CENTRE FOR THE STUDY OF AFRICAN ECONOMIES

CSAE Working Paper WPS/2018-09

Regional Market Integration and City Growth in East Africa: Local but no Regional Effects?*

Andreas Eberhard-Ruiz† Alexander Moradi‡

This version August 1, 2018.

Abstract

We investigate changes in the spatial concentration of economic activities after the establishment of a regional economic community between Kenya, Tanzania, and Uganda in 2001. Measuring city growth using satellite imagery of lights emanated out to space at night, we demonstrate that cities close to the community's internal borders expanded more than other cities further away. The growth effect is temporary and also highly localized: only cities less than 90 minutes of travel from the border experience an acceleration in growth rates; after four years growth rates revert to their pre-treatment level. We show that this is consistent with an asymmetric reduction in trade costs for two types of trade modalities that co-exist in many parts of sub-Saharan Africa, local small-scale trade and regional large-scale trade, with a larger reduction in costs of the former. Yet, while local effects are relatively large, equivalent to a 5.6% higher GDP for cities near the EAC's internal borders, they do not imply a large reorganisation of economic activity across space nor a substantial alteration of countries' urban systems.

JEL: F1, F14, F15, O17, O18, O55, R12
Keywords: Market Integration, Trade, Cross-Border Trade, City Growth, Periphery, Africa

*We are grateful for comments from Kristian Behrens, Luc Christiaensen, Markus Goldstein, Vernon Henderson, Ravi Kanbur, Samuel Marden, Mark Patridge, Adam Storeygard, Alan Winters, Albert Zeufack; Seminar participants at the joint Cornell University - World Bank conference on Secondary Towns, Jobs and Poverty Reduction (Washington D.C.), the Annual World Bank Conference on Africa (University of Oxford) and the University of Sussex.

†Andreas Eberhard-Ruiz, Department of Economics, University of Sussex, Jubilee Building, Falmer, BN1 9SN, UK; Email: A.Eberhard@sussex.ac.uk.

‡Department of Economics, University of Sussex, Jubilee Building, Falmer, BN1 9SN, UK. Also affiliated with the Center for the Study of African Economies, University of Oxford, Department of Economics, Manor Road, Oxford, OX1 3UQ, UK, and Research Associate, Department of Economics, Stellenbosch University, South Africa. E-mail: A.Moradi@sussex.ac.uk. Corresponding author.

1 Introduction

African and international policy makers regard regional integration as a means to boost economic and human development, with positive effects on a wide range of outcomes such as real income, employment, food security and education (United Nations Development Program, 2011; World Bank, 2012a; World Economic Forum, 2013). Many African countries have therefore embarked, often with significant financial support from donor agencies, on regional trade agreements and liberalisation agendas. Larger markets allow firms to specialise and realise economies of scale, raising the countries' competitiveness also on the world market stage.[1] Firms may respond to increased competition by increasing productivity. African consumers in turn could benefit from a larger variety of goods and services and lower prices. In addition, substantial benefits may come from coordinating investments into public goods, particularly in areas such as transportation, electricity and telecommunication infrastructures (World Bank, 2012b). These benefits notwithstanding, the process of regional integration may also have important distributional consequences that remain little understood.

In this paper, we investigate changes in the spatial distribution of economic activities after the East African Community (EAC) was launched in 2001, gradually eliminating trade restrictions between its member states Kenya, Tanzania and Uganda. Using a panel of 180 cities over the period 1992-2013 we apply a difference-in-difference approach using the timing of the EAC and varying treatment intensities across space as our main identification strategy. Measuring urban economies using satellite imagery of lights emanated out into space at night, we demonstrate that the EAC agreement had an asymmetric impact on city growth. Relative to their pre-EAC trend, cities close to internal EAC borders expanded more quickly than cities further inland. The effects are temporary lasting for only four years, which is consistent with the occurrence of a positive market access shock due to a one-off reduction in cross-

[1] The average African firm is indeed smaller than firms in other world regions. However, market size may not be the most binding constraint for firm growth (Bigsten and Söderbom, 2006; Iacovone et al., 2014).

border trade costs. However, the effects remain extremely local, limited only to a 90 minutes travel distance band to the border. Borrowing from the new economic geography literature on market access (Eaton and Kortum, 2002; Anderson and van Wincoop, 2003; Head and Mayer, 2011), we propose a theoretical framework to rationalise these findings. In line with anecdotal evidence, we show that our results are consistent with the EAC asymmetrically affecting two cross-border trade modalities, local small-scale trade and regional large-scale trade, with a strong reduction in trade cost for the former but almost none for the latter. The resulting local effects of the EAC are large. Assuming a nightlights elasticity of GDP as estimated in Henderson et al. (2011), the increased luminosity is equivalent to a 5.6% increase in GDP for cities near an internal EAC border. However, because cities in border regions are in the lower tail of the city distribution this leads to a relatively modest increase in the contribution of these cities to total national output of around 1 percentage point only. Consequently, we find little response in the EAC city size distribution.

