Tradable Jobs and Local Labour Market in sub-Saharan Africa

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Abstract

This paper measures the impact of attracting tradable jobs on nontradable jobs at the local level in sub-Saharan countries. Applying the local multiplier approach to 10 medium and low-income countries disaggregated into 1441 administrative entities, we show that the multipliers are 3 to 5 times larger than in high-income countries. The multipliers also increase with the employment status and the skills of the tradable jobs created, highlighting the importance of the consumption of locally produced goods. This points to the importance of manufacturing for economic development and structural transformation. The paper also suggests a modification of the usual shift-share instrumental variable in countries characterized by sectoral diversification/unconditional convergence. Lastly, we show that the multipliers maybe be impacted by the size of administrative entities.

Keywords: Local multiplier, tradable, nontradable, local labour market, structural transformation

JEL classifications: J23, J46, R11, R23, O14

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1 Introduction

Historically, the process of economic development has been associated with the emergence of manufacturing production and manufacturing employment. A key feature of sub-Saharan African economies over the past decades has been a shift away from agriculture and into services without the development of a manufacturing sector. In the ten countries considered in this paper, the share of agricultural employment in total employment has declined up to 25 percentage points since the early 2000s. While services have progressed noticeably, manufacturing employment has either increased from very low levels, stagnated or even declined.[1] A second feature of labour markets in sub-Saharan Africa is the prevalence of under-employment and informal employment relationships. The share of self-employment as part of total employment follows an opposite dynamic to that of manufacturing employment: declining in countries that have expanded manufacturing employment.[2] This calls into question the potential of job creation associated with the service sectors. Similarly, it also raises issues as to whether improvement in labour markets can only take place through a rise in manufacturing employment. The potential of job creation at the sectoral level is particularly critical in light of the demographic challenges facing African countries. By 2055, the population of sub-Saharan African countries will have increased by 1.3 billion, generating a rise in the working age population by 800 million.

In this paper, we look at the contribution of the manufacturing sector to the labour market by measuring the number of jobs created locally in the service sector for every job created in the manufacturing sector. In order to do so, we apply the local multiplier approach as proposed in Moretti (2010), Moretti and Thulin (2013) and Faggio and Overman (2014). This method based on census data aims at estimating a cross-sectoral correlation of employment variation measured at the level of a given and relatively small geographic subdivision (agglomeration, municipality or district). This paper uses this methodology to estimate, for the first time, local multipliers using a unique data set for ten sub-Saharan African countries: Bénin, Côte d'Ivoire, Ghana, Malawi, Mali, Mozambique, Rwanda, South Africa, Tanzania and Zambia and 1441 administrative entities.

This methodology has mainly been applied to high-income countries such as the United States, Sweden and the United Kingdom, whose the result have shown the substantial impact of an increase in tradable employment on nontradable employment with multipliers around 1. Berger et al. (2017) is a noticeable exception as they look at 5 emerging economies. They find that the multipliers of tradable employment on nontradable employment are in the same order than for high-income countries (from negative to 1.5) but that the multipliers increase markedly for high-skilled workers.

Our definition of tradable and nontradable sectors in section 3 matches the manufacturing/service classification and the terms are used interchangeably in the rest of the paper. The size of the multiplier

[1] As in South Africa - see Table 2

[2] See Table 2

is around 1 in high-income countries: for every job created in the tradable sector, one additional job is created in the local nontradable sector.[3] This approach highlights that the benefits of attracting tradable jobs go beyond direct job creation and can have a substantial impact on the local labour market. The size of the multiplier varies across countries and can be associated with different transmission mechanisms. The multiplier increases with the demand for locally produced goods, the skill level of the tradable jobs created and the local supply chain. By contrast, the impact of higher employment on wage inflation tends to reduce the size of the multiplier through a crowding out / competitive effect.[4]

Given the scarcity of available data in general in low-and middle-income countries, an advantage of this methodology is its reliance on census data, which constitutes the primary set of data collected in sub-Saharan African countries. A second advantage of this approach is its use of the spatial dimension of the census data in countries experiencing rapid economic changes, such as population growth, internal migration and urbanization.

We find that the multipliers are 3 to 5 times larger than the existing multipliers in high-income countries. Large multipliers in low-income countries may be explained by under-employment and wage dispersion, which tend to reinforce the transmission channels discussed above. We also find that the multipliers increase with employment status (self-employment versus salaried employment) as well as with skill level. This is indirect evidence of the importance of the consumption of locally produced goods, which increases with the remuneration of tradable jobs. This also put into perspective the results found by Berger et al. (2017) for emerging economies. Our paper indicates that manufacturing jobs can make an important indirect contribution to employment creation at the local level. This paper therefore complements existing studies on structural transformation and (un)conditional convergence that point to the positive contribution of manufacturing to productivity growth, as well as to the limited impact of manufacturing on the labour market given its relative size Rodrik (2013); de Vries et al. (2015); McMillan et al. (2014).

The paper also points to the limitations of applying the shift-share instrument in countries that experience economic diversification at the sectoral level/ conditional convergence. The paper proposes a modification of the shift-share approach to improve the quality of the instrument in such cases. It therefore contributes to the new debate on the advantages and disadvantages of shift-share approach.

Lastly, the paper shows that the multipliers are not impacted by cross-section versus panel estimations and by the inclusion of control variables such as municipality size, sea effects and distance to the main city. However, the paper points to the importance of the size of the administrative entities, and the regression specifications (in logs or in level) as a non-monotonic relation maybe strong between tradable and nontradable employment, in particular in countries such as South Africa.

[3] See the detailed discussion of the literature in the next section.

[4] See next section for a discussion of the different transmission channels.

The structure of this paper is as follows. Section 2 presents the local multiplier approach. Section 3 provides an overview of the literature and the empirical strategy. Section 4 sets out the data and some of the stylized facts outlined in the Introduction. Section 5 contains the estimates for the ten countries. Section 6 discusses the quality of the shift-share instrument and proposes a modification of the IV. Section 7 presents the robustness checks. Finally, section 8 extends local multipliers with respect to employment status and skills.

2 Conceptual framework

This section presents the economic rationale behind the local multiplier and discusses the different transmission channels that may influence its size. This section draws on Moretti (2010) and Moretti and Thulin (2013). Each geographic entity is a competitive economy that produces a vector of tradable goods and a vector of nontradable goods. Tradable goods are consumed nationally and their production can be relocated geographically if costs inflation is too strong. As the market for tradable goods is national, producers of tradable goods are price taker. Contrastingly, nontradable goods are produced and consumed locally. It follows that nontradable goods are also priced locally.

Labour is mobile across sectors within a geographic area ensuring that marginal products are equal to wages locally. Central to the labour market is labour supply, which is upward sloping. The elasticity of labour supply also depends on labour mobility. If idiosyncratic preferences are high, workers willingness to move between two cities to arbitrage real wage difference is small and labour mobility is limited.

The shock considered is a permanent increase of the local labour demand in a subset of the tradable sector. The increase in employment in the tradable sector could be due either to local authorities attracting new firms or to an increase in the productivity of existing jobs. The objective of the methodology presented in this paper is to measure the impact on the local economy. This indirect effect is made of both the impact on the local nontradable sector as well as the impact on the rest of the local tradable sector.

The impact on local nontradable employment is expected to be positive. A first transmission channel is related to the *consumption of locally produced goods*. Newly employed workers in the tradable sector spend part of their income on nontradable goods. The size of this effect depends on the consumption preference for nontradable goods, as well as the skills of the tradable jobs created. Skills and the technological profile of the tradable firms are reflected in the level of remuneration of the tradable workers. A second transmission channel has to do with technology and the degree of *labour intensity in the nontradable sector*. A third transmission channel is related to the characteristics of the *local supply chain* as it influences the extent to which local nontradable goods enter the production process of tradable goods. Lastly, the extent to which *price and wage inflation* could counter-balance

these positive transmission channels depends mainly upon the elasticity of labour supply and labour mobility.

The impact on the rest of the tradable sector is more ambivalent. Higher demand for skilled workers may result in higher labour costs for all tradable firms. As these firms are price taker, the reduction in profitability could be sizeable and could lead to relocation or bankruptcy. *The competitive / crowding out effect* tends to reduce employment in the rest of the tradable sector. This negative effect could be counter-balanced by *agglomeration effect*. Tradable firms may benefit from the creation of a local labour market for skilled workers as well as the diffusion of new technologies and industrial processes (Glaeser et al. 1992; Henderson et al. 1995).

Local multipliers are likely to be affected by the income level of the country considered. In low-income countries, under-employment is likely to limit the strength of the competitiveness effect resulting in a larger multiplier. Given the high inequality and the dispersion of wages, the local demand for nontradable goods is also likely to be strong. Remunerations are relatively high in the tradable sector, while local services are cheap given the degree of informality. Consequently, we would expect the multiplier to be larger in low-income countries. However, a high value of the multiplier may also reflect the type of jobs created: many informal jobs rather than fewer formal jobs. Against these effects, political and regional instability may be translated into smaller multipliers.

3 Empirical method

Local multipliers make use of the geographic, employment and industry related information contained in the census data. The starting point of this approach is to construct a cross-section/panel database made of sectoral employment measured at the local level. The cross-section dimension is given by the spatial information either agglomeration, municipality or district contained in the census.[5] Employment is measured at the level of industry divided into two main categories: tradable and nontradable. A tradable good is a good that can be consumed in an area different from the location of its production. It follows that our definition of tradable includes all manufacturing sectors. Our definition of nontradable includes all service sectors excluding public administration.[6] Lastly, whether the data is a cross-sectional database or a panel database depends on the number of census available.

The relationship between the change over time of employment (in log) in the tradable sector in a municipality m and the change over time in the nontradable sector in the same municipality is given by equation 1. The former is defined as $\Delta log(N^T_{m,t})$ and is the explanatory variable. The latter is the dependent variable $\Delta log(N^{NT}_{m,t})$. The estimation also includes an intercept α, and an error term $\epsilon_{m,t}$ clustered at the municipality level. Taking the change of (log) employment levels over

[5] We will use the term municipality in the rest of the paper although geographic units are country specific.

