumption decreases towards zero.

2.1.2   Production and exporting decisions

Each firm simply provides one alternative among several available; therefore, it has zero industry-wide measure and takes the aggregate price index as exogenous. Depending on the elasticity of demand, the equilibrium prices are typically marked up above marginal costs as a result of the first-order criterion for profit maximization. Given the same constant elasticity of demand in the domestic and export markets, the variable costs of trade lead to equilibrium prices in the export market being a constant multiple of those in the domestic market:

$$P_x(\Phi)=\tau P\_d (\Phi)=\tau(\sigma/(\sigma-1)\omega d/\Phi=\tau/(p\Phi) \qquad 2.3$$

We utilize nation symmetry and we use a single country's pay as the numeraire. Together, these indicate that for all nations, $\omega=1$. Substituting the pricing rule into firm revenue (2.2), we obtain the following expression for equilibrium firm revenue in the export and domestic markets:

$$r(\Phi)=\tau^{1-\sigma}r_d (\Phi)=\tau^{1-\sigma}\Phi(P\Phi)^{\sigma-1}\Phi RP\Phi^{\sigma-1} \qquad 2.4$$

This equation for equilibrium revenue was derived under the assumption that firm products would enter utility symmetrically as shown in (2.1). It is simple to allow for varied weights for each firm product to account for things such as variations in product quality. Under CES preferences and monopolistic competition, product quality has the same impact on firm revenue as firm productivity does.

2.1.3   Summary of the theory

The model highlights producer heterogeneity and steady-state entry and exit of firms. Considering fixed export costs and adequately large fixed and variable trade costs, not all firms can participate in imports and exports of final products, let alone factor inputs. The only firms likely to be favoured by this situation are large firms and highly productive ones. Smaller and less productive firms are more likely to concentrate on the domestic market due to huge export entry costs such as advertisements, exchange rate risks, distribution networks, among others. The theory opines that even though they were to venture in the international market, their survival rate will be lower and would have an early exit. The argument is that even though some of the costs are cut through trade liberalization, there is a likelihood of intra-industry resource reallocation, which would make lower productive firms exit and their position swallowed by productive firms. Larger and productive firms can overcome sunk, fixed and variables costs. This makes firms participation in international production network a self-selection process.

2.2   Empirical Literature

2.2.1   GVC participation archetypes and index construction

Veugelers et al. (2013) assert that firms integrate in GVCs from the intensity of a firm's internationalization strategy, how many international activities the firm uses in combination. They identified three criteria for qualifying a firm's GVC participation, the first being a firm sourcing its intermediate inputs from foreign markets through importation. The second is indirect exportation of parts or products through third parties in the country or direct exportation of its products or parts. The third mode of GVC relates to access to international networks, whether it is owned by foreigners, it a subsidiary of a foreign company or has stakes in foreign companies.

By adopting the modes presented by Veugelers et al. (2013), Gereffi and Fernances-Stark (2016) set the threshold values on what constitutes GVC. Having defined different thresholds, they split the three modes of GVC participation into five categories. The first category was the triple mode where a firm engages in all the three Veugelers et al. (2013) modes, dual mode where a firm only engages in two of the modes, and single mode where a firm only engages in one of the modes. Limited participation is where a firm only exports one third of its output. The fifth mode is no participation in GVC, which denotes that a firm is entirely local; it does not have international networks and it does not export or import any of its intermediate products.

De Gortari (2018) recognized two forms of GVC participation; they were firm's direct exports and indirect exports and imports of intermediate inputs. They came up with different terminologies to refer to the two modes of GVC participation and devised a formula to compute each mode. The two modes are forward linkage participation that represents Domestic value added (DVA) and backward linkage participation which represents foreign value added (FVA). Forward linkage at

firm-level is computed as the ratio of exports of firms output to the total sales of the firm. Backward participation is computed as the ratio of material input and supply originating from abroad to total procurement. For the purposes of coherence, the current study uses these terms and definitions to describe the two modes of GVC participation.