Our findings contribute to the following literatures. Firstly, there is a large literature on the economic geography of trade liberalisation. In a pioneering work, Henderson (1982) incorporated the Heckscher-Ohlin and Rybszynski theorem into a model of city size. He argued that because trade liberalisation will cause a relatively capital abundant country to produce more of the capital intensive good, cities with a higher capital usage – which tend to be the larger cities – will grow more. Applying that argument to land and labour abundant developing countries would imply that cities with an agricultural hinterland grow faster if opened to international trade. Krugman and Elizondo (1996) were among the first to relate the concentration of economic activity in mega-cities to trade openness. In their model, locational choices depend on the interplay between centripetal and centrifugal forces.[2] If cities had identical access to the world market, trade liberalization would weaken centripetal forces, causing economic activity to disperse. Alonso-Villar (1999, 2001) later showed that

[2]Centripetal forces stem from economies of scale including improved access to consumers and to firms that produce key inputs. Centrifugal forces result from cities having to transport large amounts of agricultural produce from the country's rural areas (Krugman, 1991; Krugman and Venables, 1995) and from congestion, urban wages and land rents, and increased competition (Helpman, 1998).

this insight crucially depends on the distribution of economic activity before liberalisation, as trade liberalisation would have a relatively larger impact on cities with better access to the international market.

Cross-country studies typically did not support the conclusion that trade liberalisation leads to de-concentration (Ades and Glaeser, 1995; Davis and Henderson, 2003). However, empirical works found strong responses along border regions. Hanson (1996, 1997, 2005) showed that following trade liberalisation between Mexico and the U.S. in the 1980s and 1990s wages in regions close to either side of the U.S.-Mexican border responded positively relative to wages in regions further away. Brülhart (2011) and Brülhart et al. (2012) show that after the fall of the Iron Curtain in the early 1990s cities at Austria's eastern border experienced stronger growth in employment and wages than cities in the interior. Redding and Sturm (2008) studied a negative shock - the artificial division of Germany after World War Two - and found that cities close to Germany's newly created east-west border suffered disproportionate population losses compared to other cities further away.

In this paper, we study *regional trade integration* between similarly poor, agrarian economies. Effects are more ambiguous in this context. Firstly, the countries' factor endowments are similar, hence gains from trade may be smaller. Secondly, agricultural production is characterized by constant returns to scale and is highly dependent on immobile factors such as soil quality, altitude and climate (Krugman, 1991). Hence, agglomeration economies may be smaller. Thirdly, poor countries tend to suffer from much higher internal transport costs (Buys et al., 2010). High transportation costs mitigate regional divergence (Krugman, 1991) and transportation disadvantages may be a more significant constraint than tariffs and red tape at the border. We find peripheral cities close to the internal EAC border to catch up with cities of similar market access in the country's economic core. This is in line with predictions of Krugman and Elizondo (1996) and Alonso-Villar (2001, 1999). It is also consistent with an interpretation that borders limit informal trade across border regions and development more broadly in border regions (Bensassi et al., 2017; Bouët et al., 2017; Little, 2010).

Secondly, we contribute to an economic geography literature that focuses on market access, as a driver of economic activity (Donaldson and Hornbeck, 2016; Faber, 2014; Head and Mayer, 2014; Michaels, 2008; Storeygard, 2016).[3] Trade integration expands market access by reducing border frictions. For developing countries it is plausible that market access differs according to whether goods are traded in small quantities using local and often informal channels or in large quantities using formal channels. However, the literature has not made such distinction. In this paper we demonstrate that the temporary growth effects we find can only be explained by an increase in regional market access for locally traded goods.

Thirdly, our results contribute to the literature on the stability of urban systems. Two explanations were put forward for the strong persistence in city locations and city sizes: i) natural advantages and ii) agglomeration economies (Rosenthal and Strange, 2004). Testing strategies exploit contexts where either of these two forces are removed from city locations. When agglomeration economies were weakened or removed by war time bombings as in Japan, Germany and Vietnam, cities quickly revert to their original size (Bosker et al., 2007; Davis and Weinstein, 2002, 2008; Davis and Henderson, 2003; Miguel and Roland, 2011). However, there is also evidence for persistence when natural advantages become obsolete as in the case of historical portage sites in the U.S. (Bleakley and Lin, 2012). For Africa, Jedwab and Moradi (2016) documented that colonial railroad lines created urban systems that persisted even after railroads fell into disrepair and disuse. In the case of Kenya, Jedwab et al. (2017) also showed a strong persistence in the face of large human capital shocks as indicated by the expulsion of Europeans and Asians in the late 1960s. Rosenthal and Ross (2015) explained that up and downward mobility in terms of population size is typically very slow but that patterns in industrial mix and income is more dynamic. In this paper, we study nightlights over time which is proxying income. Our findings indicate that, in the

[3]For literature reviews see Brülhart (2011) and Redding (2010).

case of the EAC, regional integration did not constitute a shock large enough to affect the urban system. While cities close to the border outgrow their counterparts, the effect is only temporary and the border cities are too small to meaningfully affect the spatial distribution of economic activity. Overall, our finding of a level effect in nightlights of border cities is in line with what trade theory would let us expect (Winters, 2004), much less so with the creation of strong agglomeration economies.