[6] We exclude mining and agriculture from the classification as their productions are localized geographically as a result of the availability of natural resources and lands but can be sold in the entire country.

time eliminates the unobservable geographic time invariant. We use 2 census in each country and build a cross sectional database of employment growth. However, panel estimation is covered in the robustness section for a selection of countries with more than two census.

$$\Delta log(N_{m,t}^{NT}) = \alpha + \beta \Delta log(N_{m,t}^{T}) + \epsilon_{m,t} \tag{1}$$

The size of β reflects the different transmission channels discussed in the previous section: the demand for local goods, labour intensity, local supply chains as well as wage and price inflation.

While 1 is our baseline estimation, section 7 presents different robustness checks including panel estimations for Bénin, Malawi and Mali, estimations for different level of disaggregation of administrative entities, controlling for omitted variables as well as estimations in difference of the level of employment (in contrast with the difference of the log).

Regarding the interpretation of the coefficient β and given the formulation in difference of the log, a 1 percent increase in tradable employment results in a β percent increase in nontradable employment. In order to obtain the absolute number of jobs created, the coefficient β must be weighted by the ratio of nontradable jobs to tradable jobs measured at the local level at the beginning of the period.[7]

$$\Delta \tilde{N}_{m,t}^{T} = \sum_{j \epsilon T} \left(\frac{N_{j,m,t-s}}{N_{m,t-s}^{T}} \left(\log \left(N_{j,t} - N_{j,m,t} \right) - \log \left(N_{j,t-s} - N_{j,m,t-s} \right) \right) \right) \tag{2}$$

The coefficient β includes three effects i) the causal effect of higher tradable employment on nontradable employment ii) the reverse causality and iii) the effect that omitted variables could have on both the explanatory and the dependent variables. In order to isolate the causal effect, we rely on an instrumental variable following the shift share approach proposed by Bartik (1991). The objective is to find a proxy for tradable employment in municipality m, which is independent from nontradable employment in the same municipality. Assuming that national employment is independent from local employment, the instrument $\Delta \tilde{N}_{m,t}^{T}$ in equation 2 is the sum of the *change in national employment in the tradable subsector j* excluding municipality m weighted by the *share of subsector j tradable employment* in municipality m at the beginning of the period.[8] The instrument therefore captures exogenous changes in local employment assuming that national employment is not affected by local labour market conditions.

Local multipliers have been mainly applied to high-income countries. The initial contribution by Moretti (2010) estimated a multiplier of 1.59 in the United States, with metropolitan area as the geographic entity of interest. van Dijk (2017) in an exercise of reverse engineering proposed a new

[7] If the regression uses the difference in the level of employment, the coefficient β can be directly interpreted as the number of jobs created in the nontradable sector for each additional job created in the tradable sector, see section 7.4

[8] The shift-share instrument follows van Dijk (2017) as we subtract from the national measure, employment in the municipality considered.

Table 1: Existing local multipliers in high-income countries

	USA Moretti (2010)	USA Dijk (2017)	Sweden MT (2013)
Tradable on nontradable	1.59^{***}	1.02^{***}	0.48^{*}
Tradable on other tradable	0.26	0.85^{***}	0.33^{***}
Tradable durable on nontradable	0.73	0.5	
Tradable nondurable on nontradable	1.89^{***}	1.26^{***}	
Tradable skilled on nontradable	2.52^{*}	1.87	2.97^{***}
Tradable unskilled on nontradable	1.04	0.5	-0.15
Tradable high tech on nontradable			1.1^{***}
	$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$		

estimate of the multiplier revised downward at 1.02. This difference is associated with modifications of the instrumental variable, the sectoral weight, a different definition of tradable and nontradable industries and different time weights. Moretti and Thulin (2013) found a coefficient of 0.58 based on Swedish data of 72 local labour market regions. A second result is that the multiplier increases with the skills of the tradable jobs. The multipliers become 2.52(1.59), 1.87(1.02) and 2.79(0.58) respectively.[9] However, the coefficient is not significant in van Dijk (2017). Lastly, all three studies indicate that the multiplier of tradable on other tradables is much smaller than the multiplier of tradables on nontradables. The multiplier fluctuates between 0.26 and 0.85 for the United States and is 0.33 in the Sweden. This is consistent with the framework presented by Moretti (2010) in which agglomeration effects are partially counter-balanced by a crowding out / competitiveness effect. Recently, the local multiplier has been applied to broader questions such as the impact of public employment on tradable and nontradable employment (Faggio and Overman 2014) or changes in employment to population ratio in Italy (Ciani et al. 2017).

We now discuss whether this approach can be applied in low-income countries. Traditional assessment of local economic development is based on input-output tables, which provide information on sectoral production at the national level. However, low and middle-income countries are characterized by a scarcity of data especially when it comes to national accounts. On the contrary, census data is the primary set of data collected in low-income countries and is therefore available even though census does not always include employment and industry related information. Low-income countries are also characterized by the rapid transformation of their economy and by a rapid growth of the population that generates internal migration and urbanization. The disaggregation of employment at the local level enables to capture these characteristics that more aggregated approaches would miss. Although census data informs most of the time about the employment status of the respondents (employees, self-employed, casual worker), the employment information fails to capture under-employment and

[9] Skilled labour is defined as workers with some college education or more in the United States and workers who have completed a post-secondary education in Sweden.

multiple activities. Despite this limitation, the last two characteristics are less relevant for workers in the tradable sector, which is the main focus of this paper.

4 Data and descriptive statistics

Ten Sub-Saharan countries compose our study: Bénin, Côte d'Ivoire, Ghana, Malawi, Mali, Mozambique, Rwanda, South Africa, Tanzania and Zambia covering West Africa, East Africa and the Southern part of Africa. Two censuses are used in every country, with one year at the beginning of the 2000s and a second year in the early 2010s. While this paper focuses on the 2000s decade, some of the results are also reproduced for a longer time interval for Bénin, Malawi and Mali, which have additional census years. There are two data source. The census data for Côte d'Ivoire, Ghana, Rwanda and South Africa have been gather individually directly from national institute of statistics or were available online. The data consists in a representative sample of 10 percent of the population. The data source for the other 6 countries are a smaller representative sub-sample made available by IPUMS (2019). The country composition is determined by the availability of the employment module in the census questionnaire as well as accessibility to the census data. Note that Ghana, Rwanda and South Africa are available through IPUMS but cannot be processed due to missing parts of the employment module or inconsistent second level administrative entities over time.[10]

The geographic information available in the census differs across countries. In Côte d'Ivoire, this work relies on relatively small administrative entity called "sous-préfécture", which increased from 232 in 1998 to 509 in 2014.[11] We have worked with the Bnetd[12] to recreate a table of correspondence between the two sets of administrative entities. Given the low response rate in certain "sous-préfécture" in 2014, we worked with the Institute of Statistics to identify these areas and to merge them with neighbouring areas.[13] We end up with 218 administrative entities in Côte d'Ivoire. In Rwanda the smallest administrative entity is the sector and is relatively small as Rwanda is subdivided into 416 sectors. The 416 sectors have been aggregated to 101 to match the municipalities (akarere) as defined in 2001. In Ghana, the 170 districts of the 2010 census have been merged into 109 districts corresponding to the 2000 census. The matching of administrative entities over time has been done in collaboration with the Ghana Statistical Service. In South Africa, numerous territorial reforms have taken place since the end of apartheid making the matching of municipalities across time difficult. Using shape files for 2011 and 2000, we have matched the main 90 municipalities with a population larger than 20 000 habitants.[14] Cities and agglomerations have been identified using the Global Rural-Urban Mapping Project of the Socioeconomic Data and Application Center from Columbia

[10] For instance, in IPUMS, the variable industry is missing from the 2011 census.
[11] This increase is due partly related to the post-electoral crisis that took place in the 2000s
[12] Bureau National d'Etudes Techniques et de Développement
[13] This map is available on request.
[14] Figures of the population distribution per geographic units as well as maps of administrative boundaries are presented in the Appendix.

university.[15] The IPUMS data provides administrative entities that are consistent over time: 77 in Bénin, 183 in Malawi, 258 in Mali, 143 in Mozambique, 113 in Tanzania and 150 in Zambia.

The labour related information contained in the census includes whether the respondent is employed, unemployed or inactive. The main feature of the labour market in sub-Saharan Africa is the fast growth rate of the population (from 15 percent up to almost 50 percent over the 2000s in the ten countries considered), which requires equivalent job creation to absorb new entrants in the labour market (see Table 2). A second feature of the labour market is the stagnating or even declining employment to population ratio especially in Bénin, Malawi, Rwanda and South Africa. In some of the countries, in particular South Africa and Zambia the employment to population ratio is very low.

Regarding employment across sectors, the share of employment in agriculture has dropped in all nine countries. This has not been compensated by a significant increase in the relative share of tradable employment but by an increase in nontradable employment. While the share of tradable employment has increased in 6 countries, the increase is very modest and tradable employment remains at very low level often well below 5 percent. Notably, the share of tradable employment has even declining in South Africa (see section 7.4 for a discussion).

These descriptive statistics are consistent with the narrative of the industrialization process in sub-Saharan Africa. The industrialization process of the 1960's and 1970's ended with the political instability of the 1980's. While growth returned in the 1990's and 2000's, this was not translated into manufacturing production but services. These trends have fed the discussion about unconditional convergence Rodrik (2013); de Vries et al. (2015). Possible explanation also includes the rise of consumption cities related to the export of natural resources Gollin et al. (2016).

When employed, the employment status is informed differentiating between salaried workers, self-employed, casual workers and contributing family workers. The categorisation differs across census and two main categories have been build: salaried workers and self-employed. The latter being the aggregation between different types of independent/informal workers.[16] As underlined in the introduction, the share of self-employment is inversely related to the share of tradable employment to the exception of Zambia.

5 Local Multipliers: difference of the logs

Table 3 shows local multipliers for tradable on nontradable in the ten countries considered. The estimation is a weighted OLS, the weight being the sum of employment in tradable and nontradable sectors in each administrative entity in the previous census. The weight accounts for the difference in size between the administrative entities. The table reports the coefficient $\hat{\beta}$ as well as the constant, the $R2$ and the number of administrative entity N. The local multiplier LM is displayed in the first

[15] http://sedac.ciesin.columbia.edu/data/set/grump-v1-settlement-points/data-download.
[16] See section 8 for more details.

