Navigating the Manufacturing Maze: Insights from African Economies

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Abstract

This paper delves into the complexities of labor productivity and employment dynamics within the manufacturing sectors of Senegal, South Africa, and Nigeria. It explores the phenomenon of large firms experiencing productivity growth without a corresponding increase in employment, known as the manufacturing puzzle, initially introduced by Diao et al. (2021). Through empirical analysis, it uncovers similar trends in these African nations, shedding light on the challenges hindering employment generation, particularly among youth populations. Employing LASSO logistic regression, the study identifies influential factors contributing to firm survival or exit, emphasizing the crucial role of firm location. Findings suggest a demand-driven structural change, underscored by new entrants concentrating around smaller employee sizes. Furthermore, the research emphasizes the need for tailored policy interventions to foster employment growth and leverage the comparative advantages of African economies, thereby paving a unique pathway to development in the face of evolving global dynamics.

Introduction

Many developing countries, particularly in Africa, Latin America, and Southeast Asia, have witnessed significant economic growth in recent years. Sub-Saharan African nations, in particular, have experienced growth rates surpassing those of the 1960s-70s, a period marked by the attainment of independence for many of these countries (Diao et al., 2019). However, numerous problems still hold the region back, one of which is an employment issue. A striking statistic is that for every 10 - 12 million youths that enter the labor market each year, only 3 million formal sector jobs are created for them (Fields, 2021). This issue is exacerbated by the continent's large youth population, with a median age of 19 years (IMF, 2023).

Hence, a crucial research inquiry lies in how to effectively utilize the burgeoning potential of African nations, especially in directing their abundant resources towards productive sectors of their economies to ensure sustained growth. This paper contributes to the extant literature by analyzing firm-level data from three sub-Saharan African countries: Senegal, South Africa, and Nigeria. Specifically, the analysis reveals that Senegal, akin to other African nations, demonstrates the trend of large firms augmenting labor productivity over time without a commensurate rise in employment levels; conversely, smaller firms experiencing declining productivity tend to witness an uptick in employment. Moreover, an exploration into the distributions of labor productivity and employment concerning firm churn (i.e., firm entry and exit) does not yield conclusive evidence suggesting that exiting firms are inherently the least productive, as anticipated based on the literature on firm churn and creative destruction. Additionally, it is noted that entering firms exhibit a higher density around lower productivity and employment levels compared to surviving firms in some instances across the examined countries, indicative of a demand-driven structural change phenomenon (Diao et al., 2019)). Furthermore, the study identifies key indicators for firm exit across dimensions beyond productivity or employment, employing the LASSO method to leverage all available firm-level data. Notably, firm location emerges as a significant indicator across all three countries.

Previous research extensively explores the concept of structural transformation, which directly pertains to the redistribution of production factors, such as labor, to more efficient sectors of the economy (Kuznets, 1955; Lewis et al., 1954; Fields, 2007). Similarly, significant attention has been given to the macroeconomic concept of Total Factor Productivity (TFP), especially regarding the impact of misallocation and subsequent reallocation of production

factors on TFP growth (Hsieh and Klenow, 2009; Baily et al., 1992). My contribution to these domains of inquiry involves amalgamating and synthesizing their findings to scrutinize recently gathered micro-level firm data. This methodological approach yields more granular insights into the specific mechanisms underpinning macro trends, particularly concerning labor allocation dynamics in developing economies.

A recent paper by Diao et al. (2021) is as a key precursor to my thesis, as they delved into the dynamics of manufacturing firm size, labor productivity, employment growth, and capital stock at a micro level, using firm-level data from Ethiopia and Tanzania. Their findings align with previous research indicating that despite significant structural changes in many African countries, such as the shift of labor from agriculture to more modern sectors like manufacturing, these countries still exhibit low productivity levels within the modern sector; this contrasts with the growth trajectory observed in Asian economies (Diao et al., 2019).

This discrepancy has hindered aggregate productivity growth in African countries. Their paper inspired my research, wherein, I examined their basic model aimed at elucidating the reasons behind this disparity in specific African countries. Their model posits that the prominent productive firms in these nations employ advanced technology that necessitates less labor compared to previous structural change movements. To test this hypothesis, I conducted a comparative analysis of capital stock vis-à-vis a manufacturing-advanced economy, Czechia. The findings indicate that Senegalese manufacturing firms utilize capital at a level that surpasses expectations considering their comparative income levels. Additionally, I identified other contributing factors to the manufacturing landscape, using firm churn as a measure of firm dynamics. Work by Aga and Francis (2015) suggest that firm exit, driven by aggregate productivity growth, leads to the removal of low-productivity firms and consequently lower productivity dispersion. Other studies have also explored the relationship between firm entry during periods of rapid growth and productivity dispersion (Foster et al., 2018; Gort and Klepper, 1982). I did not find any evidence of decreasing dispersion of labor productivity across firms; productivity variance actually increased for all countries between the time periods I study, indicating a contrary effect to the hypothesis posited by Aga and Francis (2015).

While a significant portion of the literature has traditionally emphasized the manufacturing sector as a pathway to economic prosperity, drawing on the experiences of Europe during the

Industrial Revolution and the East Asian Miracle, among others, there is a pertinent question regarding the continued viability of manufacturing for emerging economies. Studies by Amirapu and Subramanian (2015) and Fan et al. (2023) have shed light on the significant role that the services industry has played in the development of India, a country currently in the midst of development. Therefore, while my focus for this paper is on the manufacturing sector, it's essential to recognize the importance of other modern sectors. Hence, this study could potentially extend to analyzing the dynamics of alternative sectors, such as services, in Sub-Saharan African countries, and the contribution such sectors make to aggregate productivity and provision of employment.

The rest of the paper will proceed as follows: first, I will delve into a discussion of the Literature that have inspired this thesis; next, I will go into detail about the data and methodology utilized throughout the paper; then I will present the results in the following order: Senegal's labor productivity and employment growth estimates; a comparison of capital - labor ratio between Senegal and Czechia, discussion of labor productivity and employment distributions decomposed by firm churn, and LASSO logistic regression results. Finally, I will conclude and provide areas for further analysis.

Literature Review

Many African countries' recent growth have been driven, in part, by reallocating factors of production from low to high productivity sectors, such as shifting from traditional agriculture to modern sectors, such as manufacturing, termed Structural Change (Diao et al., 2019; McMillan and Rodrik, 2011; Brandt et al., 2008). Economists, such as Nobel Laureate Arthur Lewis proposed models distinguishing capitalist sectors, which fostered growth, from subsistence sectors, which impeded growth and coexists with the capitalist sector, thereby forming a dual economy (Lewis et al., 1954).

However, is structural change alone sufficient for sustained growth? McMillan and Rodrik (2011) suggest that a country can experience economic growth through reallocating factors of production without sector-specific productivity growth, but this growth may not be sustainable. Diao et al. (2019) provide a model that decomposes labor productivity growth into structural change and within-sector productivity growth, finding that structural change mainly drives growth in many African countries, particularly demand-driven growth. This

entails labor shifting from traditional agriculture to less productive modern firms to meet increased demand for modern products, often without significant productivity growth within modern sectors (Diao et al., 2019). This contrasts with East Asian development, where both structural change and within-sector productivity contribute positively to growth.

Indeed, the development narrative for sub-Saharan Africa involves more than just structural change. Another perspective, based on the neoclassical Solow model, highlights the importance of savings, capital accumulation, human capital, and innovation for growth within individual sectors. Therefore, while structural growth emphasizes reallocating factors across sectors, the Solow model focuses on growth within each sector (Diao et al., 2019).

Despite the ongoing structural change in sub-Saharan Africa, the surplus labor isn't flowing into productive areas of modern sectors to further boost productivity, according to the Diao et al. (2019) model. This raises concerns because successful cases on the continent, such as Botswana and Ghana, examined through the same model, emphasize the need for within-sector productivity growth to sustain overall productivity growth. Without this growth, recent economic accelerations in African countries might be short-lived (Diao et al., 2019).

Expanding on this, it's crucial to understand why there is a divergence in the path of development, leading to a misallocation between less and more productive firms. In the literature on misallocation, Hsieh and Klenow (2009) seminal paper underscores the significance of reallocating resources, contributing significantly to China and India's aggregate productivity growth rates of 30 - 60%, bench-marked against the relatively un-distorted U.S. economy. Similarly, Baily et al. (1992) research highlights the substantial contribution of high-productivity firms' increasing output shares in conjunction with low-productivity firms decreasing output shares to total factor productivity growth in the U.S. manufacturing sector. This underscores the pivotal role of resource reallocation in boosting aggregate productivity growth.

One approach to addressing this issue is to first pinpoint potential reasons for the misallocation. Diao et al. (2021) take a notable approach by examining firm-level data in Ethiopia and Tanzania, categorizing firms by size and estimating labor productivity and employment growth for small and large firms. Building off the model established in the earlier paper by Diao et al. (2019), Ethiopia and Tanzania serve as great case studies for understanding this misallocation, as the paper reports that even though both countries have experienced strong

structural change, they have also experienced weak within sector productivity in the modern sector. Diao et al. (2021) find that smaller, less productive firms in both countries have seen much higher employment growth than highly productive firms, negatively impacting aggregate labor productivity as highlighted above (Baily et al., 1992; Hsieh and Klenow, 2009). They suggest that this phenomenon is directly linked to highly productive firms being extremely capital-intensive, with capital stock levels comparable to richer countries like the Czech Republic, and thus, these technologically advanced firms do not require as much labor as seen in past industrialization movements in Europe or East Asia (Diao et al., 2021); this paper provides a similar empirical comparison for Senegal and presents similar findings.

An intriguing question arises, driving the core of this thesis: Does this phenomenon extend to other sub-Saharan African countries? Senegal offers a compelling comparison to Ethiopia and Tanzania, sharing a similar trend of high structural transformation paired with low productivity in the modern sector (Diao et al., 2019). On the contrary, Nigeria and South Africa belong to a different subset of sub-Saharan African countries, characterized by weak structural changes, yet still showing a negative correlation with within-sector productivity growth in the manufacturing sector (Diao et al., 2019).