The reminder of the paper is organized as follows. Section 2 describes the historical background of the EAC. Section 3 presents the data. The estimation strategy is discussed in section 4, followed by the main results and robustness checks in section 5. Section 6 discusses the results and section 7 concludes.

2 Background

Kenya, Tanzania and Uganda are small, poor and agrarian economies. In 2000, their combined population was around 90 million people (Kenya 31m; Tanzania 34m; and Uganda 24m); their GDP/c (PPP) in 2011 dollars was $2,160, $1,490 and $1,060 respectively; with about 80% of the population living in rural areas (World Bank, 2015).

In January 2001 Kenya, Tanzania and Uganda launched a 20-year plan towards increased regional economic integration with a staged introduction of a customs union, a common market, and a monetary union, with the ultimate but vague goal to establish a political federation. This marked the beginning of the East African Community (EAC). With almost immediate effect, the three countries started to reciprocally eliminate a range of trade-restrictive measures and embarked on significant trade facilitation to allow for the adoption of a common customs management law. In early 2001, the EAC trade ministers committed to discontinue the use of any discretionary duties which were often used to protect sensitive products and to generate revenue. Kenya followed suit and eliminated all suspended duties (i.e. discretionary duties imposed by a minister without parliamentary approval) except on petroleum products, and embarked on a comprehensive tariff reform strategy to reduce the top tariff rate in stages from 40% to 25% over a four year period in preparation of the customs union which would require the adoption of a common external tariff (International Monetary Fund, 2002). Tanzania eliminated all minimum duty values (i.e. duty rates that are set as a floor based on the lowest expected price for a commodity) in early 2001 and reduced the number of product categories liable to suspended duties from 17 to 4 between 2001 and 2005, as well as lowering the maximum suspended duty rate from 50% to 20% on all imports originating in the EAC (International Monetary Fund, 2002, 2003; McIntyre, 2005). This was accompanied by a simplification of the tariff structure from four to three bands as well as lowering the lower band tariff in the 2001/02 budget (Government of Tanzania, 2003). Similarly, Uganda eliminated several surcharges on a range of manufacturing products from the EAC in March 2001 (Government of Uganda, 2001).

In January 2005 a customs union came into force. A common external tariff was established. The changes in the external tariffs, however, were comparatively small. The EAC maximum tariff was fixed at 25%. This compares with pre-EAC tariffs of 35% for Kenya, 40% for Tanzania and 15% for Uganda (Booth et al., 2007). Trade between Tanzania and Uganda was fully liberalized with immediate effect, whereas tariffs on Kenyan exports to Tanzania and Uganda were gradually reduced and fully removed by 2010.[4]

In our study we treat the commencement of the EAC in 2001 as the year marking the start of the integration agenda. We did not find evidence of a coordinated removal of trade restrictions before 2001. Quite the contrary, Kenya introduced suspended duties on several products as well as hiking import duties on agricultural products as late as in 2000 (International Monetary Fund, 2002). Due to budgetary constraints, Tanzania also decided to refrain from duty reductions in the 2000/01 budget and did not change its policy regarding the use of discretionary duties until mid-2001 (Government of Tanzania, 2000). The first EAC council meeting between EAC trade ministers took place in January 2001. We also did

[4] It should be noted, however, that the customs union did not result in an elimination of border inspections, which continue to take place to date.

not find any indication that there were other contemporary events which could have affected the year in which the EAC was finally launched.[5] A feature of the EAC that could pose problems for the identification of its impact is the gradual implementation. Thus, in addition to the commencement of the EAC, we also treat the establishment of the customs union in 2005 and the end of the customs union transitionary arrangement in 2010 as key dates in the EAC integration process and test for their significance. In our analysis, identification is largely based on the asymmetric impact with respect to the distance to internal EAC border posts.

3 Data

Our unit of observation are urban agglomerations that we call cities. We measure economic activity by the amount of light emanated into space at night and recorded by weather satellites every night between 8:30pm and 10:00pm (NOAA National Geophysical Data Center, 2016). Light intensity is measured at 30 arc-second resolution (equivalent to 0.86 km^2 at the equator), on a scale from 0 to 63. Henderson et al. (2011, 2012) showed that changes in the amount of light are a powerful proxy for GDP growth, particularly when used to infer long-run growth and when disaggregate data of traditional national account based measures are lacking or unreliable. Both of these conditions are present in our study.