Table 2: Descriptive statistics

Year	Pop	Et/Pop	A/Et	M/Et	T/Et	NT/Et	SE/Et
				Bénin			
1992	4.9M	70%	54%	0.0%	7.9%	36.8%	85%
2002	6.8M	74%	44%	0.0%	8.8%	41.3%	89%
2013	10M	55%	42%	0.0%	11%	44.9%	84%
				Côte d'Ivoire			
1998	15M	63%	57.4%	0%	7.1%	35.5%	82%
2014	22M	57%	44.1%	0%	7.7%	48.2%	81%
				Ghana			
2000	18M	63%	52.8%	1.4%	10.6%	35.2%	84%
2010	24M	66%	41.6%	1.1%	10.7%	46.6%	82%
				Malawi			
1987	7.9M	79%	86%	0.18%	2.9%	8.1%	84%
1998	9.9M	78%	83%	0.05%	2.6%	12.1%	86%
2008	13M	57%	58%	0.12%	5.1%	28.8%	73%
				Mali			
1987	7.8M	63%	79%	0.07%	6.6%	13.4%	93%
1998	9.9M	59%	78%	0.17%	3.6%	14.4%	93%
2009	14M	57%	64%	0.84%	4.1%	26.2%	90%
				Mozambique			
1997	15M	69%	80%	0.48%	3%	13.6%	$n.a.$
2007	20M	69%	74%	0.72%	3.2%	19.2%	$n.a.$
				Rwanda			
2002	8.2M	73%	87%	0.2%	1.3%	11.4%	91%
2012	10M	60%	74%	0.5%	3%	22%	78%
				South Africa			
2001	44M	34%	11%	4.7%	13.4%	70.7%	10%
2011	51M	38%	5.2%	3%	9.8%	82%	20%
				Tanzania			
2002	33M	75%	80%	0.48%	2%	10.5%	89%
2012	44M	71%	65%	2.6%	3.3%	29.3%	87%
				Zambia			
2000	9.9M	55%	58%	1.2%	2.5%	16.3%	67%
2010	13M	51%	57%	1.9%	3.5%	27.3%	72%

Population (Pop), employment (Et), employment in agriculture (A), mining (M), tradable (T), nontradable (NT), self-employment (SE). Employment to population ratio is 15+ except for South Africa 16 to 65.

Table 3: Regression Tradable on nontradable - difference of the logs

	$\Delta log\left(N_{m,t}^{NT}\right)$									
	BJ	CI	GH	MW	ML	MZ	RW	SA	TZ	ZM
LM	1.34***	3.01***	1.61***	1.78***	1.06***	2.27***	4.62***	0.53**	3.75***	3.68***
$\Delta log\left(N_{m,t}^{T}\right)$	0.29***	0.61***	0.51***	0.39***	0.27***	0.51***	0.67***	0.13**	0.72***	0.58***
	(0.10)	(0.06)	(0.10)	(0.04)	(0.08)	(0.07)	(0.08)	(0.05)	(0.16)	(0.09)
cst	0.04	0.38***	0.45***	0.54***	0.67***	0.45***	0.24**	0.57***	0.53***	0.33***
	(0.05)	(0.05)	(0.05)	(0.07)	(0.05)	(0.03)	(0.09)	(0.02)	(0.12)	(0.07)
N	77	218	109	183	257	143	101	90	113	150
R^2	0.074	0.545	0.432	0.332	0.116	0.423	0.588	0.102	0.311	0.516

This table presents the results of the weighted OLS regression of tradable jobs $\Delta log\left(N_{m,t}^{T}\right)$ on nontradable jobs $\Delta log\left(N_{m,t}^{NT}\right)$ in logs. Country abbreviations are BJ Benin, CI Côte d'Ivoire, GH Ghana, MW Malawi, ML Mali, MZ Mozambique, RW Rwanda, SA South Africa, TZ Tanzania, ZM Zambia. LM is the local multiplier associated with 1 additional tradable job. It is the regression coefficient weighted by the ratio of nontradable jobs to tradable jobs in the economy. The following lines are the weighted OLS regression's results with the error clustered at the municipality level. N is the number of administrative entities.

line of the table. Given that the local multiplier is the number of jobs created in the nontradable sector for every job created in the tradable sector, the coefficient $\hat{\beta}$ is multiplied by the ratio between total employment in the nontradable sectoral E^{NT} and total employment in the tradable sector in the economy E^{T}.

The multipliers of tradable on nontradable are comprised between 1 and 5 in all ten countries. The highest multipliers are found in Rwanda, Tanzania, Zambia and Côte d'Ivoire, while the multipliers are smaller in Bénin, Ghana, Mali, South Africa. The multipliers are statistically significant. We discuss in section 7 whether the size of the administrative entities impacts the size of the multipliers.

The multipliers are higher than in high-income countries as the multiplier is around 1 in the United States and 0.5 in Sweden. The multipliers are more similar to the high-skilled multipliers in high-income countries. This echoes the discussion of the size of the multiplier in low-income countries in section 3. We discussed three mechanisms that could explain such large multipliers. First under-employment limits the negative competitiveness effect on nontradable firms, as higher employment is unlikely to generate wage inflation. Secondly, wage inequality implies that individuals in the tradable sector have a high purchasing power and that locally produced nontradable goods are relatively cheap. It follows that the consumption effect is likely to be significant. Third, high multipliers could simply reflect that jobs created are part time/informal jobs rather than full time jobs. These transmission channels are further discussed when estimating the multiplier for different skills level and different employment status in section 8.

Table 4: Regression nontradable on tradable - difference of the logs

	BJ	CI	GH	MW	ML	MZ	RW	SA	TZ	ZM
					$\Delta log\left(N_{m,t}^{T}\right)$					
LM	0.05*	0.18***	0.26***	0.18***	0.11***	0.18***	0.12***	0.19**	0.08***	0.14***
$\Delta log\left(N_{m,t}^{NT}\right)$	0.26*	0.90***	0.85***	0.86***	0.43***	0.84***	0.88***	0.81**	0.43***	0.90***
	(0.15)	(0.06)	(0.12)	(0.12)	(0.16)	(0.10)	(0.08)	(0.31)	(0.06)	(0.07)
cst	0.25*	−0.19***	−0.21**	-0.13	0.13	−0.28***	0.11	−0.44***	0.31***	-0.07
	(0.13)	(0.04)	(0.08)	(0.13)	(0.15)	(0.06)	(0.08)	(0.16)	(0.11)	(0.09)
N	77	218	109	183	257	143	101	90	113	150
R^2	0.074	0.545	0.432	0.332	0.116	0.423	0.588	0.102	0.311	0.516

This table presents the results of the weighted OLS regression of nontradable jobs on tradable jobs in logs. Country abbreviations are BJ Benin, CI Côte d'Ivoire, GH Ghana, MW Malawi, ML Mali, MZ Mozambique, RW Rwanda, SA South Africa, TZ Tanzania, ZM Zambia. LM is the local multiplier associated with 1 additional tradable job. It is the regression coefficient weighted by the ratio of tradable jobs to nontradable jobs in the economy. The following lines are the weighted OLS regression's results with the error clustered at the municipality level. N is the number of administrative entities.

The multipliers reflect as well the relatively small size of the tradable sector relative to the size of the nontradable sector. In the three countries in which the multipliers are the highest, the relative size of the tradable sector is the smallest with a ratio of nontradable to tradable employment of 6.9 in Rwanda, 6.3 in Zambia and 5.2 in Tanzania. In the section on robustness check, we compare the local multipliers based on the difference of the logs with the multipliers based on the difference of the level of employment. It seems that the approach based on the difference of the logs is driven to a large extent by the ratio of the relative size of the sectors $\frac{E^{NT}}{E^{T}}$ that is used to transform the coefficient β into numbers of jobs created. In the Appendix in Figure 4, we display the scatter plot of the difference of the logs of tradable employment (on x-axis) with nontradable employment (on y-axis).

Table 4 displays the local multipliers of nontradable on tradable. The multipliers are significant but close to zero in all ten countries. This result is in line with the results for high-income countries. The main reason is that the geographic location of tradable goods production and tradable goods consumption can differ in contrast with nontradable goods. New nontradable jobs may be associated with an increase in the consumption of tradable goods but these goods may have been produced in a different administrative entity or country. Here as well the multipliers reflect the relative size of the tradable sector relative to the nontradable sector. Lastly, this coefficient does not capture the impact of nontradable jobs in a given subsector on other nontradable jobs. This effect can be large in sectors with relatively high wages.

As mentioned earlier, agriculture is excluded from the definition of tradable goods as arable lands are determined by natural criteria such as soil composition and climate for instance. However, given

the importance of agriculture in Sub-Saharan Africa we display the different possible interactions of tradable and nontradable employment with agriculture employment. The results are in general non-significant. The decline in agriculture employment that is taken place in most administrative entities is not associated with a clear pattern in either an increase in tradable employment or nontradable employment in the same administrative entity. An explanation might be related to internal migration between rural areas and urban areas. Another explanation is that census questionnaires only report on the main activity and do not capture the changing composition of activities that can be associated with multiple jobs. These results are displayed in Appendix in Table 11.

6 Convergence and the quality of the shift-share instrument

The coefficients of tradable jobs on nontradable jobs estimated in the previous section may be impacted by various statistical bias. A first bias is reverse causality although the previous section has also shown that nontradable jobs have very little impact on tradable jobs. A second bias is omitted variable as a third variable may impact both tradable and nontradable jobs creation and bias the estimated coefficient upward.

In order to control for the potential bias, we construct an instrument variable following the shift-share approach (Bartik, 1991). The instrument for tradable jobs $\Delta\tilde{N}^{T}_{m,t}$ in 2 is the sum of changes in subsectors' tradable jobs (in logs) at the country level (the shift) weighted by the share of subsectors' tradable employment in a given municipality in total tradable employment in the same municipality in the previous census (the share). Note that the change in tradable jobs at country level is measured net of tradable employment in the municipality of interest. The main intuition behind the shift-share variable is that national tradable employment is uncorrelated with tradable employment at municipality level.