Alongside estimating labor productivity and employment growth over time for Senegal at the firm level, akin to the approach used for Ethiopia and Tanzania, I delve deeper into the relationship between firm churn (mainly exit and entry) and labor productivity and employment dispersion to better understand firm dynamics within the manufacturing sector. There is rich Literature on the role that of firm entry and exit play in affecting aggregate industry productivity, particularly over extended periods of time as those dynamics interact with changing technologies (Olley and Pakes, 1992; Baily et al., 1992; Melitz and Polanec, 2015). Olley and Pakes (1992) highlight in their empirical work that less productive firms exit and incoming firms are usually more productive than those exit firms, albeit they are smaller and not as productive as surviving firms.

Furthermore, various studies delve into the nexus between firm exit and entry, innovation, and the process of creative destruction, wherein resource reallocation results in heightened overall productivity within industries and decreased productivity dispersion (Foster et al., 2018; Hsieh et al., 2018). My study extends upon this literature by examining these dynamics within a developing context, particularly by scrutinizing whether such theories hold true

in contexts divergent from the primary settings of these studies, which predominantly focus on industries in the U.S., Europe, and other developed economies. The subsequent section provides detailed insights into the data utilized and the estimation techniques employed.

Data and Methodology

Data

The data is sourced from the World Bank's Private Sector Enterprise survey (ES), which comprises a random sample of formally registered firms operating in the non-agricultural sector with five or more employees[1]. This dataset is meticulously designed to be representative of the population of firms within each economy. Statistics for manufacturing firms in the economies under analysis are provided by Table 1[2]. The amount of the data per firm within the survey is quite rich, with upwards of 500 variables provided for each firm, allowing for a comprehensive understanding of the business environment within which these firms operate.

A goal of the surveys is to provide data that allows researchers to analyze how the business environment changes over time. As a result, the survey design makes a concerted effort to re-interview firms in later waves that had been interviewed in the initial wave. During the screening process, as firms undergo evaluation for eligibility into the study, numerous codes are generated to denote the continued existence of firms previously interviewed in the initial wave (Aga and Francis, 2015). This coding enables the calculation of firm exit rates. However, a limitation of the survey methodology arises when firms included in subsequent waves but not in the initial stage are treated as a "fresh sample" (WorldBank, 2023). Consequently, firms appearing as new in later survey waves may have been operating longer than the data indicates, making the identification of new entrants potentially more challenging than that of firm exits. Further inference from additional variables provided in the data, such as the year operations began, may be necessary in such cases.

The data is collected via stratified random sampling, wherein strata levels encompass firm size, sector, and region, with sampling weights utilized to ensure population representation.

[1]The appendix provides a visual presentation of the geographical coverage of the survey for all three countries

[2]I thank the Enterprise Analysis Unit of the Development Economics Global Indicators Department of the World Bank Group for making the data available.

Table 1: Summary Statistics

	Mean	SD	Number of Firms (Unweighted)	Number of Firms (Weighted)
Senegal 2007 & 2014				
Full Time Employees	54.59	9.99	506	1,277
Value Added per Worker (USD 2009)	15,192.89	1,508.44	397	925
Large Firms	0.20	0.03	508	1,287
Exporter Firms	0.04	0.01	508	1,287
Foreign Firms	0.08	0.02	508	1,287
South Africa 2007 & 2020				
Full Time Employees	80.62	12.89	1022	125,510
Value Added per Worker (USD 2009)	37,058.53	2,076.17	982	122,068
Large Firms	0.29	0.02	1024	125,619
Exporter Firms	0.01	0.00	1013	124,820
Foreign Firms	0.06	0.01	1014	124,887
Nigeria 2007 & 2014				
Full Time Employees	25.14	1.69	2321	11,156
Value Added per Worker (USD 2009)	3,705.86	224.84	1332	5,305
Large Firms	0.09	0.01	2375	11,355
Exporter Firms	0.02	0.00	2154	9,868
Foreign Firms	0.02	0.00	2251	10,261

Weights are provided by the World Bank Enterprise Survey Datasets and are based on strata association, comprised of firm size, region, and industry of the firm.
A large firm is defined as a firm with more than 50 employees in the first year the firm appears. An export and foreign firm are defined as firms with 50% of sales in direct exports and 50% foreign ownership

Absolute weights are determined as follows:

$$w_{ijh} = \frac{1}{p_{ijh}} = \frac{N_{ijh}}{n_{ijh}}$$

where i, j, h represent the stratification levels of industry, firm size, and region respectively. N_{ijh} represents the total number of establishments within a specific ijh stratified cell, while n_{ijh} denotes the number of firms included in that stratum during actual data collection. Further adjustments are made to rectify any miscalculations in N_{ijh} with relative weights also computed to mitigate extreme weights stemming from very small realized samples relative to their population counterparts.

For the countries under scrutiny in this paper—Senegal, South Africa, and Nigeria—the data spans from 2007 to 2020, with South Africa having the longest time span from 2007 to 2020. Each country possesses at least two years of panel data, as delineated in Table 1, thereby offering some insights into firm exits and entries during these periods. However, a notable limitation of the data, as pointed out by Aga and Francis (2015), is the substantial gaps between initial and final years. Consequently, it becomes impractical to discern anything about

the firms that entered and exited within these time frames and their impact on the variables of interest.

The following section delves deeper into my approach to defining firm entry and exit, drawing on models established in previous literature, and the methodology for estimating the correlations between firm size, productivity, and employment growth.

Methodology

First, building on the framework established in the study by Diao et al. (2021), I examine the evolution of employment levels and labor productivity[3] across different firm sizes and types over the available time periods. This investigation aims to ascertain if a similar pattern persists, wherein large firms with higher productivity witness stagnant employment levels while smaller, less productive firms experience employment growth over time. This relationship can be represented by the following estimating equation:

$$y_{isrt} = \alpha_{year} Y_t + \beta_1 (Y * L_{it}) + \beta_2 (Y * F_{it}) + \beta_3 (Y * Ex_{it}) + \gamma_i + \varepsilon_{isrt}$$

Here, i, s, r, t represent the individual firm, sector/industry, region, and time respectively. y_{isrt} represents either value added per worker for a firm at time t or employment levels. Y and L represent year and the indicator variable for whether a firm is large or not. F and Ex represent foreign and exporter firms. γ_i represents firm fixed effects. To stay consistent with Diao et al. (2021), a large firm is defined as one with 50 or more employees based on observations from the initial year of analysis. A foreign firm is defined as one with more than 50% of the company being foreign owned, and an exporter firm is defined as one with direct exports making up more than 50% of sales[4]. Another limitation of the data is that it does not provide information on publicly owned firms, and as a result, they have been excluded from this analysis.

Due to data limitations regarding the availability of panel firms (i.e. firms with identifiers that appear in both years) in Nigeria and South Africa, this analysis was performed only for Senegal in order to account for firm level fixed effects. I further test the simple model posited

[3]Labor productivity henceforth is measured as the log of Value Added per worker, in constant 2009 U.S$ as provided in the data

[4]The measures of foreign and exporter firms are time variant and is determined based on the year when the variables are observed.

by Diao et al., 2021, which relates to the technology choice faced by manufacturing firms in African economies in the modern world, by comparing a measure of Senegal's capital intensity, namely capital to labor ratio, to Czechia, a country with a strong manufacturing sector.

Continuing to the analysis of firm churn, Diao et al. (2021) define exit firms as those present in the initial year of data but absent in the final year, entry firms as those absent in the initial year but present in the final year, and survivors as those present in both the initial and final years of their panel data. Similarly, Baily et al. (1992) decomposed industry productivity growth among three categories: stayers (those operating in time t and t - τ), the entrants (those operating in time t and entered between t and t - τ), and the exiters (those operating in time t - τ who are not operating in time t). Baily et al. (1992) further broke down the contribution of stayers to productivity growth into productive improvements of the surviving firms or reallocation of output shares.

In this paper, given the constraints of using a random sample rather than complete census data, a more cautious approach will be adopted in defining the groups of firms. Aga and Francis (2015), who also utilize the Enterprise survey for analyzing firm exit in a cross-country context, propose a method that leverages the screening codes provided in the data. They posit that a firm appearing in the initial year of the panel data is presumed to be operational unless specific criteria indicate otherwise. These criteria are established during the screening process for subsequent waves of the survey when the same firms are recontacted. If firms are confirmed to be out of operation, have exited the survey's coverage universe, possess contact information leading to non-existent or inaccurate phone numbers, or if their contact information is incorrect with no new records available, they are categorized as exiters. The first three correspond to what Aga and Francis (2015) term "strict exit", while the additional criterion contributes to"weak exit."

Table 2: Exit and Entry Rates (Weighted)

	Start Year		**End Year**	
	Exiters	Stayers	Entrants	Stayers
Senegal (%)	30.62	69.38	10.28	89.72
South Africa (%)	14.97	85.03	16.38	83.62
Nigeria (%)	36.50	63.50	14.96	85.04

Exit and Stayer rates are calculated using the weak exit specification. Entry rates are not affected by exit specifications.

Additionally, I define new entrants as firms present in the last year of the panel data but absent in the initial year, with the commencement of their operations falling between the first and last years of the panel. Based on these definitions, the following sets of firms are considered based on time:

$$S = \{i_t \| (t \in T) \cap (t \in T - \tau)\}$$

$$E = \{i_t \| (t \in T) \cap (t \notin T - \tau) \cap ((T - \tau) < t_0 < T)\}$$

$$X = \{i_t \| (t \notin T) \cap (t \in T - \tau)\}$$

Here t represents time in general, T is the last period of the panel, $T - \tau$ is the initial period, and t_0 is the first year of operations for the firm. Specifically concerning the data, the set X encompasses any firm labeled with a screening code meeting the specified criteria outlined above. Table 2 shows that the percentage of exit firms in 2007 for both Senegal and Nigeria are substantial with rates of approximately 30%; the rates for South Africa are about half of that, although the country does see a higher percentage of entry firms of the whole population of firms within the sample compared to the others.