Antràs (2020) used the modes of GVC participation by Veugelers et al. (2013) to compute the GVC participation index. In their computation, they multiplied the percentage of firm's direct and indirect exports over sale multiplied by percentage of material Inputs and Supplies of foreign origin over total procurements. This approach, however, is akin to the double mode approach by Gereffi and Fernances-Stark (2016), where firms participate in both importation and exportation. In set theory, it can be compared to the intersection of sets whose drawback is excluding many firms that may be taking part in GVC participation but are not fully integrated. This is likely to underestimate the frequency of firms that take part in GVC participation. The current study adopts the union of a set approach, which is a summation of forward and backward linkage.

2.2.2 Drivers of GVC participation

A vast majority of studies on GVC participation have mainly adopted the macroeconomic approach. There is a scarcity on studies that have paid attention to firm-level GVC participation and to a larger extent in the Sub-Saharan region. In addition, the handful firm-level studies have produced discordant empirical results on various determinants of GVC. This study finds these two as adequate gaps that need to be filled. Focusing on the determinants of GVC participation among firms, financial constraints and productivity have been extensively researched in relation to firms' GVC participation, particularly in the literature on heterogeneous firm models of trade (e.g. Melitz, 2003; Bernard et al., 2003; Manova, 2013; Chaney, 2016). Investigating the potential effects of these variables on GVC participation forms the starting point of this empirical review.

The most essential determinant in a firm's involvement in export and import markets is its productivity. Theoretical studies of heterogeneous firm models, including that of Melitz (2003) claimed that only highly productive firms can surmount sunk export costs, becoming exporters with more pricing power. This idea of productivity selection has gained widespread empirical support. Baldwin and Gu (2003), for instance, utilized Canadian data, Amiti and Konings (2007) used Indonesian data, and Mallick and Yang (2013) used Indian data to demonstrate that more productive enterprises are predisposed to take part in exportation. Mallick and Marques (2016) investigated the price behaviour of Chinese and Indian exporters based on product quality and discovered evidence of greater product quality in Chinese exports. Considering these findings, we look at how productivity can explain firm-level variation in GVC.

Another important contributor of GVC participation is availability of finances. Financial constraints make it difficult for firms to export and import, and this makes their production and sales local. The reasoning behind this is that exports have

some fixed elements inter alia research and development, commissions, duties, warehousing and innovation cost (Chaney, 2016). A theoretical study by Goksel (2012) revealed that firms that are financially constrained perform dismally in export trade. The study argued that there are frictions in the financial market that can curtail small and medium firms to access finances and this adds on to their overall costs. Regarding import trade, Bas and Berthou (2012) conducted studies on Indian firms and established that financial constraints deterred purchases of imports by smaller and medium firms. Muûls (2015) established that firms faced with lower obstacles to financial access have enough capital to import and can engage in backward linkage GVC.

In addition to financial restrictions and business productivity, existing literature provides evidence of other factors that impact firm level involvement in GVC, firm ownership being one of them. Banerjee and Zeman (2020) examined the factors that influence GVC participation on a panel of 43 countries in Europe, America and Asia between 2000 and 2014. The explanatory variables comprised of country size, real effective exchange rate, openness, labour skills, exports, GDP per capita, institutional quality and foreign direct investment that proxied foreign ownership. The study established that GVC archetypes responded positively, foreign direct investment, country size, and openness. Feenstra et al. (2014) coined the term "ownership-based financial discrimination". They contend that foreign-owned enterprises are more likely to be backed by their financial institutions. Domestically, financiers prefer to fund state-owned corporations over privately held corporations. They find that foreign-owned enterprises are better funded than indigenous firms.

Reddy et al. (2021) used data from 2006 to 2017 to study the association between innovation and GVC involvement in 90 countries. Using a reverse causality technique, the study discovered that corporate innovation was a crucial determinant in firm GVC participation. Lu et al. (2018) notes that investment in R&D by a company has a beneficial influence on its exports, which leads to increased GVC involvement. Blind et al. (2020) established that internationally recognized quality certification and innovation are important determinants of small and medium-sized companies' growth and ultimately involvement in international production networks. Certification is a key factor in gaining new clients and winning competitive bids. It allows organizations to increase their process efficiency and product or service quality. As a result, having internationally recognized certification, such as that provided by the International Standards Organization, will provide business with an advantage over foreign competitors.