The shift-share has become a popular approach in trade economics and in economic geography. Despite its popularity, it is only recently that specific studies have investigated the properties of the shift-share approach. For instance, Adão et al. (2019) list a series of limitations related to shift-share such as cross-regional general equilibrium effects and heterogeneous "shifters" across sectors and regions. In particular, they show that unobserved shocks impact administrative entities similarly and produces correlation in the error term. Jaeger et al. (2020) point to the limitation of the shift-share instrument by revisiting the link between fertility and TV program for young mother. They argue that third factors, the impact of the Great Depression on less advantaged teens, eliminates the effect of the TV program on fertility. Similarly, Christian and Barrett (2017) show that existing study linking U.S. food aid with conflict in recipient countries identifies a spurious relationship. Lastly, Goldsmith-Pinkham et al. (2020) point to the importance of a handful of industries for the overall variation in the shifter.

Potentially, applying a shift-share approach on sectoral employment data in Sub-Saharan Africa may present several limitations. For instance, the concentration of employment in agriculture limits the number of subsectors used in the construction of the IV. In addition, the fast rate of urbanisation and the lack of industrial diversification question the independence between aggregate sectoral employment variation and employment variation at municipality level. Lastly, internal migration can impact the estimated coefficients as migration inflows may well lead to additional jobs creation in both tradable and nontradable sectors, especially in countries with no social insurance.

This is with this limitation in mind that we present the instrumental variable. The IV cannot be built from IPUMS data for Mali and Tanzania in the absence of a disaggregation of the manufacturing sector. We therefore only present the results for Bénin, Côte d'Ivoire, Ghana, Malawi, Mozambique, Rwanda, South Africa and Zambia. We build a shift-share instrument using three subsectors for manufacturing initially in order to be able to decompose the different elements of the shift-share. Our choice is driven by the limited diversity of economic sectors in many African economies. In addition, the geographic disaggregation limits the industry disaggregation.

The result of the 2SLS regression using an instrumental variable for tradable jobs is displayed in Table 5. A first result is that the instrumental variable as defined in 2 is poor. The local multiplier of the IV of tradable jobs on nontradable jobs turns negative in Bénin, Côte d'Ivoire, Ghana and Mozambique. In Malawi and South Africa, the multiplier remains positive and significant but twice larger than the OLS specification. Tradable employment appears to be only endogenous in Bénin, Côte d'Ivoire and Mozambique ($F1$ test). In addition, the Bartik shift-share is a poor instrument for tradable employment ($F2$ test).

We now look at the IV more closely to determine the reasons behind the poor results of the IV estimation. In Figures 1 and 2, we present the shift-share variable (in blue) at each subsector level as well as the share component of the IV (in red). Note that the shift-share component of the IV at subsector level is made of three components. The first component is simply the national change in employment in subsector j and is given by $(\log(N_{j,t}) - \log(N_{j,t-s}))$. This first component is a vertical line with the x-coordinate given by the national change in (logs) employment in subsector j. The second component measures the national change in employment in subsector j net of the employment in subsector j in municipality m: $(\log(N_{j,t} - N_{j,m,t}) - \log(N_{j,t-s} - N_{j,m,t-s}))$. The vertical axis now tips to the left. Given that the shift component is taken net of tradable employment at the city level, there is a natural tendency for the instrument to be negatively linked with changes in tradable employment at municipality level. Put differently $N_{j,m,t}$ enters positively in the y-axis and negatively in the x-axis. The third component is the shift-share element for each of the three sectors $\frac{N_{j,m,t-s}}{N^T_{m,t-s}}(\log(N_{j,t} - N_{j,m,t}) - \log(N_{j,t-s} - N_{j,m,t-s}))$. From Figures 1 and 2, it appears clearly that the share component explains most of the IV. The only exceptions are when the shift is negative (the change in sectoral employment at domestic level is negative). In most countries and most subsectors,

Table 5: Regression Tradable on nontradable - difference of the logs - 2SLS IV

	$\Delta log\left(N_{m,t}^{NT}\right)$									
	BJ	CI	GH	MW	ML	MZ	RW	SA	TZ	ZM
LM	-2.82	-1.75	-0.81	3.51**	n.a.	-4.62	3.68	1.17***	n.a.	2.04
$\Delta\tilde{N}_{m,t}^{T}$	-0.60	-0.35	-0.26	0.76**	n.a.	-1.03	0.53	0.27***	n.a.	0.32
	(0.52)	(1.24)	(1.16)	(0.35)	n.a.	(1.68)	(0.44)	(0.10)	n.a.	(0.21)
cst	0.29	0.71*	0.69	0.35*	n.a.	0.71**	0.34	0.56***	n.a.	0.45***
	(0.26)	(0.43)	(0.43)	(0.20)	n.a.	(0.33)	(0.36)	(0.02)	n.a.	(0.11)
N	77	218	109	183	n.a.	142	101	90	n.a.	150
R^2	.	.	.	0.021	n.a.	.	0.560	.	n.a.	0.414
$F1$	9.11***	4.42**	2.07	3.05*		5.38**	0.15	2.64*		1.36
$F2$	6.27**	0.59	1.04	3.89**		0.93	1.97	22***		6.68***

This table presents the results of the 2SLS regression of the instrumental variable of tradable jobs on nontradable jobs in logs. Country abbreviations are BJ Benin, CI Cote d'Ivoire, GH Ghana, MW Malawi, ML Mali, MZ Mozambique, RW Rwanda, SA South Africa, TZ Tanzania, ZM Zambia. LM is the local multiplier associated with 1 additional tradable job. It is the regression coefficient weighted by the ratio of nontradable jobs to tradable jobs in the economy. The following lines are the weighted regression's results with the error clustered at the municipality level. N is the number of administrative entities. F1 reports the statistics for the endogeneity of the explanatory variable under the assumption H_0: variable is exogenous. F2 tells us about the quality of the instrument.

the share component tends to accentuate the negative relationship between the instrument and the instrumented variables. The main reason here is that tradable subsectors that accounted for a relatively small share of tradable employment in municipality m in the previous census displayed strong growth rate between the two census.

This tells us that in order for the IV to be correlated with the instrumented variable, the fastest growing industries must also be the industries with the largest share in the previous period. If industrial specialization can be seen as a municipality expanding the size of its industries that are already prominent, then the condition for the shift-share IV to be valid is that such a specialization process takes place. On the contrary, if industrial diversification takes place i.e. a municipality expands relatively small subsectors, then the shift-share approach produces poor instruments.

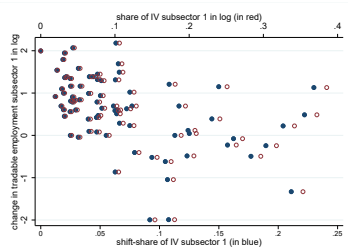
This result echoes the debate on (un)conditional convergence (the poorer countries/ administrative entities are expected to grow faster than the relatively richer countries/ administrative entities see Chanda and Kabiraj (2020)). As shown above, the shift-share depends heavily on the share component. It follows that there is an implicit assumption between the instrumented variable (growth of tradable employment at municipality level) and the share component. This assumption is that the largest subsectors at $t-s$ (the share) are also the fasted growing subsectors (the instrumented variable). In Sub-saharan Africa, this assumption is violated. Subsectors tradable employment seems to be characterized by convergence. We do not explicitly test for conditional convergence as the conditional convergence literature relies on productivity level and productivity growth data. We now propose an alternative construction based on subgroups aggregation for the shift.

The solution we propose to this issue $\Delta\bar{N}^{T}_{m,t}$ is to construct the shift component for subgroups $N^{q}_{j,t}$ that are defined by the pace at which tradable employment grow at municipality level. We assign municipalities to groups depending on the quantile distribution of tradable employment growth. The shift is group dependent and is the sum of employment across each quantile $N^{q}_{j,t}$. The instrument is now defined in 3.

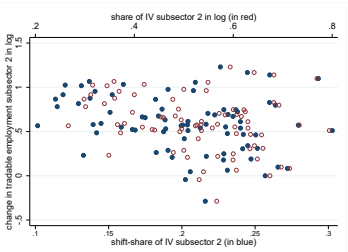
$$\Delta\bar{N}^{T}_{m,t} = \sum_{j \epsilon T} \left(\frac{N_{j,m,t-s}}{N^{T}_{m,t-s}} \left(\log\left(N^{q}_{j,t} - N_{j,m,t}\right) - \log\left(N^{q}_{j,t-s} - N_{j,m,t-s}\right) \right) \right) \tag{3}$$

The appealing feature of this approach is that municipalities with a fast growth of subsector j display a shift component that is higher than municipalities with a slow growth (or negative growth) of subsector j. The result of the regression using the new instrument is displayed in Table 6. The coefficient with the new instrument now has the same sign as the OLS regression. The multiplier with the new instrument increases slightly for Bénin, Côte d'Ivoire, Ghana, Malawi and Mozambique. The multiplier decreases slightly in Rwanda and Zambia. It is unchanged in South Africa. The test $F2$ now indicate that the modified shift-share is a good instrument. Figure 3 also underlines that the new

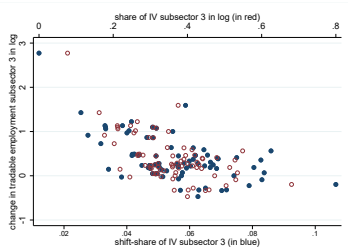
Figure 1: Scatter plots of difference in (log) tradable employment (y-axis) and shift-share / share component of the IV (x-axis) at subsector level