Theoretically, how firm churn influences the dispersion of labor productivity hinges on the contrast between exiting and entrant firms. Assuming that the least productive firms are more likely to exit, as noted by Aga and Francis (2015), and presuming that the labor productivity of the stayers is constant between the time periods, if the entrant firms are more productive than the exiting firms, then the lower bound of productivity would be higher and result in a lower spread of the distribution. However, these assumptions may not always hold true, particularly regarding the constancy of productivity among stayers. It's plausible that some stayers, or specific firms within the group, become more productive, thereby elevating the upper bound of productivity. Conversely, the spread could widen. Additionally, it's possible that both scenarios counterbalance each other, resulting in an unchanged spread between the compared time periods. Foster et al. (2018) also demonstrate that during periods of robust growth and experimentation, there are elevated rates of firm entry, leading to increased productivity dispersion. However, over time, the best-equipped new firms tend to persist while the less capable ones exit.

This paper aims to better understand these firm churn dynamics across the three countries,

mainly by examining the univariate distributions of each category of firms and their correlation with the overall univariate distribution of all firms within the sample. Furthermore, it is of interest to ascertain the factors contributing to the prediction or classification of these firms. Fortunately, the rich dataset per firm in the survey facilitates the application of methods such as PCA, Discriminant Analysis, or LASSO, all of which effectively reduce dimensionality or identify the most salient variables explaining the outcome of interest. It is important to note that this study does not aim to establish causal interpretations of these variables concerning firm churn but rather aims to discern variables within the surveyed firms' universe that may be associated with firm churn, thereby informing future causal analyses. To facilitate interpretation of the variables themselves, LASSO will be employed to extract the most explanatory variables.

LASSO serves as a regularization technique for regressions, designed to prevent model over fitting (IBM, 2024), thereby enhancing the external validity of the analysis. This is achieved by incorporating a shrinkage term into the standard loss function of a regression model, which is to be minimized. This shrinkage term, denoted as λ, is multiplied by the absolute values of the coefficients selected. Consequently, in order to minimize this revised loss function, LASSO selects only those coefficients that most effectively explain the outcome of interest, while setting all other coefficients to zero. In this study, a cross-validated LASSO function is employed within the R program, iterating over various λ values to identify the value that yields the lowest predicted errors[5]. The next sections go over the results of my analysis, first starting with the analysis of productivity and employment growth in Senegal.

Senegal Case Study: Labor Productivity, Employment, and Technology Choice

This section presents the findings regarding labor productivity and employment growth in Senegal[6]. Additionally, it compares Senegal's capital-to-labor ratio with that of Czechia, highlighting the puzzle wherein Senegal employs capital—within the manufacturing sector—at a significantly higher level than anticipated based on its income levels.

[5]The cross-validation function utilized in the R program is cv.glmnet(), which partitions the data into folds. Each fold is treated as a test dataset while the rest serve as the training dataset. This process iterates over each fold for every λ value.

[6]The Appendix section presents the results on the estimation of productivity and employment levels for Senegal

Table 3: Firm Growth in Value Added per Worker and Employment (Senegal)

	(1) Basic Model	(2) Large Firm	(3) Exporter	(4) Foreign	(5) All
Growth in Log Value Added per Worker					
Year	-0.0957	-0.375***	-0.158	-0.166	-0.449***
	(0.131)	(0.107)	(0.131)	(0.126)	(0.117)
Year x Large Firm		1.626***			1.547***
		(0.484)			(0.457)
Year x Exporter			0.644		0.710*
			(0.391)		(0.296)
Observations	529	529	529	529	529
R-Squared	0.871	0.896	0.875	0.877	0.900
Growth in Employment					
Year	-9.303	2.720*	4.909	0.200	5.505*
	(8.305)	(1.348)	(3.800)	(1.802)	(2.748)
Year x Large Firm		-88.10			-16.47
		(60.18)			(13.13)
Year x Exporter			-248.8		-35.76
			(171.3)		(39.05)
Year x Foreign				-343.1	-351.2
				(239.9)	(215.2)
Observations	592	592	592	592	592
R-Squared	0.967	0.970	0.975	0.979	0.981

This table presents results on firm fixed effect regression that shows the change in Value added per worker (measured in 2009 USD) and employment for Senegal between the years of 2007 and 2014, without adjusting for growth within these periods due to data availability.

A large firm is defined as one with more than 50 employees the first time it appeared in the data. An exporter or foreign firm is one with more than 50% sales being direct exports and 50% foreign ownership.

$p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Standard Errors in parentheses.

Labor Productivity and Employment Growth (Firm Fixed Effects)

First, I will start by presenting the results on labor productivity and employment growth between 2007 and 2014. Table 3 shows the results of the estimating equation proposed above in which every interaction term also includes a control function for the individual variables. For example, when the interaction between year and firm size is included, year and firm size are included in the equation as well. As already highlighted above, the ES data does not provide coverage for the years within that broad time range, and so these results do not account for the dynamics of firms in Senegal in those years.

Beginning with labor productivity growth, Table 3 shows a 9% overall reduction in labor productivity between 2007 and 2014 although this change is not significant. This coefficient on year stays negative and decreases even to reach levels of a 16% to almost 45% reduction, and is significant when the interaction between year and firm size is included. As a result, the results show that small firms actually saw a decline in labor productivity between the years. This differs from Diao et al. (2021) results, which still show significant, albeit small increases in labor productivity for small firms over time.

On the other hand, large firms saw immense growth in labor productivity over the 7 year period, with growth rates ranging from 150% to 160% and are all statistically significant. The direction of these estimates are in line with the findings of Diao et al. (2021) although the magnitude is almost double what was found in that study. In addition, export firms also see big productivity gains with growth rates ranging from 60% to 70%, although this effect is only significant when firm size and its interaction with year is also controlled for. It's plausible that the strong negative trend effect overwhelms any positive changes for export firms, making positive changes discernible primarily within large firms. The interaction between the year and foreign firm indicator was omitted from the model as its effect was captured by firm fixed effects.

Overall, In general, the findings align with previous research; however, the effect sizes are notably larger, nearly double, which stems from extending the average year productivity effects identified in Diao et al. (2021) over a 7-year span. One possible explanation for this discrepancy could be the exclusion of publicly owned firms. Diao et al. (2021) found that public firms exhibited statistically significant declines in labor productivity. Consequently, the exclusion of such firms from the dataset and analysis might bias the estimates upwards,

as the negative impact of public firms, particularly large ones, fails to dampen the average growth trajectory.

For employment growth, the results are generally not significant. For small firms, there is an employment increase of about 3 to 5 people, which is statistically significant. Once again, the exact opposite dynamic exists for large firms, as well as export and foreign owned firms in which there are large decreases in employment, although none of these estimates are significant. However, there is an economic significance behind the numbers, particularly for foreign firms with a loss in headcount of about 300 people. Large firms lost less employees in terms of magnitude although this still holds economic importance with losses ranging from 16 to 88 people. The lack of significance in the employment growth results may be attributed to low statistical power, primarily due to a small sample size, particularly among firms experiencing declining employment. A limited sample size may also contribute to increased noise, further diminishing the analytical power of this study, thereby warranting additional investigation.

In summary, from these results, I conclude that a manufacturing puzzle is also at play in Senegal, where small firms with declining labor productivity are actually absorbing more labor; the contrapositive of that statement would imply that labor is not flowing into large firms with increasing labor productivity, although the results conclusively only support that large firms do have higher labor productivity over time. These results, on the aggregate level, can lead to an overall decline in productivity in the country as less productive firms, weighted by higher employment can drive down the aggregate measure for Senegal.

Technology Choice

The next step from these conclusions is to ask why? Why is this phenomenon prevalent, even here in Senegal. Diao et al. (2021) propose the alternative solution of inadequate technologies in highly productive manufacturing firms that do not encourage absorption of labor by these firms. One of the empirical ways to test or identify this is to directly compare Senegal to a benchmark of high level technology usage. Diao et al. (2021) compare Ethiopia and Tanzania to Czechia to get a sense of the technology levels of those two countries. I also employ such comparison of Senegal's capital - labor ratio to Czechia's for the year 2014, as that is the last year data that is available in ES universe for Senegal.

I utilize the KLEMS dataset, which provides coverage on the U.S., Japan, and European

countries for capital, labor, and productivity data, aggregated to the industry level, to determine the capital - labor ratio for Czechia's manufacturing sector[7] (Adarov and Stehrer, 2019; F. et al., 2023).

Table 4: Senegal Relative to Czechia (% 2014 levels)

	GDP Per capita	All Manufacturing Firms	Large Firms	Exporter Firms	Foreign Firms
% Capital - labor Ratio	8.837	27.472	28.098	39.116	59.494

Numbers are relative to Czechia, which has a 100 for all measurements.
GDP per capita comparisons were calculated using data from World Bank Micro Data bank. Measures for both countries is in current international $, PPP adjusted (WorldBank, 2014)

Table 4, in the first column, shows how Senegal compares to Czechia in income levels, measured by GDP per capita, PPP adjusted[8]. Senegal, in 2014, had income levels that were only 8% that of Czechia's levels. This gap has further widened in recent years, given Czechia's rapid growth and Senegal's almost flat growth (WorldBank, 2014). At the same time, the weighted total capital - labor ratio for manufacturing firms in Senegal was 27% that of Czechia.

Narrowing down within the broad sector of manufacturing using the familiar classification of firms we have dealt with so far, large firms have slightly higher capital intensity with 28% of Czechia's. Exporter and foreign owned firms are even higher with capital - labor ratios of 39% and 60% of Czechia's respectively. This serves as initial evidence that Senegal's manufacturing firms are more capital intensive than would be expected giving their income standing, relative to a country like Czechia. Further pieces of evidence could involve documenting the parallel low levels of labor intensity within manufacturing or decomposing this trend based on specific industries in Senegal as done in Diao et al. (2021).