3.   Research Methodology

The study obtained firm level data from the World Enterprise Survey 2018. This is a cross sectional data covering 1,001 firms across 7-broad sectors derived from International Standards Industrial Classification (ISIC). The firms are distributed in ascending order beginning from other manufacturing that constituted 188 firms, and was closely followed by retail 178, other services had 167 firms, food 160 firms, chemical, pharmaceutical, and plastic 112, while textile and garments had 60 firms. These 7 sectors are distributed in Table 3.1.

Table 3.1: Broad sector classification of firms

Industry Sampling Sector	Frequency
Other manufacturing	188
Retail	178
Other services	167
Food	160
Tourism	136
Chemical, pharmaceutical, and plastic	112
Textiles and garments	60
Total	1001

Source: World Enterprise Survey, 2018

The specific sub-sectors covered are 25 in total, distributed across the seven sectors in Table 1. On top of the list is retail sector comprising 194 firms, hotel and restaurants 149 firms, food 143 firms, service of motor vehicles 59. The least sub-sectors in the survey were basic metals with 4 firms, recycling with 3 firms and precision instrument with only 1 firm. Their distribution is as presented in Table 3.2.

Table 3.2: Industry sub-sectors

Industry Screener Sector	Frequency
Retail	194
Hotel and restaurants: section H	149
Food	143
Services of motor vehicles	59
Wholesale	54
Chemicals	49
Construction Section F:	49
Plastics and rubber	39

Furniture	38
Garments	33
Transport section I: (60-64)	28
Textiles	25
Non-metallic mineral products	23
Fabricated metal products	22
Publishing, printing, and recorded media	14
Paper	13
IT	13
Transport machines (34-35)	12
Leather	10
Wood	9
Electronics (31-32)	9
Machinery and equipment (29-30)	8
Basic metals	4
Recycling	3
Precision instruments	1
Total	1,001

Source: World Enterprise Survey, 2018

3.2   Construction of GVC index

There are two main forms of GVC participation, namely forward linkages that represent Domestic value added (DVA) and backward linkages that represent foreign value added (FVA). Forward linkage at firm-level is computed as the ratio of exports of firms output to the total sales of the firm. On the other hand, is computed as the ratio of material input and supply originating from abroad to total procurement (de Gortari, 2018). GVC participation index in a firm-level setting is computed as a set of firms emanating from the forms (Antras, 2020).

To address the first objective, we construct an index to measure the degree of GVC participation index by firms in the 27 sectors using the formula suggested by Antràs (2020). This gives individual industry index and overall index.

GVC = (exports/(total sales))*

(% of material inputs and supplies of foreign origin in last fiscal year/ total procurements)   3.1

However, this approach is an intersection approach that only considers only the firms that take part in both forms of GVC participation. This is likely to exclude many firms and underestimate GVC participation. To alleviate this problem, we

augment the model and follow a union approach where all firms that take either forward or backward linkage, or both, are included in the computation. In this regard, the formula adopted by the study becomes:

GVC=(exports/(total sales))+(% of material inputs and supplies of foreign origin in last fiscal year/total procurements)   3.2

The index obtained is then normalized to 100 using the formula:

GVC index=(GVC-min(GVC))/(max(GVC)-min(GVC))*100   3.3

3.3   Empirical Estimation

In this analysis, we aim to establish the drivers of GVC participation in Kenya. It is however worth noting that not all firms in the survey participate in GVC, leading to zero-inflated problems in the dataset. With GVC being the dependent variable in the data, there is need to account for the excess zeros, and Ordinary Least Square (OLS) technique would be inadequate in this case as its estimates would be biased downwards (Dow and Norton, 2003). In such a situation, Tobit model has been identified as a suitable model to alleviate biased estimate that may occur from such a data structure (Greene, 2008). The standard Tobit model is applicable when the outcome variable values are completely non-negative and clustered around zero (Tobin, 1958). The model is stated as:

$$Y^*=\beta^T X_i+\varepsilon_i \qquad \varepsilon_i \sim N(0,\delta^2) \qquad\qquad 3.4$$