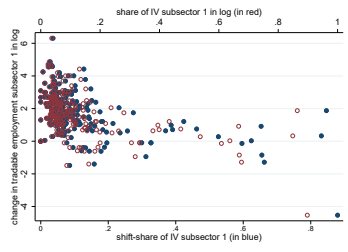
(a) Bénin subsector 1



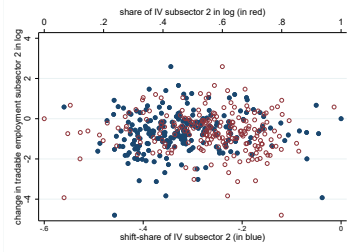
(b) Bénin subsector 2



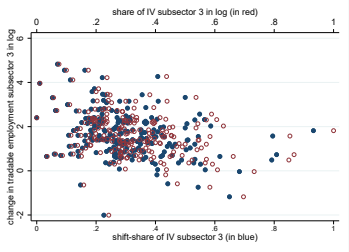
(c) Bénin subsector 3



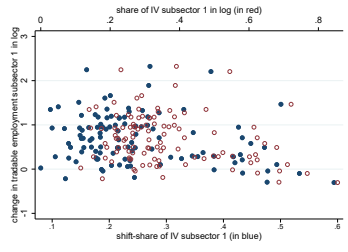
(d) Côte d'Ivoire subsector 1



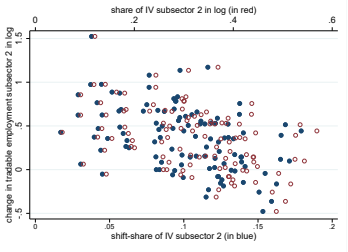
(e) Côte d'Ivoire subsector 2



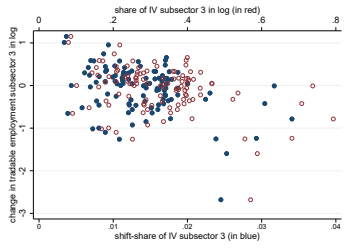
(f) Côte d'Ivoire subsector 3



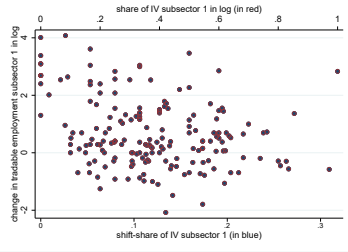
(g) Ghana subsector 1



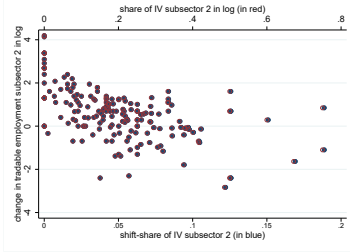
(h) Ghana subsector 2



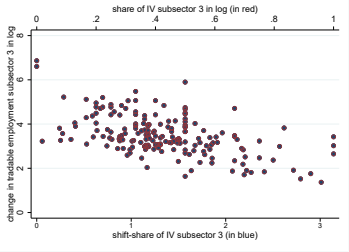
(i) Ghana subsector 3



(j) Malawi subsector 1

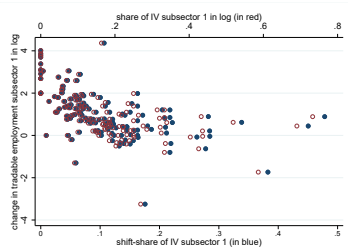


(k) Malawi subsector 2

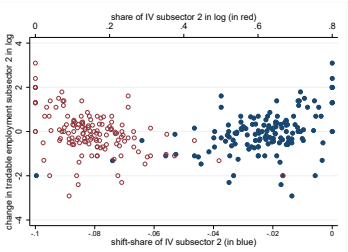


(l) Malawi subsector 3

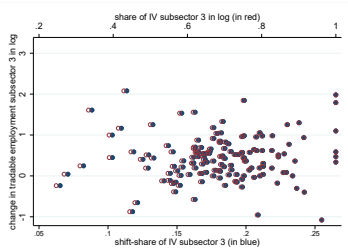
Figure 2: Scatter plots of difference in (log) tradable employment (y-axis) and shift-share component of the IV (x-axis) at subsector level



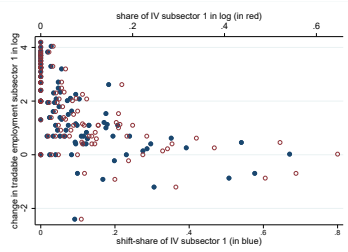
(a) Mozambique subsector 1



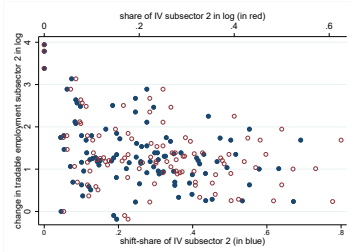
(b) Mozambique subsector 2



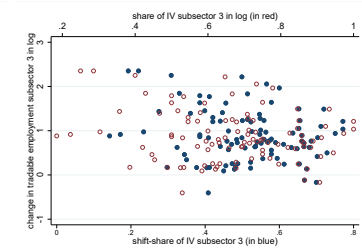
(c) Mozambique subsector 3



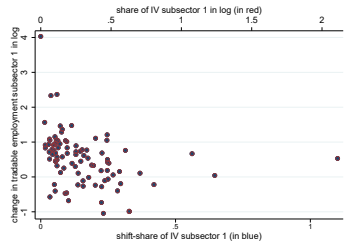
(d) Rwanda subsector 1



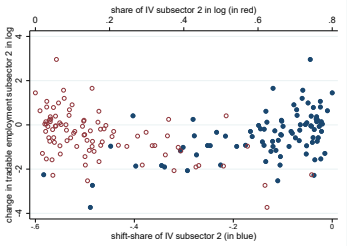
(e) Rwanda subsector 2



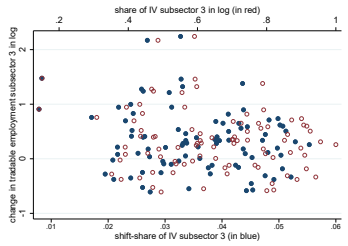
(f) Rwanda subsector 3



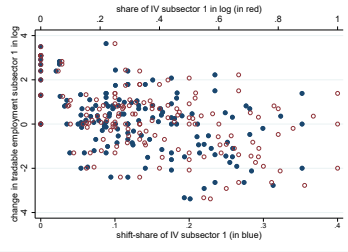
(g) South Africa subsector 1



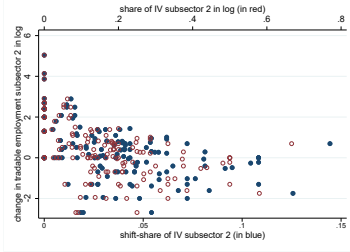
(h) South Africa subsector 2



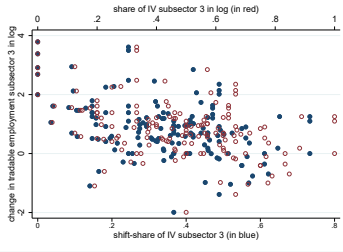
(i) South Africa subsector 3



(j) Zambia subsector 1



(k) Zambia subsector 2



(l) Zambia subsector 3

Table 6: Regression Tradable on nontradable - difference of the logs - 2SLS IV by quantile

	$\Delta log\left(N_{m,t}^{NT}\right)$									
	BJ	CI	GH	MW	ML	MZ	RW	SA	TZ	ZM
LM	1.41***	3.60***	1.75***	2.15***		2.37***	4.6***	0.53*		3.42***
$\Delta \bar{N}_{m,t}^{T}$	0.30**	0.73***	0.56***	0.47***	n.a.	0.53***	0.66***	0.12***	n.a.	0.54***
	(0.13)	(0.08)	(0.10)	(0.06)	n.a.	(0.07)	(0.08)	(0.04)	n.a.	(0.08)
cst	0.03	0.34***	0.44***	0.50***	n.a.	0.45***	0.24***	0.57***	n.a.	0.35***
	(0.05)	(0.04)	(0.05)	(0.08)	n.a.	(0.03)	(0.09)	(0.02)	n.a.	(0.06)
N	77	218	109	183	n.a.	142	101	90	n.a.	150
R^2	0.074	0.523	0.428	0.318	n.a.	0.422	0.588	0.102	n.a.	0.514
$F1$	0.007	2.68	4.41**	3.27*		0.35	0.01	0.003		1.31
$F2$	72***	76***	898***	247***		300***	255***	268***		321***

This table presents the results of the 2SLS regression of the improved instrumental variable of tradable jobs on nontradable jobs in logs. Country abbreviations are BJ Benin, CI Cote d'Ivoire, GH Ghana, MW Malawi, ML Mali, MZ Mozambique, RW Rwanda, SA South Africa, TZ Tanzania, ZM Zambia. LM is the local multiplier associated with 1 additional tradable job. It is the regression coefficient weighted by the ratio of nontradable jobs to tradable jobs in the economy. The following lines are the weighted regression's results with the error clustered at the municipality level. N is the number of administrative entities. F1 reports the statistics for the endogeneity of the explanatory variable under the assumption H_0: variable is exogenous. F2 tells us about the quality of the instrument.

instrument is positively related to the instrumented variable. One limitation of this new instrument is that the more subgroups the more likely that the shift is explained by a particular municipality.

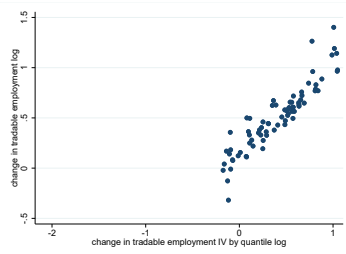
7 Robustness check

In this section, we present different robustness checks including i) panel estimations for Bénin, Malawi and Mali ii) the size of the spatial unit of analysis iii) controlling for omitted variables, iv) and difference in log versus difference in level regressions.