Firm Dynamics: Churn and Dispersion

This section extends the analysis to Nigeria and South Africa, alongside Senegal and examines the classification of firms into exiters, entering firms, and surviving firms. I first start by exploring the distributions of labor productivity and employment levels across these groups to understand how the change of dispersion across time might relate to specific distributions for each group, and if what is observed is in line with the Literature on firm churn, creative

[7] I go into details of the calculations and conversion of values to comparable currencies and base years in the appendix section.

[8] WorldBank (2014)

destruction, and so on, as highlighted earlier or if there exists significant divergence from such mechanisms. The expectation is that exit firms are on the lower end of the labor productivity distribution, while entering firms are at least more productive than exit firms. The distributions for all countries are presented using weak exit specifications, with employment capped at 100 employees due to the pronounced left skewness of firm size across all countries. Subsequently, the LASSO method is applied to a logistic regression model, leveraging the comprehensive data on firm characteristics to identify traits that may aid in classifying these firms, particularly exit firms. Notably, this study does not encompass an analysis of productivity redistribution within stayers, leaving room for future investigation in this regard.

Labor Productivity and Employment Dispersion, decomposed

0.0.1 Senegal

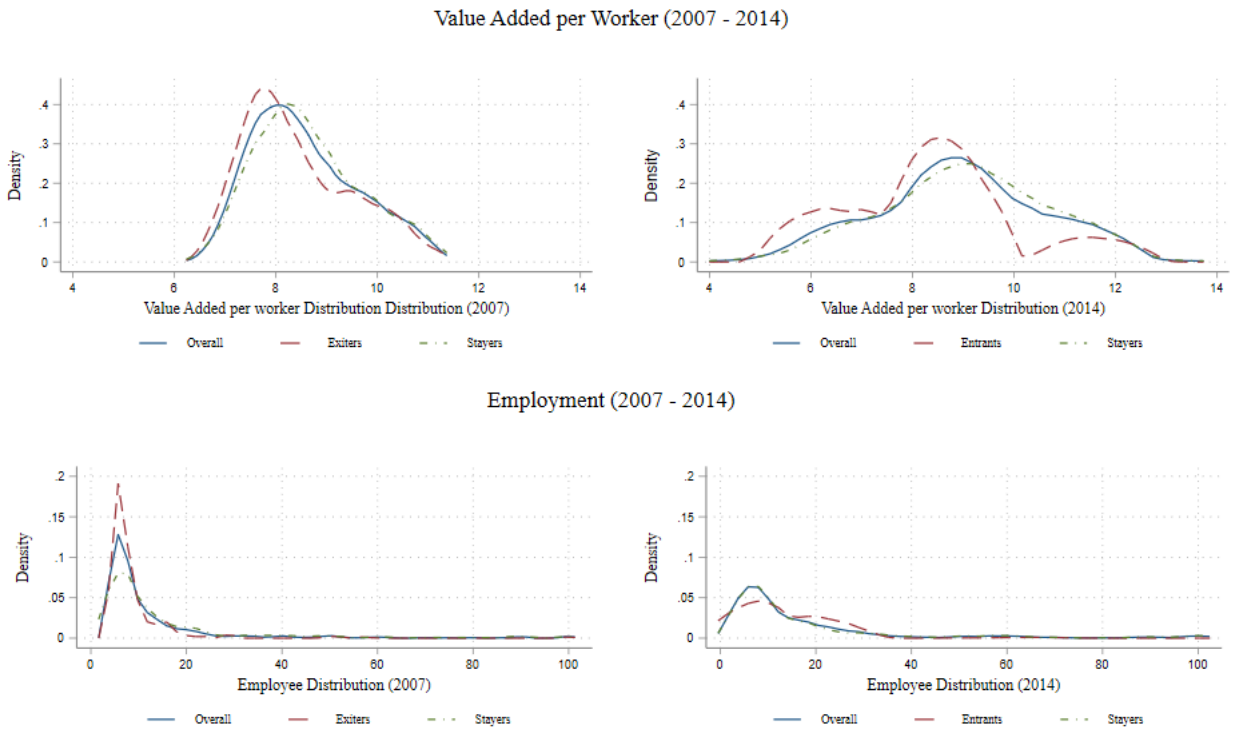

Figure 1: Weighted Labor Productivity and Employment distribution across time (Senegal).

Starting with Senegal, Figure 1 shows the distribution of both labor productivity and employment between 2007 and 2014. The distribution in 2007 shows the comparison between exit and stayer firms while 2014 shows the comparison between entry and stayer firms. In 2007, the labor productivity figure shows us that the distribution of both exit and stayer firms

are quite similar and both closely resemble the overall distribution; although there is a slight leftward shift towards lower productivity levels of the exit firms distribution as compared to the stayer firms.

In 2014, overall dispersion increased, with the lower and upper bounds of productivity levels expanding. This could be due to multiple reasons. In accordance with the model posited by Diao et al. (2021), with demand driven growth, many firms crop up at the margins, many times with low productivity, in order to meet increased demand caused by demand shocks or increased productivity in the agricultural sector, which employs large portions of the labor force in many African economies. As a result, dispersion of labor productivity might actually increase over time due to structural change; this is also consistent with the findings of Diao et al. (2019), in which Ethiopia and Tanzania saw increasing dispersion of labor productivity over time, as well as Olley and Pakes (1992). Foster et al. (2018) also suggests another mechanism in which during high innovation periods, dispersion of productivity might increase, particularly as firms experiment with new technologies; however, over time, such firms should be pushed out due to competition and ability to survive. Another aspect that could contribute to this might be the collection of data itself. There might have been broader coverage of firms in 2014, thereby encompassing less productive firms that might have been excluded in 2007. Considering all these factors, it appears that entering firms exhibit a slightly left-skewed distribution towards lower productivity levels when compared to stayers.

For employment, the distribution is heavily left skewed. This is quite consistent with work by Hsieh and Olken (2014), which found no evidence of firms in the middle of the distribution of firm size, because there was no bimodal distribution of firm size to warrant a middle. Exit firms do have a higher density around lower employee count (around 7 - 8 employees). In 2014, dispersion also increases all around, with entry firms having the most spread.

0.0.2 South Africa

For South Africa, Figure 2 shows similar dynamics also exist in which dispersion of labor productivity increases overall between 2007 and 2020, although not as much as in Senegal. In 2007, the exit firms, have a more obvious leftward shift towards lower productivity levels, compared to stayers. In 2020, there is greater dispersion, which could be due to similar

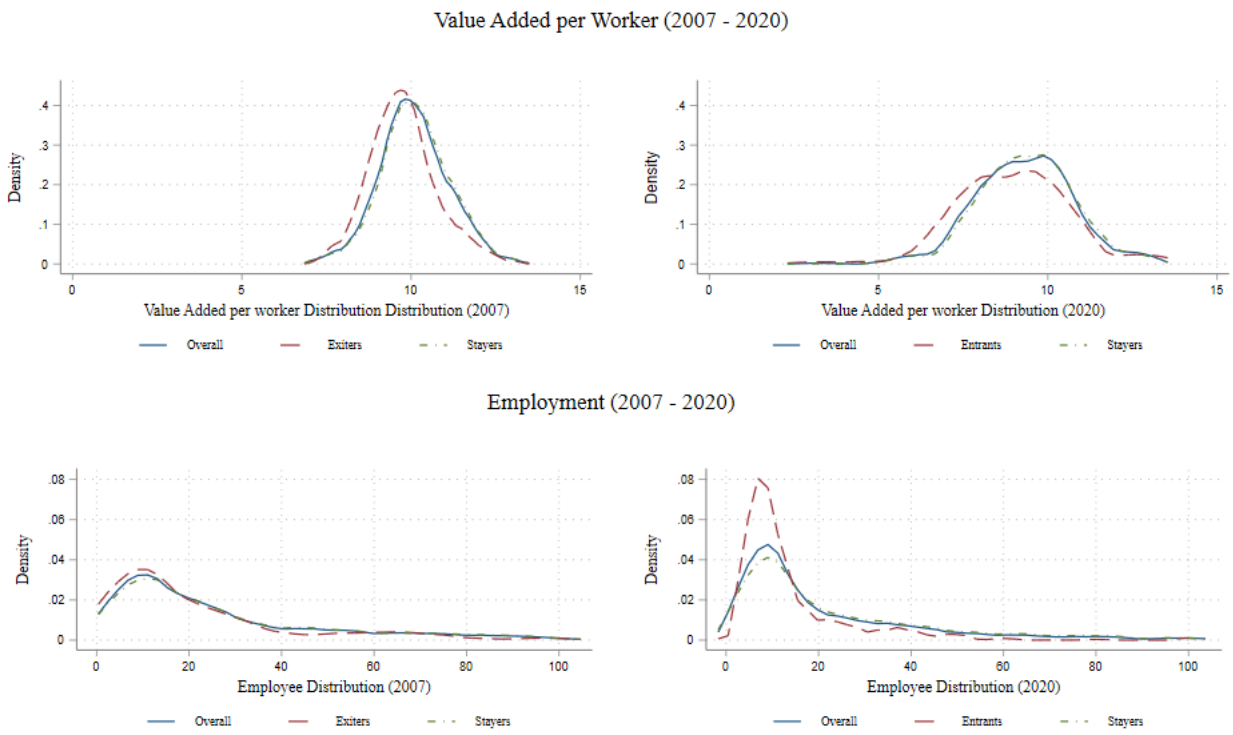

Figure 2: Weighted Labor Productivity and Employment distribution across time (South Africa).

reasons or mechanisms highlighted above for Senegal; entry firms continue to have a slight leftward shift compared to stayers.