Following Henderson et al. (2017), we define a city and its boundaries as the contiguous lit area in any year between 1992 and 2013 (i.e. this is the outer envelope of lights after overlaying the stable nightlights images for each year).[6] We then retrieve the sum of nightlights within a city's boundary for each year. We define the city centre as the on average most intensely lit grid cell within a city's boundary. To establish the population of each city, we draw data from the three most recent censuses in each country (1989, 1999 and 2009

[5]The same cannot be said for the EAC's expansion in 2007 when Burundi and Rwanda became formal members of the trade bloc. It was only after the end of the Burundian civil conflict and the return of political stability to Rwanda in the early to mid-2000s that formal negotiations on their accession to the EAC commenced. For this reason, our study only focuses on Kenya, Tanzania, and Uganda.

[6]Web Appendix 1 provides a more detailed account of data sources and construction.

for Kenya; 1988, 2002 and 2012 for Tanzania; 1991, 2002 and 2014 for Uganda). For years falling between the census years, we interpolate population figures. Overall, we have a panel of 180 cities in Kenya, Tanzania and Uganda over the period 1992-2013.

We then measure the distance to the EAC internal border by travel time. We connect each city centre to East Africa's road network, which we establish using a Michelin road map of the region. We used a map of 1991 to abstract from endogeneity problems. Following Michelin's road classification we distinguish between three types of roads: tarmac roads, improved roads, and earth roads. In addition, we identify the location of the EAC's official internal border crossings (East African Community Secretariat, 2015). Using road-type specific travel speeds for sub-Saharan Africa from Dorosh et al. (2010) we calculate the shortest travel time between cities and the EAC's internal border crossings.[7] We do not consider other forms of transport such as rail and water, as they only play a marginal role in the region's transport network.

We define border regions as any location that falls within 90 minutes travel time to any official EAC internal border crossing. We chose this threshold to ensure that any city falling into the border region is always closer to an EAC border than to the primate city (Kampala and Nairobi are between 3 to 4 hours from the closest EAC border). In section 5.3 we relax this definition and test for effects beyond 90 minutes. Of the 180 cities in our sample, 21 fall into the EAC's border regions.[8] In 1992, all except one of these 21 cities near the EAC's internal borders had a population of less than 100,000. This continued to be the case in 2013. Figure 1 shows the 1992 road network and the spatial distribution of cities. Table 1 provides summary statistics by country and city location.

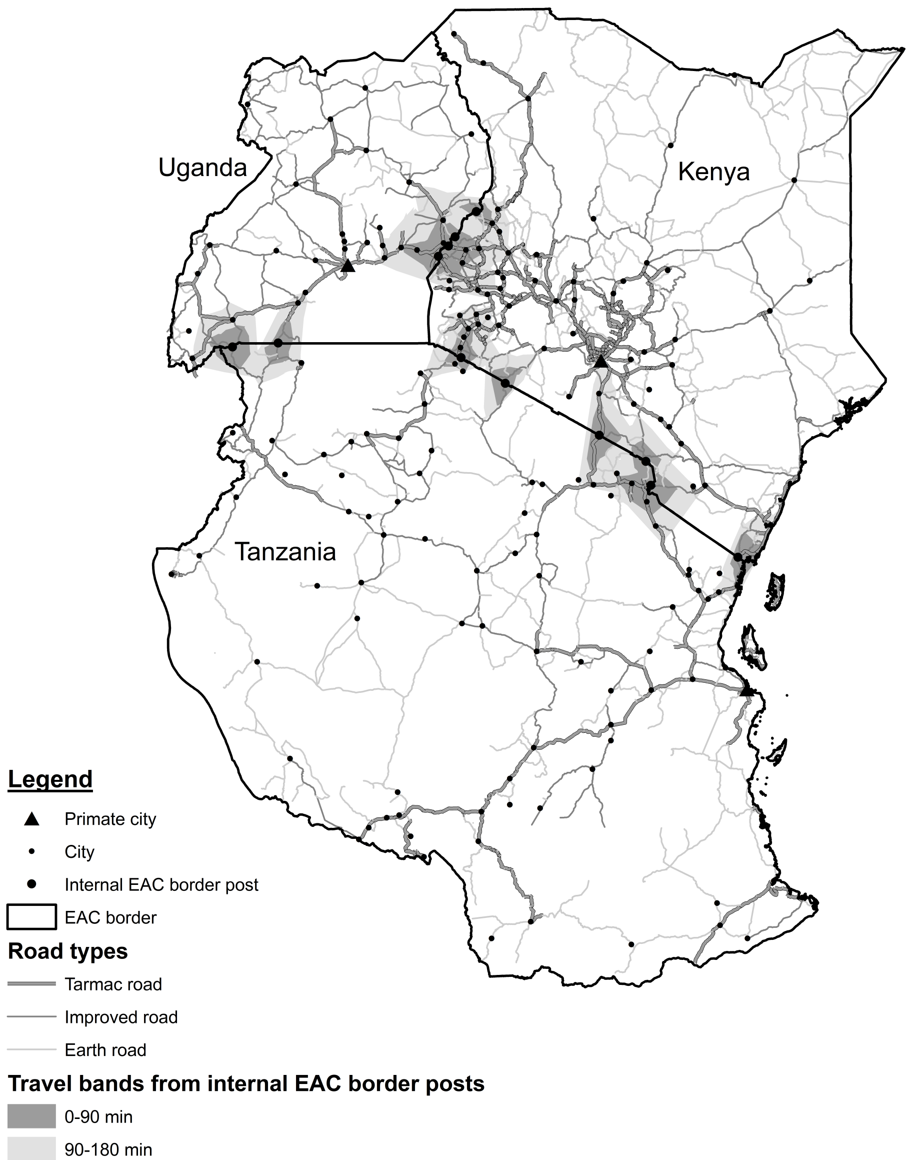
In addition, we account for the cities' market access by constructing two population-based market access indicators.[9] First, we calculate a measure for each city i's access to