$$Y_i=Y^*i \qquad\qquad \text{if } Y>0$$

$$Y_i=0 \qquad \text{if } Y<0$$

In this case, Y^*, is latent or censored value for values less than zero and there assumed not to be observed. However, for values greater than zero, Y_i is observed. X_i is a vector of explanatory variables, while β is a vector of coefficients. ε_i is stochastic error term that is independent and identically distributed (IID), with a mean of zero and constant variance. In this model, therefore, Y^* is normally distributed with the mean $\beta^T X$ and a standard deviationδ. It is expressed as

$$Y^*N\sim\beta^T X_i,\delta^2 \qquad\qquad 3.5$$

The coefficients for Tobit are obtained using maximum likelihood estimation. However, it is vital to continue further with the examination of marginal effects of the independent variables on some conditional mean function. The conditional mean in the OLS is stated as

$$E(Y||X)=\beta^T X_i \qquad\qquad 3.6$$

The marginal effect is the partial derivative of the conditional mean and is given as:

$$\partial E(Y||X)/\partial x_j=\beta_J \qquad\qquad 3.7$$

Where x_j is the jth independent variable. This aids in making the interpretation distinct and clear-cut: A measures the marginal effect of the jth independent variable on Y.

3.4   Analytical Model

To address the second objective, Tobit regression was applied. This choice is informed by the theory of heterogenous firm, which postulates that firm participation in international markets is a self-selection process. These assertions make binary choice model suitable for analysis. However, there is need for censoring to deal with the problems for zero exports. The functional form of the model is thus given as:

>   *GVC = f (SIZE, AGE, FOREIGN_OWNERSHIP, FINANCE, PRODUCTIVITY, TECHNOLOGY, INNOVATION)*

Where:

- GVC is a continuous index ranging from 0 to 100

- SIZE of the firms based on number of employees (1 if small, 2 if medium, 3 if large)

- Productivity is volume of sales per worker

- Ownership by shares-(1 if foreign or domestic owners otherwise 0)

- Innovation is participation of the firm in intellectual property (1 if firm filed for patents, industrial design, or trademark, otherwise 0)

- R&D- Firm's expenditure on research and development (1 if Yes, 0 if No)

- Quality certification –internationally recognize quality certification (1 if Yes, 0 if No)

- Obstacles of obtaining finance (0 if No obstacle, 1 if Minor obstacle, 2 if Moderate obstacle, 3 if Major obstacle, 4 if Very severe obstacle)

3.5   Descriptive Analysis

The overall GVC index had a mean of 18.67 out of a score of 100. The standard deviation was 21.93, majorly due to differences in GVC participation levels by firms some participates in all the two levels of GVC, namely backward linkage and forward linkage and some do not participate in any form as depicted by the minimum and maximum values. The mean for backward linkage was 23.61 with a standard deviation of 33.95. Forward linkage had a mean 13.74 and a standard deviation of 29.50. These statistics imply that backward linkage is the dominant form of GVC in Kenya as many firms import raw materials that they use in production compared to those that export intermediate and parts to other countries. Results are displayed in Table 3.3.

Table 3.3: Descriptive statistics for continuous variables

Variable	Obs	Mean	Std. Dev.	Min	Max
GVC index	839	18.67	21.93	0	100
Backward Linkage	839	23.61	33.95	0	100
Forward Linkage	839	13.74	29.50	0	100
Domestic ownership	839	89.14	28.25	0	100
Foreign ownership	839	9.37	26.66	0	100

Source: Author's construction, based on World Enterprise Survey Data, 2018

Categorical response variables were subjected to frequency analysis. The analysis was crucial in allowing the researcher to comprehend the data distribution. Small enterprises accounted for 42.67 per cent, medium firms for 37.31 per cent, while large firms accounted for 20.02 per cent. Regarding innovation, only a small fraction of firms filed for various intellectual property rights. 6.79 per cent filed for patents, 5.36 registered for industrial design, while 18 per cent applied for trademark.

Only 19.55 per cent of businesses spend money on research and development. Only 21.57 of the institutions have internationally recognized quality certification. Finally, 25.15 percent of enterprises indicated no financial access limits, 27.77 per cent reported minor hurdles, 23.36 per cent reported moderate difficulties, 20.26 per cent reported major obstacles, and 3.46 per cent reported severe impediments. The results are presented in Table 3.4.