However, employment distributions seem to have a complete opposite trend than Senegal, in which the distribution narrows in 2020 from 2007. Assuming that the collection of the Enterprise Surveys are standardized across countries, the argument highlighted above in which coverage increased to include certain types of firms not previously included does not seem to hold. In 2007, there is not much difference in employment distributions between exit and surviving firms. For 2020, the demand driven growth model seems to hold as the entry firms do have a tighter distribution around 10 employees, compared to stayer firms. This is because the model predicts that less productive firms enter to meet excess demand, and on average, smaller firms are less productive as shown in Table 9 in the appendix.

0.0.3 Nigeria

Finally, Figure 3 presents the distributions over time for Nigeria. Nigeria serves as an interesting case study, as its trend seems to be in direct conflict with the literature. Taking a look at labor productivity distributions, in 2007, it seems that the exit firms have a slightly,

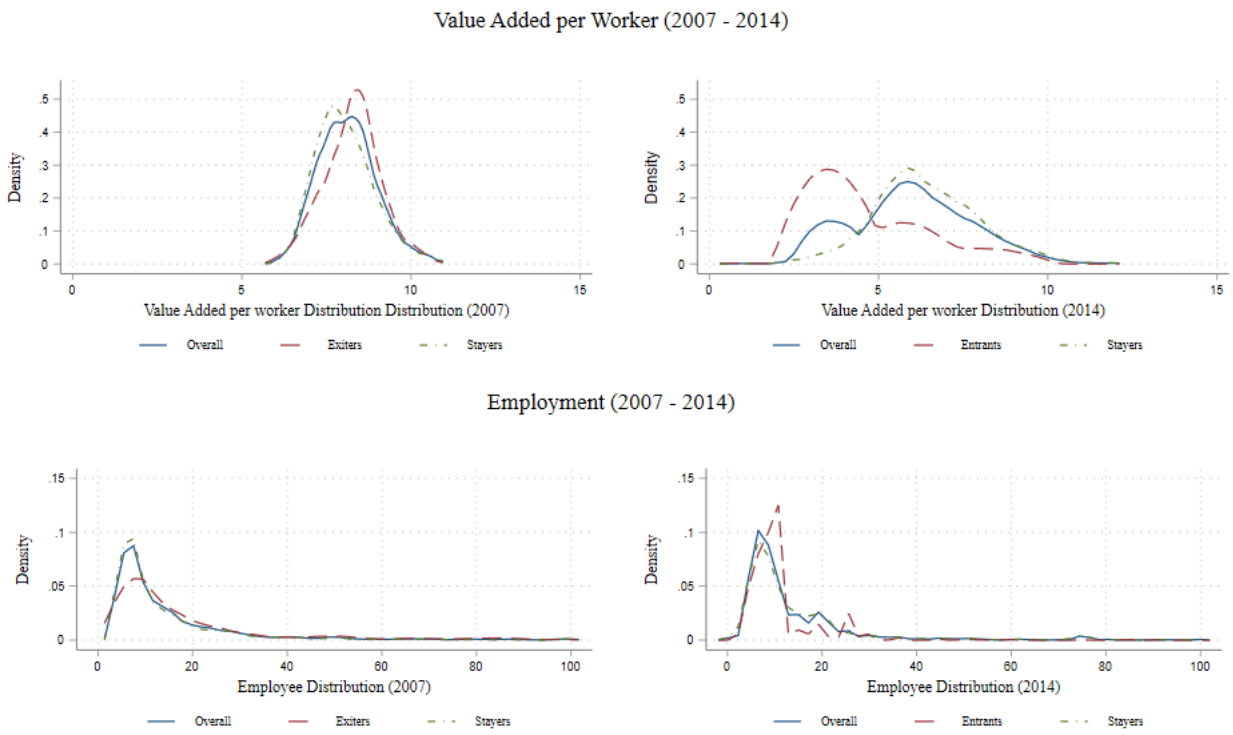

Figure 3: Weighted Labor Productivity and Employment distribution across time (Nigeria).

rightward distribution compared to surviving firms, although there is still much overlap. The appendix presents these graphs using strict exit specification, but this does not change this phenomenon. In 2014, there is not much improvement, as the entry firms evidently have higher density around lower levels of productivity, compared to both surviving firms and exit firms. The spread does increase similar to the other countries. In light of the literature highlighted in previous sections, this trend can be detrimental for increased productivity for the aggregate economy. This is because less productive firms are not being pushed out of the market effectively, while just as productive (or even less productive) firms are coming in, which could drag down overall measure of productivity, particularly if the surviving firms as well are not increasing productivity. However, as suggested by Foster et al. (2018), this might be because 2014 was a period of high innovation for the manufacturing sector in Nigeria, which could increase dispersion due to low productive firms entering the mix; this could also be the case for the other countries as well. For employment distributions, Nigeria is similar to South Africa, with variance decreasing over time, although ever so slightly. In 2007, exiters have slightly higher dispersion than surviving firms. In 2014, overall, there is a tighter spread around 12 - 15 employees, with entry firms having the narrowest spread around those numbers, and a slight rightward shift of their distribution.

0.0.4 Summary: Dispersion

In summary, the ES data provides evidence for the model constructed by Diao et al. (2019), in which firms entering the market do have lower productivity as they join on the margins to meet the increased demand induced by positive shocks or increased productivity in traditional sectors. Diao et al. (2019) argue that such trends can hold back developing countries, particularly in Africa, from sustaining any recent growth. On the other hand, there is some good news on the creative destruction and firm dynamics literature, at least for Senegal and South Africa. In those countries, the data does suggest that the firms exiting might have lower productivity than surviving firms, although this is not entirely definitive, given there is much overlap of labor productivity of both exiters and stayers. In Nigeria, the data provides contrary evidence to creative destruction recommendations, particularly for the distinction between exit and surviving firms, with exit firms distribution having a tighter distribution around higher productivity compared to stayers.

In addition, Foster et al. (2018) provides some explanation for the observed increased labor productivity dispersion we see across all countries, which occurs in periods of high innovation; however, with this argument, such dynamics should not exist for extended periods of time. By this mechanism, 2014 could have been periods of high innovation for Senegal and Nigeria especially, so it would be interesting to extend this analysis to more recent data to see if there has been a reduction in labor productivity in the manufacturing sector, as the highly productive firms push all others out. The situation is somewhat complex for South Africa, given the lengthiest time gap, with data extending to 2020. Hence, it's pertinent to investigate whether higher dispersion indeed correlates with increased innovation, and if so, pinpoint the onset of such a period and its duration until reaching a steady state with reduced labor productivity dispersion. Expanding on this, further analysis will explore additional variables within the data to aid in identifying firms exiting these economies.

Exit classification: LASSO methods on Logistic Regression Model estimates

This section provides results on the LASSO logistic regression for all three countries. I focus on the discrimination between exit and surviving firms; as a result, this part of the analysis focuses on data in 2007 for all the countries, where information about exit firms are present.

Table 5: LASSO Survival Prediction Accuracy

	Senegal	South Africa	Nigeria
Accuracy Rate	0.63	0.81	0.75

This presents the accuracy rate of LASSO logistic regression for the prediction of whether a firm is a surviving or an exit firm, by predicting the probability that the firm survives.
Exit is calculated using the weak exit specification.

Table 5 illustrates the accuracy of the LASSO logistic regression in predicting whether a firm exits or stays. Senegal exhibits the lowest accuracy rate, which aligns with expectations due to its smaller sample size, providing less data for model training, while South Africa demonstrates the highest accuracy rate. Additionally, Figures 4 - 6 visually depict these results, plotting average probabilities against actual firm classifications as exiters or stayers. The figures reveal lower average probabilities for exit firms predicted by the LASSO model compared to stayer firms, with this contrast being most notable in Nigeria. Nevertheless, across all countries, the average probability exceeds 0.5, underscoring the significant overlap between exit and surviving firms, as observed in the labor productivity distribution graphs.

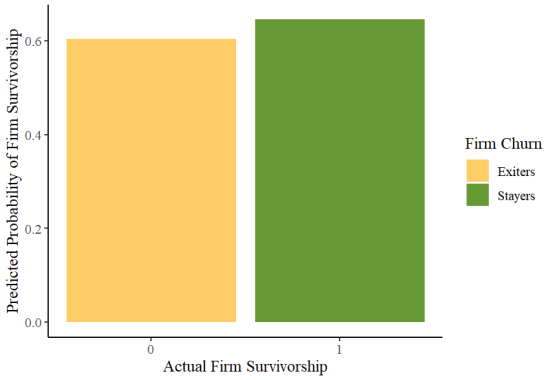

Figure 4: Senegal

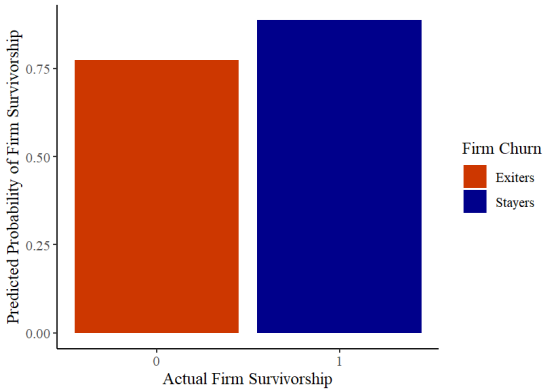

Figure 5: South Africa

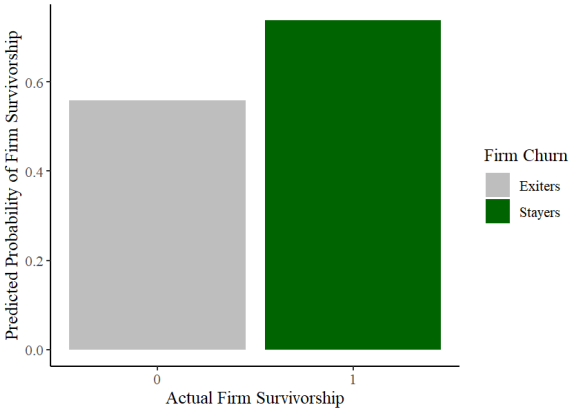

Figure 6: Nigeria

Which variables are critical for comprehending the reasons behind firms exiting within the ES universe of firms in these countries? For Senegal[9], the variables that had the biggest effects, in terms of increasing the odds of a firm surviving, include being located in Thies, the passageway between the capital city of Dakar and other regions of Senegal, and investing in new technologies that increased productivity with increased odds of about a factor of 3. Other variables that enhance the likelihood of survival include maintaining communication with customers through a company website, and intriguingly, citing informal sector competitors as a business obstacle. However, this latter finding may not be surprising if increased competition actually boosts firms' productivity, thereby improving their chances of survival. Conversely, variables that decrease the odds of survival have a comparatively smaller impact; the most significant effect stems from whether a firm sought connection to a landline in the last 2 years, with a factor of only 0.38. This could underscore deeper issues confronting exiting firms, such as infrastructure or location-related challenges, which impact their telecommunication capabilities and consequently their market exposure.