[7]The average travel speeds are: 50km/h for tarmac roads, 35km/h for improved roads, and 25km/h for earth roads.

[8]Web Appendix 2 table A1 lists the name and population of each of the 21 cities.

[9]The use of population-based market access indicators to measure the number and size of markets available at low trade cost can be traced back to Harris (1954). More recent studies have shown that population-based market access indicators are a good proxy for more model dependent market access measures derived from

Figure 1: The East African road network and location of cities in the EAC



Notes: This map shows the 1991 road network and the spatial distribution and connectivity of the 180 cities across the East African Community.

the domestic market, which we define as $DMA_i = \sum_{d \neq i}^{D_i} POP_d / e^{\sigma \times travel_{id}}$, where D_i is the total number of domestic cities accessible within the country of city i, POP_d is population of city d and $travel_{id}$ is the network distance between city i and city d (in hours of travel) via the road network of 1991. Second, we establish a measure for each city i's access to the regional market, when assuming frictionless movement across borders. We therefore

formal structural gravity trade models (Donaldson and Hornbeck, 2016; Eaton and Kortum, 2002).

Table 1: Summary Statistics

Variable	Statistic	Kenya EAC Border Regions	Kenya Other Regions	Tanzania EAC Border Regions	Tanzania Other Regions	Uganda EAC Border Regions	Uganda Other Regions
Cities	n	10	53	7	81	4	25
1992 Nightlights	mean	513	2,533	1,450	904	556	1,173
	sd	298	9,471	2,310	2,346	427	3,648
1992 Population	mean	21,960	74,322	22,530	48,526	28,825	59,911
	sd	17,113	301,782	38,304	164,546	21,052	177,069
1992 DMA	mean	2,872,017	2,865,395	1,913,993	1,924,501	1,045,740	1,214,329
	sd	51,002	522,707	346,801	412,621	54,700	200,381
1992 RMP	mean	2,728,595	2,468,985	3,689,651	2,249,626	4,195,850	3,278,941
	sd	93,085	412,426	192,291	732,851	85,973	468,473
Traveltime to nearest EAC border post (hrs)	mean	0.75	6.36	0.54	12.94	0.61	5.28
	sd	0.57	5.57	0.50	8.09	0.53	3.17
Traveltime to primate city (hrs)	mean	8.43	7.20	19.00	17.60	4.11	4.81
	sd	0.49	5.23	8.17	9.13	0.85	3.64
Average annual rainfall (mm)	mean	1,322	829	906	923	1,293	1,036
	sd	240	399	260	168	127	180

Note: The EAC border region is defined as locations within 90 minutes of an internal EAC border crossing; population estimates are based on census data.

refer to this measure as city i's regional market *potential*. We calculate it as $RMP_i = \sum_{f \neq i}^{F_i} POP_f / e^{\sigma \times travel_{if}}$, where F_i is the total number of foreign cities f outside the country of city i, POP_f is population of city f and $travel_{if}$ is the network distance between city i and foreign city f (in hours of travel) via the road network of 1991. For both measures σ is the distance decay parameter. Several structural gravity models show that σ is implicitly defined by $\sigma = \theta \times \gamma$, where θ stands for the trade elasticity measuring the responsiveness of trade to an increase in trade costs (Anderson and van Wincoop, 2003, 2004; Eaton and Kortum, 2002). From the literature we take $\theta = 8.4$.[10] In our case γ represents the average per unit cost of transporting a good for one hour over the East African road network relative to the good's overall value; i.e. $e^{\sigma \times travel_{ij}} - 1$ represents the average ad-valorem tariff equivalent

[10]The preferred estimate for θ in Eaton and Kortum (2002) is 8.28; Donaldson and Hornbeck (2016) estimate a value of $\theta = 8.22$; Caliendo and Parro (2015) find $\theta = 8.64$ across 20 industries.

of transporting a good between city i and city j. Using monthly petrol prices for seven Ugandan cities between 2005 and 2015 we find $\gamma = 0.005$. Hence, $\sigma = 0.042$.[11]

The EAC covers different agro-climatic zones. To account for these differences, we use rainfall data from TAMSAT (Tarnavsky et al., 2014).[12] Specifically, we calculate annual and average rainfall between 1992 and 2013 from each 0.5 grid cell in which the cities fall.