Table 3.4: Frequency analysis for categorical variables

Variable	Label	Frequency	Percentage
Firm size	Small	358	42.67
	Medium	313	37.31
	Large	168	20.02
Establishment applied for patent concerning any product or process innovation?	Yes	57	6.79
	No	782	93.21
Establishment applied for register and industrial design?	Yes	45	5.36
	No	794	94.64
Establishment applied for trademark?	Yes	151	18.00
	No	688	82.00

During last fiscal year			
Establishment spent on R&D (Excl market research)?	Yes	164	19.55
	No	675	80.45
Does establishment have an internationally recognized quality certification?	Yes	181	21.57
	No	658	78.43
How much of an obstacle: Access to finance	No obstacle	211	25.15
	Minor obstacle	233	27.77
	Moderate obstacle	196	23.36
	Major obstacle	170	20.26
	Very severe obstacle	29	3.46

Source: Author's construction, based on World Enterprise Survey Data, 2018

Table 3.5: Pairwise correlations for dependent and explanatory variables

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) GVC_index2	1.00												
(2) Backward linkage	0.74	1.00											
(3) Forward linkage	0.63	-0.05	1.00										
(4) Size of firms	0.16	0.11	0.12	1.00									
(5) Productivity	0.07	0.02	0.08	0.04	1.00								
(6) Domestic ownership	-0.15	-0.17	-0.03	-0.11	-0.04	1.00							
(7) Foreign ownership	0.18	0.20	0.04	0.13	0.05	-0.93	1.00						
(8) Patent	-0.05	-0.08	0.02	-0.13	-0.02	0.09	-0.08	1.00					
(9) Industrial design	-0.07	-0.11	0.02	-0.11	-0.04	0.05	-0.06	0.40	1.00				
(10) Trademark	-0.04	-0.08	0.02	-0.15	-0.08	0.05	-0.07	0.29	0.36	1.00			
(11) Research & Development	-0.20	-0.15	-0.12	-0.15	-0.08	0.06	-0.06	0.20	0.15	0.18	1.00		
(12) Quality certification	-0.38	-0.12	-0.43	-0.28	-0.10	0.14	-0.16	0.16	0.09	0.13	0.24	1.00	
(13) obstacles to finance	-0.01	0.02	-0.06	-0.04	-0.05	0.06	-0.07	-0.01	0.07	0.04	-0.15	0.08	1.00

Source: Author's construction, based on World Enterprise Survey Data, 2018

4.   Results and Discussion

This section begins by presenting results for distribution of firms in terms of the different archetype of GVC, namely the indirect exports, direct exports, import supplies and GVC index. To compute the GVC index, the study used the archetypes of GVC participation by firms suggested by Veugelers et al. (2013) and Fernances-Stark (2016). The archetypes entailed whether the firm exports its output directly; whether it exports indirectly to third countries; whether it sources its material inputs from foreign countries, and finally whether the firm has access to international networks. Having these modes of participation in mind, the study followed the method proposed by Antràs (2020), which mainly multiplies the percentage of direct and indirect exports over sale multiplied by percentage of material inputs and supplies of foreign origin over total procurements.

4.1   GVC Participation Index by Sector

The total GVC index for all the firms is 18.64. A higher index of 30.16 was recorded by firms in the Chemical, Pharmaceutical, and Plastic. This was closely followed by the food sector with 26.6, other manufacturing a distance third with 19.23, and textiles and garments 18.78. The sectors below the industry mean were retail 16.82, other services 12.04 and tourism 7.35. These results are presented in Table 4.1.