For South Africa, being located in Guateng, which contains its largest city of Johannesburg, greatly increases the odds of a firm surviving with a factor of 52. Other important variables include labor productivity, which increases odds of survival by a factor of 1.4, and lost shipments due to theft, which decreases odds of survival by 0.5. Interestingly, in Nigeria, the variables with the most significant impact on increasing survival odds are those indicating if a firm encountered transportation or relocation obstacles due to its location (a factor of 12), and if the firm faced high absenteeism resulting from employees caring for family members with HIV/AIDS (a factor of 4). Since these variables represent business obstacles, it's plausible that these results could be influenced by outlier firms with distinct characteristics that contribute to their survival, which may not be captured by LASSO. The primary factor contributing to decreased survival odds is federal tax requirements, especially application and form filling obligations. Furthermore, it seems that being situated in certain states doesn't enhance survival odds as it does in other countries.

In summary, the outcomes of the LASSO logistic regressions reveal that the location of a firm can significantly impact its survival prospects in these three countries, either positively or negatively. However, the primary contributors to the predictor models are variables that increase the odds of survival rather than decrease them. Consequently, this doesn't provide a

[9]The full variable list and their odds ratios are provided in Table 6 to 8.

clearer insight into the adverse conditions that might lead to a firm's exit.

Conclusion

In conclusion, this study offers additional evidence of the manufacturing puzzle outlined by Diao et al. (2021), wherein large firms experiencing higher productivity fail to correspondingly increase employment over time. Through a case study of Senegal's manufacturing firms, this phenomenon is demonstrated, alongside the notable capital intensity exhibited by Senegalese firms, which contrasts with the country's income level.

Furthermore, I investigated firm dynamics in Senegal, South Africa, and Nigeria by analyzing firm churn and decomposing labor productivity and employment across three categories: exiters, entrants, and stayers. Additionally, LASSO analysis was employed to identify the most influential predictors for categorizing firms into these groups. The findings suggest a demand-driven structural change, particularly evident in countries where new entrants exhibit a concentration around smaller employee sizes, notably observed in South Africa and Nigeria. Moreover, the LASSO results underscore the significance of firm location in enhancing the likelihood of firm survival over time.

Further analysis is warranted, including extending the manufacturing puzzle to additional African countries and industries. These findings underscore the diminishing significance of the manufacturing sector in the structural transformation narrative as a pathway to higher income levels in developing economies, particularly in sub-Saharan Africa. In terms of policy recommendations, avenues could include labor regulations or subsidies to foster employment growth in high-productivity firms, as well as improved urban planning to align potential employees with firms that have greater chances of survival, among other strategies.

The fundamental inquiry underlying all of this revolves around establishing an environment conducive to supporting firms that effectively leverage the endowments and comparative advantages within African economies. This multifaceted question encompasses the development of human capital, technologies, industrial policies, and more. This study has aimed to comprehend the current dynamics at play, with the goal of better addressing this overarching question of forging a distinctive path to development that is more adaptable to the evolving global landscape and the particular challenges confronting sub-Saharan African economies today and in the near future.

References

Adarov, A. and Stehrer, R. (2019). Tangible and intangible assets in the growth performance of the eu, japan and the us. Technical report, wiiw Research Report.

Aga, G. and Francis, D. (2015). As the market churns: estimates of firm exit and job loss using the world bank's enterprise surveys. *World Bank Policy Research Working Paper*, (7218).

Amirapu, A. and Subramanian, A. (2015). Manufacturing or services? an indian illustration of a development dilemma. *Center for Global Development Working Paper*, (408).

Baily, M. N., Hulten, C., Campbell, D., Bresnahan, T., and Caves, R. E. (1992). Productivity dynamics in manufacturing plants. *Brookings Papers on Economic Activity. Microeconomics*, 1992:187–267.

Brandt, L., Hsieh, C.-T., and Zhu, X. (2008). Growth and structural transformation in china. *China's great economic transformation*, pages 683–728.

Diao, X., Ellis, M., McMillan, M. S., and Rodrik, D. (2021). Africa's manufacturing puzzle: Evidence from tanzanian and ethiopian firms. Technical report, National Bureau of Economic Research.

Diao, X., McMillan, M., and Rodrik, D. (2019). *The recent growth boom in developing economies: A structural-change perspective*. Springer.

F., B., Corrado C., H. J., and Iommi M., J.-L. C. (2023). industry productivity accounts with intangibles - sources of growth and productivity trends: methods and main measurement challengesindustry productivity accounts with intangibles - sources of growth and productivity trends: methods and main measurement challenges.

Fan, T., Peters, M., and Zilibotti, F. (2023). Growing like india—the unequal effects of service-led growth. *Econometrica*, 91(4):1457–1494.

Fields, G. S. (2007). Dual economy.

Fields, G. S. (2021). Reflections on africa's youth employment problem1.

Foster, L., Grim, C., Haltiwanger, J. C., and Wolf, Z. (2018). Innovation, productivity dispersion, and productivity growth.

Gort, M. and Klepper, S. (1982). Time paths in the diffusion of product innovations. *The economic journal*, 92(367):630–653.

Hsieh, C.-T. and Klenow, P. J. (2009). Misallocation and manufacturing tfp in china and india. *The Quarterly journal of economics*, 124(4):1403–1448.

Hsieh, C.-T., Klenow, P. J., et al. (2018). The reallocation myth. *Center for Economic Studies Working Paper*, 18:1–25.

Hsieh, C.-T. and Olken, B. A. (2014). The missing "missing middle". *Journal of Economic Perspectives*, 28(3):89–108.

IBM (2024). International comparison program. https://www.ibm.com/topics/lasso-regression, last accessed on 2024-05-09.

IMF (2023). Picture this: African century. https://www.elibrary.imf.org/view/journals/022/0060/003/article-A005-en.xml.

Kuznets, S. (1955). Economic growth and income inequality. *American Economic Review*.

Lewis, W. A. et al. (1954). Economic development with unlimited supplies of labour.

McMillan, M. S. and Rodrik, D. (2011). Globalization, structural change and productivity growth. Technical report, National Bureau of Economic Research.

Melitz, M. J. and Polanec, S. (2015). Dynamic olley-pakes productivity decomposition with entry and exit. *The Rand journal of economics*, 46(2):362–375.

OECD (2024). Oecd exchange rates. https://data.oecd.org/conversion/exchange-rates.htm, last accessed on 2024-05-09.

Olley, S. and Pakes, A. (1992). The dynamics of productivity in the telecommunications equipment industry.

WorldBank (2014). Gdp per capita, ppp (current international $), czechia, senegal. Data retrieved from World Bank Micro Data Bank, https://data.worldbank.org/indicator/NY.GDP.PCAP.PP.CD?locations=CZ-SN.

WorldBank (2023). Worldbank enterprise surveys. https://enterprisesurveys.org/, last accessed on 2024-03-11.

WorldBank (2024). International comparison program. https://www.worldbank.org/en/programs/icp, last accessed on 2024-05-09.

Appendices

A LASSO Coefficient Results

Table 6: LASSO Survival Prediction Accuracy (Senegal)

	Logit Coefficient	Odds Ratio
Location: Thies	1.35	3.85
Firm Size: Small (5 to 19)	−1.71	0.18
Requested Connection to Landline	−0.97	0.38
Communicates with Customers via Website	1.03	2.81
Effect of New Technology Investments: Better productivity	1.12	3.07
Foreign Owned	−1.64	0.19
Corruption (Obstacle)	−1.27	0.28
Practices of competitors in the informal sector (Obstacle)	0.79	2.20

This table presents the coefficients with statistically significant estimates from LASSO logistic regression run on 2007 firm data for classification into exit and stayer firms.
The coefficients of Logistic regression are exponentiated to give odds ratio

Table 7: LASSO Survival Prediction Accuracy (South Africa)

	Logit Coefficient	Odds Ratio
Location: Gauteng	3.96	52.68
Credit Source: First National Bank	−3.52	0.03
Lost Shipment Value due Theft (%)	−0.68	0.51
Courts are Fair and Uncorrupted (Tend to disagree)	−0.74	0.48
Log Value Added per worker	0.33	1.39

This table presents the coefficients with statistically significant estimates from LASSO logistic regression run on 2007 firm data for classification into exit and stayer firms.
The coefficients of Logistic regression are exponentiated to give odds ratio

Table 8: LASSO Survival Prediction Accuracy (Nigeria)

	Logit Coefficient	Odds Ratio
Location: Enugu	−1.15	0.32
Location: Lagos	−2.55	0.08
Publicly Sourced Water Supply (%)	0.01	1.01
High Absenteeism (HIV / AIDS Caretaking)	1.54	4.68
Cost of Finance (Moderate obstacle)	−0.72	0.49
Transportation / Relocation obstacle	2.51	12.30
Prefers Business Environment with Good Cost of finance	−1.09	0.34
Prefers Business Environment with Good Courts	−1.88	0.15
Federal Tax Requirements	−0.01	0.99
Use of Financial Statements: Budget Planning	−3.14	0.04
Job Application Misstatement	−0.77	0.46
Located in Export Processing / Industrial Zone	−0.78	0.46

This table presents the coefficients with statistically significant estimates from LASSO logistic regression run on 2007 firm data for classification into exit and stayer firms.
The coefficients of Logistic regression are exponentiated to give odds ratio

B Firm Level Value Added and Employment Levels Estimate

The estimating equation for the following regression results is as follows:

$$y_{irt} = \alpha_1 L_{it} + \alpha_2 F_{it} + \alpha_3 Ex_{it} + \beta_{year} Y_t + \gamma_r + \varepsilon_{it}$$

where i, r, t represent the individual firm, region, and time respectively. y_{isrt} represents either value added per worker for a firm at time t or employment levels. L is the indicator variable for whether a firm is large or not. F and Ex represent foreign and exporter firms. γ_i represents firm fixed effects, and $\beta_{year} Y_t$ is time fixed effects.