Finally, we use data from the 2002 Uganda Business Register (UBR), which recorded all Ugandan businesses with a physical establishment across all towns and trading centres. A key characteristic of this data is that it also includes micro-enterprises which are typically 'informal' type of businesses. This very rich set of information is only available for Uganda, but it allows us to validate the use of nightlights as a proxy of economic activity and shed some light on the sector composition before and after the establishment of the EAC.

4 Empirical strategy

Our main hypothesis is that regional liberalisation under the EAC caused a trade shock that was larger for cities near an internal EAC border than similar cities further away. We investigate this hypothesis in a difference-in-difference framework using the timing of the EAC and varying treatment intensities across space as our main identification strategy.

Our baseline specification takes the following form, as proposed by Redding and Sturm (2008) and Brülhart (2011):

$$\triangle logNL_{it} = \alpha_0 + \beta Border_i + \gamma(Border_i \times EAC_t) + X_{it}\delta + \theta_{ct} + \varepsilon_{it} \tag{1}$$

where $\triangle logNL_{it}$ is the change in log nightlights NL of city i between year t and $t-1$.[13] $Border_i$ is a dummy variable equal to one, if city i is located within 90 minutes of travel from an internal EAC border point. EAC_t is a dummy variable equal to one for

[11] Web Appendix 3 provides a more detailed account of how trade costs are estimated.
[12] TAMSAT data is available at https://www.tamsat.org.uk.
[13] Nightlights are positive for all cities and years, so that taking the log does not result in missing values.

all years after the EAC was launched in 2001. X_{it} is a vector of control variables that includes time invariant factors such as city i's travel distance to the primate city, log domestic market access $logDMA_i$ and log population, all measured in 1992, average rainfall, and time variant variables such as annual changes in rainfall and domestic market access over time $\triangle logDMA_{it}$. We include country-year fixed effects θ_{ct} to account for country specific time trends. Controling flexibly for time is important, because African countries enjoyed a strong expansion in income and nightlights in the 2000s in general.[14] Identification then comes from changes across space within countries. ε_{it} is the error term. All our standard errors are adjusted for clustering at the city level.

We use growth rates in nightlights $\triangle logNL_{it}$ to better distinguish between the dynamic effects of the EAC that influence the growth rate as opposed to the level. This distinction is particularly important in the case of developing countries where ongoing structural transformation processes could result in differing growth rates of cities within the same country. Capturing this distinction in a difference-in-difference set-up is not straightforward (Baum-Snow and Lutz, 2011; Lee and Solon, 2011; Wolfers, 2006). An alternative option would be to test the impact of the EAC using a levels specification in nightlights that controls for group or city specific trends. However, as Meer and West (2015) demonstrated, the problem with such an approach is that, if the true impact of a change in policy is gradual and spread over several periods, the inclusion of city specific time trends will mechanically attenuate estimates of the policy impact. Moreover, it will lead to an underestimation of the true impact, if the policy affects not only the level but also the growth rate of the response variable.

Specification (1) allows us to examine whether the launch of the EAC induced a change in the growth performance of cities near an internal EAC border (our treatment group) relative to cities further away from the border (our control group). Our main coefficient of interest is γ, which we expect to be positive reflecting a higher growth impact of the EAC

[14] The nightlights data is constructed using imagery from satellite F10 for the years 1992-94, F12 for 1995-1997, F14 for 1998-00, F15 for 2001-03, F16 for 2004-09, and F18 2010-13. There may be systematic differences in measuring nightlight emissions across satellites. This also warrants the inclusion of year fixed effects.

on cities near the border induced by the relative proximity of the EAC market. β accounts for any systematic differences in the growth rates between border and control cities in the pre-EAC era between 1993 and 2000. In a fully matured city system, β is likely to be zero. In our case, however, the city systems undergo a structural transformation process in which agriculture accounts for a declining share of total output inducing rural-urban reallocation of labour.[15] Henderson et al. (2016) show that due to urban scale economies this process tends to favor existing urban agglomerations with little city development in the agricultural hinterland. If these periphery effects also prevailed in the case of the EAC, β would have to be negative.