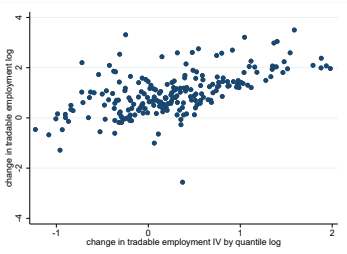
7.1 Panel estimations for Bénin, Malawi and Mali

The regressions above are performed on cross section data rather than panel as in the original contribution of Moretti. Although this should not impact the results, we here display the panel estimation for the three countries for which it is feasible: Bénin, Malawi and Mali. We estimate a fixed effect panel with errors clustered at the level of the administrative entities (see regressions 1 to 3 in Table 7). The coefficients are slightly smaller from 1.34 to 1.11 for Bénin, 1.78 to 1.21 in Malawi and 1.06 to

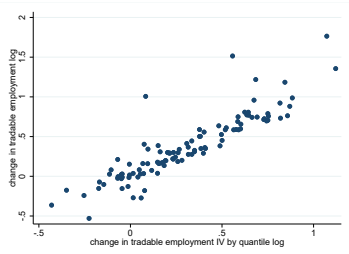
Figure 3: Scatter plots of difference in (log) tradable employment (y-axis) and improved IV (x-axis)



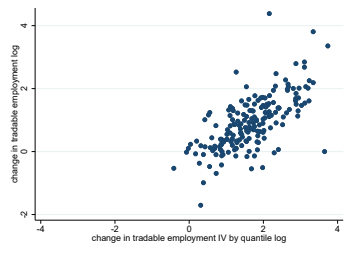
(a) Bénin



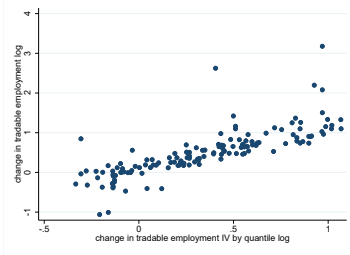
(b) Côte d'Ivoire



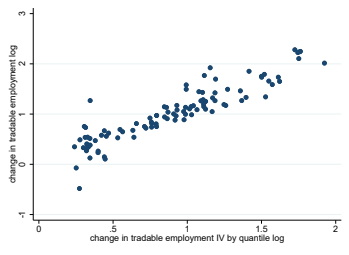
(c) Ghana



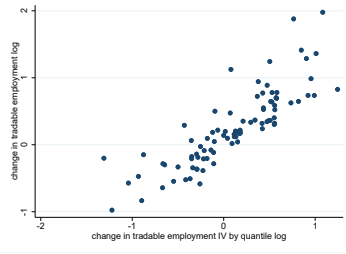
(d) Malawi



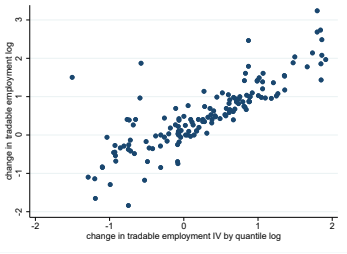
(e) Mozambique



(f) Rwanda



(g) South Africa



(h) Zambia

Table 7: Regression Tradable on nontradable - difference of the logs - Robustness checks

	$\Delta log\left(N_{m,t}^{NT}\right)$			
	BJ	MW	ML	RW 416
	(1)	(2)	(3)	(4)
LM	1.11	1.21***	0.99***	3.15***
$\Delta log\left(N_{m,t}^{T}\right)$	0.24	0.26***	0.25***	0.45***
	(0.17)	(0.06)	(0.08)	(0.04)
N	154	366	514	416
R^2	0.708	0.870	0.759	0.44

Regression 1 to 3 are the weighted fe panel regression of tradable jobs $\Delta log\left(N_{m}^{T}\right)$ on nontradable jobs $\Delta log\left(N_{m}^{NT}\right)$ in logs for BJ Benin, MW Malawi and ML Mali. Regression 4 is the cross-section regression for Rwanda for 416 administrative entities. LM is the local multiplier associated with 1 additional tradable job. It is the regression coefficient weighted by the ratio of nontradable jobs to tradable jobs in the economy. The following lines are the fixed effects regression's results with the error clustered at the municipality level. N is the number of administrative entities.

0.99 for Mali. The 1990s decade was characterised by poor growth performance in Africa in general and this may be reflected in smaller coefficients for this period of time. The coefficient for Bénin is just above the 10% significance level.

7.2 Size of the administrative entities

Another robustness check is related to the size of the administrative entities. In the original contribution of Moretti the census administrative entities are re-aggregated as a function of commuting time. This information is not available for African countries and this is not the objective of the paper to construct such an information. The census data are in general quite short and do not contain any information about commuting. The idea of commuting may be also difficult to apply to countries where there is little public transport, limited car ownership and a high prevalence of informal workers. We have therefore used the administrative entities contained in the census that reflects an administrative territory rather than an economic territory.[17]

However, it is interesting to investigate whether changing the size of the administrative entities may impact the size of the multiplier. Originally, Rwanda is disaggregated into 416 administrative entities that have been re-aggregated to 101 to match the second level administrative entities prevailing in the late 1990s. We expect that the smaller the size of the administrative entities the smaller the multiplier as the particularity of this approach is to capture the local dimension associated with consumption

[17] See the recent contribution by Ch et al. (2020)

effects and value chains. We show in regression 4 in Table 7) the regression for 416 administrative entities. The multiplier confirms this assumption as it is down from 4.62 to 3.15.

7.3 Additional control variables

We now turn to the issue of omitted variables. Faggio and Overman (2014) underline the importance to control for city size in a city growth equation. Controlling for initial city size is important to avoid misleading inference between the impact of tradable employment growth and nontradable employment growth. If large cities are growing faster than smaller cities, omitting to control for initial city size is likely to bias the estimated coefficient upward. Faggio and Overman (2014) include initial employment level as well as initial working age population level measured for different level of education. Similarly, Jedwab and Moradi (2016) include initial city population to control for city size.

Additional omitted variables are also likely to impact the coefficient estimated. Municipalities with better institutions and infrastructures are likely to grow faster and to attract more tradable jobs. In addition, fast growing cities will create mechanically more nontradable jobs, which are partially depending on the size of the population. Our set of local control variables includes the initial population size of the municipality as well as dummies for municipality bordering neighbouring countries, dummy for municipality with access to the sea (except for landlocked country) and the euclidian distance (in (10) km) between the administrative entity centroid and the main city. These last three variables are included as control as they may explain faster growth of cities. Lastly, we estimate the regression without a constant.

The results in Table 8 show an increase in the local multiplier in Bénin, Ghana, South Africa and Tanzania. In the other countries, the coefficient is unchanged. The lagged population level is significant in 6 countries and positive in 4 countries. Administrative areas with a larger population in the previous census tend to create more nontradable jobs mechanically as discussed above. So do administrative entities located near the border with another country. The border dummy in Bénin is not significant probably due to the fact most administrative entities have a border with a neighbouring country. While the administrative entities from Côte d'Ivoire with a border with Ghana might have benefited from the good growth performances of Ghana over the 2000s, Ghanaian administrative entities close to Côte d'Ivoire might have been impacted negatively by the post-electoral crisis. The dummy for sea access is not significant.

7.4 Estimation in level and non-monotonic effect

Most contributions on the estimation of the local multipliers have used the difference of logs specification. However, one of the early paper also adopted a specification in difference of the level of

Table 8: Controlling for city size, distance to the main city

	$\Delta log\left(N_{m,t}^{NT}\right)$									
	BJ	CI	GH	MW	ML	MZ	RW	SA	TZ	ZM
LM	2.82***	3.05***	2.56***	1.43***	1.16***	2.26***	4.97***	1.13**	4.77***	3.66***
$\Delta log\left(N_{m,t}^{T}\right)$	0.60***	0.61***	0.81***	0.31***	0.29***	0.50***	0.72***	0.26**	0.91***	0.57***
	(0.09)	(0.05)	(0.08)	(0.04)	(0.11)	(0.07)	(0.06)	(0.13)	(0.15)	(0.09)
$pop_{m,t-s}$	0.10	0.08***	0.17***	−0.56***	3.45***	0.17	1.26	0.19***	-0.23	−1.97**
	(0.33)	(0.02)	(0.05)	(0.19)	(0.50)	(0.22)	(0.87)	(0.03)	(0.19)	(0.87)
dist	−0.015***	0.013***	0.012***	0.001*	0.006***	0.001	0.006	0.004**	0.002	−0.003*
	(0.004)	(0.001)	(0.001)	(0.001)	(0.002)	(0.004)	(0.007)	(0.001)	(0.003)	(0.002)
d_border	0.03	0.14*	−0.28***	0.64***	0.28**	0.40***	0.18**	0.29***	0.54***	0.63***
	(0.10)	(0.08)	(0.09)	(0.06)	(0.12)	(0.07)	(0.07)	(0.08)	(0.20)	(0.13)
d_sea	0.17	0.04	0.11	n.a.	n.a.	0.00	n.a.	−0.30**	-0.26	n.a.
	(0.18)	(0.07)	(0.06)	n.a.	n.a.	(.)	n.a.	(0.13)	(0.16)	n.a.
N	77	218	109	183	257	143	101	90	113	150
R^2	0.483	0.885	0.868	0.870	0.689	0.855	0.916	0.771	0.899	0.803

This table presents the results of the weighted OLS regression of tradable jobs $\Delta log\left(N_{m}^{T}\right)$ on nontradable jobs $\Delta log\left(N_{m}^{NT}\right)$ in logs. Country abbreviations are BJ Benin, CI Côte d'Ivoire, GH Ghana, MW Malawi, ML Mali, MZ Mozambique, RW Rwanda, SA South Africa, TZ Tanzania, ZM Zambia. Additional control variables includes population in the previous census $pop_{m,t-s}$, euclidian distance from polygon center to the main city *dist*, border *d_border* and sea *d_sea* dummies. LM is the local multiplier associated with 1 additional tradable job. It is the regression coefficient weighted by the ratio of nontradable jobs to tradable jobs in the economy. The following lines are the weighted OLS regression's results with the error clustered at the municipality level. N is the number of administrative entities.

employment (Moretti and Thulin, 2013). A systematic comparison between the two specifications has not been conducted yet.

There are two reasons to justify the use of difference in level estimation. The first reason is that the log specification tends to linearize the data and may ignore non-monotonic effects that can be substantial. The second reason is that the size of local multipliers in the log specification depends quite heavily on the relative size of the two sectors, which is not the case in the level specification. The difference of the level specification is now $\Delta N_{m,t}^{NT} = \alpha + \beta \Delta N_{m,t}^{T} + \epsilon_{m,t}$ with $\Delta N_{m,t}^{T}$ the change in tradable employment level in municipality m.

Table 9 shows the results of the local multipliers of tradable on nontradable jobs in the difference of the level specification with panel A the OLS estimation and panel B the IV 2SLS estimation.[18] In level, local multipliers are much larger than in log difference. This may confirm the impact of the log specification on the data. Another explanation is that large municipalities such as Accra or Abidjan that concentrate numerous tradable and nontradable jobs tend to increase the size of the multipliers.