Table 4.1: GVC participation by sector

Sector	mean	sd	Min	max
Chemical, pharmaceutical, and plastic	30.16	22.82	0	100
Food	26.63	22.76	0	90
Other manufacturing	19.23	23.41	0	100
Textiles and garments	18.78	21.50	0	97.5
Retail	16.83	19.90	0	55
Other services	12.04	19.05	0	80
Tourism	7.36	13.97	0	70
Total	18.65	21.92	0	100

Source: Author's construction, based on World Enterprise Survey Data, 2018

Moving to sub-sectors, firms in precision instrument top the list with 50. There was only one firm that deals in this, and this could explain the high index. Second on the list are firms dealing with paper with 36.9. This is because the raw materials used in the industry are mainly imports. Electronics have an index of 33.11, while plastics and rubbers have 32.61. Among the least performing sectors are wholesale with an index of 13.28, leather 10.31, and construction section F with an index of 6.85, and hotels and restaurant with an index of 6.276. Several sectors, inter alia

garments, retail, wholesale and total firms have higher standard deviation than the mean, which is an indicator of different levels of participation among the firms in this sector. The results are presented in Table 4.2

Table 4.2: GVC participation index by sub-sector

Sub-sector	mean	sd	Min	max
Precision instruments	50	.	50	50
Paper	36.90	23.03	0	76
Electronics (31-32)	33.11	31.44	0	96.5
Plastics and rubber	32.61	22.49	0	65
Recycling	32.50	28.39	0	52.5
Transport machines (34-35)	29.28	21.10	0	50
Chemicals	28.44	22.86	0	100
Food	27.30	22.91	0	90
Machinery and equipment (29-30)	26.66	26.20	0	55
Fabricated metal products	26.325	25.80	0	65
IT	26.32	27.41	0	65
Basic metals	23.75	22.87	0	50
Textiles	23.55	21.46	0	67
Garments	19.85	27.96	0	100
Wood	18.33	18.87	0	45
Retail	17.78	19.71	0	55
Publishing, printing, and recorded media	17.50	29.03	0	100
Non-metallic minerals	17.27	20.99	0	60
Services of motor vehicles	16.09	19.46	0	52.5
Transport section I: (60-64)	13.55	22.76	0	80
Furniture	13.42	18.08	0	55
Wholesale	13.28	20.60	0	56.5
Leather	10.31	22.22	0	62.5
Construction section	6.85	12.62	0	52.5
Hotel and restaurants	6.28	12.57	0	70
Total	18.68	21.92	0	100

Source: Author's construction, based on World Enterprise Survey Data, 2018

4.2 Drivers of GVC participation

Separate estimations were conducted for each of the GVC participation archetype with the same set of independent variables. The study used Tobit analysis to censor the multiple zeros in the data set, resulting from firms that were not integrated in the global value chain in any form. The findings are presented in Table 4.3

The study found that firm size shapes GVC participation at the country-industry level. This study obtains positive and significant coefficient (β=11.53, t=1.83) for the medium firm in relation to forward linkage in the third column. This is indicative that scaling up of a firm from small to medium sized would lead to an increase in forward linkage participation by 8.06. Similar results were obtained for large firms across the three GVC modes. In the first equation, the coefficient obtained is 8.017 and is statistically significant at 1 per cent. This denotes that graduation of firms from small to large size would result in a corresponding GVC participation index of 8.017. The coefficient obtained for large firms in relation to backward linkage is 17.26, and is statistically significant at 1 per cent. This shows that larger firms have a higher predicted backward integration score than smaller firms by 17.26. Finally, the coefficient for large firms in relation to forward linkages is 5.394 and statistically significant at 1 per cent level of significance. These findings are in line with the theory of heterogenous firms and several empirical literature.

The other driver of GVC participation hypothesized in this study was productivity. This had been featured extensively in the theory of heterogenous firms, and notable literature including Antràs, Fort and Tintelnot (2017). Just as suggested by extant studies, productivity is positively related to GVC participation as depicted by the coefficients obtained for the three modes of GVC. It is high in the backward linkage (β=7.748), meaning that a percentage increase in productivity would result in a 7.748 increase in backward linkage by firms. The second largest effect is on forward linkage with a coefficient of 5.394, which is indicative that a 1 per cent increase in productivity is likely to lead to a 5.394 per cent increase in forward linkage, holding other factors constant. Regarding GVC participation index, however, a 1 per cent increase in productivity level is only likely to cause a 4.05 increase in GVC participation index. According to Melitz (2003), only highly productive enterprises may overcome buried export costs and become exporters with more price power.