The disadvantage of using the growth specification in (1) is that it imposes a strong assumption about the nature of the dynamics of the treatment effect, as it does not allow γ to vary over time. In other words, it does not allow to distinguish whether the treatment impact stems from a levels effect, a growth effect, or both. If, for instance, the treatment effect only stems from a levels effect in the early years of the policy the size of γ would decline the longer the post-treatment period. We therefore augment specification 1 allowing γ to vary over time:

$$\begin{aligned}\triangle logNL_{it} &= \alpha_0 + \beta Border_i + \gamma_1(Border_i \times EAC_{01-04}) + \gamma_2(Border_i \times EAC_{05-09}) \\ &\quad + \gamma_3(Border_i \times EAC_{10-13}) + X_{it}\delta + \theta_{ct} + \varepsilon_{it}\end{aligned} \quad (2)$$

EAC_{01-04}, EAC_{05-09} and EAC_{10-13} are dummy variables equal to one in years 2001 to 2004, 2005 to 2009, and 2010 to 2013, respectively. Specification (2) considers the three main phases of the EAC to date, i.e. (i) the pre customs union years from 2001 to 2004, (ii) the post customs union years from 2005 to 2009, (iii) and the years following the end of the transitionary arrangement of customs union and the adoption of a common market

[15] Between 1991-2000, average agricultural output as a share of GDP amounted to 31% in Kenya, 43% in Tanzania and 45% in Uganda (World Bank, 2015). For the period 2001-2010 these shares had fallen to 26%, 31%, and 26% respectively.

protocol in 2010. By comparing the relative sizes of γ_1, γ_2, and γ_3 we are able to shed light on the dynamics of the treatment effect and whether there is a change in the long-run trend or merely a levels effect.

First-differencing nightlights addresses time-invariant unobservables that affect the level of nightlights. However, there may be unobservables affecting the change in nightlights. Hence, we also estimate equations (1) and (2) with city fixed effects. Including city fixed effects, however, does not permit the estimation of β - nightlights growth before the EAC. This compromises our ability to interpret the results in terms of the EAC's impact on the overall distribution of economic activities. We therefore rely on estimation without city fixed effects for the interpretation of most of our results, and validate them against a specification with city fixed effects to ensure that results are not driven by any city-specific unobservables affecting the change in log nightlights.

We then augment our baseline specifications in equations (1) and (2) to allow for heterogeneity in the treatment effect. First, we investigate how the treatment effect varies as one moves away from the border. The gains in market access should be larger for cities closer to the EAC border. Hence, we expect city growth to decline with distance to the EAC border. Second, we examine city size. As argued by Redding and Sturm (2008), the larger home market of larger cities makes them less reliant on trade with other cities. We thus test whether the size of the treatment effect γ decreases with city size. Third, we investigate whether varying levels of regional market potential constitute different treatment intensities within the treatment group. Fourth, we compare whether the results hold for each country separately. Analogous to the expected impact of different city sizes, we predict cities in countries with a larger home market (i.e. Kenya) to be less reliant on cross-border trade resulting in a smaller treatment effect.

We use several identification strategies. First, we use placebo leads. Second, we apply falsification tests. Third, we apply a matching strategy.

5 The spatial impact of the East African Community

5.1 Main results

Our baseline estimation results are reported in Table 2. Column 1 provides a parsimoneous estimation of equation 1 excluding all control variables except country-year fixed effects, which are important to absorb the general increase in nightlights in the 2000s. Column 2 includes market access and rainfall controls. In column 3 we include city fixed effects. The different specifications make little difference. In all three estimations the treatment effect γ is positive and significant. After the establishment of the EAC, cities in border regions outgrew cities in interior regions by 1.2-1.6 percentage points, relative to their respective pre-EAC growth rates. This indicates that the establishment of the EAC had a strong local effect on economic activities in cities near the border. The pre-treatment effect β is negative and remains significant even after controlling for a range of market access variables. This suggests that without regional integration there existed a periphery effect in border regions.

Columns 4 to 6 of table 2 shed more light on the dynamics of the treatment effect over time, in line with specification (2). Between 2001 and 2004 the treatment effect amounted to 3 percentage points per annum. Considering that EAC border cities were underperforming before 2001, they catch up during the 2001-04 period, growing then at about a 2 percentage points faster rate than non-border cities (column (4) and column (5)). After the initial four-year period, however, the growth rate declined in magnitude. While the coefficients for the post-2004 periods are positive and roughly of a size that cancels the negative pre-treatment trend of border cities, they are not significantly differently from zero. Thus, overall, following the launch of the EAC cities near an internal EAC border experienced a levels effect rather than a growth effect.