In order to capture the potential non-monotonic relation between tradable jobs and nontradable jobs, we estimate the regression using threshold models as proposed by Hansen (1999). The panel threshold regression consists in estimating equation 4. There are two coefficients associated with $N_{m,t}^{T}$. One coefficient β_1 captures the relationship when the threshold variable is below the cut-off point γ. A second coefficient β_2 captures the relationship when the threshold variable is above the cut-off point γ. The advantage of threshold regression is that the choice of the cut-off point is based on a statistical criteria. γ is the threshold that minimizes the sum of square error.

$$\Delta N_{m,t}^{NT} = \alpha + \beta_1 \Delta N_{m,t}^{T} I(q_i \leq \gamma) + \beta_2 \Delta N_{m,t}^{T} I(q_i > \gamma) + \epsilon_{m,t} \tag{4}$$

As shown in panel C of Table 9, the multipliers below the threshold are closer to the multipliers in log form especially in Bénin, Côte d'Ivoire, Mali and Rwanda. The parameter estimated above the threshold often concerns just a handful of data points. The threshold is significant in all but three countries. Interestingly, the relationship is strongly non-monotonic in South Africa with some municipalities showing a negative relation between tradable and nontradable employment.

One of the main characteristics of South Africa is the declining share of tradable employment in total employment by 3 percentage points between the two censuses (see Table 2). More precisely, while tradable employment expands in absolute terms, its is mainly explained by the City of Johannesburg. Contrastingly, tradable employment declines in the next three biggest cities: Ekurhuleni, Durban and Cape Town. This feature is consistent whether or not Ekurhuleni is merged with the City of Johannesburg. In the meantime, nontradable employment has progressed everywhere in the country. A consequence is that the relationship between changes in tradable employment and changes

[18] In level, the instrumental variable is defined as $\Delta \bar{N}_{m,t}^{T} = \sum_{j \epsilon T} N_{j,m,t-s} \left(\log \left(N_{j,t}^{q} - N_{j,m,t} \right) - \log \left(N_{j,t-1}^{q} - N_{j,m,t-s} \right) \right)$

Table 9: Regression Tradable on nontradable - difference of the level

	BJ	CI	GH	MW	ML	MZ	RW	SA	TZ	ZM
	Panel A: OLS estimation $\Delta N_{m,t}^{NT}$									
$\Delta N_{m,t}^{T}$	3.24**	10.96***	5.96***	3.91***	6.95***	3.05	6.81***	-0.78	5.50***	5.86***
	(1.28)	(0.78)	(1.47)	(1.08)	(0.63)	(2.42)	(0.76)	(6.66)	(0.12)	(0.83)
N	77	218	109	183	257	143	101	90	113	150
R^2	0.567	0.925	0.593	0.317	0.849	0.135	0.612	0.002	0.923	0.713
	Panel B: IV 2SLS estimation ΔN_{m}^{NT}									
	BJ	CI	GH	MW	ML	MZ	RW	SA	TZ	ZM
$\Delta \bar{N}_{m,t}^{T}$	4.24***	11.54***	6.83**	7.38***	n.a.	9.35***	15.06**	3.01	n.a.	3.65***
	(0.64)	(0.21)	(3.17)	(2.46)	n.a.	(1.35)	(7.65)	(3.39)	n.a.	(1.41)
N	77	218	109	183	n.a.	143	101	90	n.a.	150
R^2	0.334	0.996	0.422	0.333	n.a.	0.468	0.60	0.070	n.a.	0.646
$F1$	18.53***	0.81	1.80	10.22***	n.a.	25.40***	2.69*	0.02	n.a.	12.02***
$F2$	27.42**	224***	43.20***	154***	n.a.	869***	4.09**	14.56***	n.a.	28.47***
	Panel C: Threshold estimation ΔN_{m}^{NT}									
	BJ	CI	GH	MW	ML	MZ	RW	SA	TZ	ZM
$\Delta \bar{N}_{m,t}^{T} < \gamma$	1.15	4.66	0.67	4.50	1.49	0.73	5.95	−12.18	6.96	8.60
.95 CI	[.36,2.13]	[3.18,6.13]	[-1.68,3.03]	[.04,9.93]	[.25,2.41]	[-53.70,30.97]	[-.31,18.54]	[-16.73,-7.72]	[5.20,8.71]	[-47.58,12.21]
$\Delta \bar{N}_{m,t}^{T} > \gamma$	5.92	12.90	6.18	8.69	8.02	4.01	11.01	23.83	4.77	7.71
.95 CI	[4.69,7.03]	[12.71,13.08]	[-3.19,15.56]	[5.54,10.97]	[6.37,9.63]	[-55.45,25.01]	[5.55,13.20]	[20.14,26.94]	[4.21,5.34]	[-2.60,22.75]
γ	2210	3137	12130	2150	1060	20	1150	1634	7472	2820
.95 CI	[-50,2990]	[3136,3138]	[12129,12131]	[1950,3590]	[160,1110]	[-1460,7040]	[-130,3500]	[1044,2169]	[7471,7473]	[-690,7340]
$N < \gamma$	69	214	105	176	243	27	89	70	108	146
N	77	218	109	183	257	143	101	90	113	150

This table presents the results of the weighted OLS regression and IV regression of tradable jobs $\Delta\left(N_m^T\right)$ on nontradable jobs $\Delta\left(N_m^{NT}\right)$ in logs. Country abbreviations are BJ Benin, CI Côte d'Ivoire, GH Ghana, MW Malawi, ML Mali, MZ Mozambique, RW Rwanda, SA South Africa, TZ Tanzania, ZM Zambia. The error is clustered at the municipality level. N is the number of administrative entities. We do not report the constant term.

in nontradable employment is strongly non-monotonic. This pattern applies beyond the largest municipalities.

8 Transmission channels: employment status and skills

In this section, we discuss the size of the multipliers of tradable on nontradable across different dimensions: employees versus self-employed, skills versus unskilled. Low-income countries are characterized by the importance of informal employment relationships. Salaried workers are usually employed in the formal sectors, are performing skilled tasks and are receiving higher compensation.

Using census data, self-employment is defined as self-employed, employers and contributing family workers. The multipliers of tradable employees on nontradable are much larger than the multiplier of tradable on nontradable jobs (see Panel A Table 10). The transmission channel via the demand for locally produced nontradable goods cannot be tested directly as censuses do not contain information about wages. However, the fact that the multiplier is larger for employees tradable jobs is indicative of the strength of this channel as the main implication for employment status is difference in remuneration.

In sub-Saharan Africa, the distribution of skills is highly skewed towards low education levels. For this reason, the distinction between high skilled and low skilled is chosen relatively to the overall education level of the country. In this set of countries, low skilled workers are individuals with an education level up to lower secondary. The multipliers for tradable skilled on nontradable are 2 to 5 times the baseline multipliers with very high values for Côte d'Ivoire and Mozambique and Tanzania (see Panel B Table 10). Higher multipliers for skills tradable jobs constitute further indirect evidence of the importance of the demand for locally produced nontradable goods.

9 Conclusion

In this paper, we measured the impact of attracting tradable jobs in a municipality on nontradable jobs in medium-and low-income countries. We do so by putting together a unique database of 1441 administrative entities across 10 sub-Saharan African countries. We find that the multipliers, comprised between 1 and 5, by far exceed the multipliers previously estimated in high-income countries. These multipliers increase further when jobs created in the tradable sector are salaried jobs or high-skilled jobs.

Explaining the difference in the multipliers between high-and low-income countries is a difficult task, as census data are not designed to gather a large array of information about the labour market. We hypothesized that the under-employment and wage dispersion that characterize low-income countries are likely to raise the multipliers. In particular, under-employment limits wage inflation from

Table 10: Regression Employment status and skilled - difference of the logs

	Panel A: Employees tradable jobs on nontradable jobs									
	$\Delta log\left(N_{m,t}^{NT}\right)$									
	BJ	CI	GH	MW	ML	MZ	RW	SA	TZ	ZM
LM	0.23	4.25***	6.05***	2.62***	6.82		7.84***	0.53**	4.76***	4.61***
$\Delta log\left(N_{m,t}^{EEST}\right)$	0.01	0.27***	0.30***	0.28***	0.10		0.31***	0.11**	0.30**	0.37***
	(0.09)	(0.03)	(0.07)	(0.03)	(0.10)		(0.06)	(0.05)	(0.12)	(0.11)
_cons	0.11	0.53***	0.56***	0.61***	0.80***		0.37***	0.58***	0.86***	0.43***
	(0.08)	(0.07)	(0.06)	(0.07)	(0.07)		(0.10)	(0.02)	(0.12)	(0.08)
N	76	179	109	161	58		90	90	113	111
R^2	0.000	0.225	0.269	0.282	0.041		0.366	0.096	0.101	0.248
	Panel B: High skilled tradable jobs on nontradable jobs									
	$\Delta log\left(N_{m,t}^{NT}\right)$									
	BJ	CI	GH	MW	ML	MZ	RW	SA	TZ	ZM
LM	8.17	21***	9.28***	8.07***	48	20**	11.33***	2.57**	26***	7.19***
$\Delta log\left(N_{m,t}^{HST}\right)$	0.03	0.24***	0.55***	0.20***	0.12	0.08**	0.24***	0.11***	0.73***	0.32***
	(0.05)	(0.04)	(0.09)	(0.04)	(0.08)	(0.03)	(0.05)	(0.04)	(0.08)	(0.09)
_cons	0.08	0.34***	0.53***	0.51***	0.69***	0.48***	0.45***	0.57***	0.13	0.27**
	(0.08)	(0.09)	(0.05)	(0.09)	(0.07)	(0.05)	(0.11)	(0.02)	(0.13)	(0.12)
N	77	218	109	183	257	143	101	90	113	150
R^2	0.005	0.180	0.494	0.183	0.038	0.052	0.295	0.104	0.512	0.253

This table presents the results of the weighted OLS regression of employees tradable jobs $\Delta log\left(N_m^{EEST}\right)$ and high skilled tradable jobs $\Delta log\left(N_m^{HST}\right)$ on nontradable jobs $\Delta log\left(N_m^{NT}\right)$ in logs. Country abbreviations are BJ Benin, CI Côte d'Ivoire, GH Ghana, MW Malawi, ML Mali, MZ Mozambique, RW Rwanda, SA South Africa, TZ Tanzania, ZM Zambia. The employement status is not available for Mozambique. LM is the local multiplier associated with 1 additional tradable job. It is the regression coefficient weighted by the ratio of nontradable jobs to employees/high skilled tradable jobs in the economy. The following lines are the weighted OLS regression's results with the error clustered at the municipality level. N is the number of administrative entities.

new tradable jobs. Additionally, wage dispersion reinforces the demand for locally-produced goods as tradable workers enjoy strong purchasing power and as locally-produced goods are cheap.