The study's findings indicate that corporate ownership has a substantial impact on GVC involvement. Firms that have higher a percentage of foreign ownership have positive and significant coefficients for the GVC index (β=0.262, t=1.77) and backward linkage (β=0.794, t=2.95). This means that foreign-owned enterprises have a higher likelihood of involvement in GVC compared to private domestically owned firms. According to Feenstra et al. (2014), foreign-owned firms are more likely to be supported by their financial institutions. Domestic financiers prefer to fund state-owned enterprises over privately held enterprises. They discover that foreign-owned businesses are better financed than domestic businesses.

Research and development play a pivotal role in GVC participation. The impact is more on backward linkage (β=17.38, t=2.86), followed by forward linkage

(β=16.38, t=2.48) and finally GVC index (β=9.59, t=3.27). This means that firms that spend on research and development have 9.59 per cent chance of contributing to GVC compared to those that do not. Blind et al. (2020) assert that research and development contribute to a higher product quality and better marketing strategies.

Internationally recognized certification was shown to be highly associated with GVC index (β=22.21, t=7.80) and forward linkage (β=61.96, t=9.65). These results are indicative that firms that have internationally recognized certification have a 22.21 per cent likelihood of participating in GVC. Similarly, firms that possess these kinds of certifications have a 61.96 per cent likelihood to participate in forward trade. Lu et al. (2018) observe that a company's investment in R&D has a positive impact on its exports, resulting in higher GVC participation. According to Blind et al. (2020), certification is an important aspect in attracting new clients and competing for bids. It enables firms to improve the efficiency of their processes and the quality of their products or services. From Table 4.4, this is more pronounced among smaller firms (β=28.84, t=4.82), followed closely by medium sized firms (β=23.00, t=5.13) and larger firms (β=14.84, t=3.40). Larger firms have important networks and are largely known. It is therefore much easier for them to gain access to international markets as opposed to smaller firms. As a result, smaller and medium-sized businesses must work extra hard to show their worth on the global stage. One way around this is to obtain an internationally acknowledged accreditation, which helps them create confidence with clients.

Finally, the study finds that financial obstacles have an adverse impact on GVC participation and backward linkage. Firms with minor obstacles are 5.82 per cent less likely to contribute to GVC participation compared to those with no financial constraint. Finances play an integral role in the success of any organization. It enables process to run and get better staff and capital to produce quality output (Chaney, 2016). Similarly, firms with severe financials are less likely to participate in backward linkage by 24.79 per cent compared to those with no financial obstacles. Bas and Berthou (2012) discovered that financial restrictions discouraged smaller and medium-sized firms from purchasing imports. Muûls (2015) found that enterprises with fewer financial access barriers have adequate money to import and may engage in backward linkage GVC. Financial obstacles have a larger effect size among small and medium sized companies compared to larger firms as indicated in Table 4.4.

Table 4.3: Estimated results for the drivers of GVC participation

	Model (1)	Model (2)	Model (3)
	GVC index	Backward linkage	Forward Linkage
Firm size			
Medium	-0.276	-2.858	12.31*
	(-0.11)	(-0.53)	(1.93)

Large	7.177**	14.62**	23.10***
	(2.27)	(2.25)	(3.10)
Lnproductivity	3.944***	7.479***	5.287***
	(5.41)	(4.93)	(3.05)
Firm ownership			
% Owned domestically	0.112	0.362	-0.274
	(0.76)	(1.12)	(-0.88)
% Owned by foreigners	0.262*	0.794***	-0.259
	(1.77)	(2.95)	(-1.08)
Innovation			
Patent	6.321	0.383	15.01
	(1.27)	(0.04)	(1.33)
	-6.120	-13.95	-3.936
Trademark	(-1.12)	(-1.26)	(-0.31)
Industrial design	1.488	-4.796	8.403
	(0.47)	(-0.74)	(1.13)
Research and development expenditure	9.588***	17.38***	16.38**
	(3.27)	(2.86)	(2.48)
Internationally recognized quality certification	22.21***	0.605	61.96***
	(7.80)	(0.10)	(9.65)
Obstacles to financial access			
Minor obstacle	-5.829*	-9.488	-7.698
	(-1.87)	(-1.47)	(-1.02)
Moderate obstacle	4.112	3.310	13.82
	(1.27)	(0.50)	(1.81)
Major obstacle	-1.389	-0.665	1.939
	(-0.40)	(-0.09)	(0.24)
Very severe obstacle	7.129	-24.79*	8.912
	(1.13)	(-1.96)	(0.60)
var(e.GVC index)	890.7***		
	(14.15)		
var(e. backward)		3459.5***	
		(12.27)	

var(e.foward)			3634.3***
			(9.95)
Observations	839	839	839
t statistics in parentheses			
* p < 0.1, ** p < 0.05, *** p < 0.01			