Table 9: Firm Level in Value Added per Worker and Employment (Senegal)

	Value Added	Employment
Large Firm	1.563***	159.0***
	(0.333)	(36.67)
Exporter	0.225	353.5
	(0.814)	(273.3)
Foreign	1.573*	11.74
	(0.668)	(37.50)
Constant	8.684***	13.08***
	(0.190)	(3.881)
Time FE	✓	✓
Region FE	✓	✓
Observations	294	446
R-Squared	0.349	0.437

This table presents results of the regression of labor productivity and employment levels on different categories of firms.
A large firm is defined as one with more than 50 employees the first time it appeared in the data. An exporter or foreign firm is one with more than 50% sales being direct exports and 50% foreign ownership.
$p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Standard Errors in parentheses.

C Capital - Labor Ratio Calculations

For Czechia, I utilized the EU KLEMS database to calculate the capital - labor ratio. I use only data on the manufacturing sector for the year 2014, identified by the codes provided in the database. Capital stock includes only machinery and non-residential buildings. I first convert the the value of the stock to 2014 local currency value, machinery is multiplied by a deflator of 1, while buildings is multiplied by the specific building deflator for Czechia provided in the database. I then go on to convert the value of the stock to 2014 U.S. $, by

multiplying to the OECD exchange rate for 2014, which is further adjusted by multiplying by the ICP PPP price index for machinery and buildings (OECD, 2024; WorldBank, 2024). These final values are then added to give the total capital stock. Employment information for 2014 is provided in database with no further alteration beyond multiplication by 1000.

For Senegal, I utilize survey variables which ask the firms how much it would cost for them to repurchase all machinery and buildings. The values are already reported in 2014 local currency. I then repeat the same procedure of multiplying by OECD exchange rate for 2014 and then adjusting by ICP PPP index. Employment data is only used for firms that reported machinery and building cost replacement information. I utilize the Stata survey sub-population function to calculate the capital to labor ratio for each category of firm: large, exporter, and foreign.

D Strict Exit Specification

D.1 Strict Exit Summary Table

Table 10: Exit and Entry Rates (Weighted)

	Start Year		**End Year**	
	Exiters	Stayers	Entrants	Stayers
Senegal	5.03	94.97	10.28	89.72
South Africa	14.37	85.63	16.38	83.62
Nigeria	15.49	84.51	14.96	85.04

Exit and Stayer rates are calculated using the strict exit specification.

D.2 Strict Exit Labor Productivity and Employment Distributions

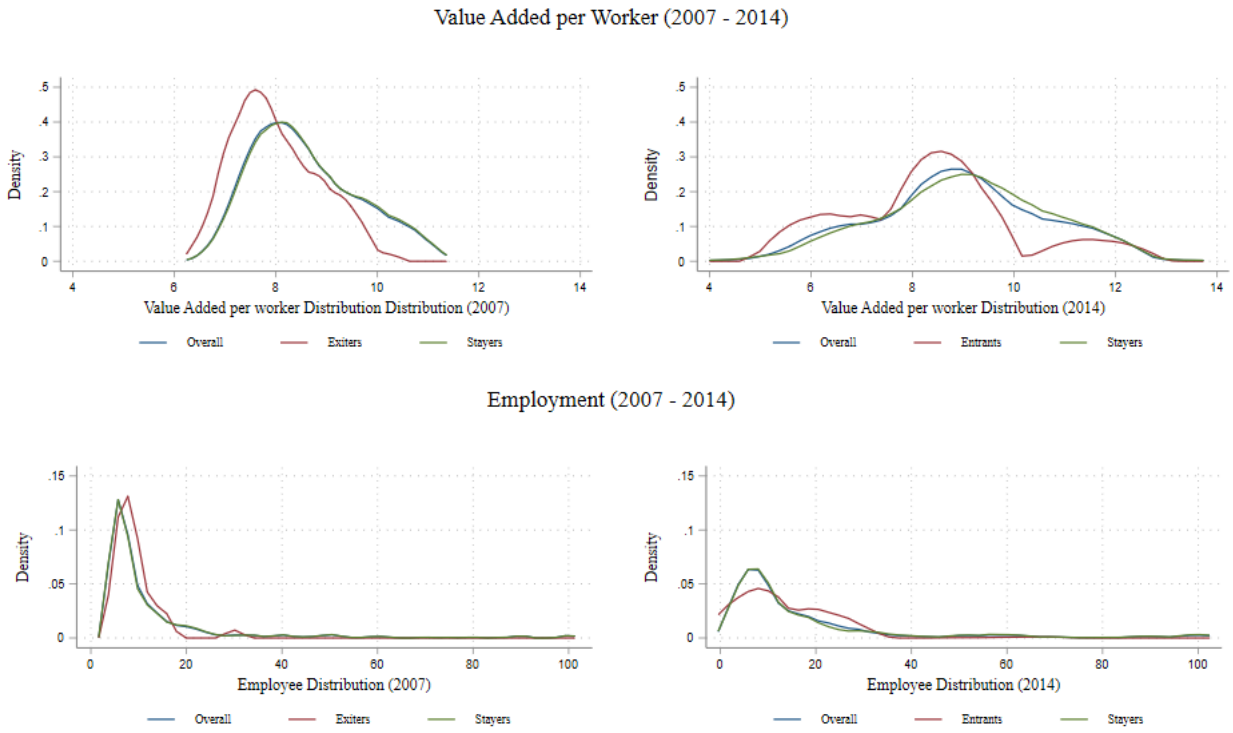

Figure 7: Weighted Labor Productivity and Employment distribution across time (Senegal).

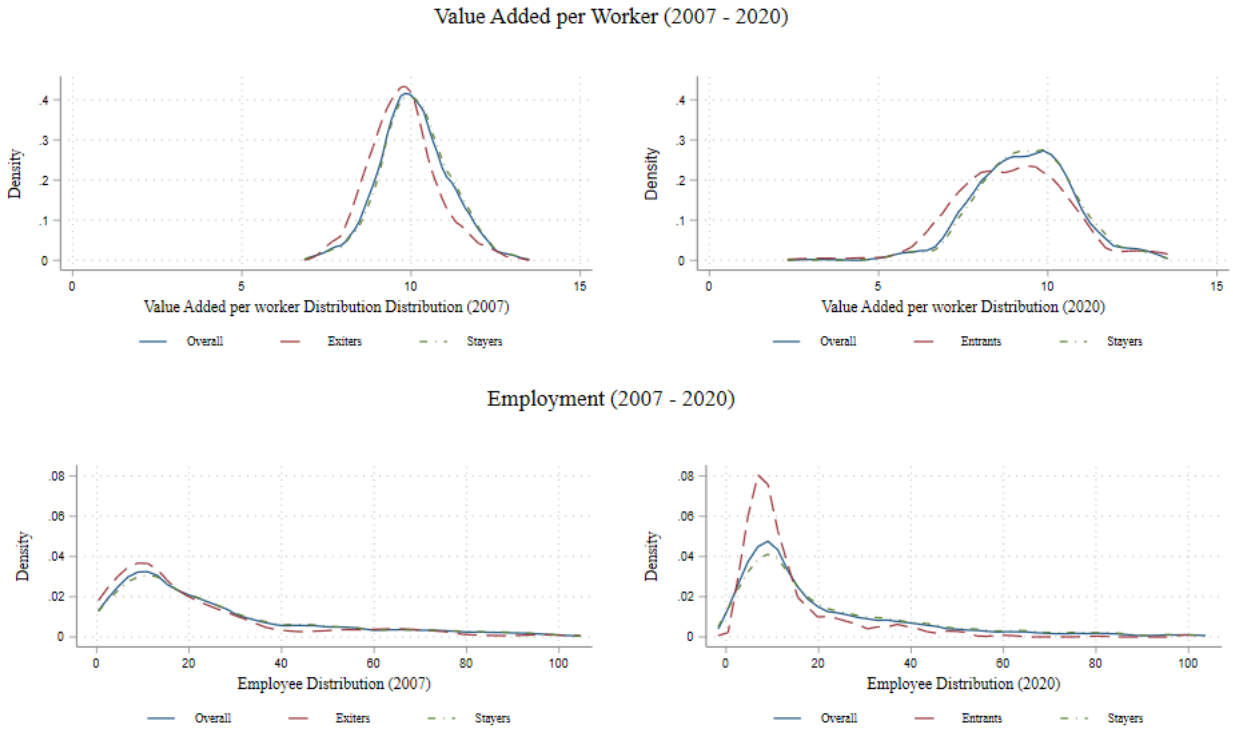

Figure 8: Weighted Labor Productivity and Employment distribution across time (South Africa).