The large size of the multipliers adds new insight to the debate on structural transformation and (un)conditional convergence. This literature points to an existing but limited impact of manufacturing on aggregate labour productivity given the limited reallocation of labour to tradable sectors. Our results show that the contribution of tradable sectors to the labour market goes beyond tradable sectors and may have a sizeable effect through indirect nontradable job creation.

We also showed that the usual shift-share approach produces poor instrumental variables in countries where small sectors (in the last census) are shown to be growing fast. We show that this is particularly the case in the countries considered in the paper and that it is a sign of sectoral diversification and/or conditional convergence. We proposed a modified version of the shift-share approach, where the shift is constructed for different quantiles.

Lastly, we showed that the size of the multiplier is not impacted by the cross-section data that we used in this paper, while the existing contributions in the literature rely on panel. Another result is that the multipliers are robust to the inclusion of a large set of control variables capturing city size, sea effect, border effect and distance to the main city. However, we showed that the multipliers are sensitive to the size of the administrative entities considered given that the methodology measures local transmission channels. We also underlined that the "difference of the log" specification and the "difference of the level" specification, both encountered in the literature, yield slightly different results and that the latter can be mobilized to capture non-monotonic effects that are strong in medium-and low-income countries.

References

Adão, R., M. Kolesár, and E. Morales (2019, 08). Shift-share designs: Theory and inference. *The Quarterly Journal of Economics 134*(4), 1949–2010.

Bartik, T. J. (1991). *Who Benefits from State and Local Economic Development Policies?* W.E. Upjohn Press.

Berger, T., C. Chen, and C. B. Frey (2017). Cities, industrialization, and job creation: Evidence from emerging economies. *mimeo University of Oxford*, 1–25.

Ch, R., D. A. Martin, and J. F. Vargas (2020). Measuring the size and growth of cities using nighttime light. *Journal of Urban Economics forthcoming*, 1–39.

Chanda, A. and S. Kabiraj (2020). Shedding light on regional growth and convergence in india. *World Development 133*, 104961.

Christian, P. J. and C. B. Barrett (2017, August). Revisiting the effect of food aid on conflict : a methodological caution. Policy Research Working Paper Series 8171, The World Bank.

Ciani, E., F. David, and G. de Blasio (2017). Local labour market heterogeneity in italy: estimates and simulations using responses to labour demand shocks. *Banca d'Italia working paper 1112*, 1–50.

de Vries, G., M. Timmer, and K. de Vries (2015). Structural transformation in africa: Static gains, dynamic losses. *The Journal of Development Studies 51:6*, 674–688.

Faggio, G. and H. Overman (2014). The effect of public sector employment on local labour markets. *Journal of Urban Economics 79*, 91–107.

Glaeser, E. L., H. D. Kallal, J. A. Scheinkman, and A. Shleifer (1992). Growth in cities. *Journal of Political Economy 100, no. 6 (Dec., 1992)*, 1126–1152.

Goldsmith-Pinkham, P., I. Sorkin, and H. Swift (2020). Bartik instruments: What, when, why, and how. *American Economic Review, forthcoming*, 1–67.

Gollin, D., V. Dietrich, and R. Jedwab (2016). Urbanization with and without industrialization. *Journal of Economic Growth 21(1)*, 35–70.

Hansen, B. E. (1999). Threshold effects in non-dynamic panels: Estimation, testing, and inference. *Journal of Econometrics 93*, 345–368.

Henderson, V., A. Kuncoro, and M. Turner (1995). Industrial development in cities. *Journal of Political Economy 103, No. 5 (Oct., 1995)*, 1067–1090.

IPUMS (2019). Minnesota population center. integrated public use microdata series, international: Version 7.2 [dataset]. minneapolis, mn: Ipums, 2019.

Jaeger, D. A., T. J. Joyce, and R. Kaestner (2020). A cautionary tale of evaluating identifying assumptions: Did reality tv really cause a decline in teenage childbearing? *Journal of Business & Economic Statistics 38*(2), 317–326.

Jedwab, R. and A. Moradi (2016). The permanent effects of transportation revolutions in poor countries: Evidence from africa. *The Review of Economics and Statistics 98(2)*, 268–284.

McMillan, M., D. Rodrik, and Íñigo Verduzco-Gallo (2014). Globalization, structural change, and productivity growth, with an update on africa. *World Development 63*, 11 – 32. Economic Transformation in Africa.

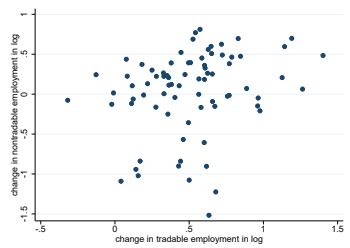
Moretti, E. (2010). Local multipliers. *American Economic Review: Papers & Proceedings 100*, 1–7.

Moretti, E. and P. Thulin (2013). Local multipliers and human capital in the united states and sweden. *Industrial and Corporate Change 22(1)*, 339–362.

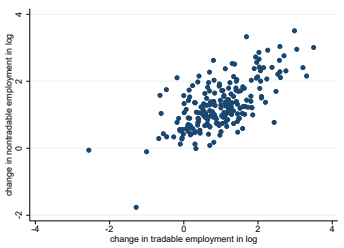
Rodrik, D. (2013). Unconditional convergence in manufacturing. *The Quarterly Journal of Economics 128(1)*, 165–204.

van Dijk, J. J. (2017). Local employment multipliers in u.s. cities. *Journal of Economic Geography 17(2)*, 465–487.

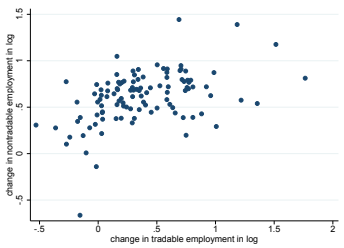
Figure 4: Scatter plots of the tradable employment (x-axis) and nontradable employment (y-axis) in difference of logs



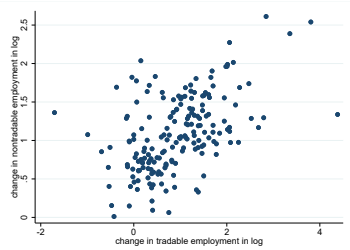
(a) Benin



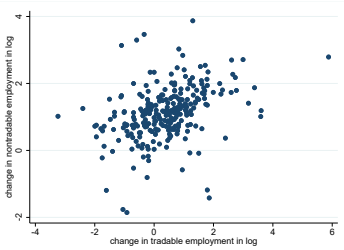
(b) Côte d'Ivoire



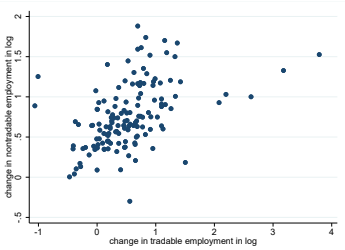
(c) Ghana



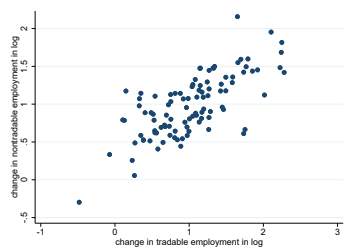
(d) Malawi



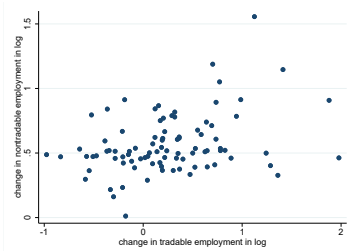
(e) Mali



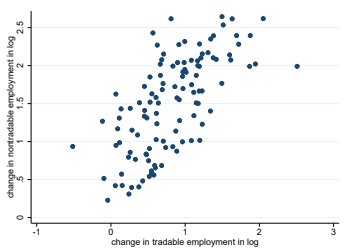
(f) Mozambique



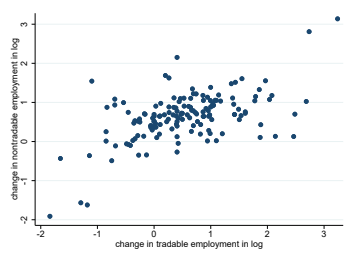
(g) Rwanda



(h) South Africa



(i) Tanzania



(j) Zambia

Table 11: Regression with agriculture - difference of the logs

	BJ	CI	GH	MW	ML	MZ	RW	SA	TZ	ZM
	Panel A: tradable on agriculture									
LM	0.27	0.41	0.91	1.16	-0.95^{***}	3.74^{***}	4.12	-0.36^{***}	1.14	1.96^{*}
	Panel B: agriculture on tradable									
LM	0.02	.02	0.04^{*}	0.01	-0.03^{***}	0.03^{***}	0.01^{*}	-0.48^{***}	0.01	0.03^{***}
	Panel C: nontradable on agriculture									
LM	-0.14^{**}	0.04	0.47	-0.62	0.34^{**}	1.24^{***}	1.01^{*}	-0.05	0.29	0.82^{***}
	Panel D: agriculture on nontradable									
LM	-0.52^{**}	0.03	0.09^{*}	-0.02	0.05^{***}	0.09^{***}	0.03^{**}	-0.28	0.02	0.24^{***}

This table presents the local multipliers associated with agriculture in logs. Country abbreviations are BJ Benin, GH Ghana, MW Malawi, ML Mali, MZ Mozambique, RW Rwanda, SA South Africa, TZ Tanzania, ZM Zambia.