Table 4.4: Regression results of firms based on size

	Model (1)	Model (2)	Model (3)
	Small firms	Medium Firms	Large firms
Lnproductivity	6.592***	3.468***	1.328
	(4.79)	(2.87)	(1.13)
Firm ownership			
% owned by domestically	0.0425	0.348	0.389
	(0.23)	(0.82)	(1.93)
% owned by foreigners	0.171	0.479	0.569***
	(0.86)	(1.11)	(2.74)
Innovation			
Patent	11.11	11.53	-5.743
	(1.02)	(1.37)	(-0.82)
Industrial design	-16.34	-14.76	14.64
	(-1.47)	(-1.71)	(1.73)
Trademark	-0.699	2.108	-2.421
	(-0.11)	(0.43)	(-0.46)
R&D expenditure	11.93**	6.511	11.88**
	(2.19)	(1.36)	(2.45)
Internationally-recognized quality certification	28.84***	23.00***	14.84***
	(4.82)	(5.13)	(3.40)
Financial obstacle			
Minor obstacle	-6.150*	-6.527**	-7.036
	(-1.79)	(-2.32)	(-1.29)

Moderate obstacle	7.681	-1.555	6.657
	(1.35)	(-0.31)	(1.10)
Major obstacle	-2.100**	-3.005**	-5.546
	(-2.35)	(-2.53)	(-0.87)
Very severe obstacle	-14.67***	-5.175**	-2.950**
	(-4.46)	(-2.09)	(-2.27)
Sigma			
Constant	32.64***	29.13***	25.13***
	(16.63)	(17.32)	(15.14)
Observations	358	313	168
t statistics in parentheses			
* p < 0.1, ** p < 0.05, *** p < 0.01			

5. Conclusions and Policy Recommendations

Kenya's global value chain participation index at firm-level was estimated at 18.65 per cent, implying that only 2 in every 10 Kenyan firms integrated value chains in production processes. Fragmentation of production process across different countries has been shown to be beneficial to economies' transformation because not only do they aid in creating employment but also in introducing and infusing new technologies and ideas of production. The low value chain participation index by Kenyan firms shows that there is need to put emphasis on participation in global value chains through identification of challenges that prevent their participation. The key findings are as follows:

- Industries that have benefited from government policies, such as the Economic Processing Zones, recorded better participation index compared to their counterparts. Notable among these are garments, recycling publishing, printing, and recorded media industries.

- Firm size is a critical factor that shapes the participation of firms in global value chains. Specifically, large firms have a higher participation score compared to smaller and medium firms. This is partly the case since most of the larger firms can meet the sunk costs involved in participating in global networks. The study also concludes that firm productivity has a positive effect on global value chains' participation, in all the archetype of GVC, more so in backward linkage.

- Research and development significantly and positively affect all the three archetypes of global value chains. Internationally recognized quality certification has a positive effect on GVC index and forward linkage. This is critical for foreign marketing and ultimately foreign sales.

- Obstacles to financial access is an impediment to global value chains participation.

- To improve competitiveness of local firms in global value chains, the following policy actions are important:

- Increasing productivity of firms is important, and this can be done through investment in human capital development, including on-job training programmes, and investment in efficient technology.

- There is need to conduct awareness to firms on the importance of international certifications on business and sensitization in participating in global value chains. This can be done through close collaboration between government agencies concerned with quality and business membership organizations (BMOs) that the firms are registered in.

- To increase access to finance, there is need to create credit information infrastructure for firms that look at the credit score or rating.

- Investment in research and development through creation of business hubs and innovation centres and creating acceleration programmes will improve firms' capability when participating in global value chains.

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