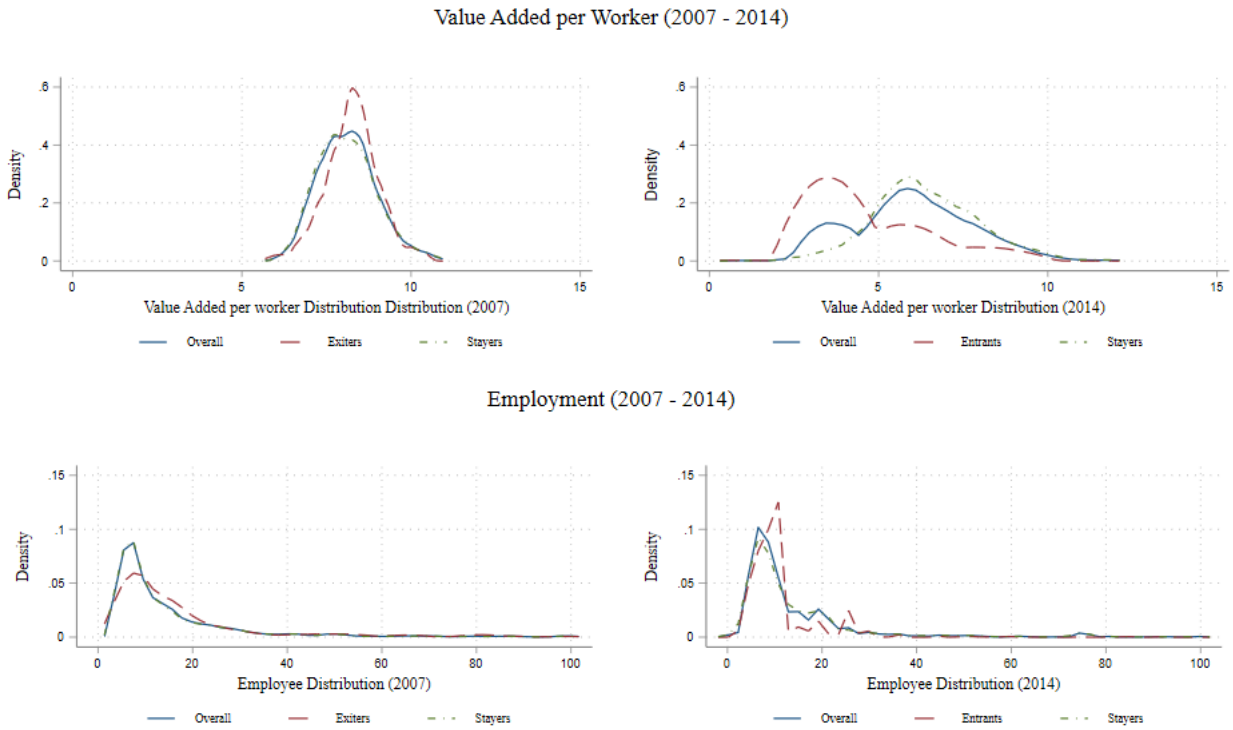

Figure 9: Weighted Labor Productivity and Employment distribution across time (Nigeria).

E World Bank Enterprise Survey Geographical Coverage

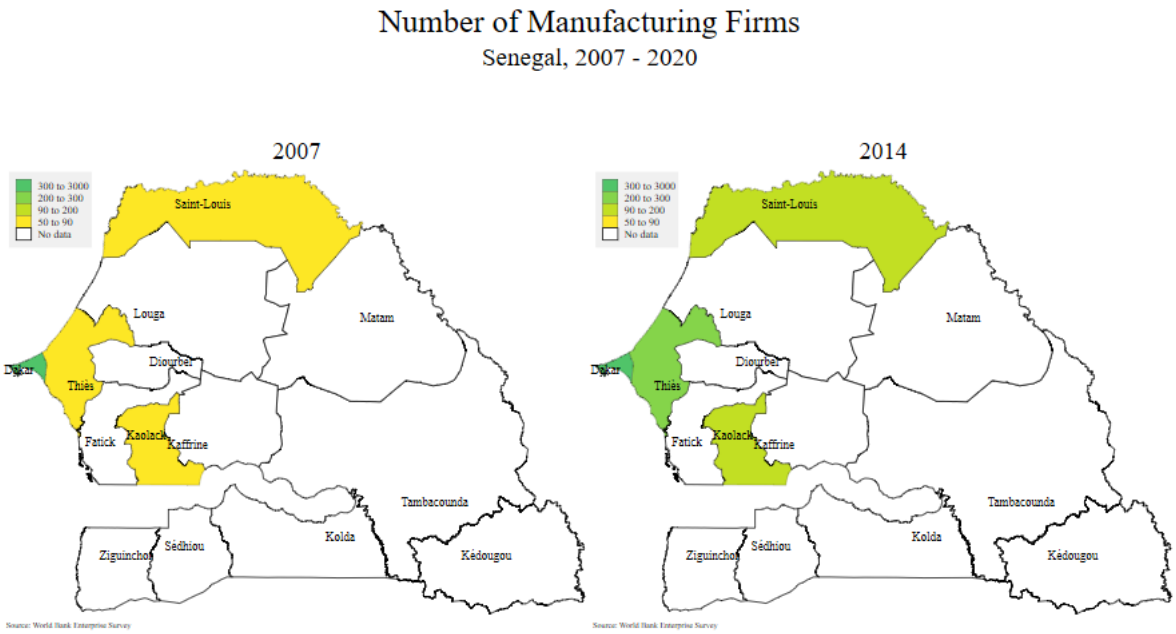

Figure 10: WorldBank ES Coverage (Senegal).

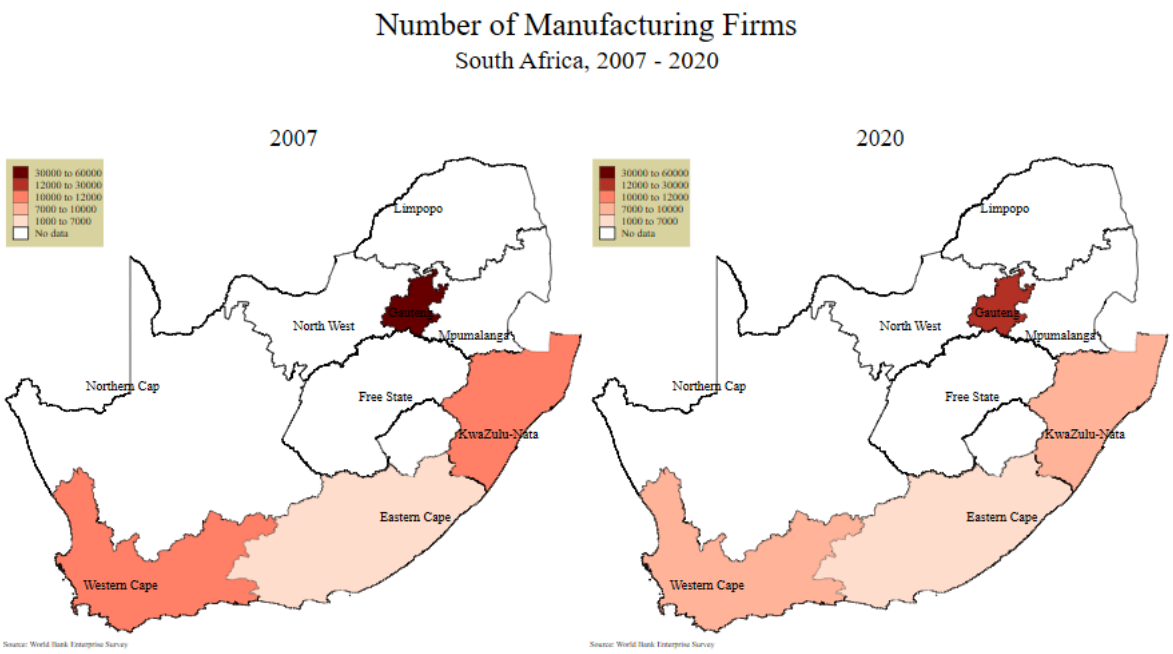

Figure 11: WorldBank ES Coverage (South Africa).

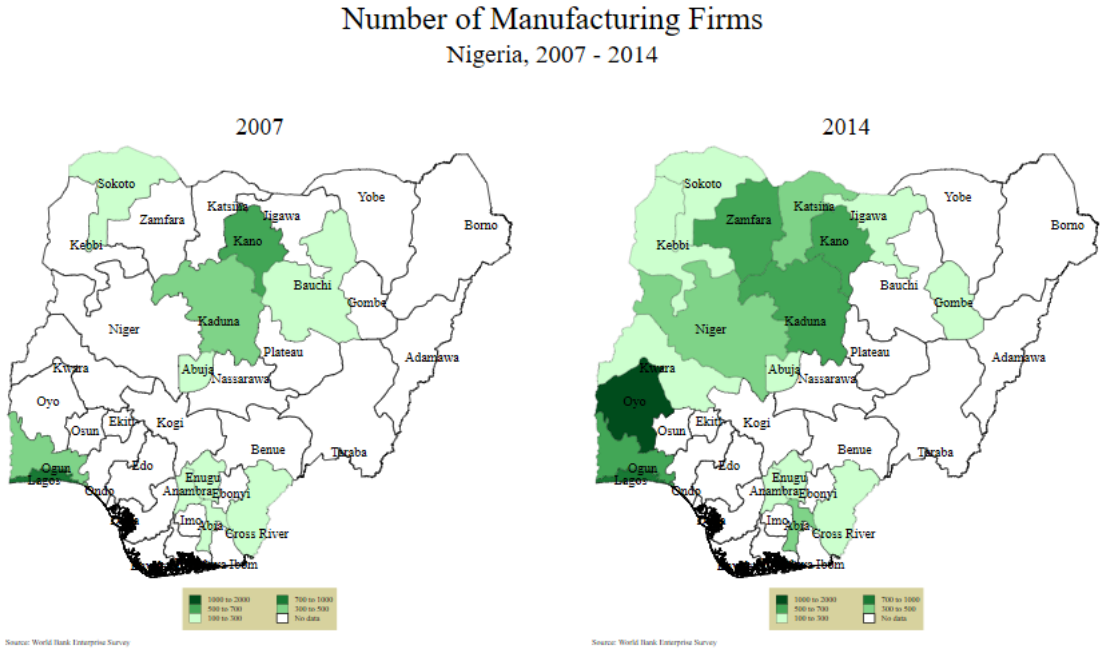

Figure 12: WorldBank ES Coverage (Nigeria).