Table 2: Baseline results - The spatial impact of the EAC on city growth

Variables	(1)	(2)	(3)	(4)	(5)	(6)
Border	-0.011***	-0.010**		-0.011***	-0.010**	
	(0.004)	(0.004)		(0.004)	(0.004)	
Border x EAC 01-13	0.012*	0.013**	0.016**			
	(0.006)	(0.006)	(0.007)			
Border x EAC 01-04				0.028***	0.029***	0.030***
				(0.009)	(0.009)	(0.009)
Border x EAC 05-09				0.002	0.004	0.007
				(0.006)	(0.006)	(0.006)
Border x EAC 10-13				0.007	0.009	0.011
				(0.008)	(0.008)	(0.009)
Market access controls	NO	YES	YES	NO	YES	YES
Rainfall controls	NO	YES	YES	NO	YES	YES
Country-year FE	YES	YES	YES	YES	YES	YES
City FE	NO	NO	YES	NO	NO	YES
Observations	3,780	3,780	3,780	3,780	3,780	3,780

Notes: Data based on a panel of 180 cities in Kenya, Tanzania, and Uganda from 1992-2013. The dependent variable is the annual change in log nightlights. Border is a dummy variable taking the value 1 for a city within 1.5 hours travel distance of an internal EAC border crossing. EAC 01-13, 01-04, 05-09 and 10-13 is a dummy variable taking the value 1 for the post-EAC years 2001-13, 2001-04, 2005-09 and 2010-13 respectively. Market access controls include log population in 1992, log domestic market access (DMA) in 1992, the annual change in $logDMA$, and travel time to the primate city (in 10h). Rainfall controls include average rainfall 1992-2013 as well as yearly changes. Robust standard errors adjusted for clustering at the city level in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% respectively.

5.2 Identification

A common pitfall in identifying the effect of a policy intervention stems from anticipation effects that may cause a response before the policy actually takes effect, thus compromising the identification of the treatment effect. For instance, an expectation of lower customs duties or prices could lead market participants to delay investment or consumption decisions in the years prior to the agreement. First, the context of the establishment of the EAC suggests that this is less of a concern. Second, when we include placebo leads for the years 2000 and 1999, as in table 3, we do not find evidence for a significant decline in nightlights growth rates among treatment cities in the years before the establishment of the EAC. Meanwhile, the strongly positive and significant treatment lags for the years 2001 and 2002 confirm our main result of a strong but temporary impact of the EAC on cities near the border.

Table 3: Placebo leads and treatment lags

Variables	(1)	(2)
Border	-0.008 (0.005)	
Placebo leads		
Border x EAC 99	-0.004 (0.022)	-0.005 (0.022)
Border x EAC 00	-0.015 (0.017)	-0.015 (0.018)
Treatment lags		
Border x EAC 01	0.032** (0.014)	0.031** (0.015)
Border x EAC 02	0.035** (0.017)	0.035* (0.018)
Border x EAC 03	0.014 (0.020)	0.017 (0.020)
Border x EAC 04	0.026 (0.020)	0.029 (0.021)
Border x EAC 05-09	0.002 (0.007)	0.004 (0.007)
Border x EAC 10-13	0.006 (0.009)	0.009 (0.010)
Rainfall controls	YES	YES
Country-year FE	YES	YES
City FE	NO	YES
Observations	3,780	3,780

Notes: Data based on a panel of 180 cities in Kenya, Tanzania, and Uganda from 1992-2013. The dependent variable is the annual change in log nightlights. Border is a dummy variable taking the value 1 for a city within 1.5 hours travel distance of an internal EAC border crossing. Market access controls include log population in 1992, log domestic market access (DMA) in 1992, the annual change in $logDMA$, and travel time to the primate city (in 10h). Rainfall controls include average rainfall 1992-2013 as well as yearly changes. Robust standard errors adjusted for clustering at the city level in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% respectively.

We conduct a falsification test examining whether cities at the EAC's *external* border responded to the launch of the EAC in a similar way. We find that cities located within a 90 minutes travel band from the EAC's external borders did not experience a break in their pre-EAC trend (Web Appendix 2, Table A2). Unfortunately, the context of the external border cities does not allow us to put much weight on this finding. Several armed conflicts were taking place in the neighboring countries (e.g. Burundi, Democratic Republic of Congo and in the territory of today's South Sudan) during the 1990s and early 2000s, which led to the establishment of several refugee camps close to the EAC's external borders. This may have contributed to different patterns in economic activity (Alix-Garcia et al., 2018). As indicated by Web Appendix 2 Table A2, cities close to the EAC's external border do not share a negative pre-treatment trend but growth rates of these cities fell behind the other cities post 2005, coinciding with the end of the majority of conflicts during the second half of the 2000s.[16]

We then match each of the 21 treatment cities with one control city so that both are located within the same country, and share similar characteristics in terms of their average annual rainfall levels, 1992 nightlights, population, domestic market access, and distance to the primate city.[17] Table 4 reports the results when we re-estimate our baseline equation (2) using matched cities. Matching strongly reduces the number of observations. Yet, the overall growth impact on cities near the border is only marginally lower than in table 2, column 5 and remains significant at the 5% level. This is further evidence that differences in city characteristics are not driving our results and that cities near the border experienced a strong but temporary increase in local economic activity due to their better access to the EAC market.

[16]In Burundi a 12-year civil conflict ended in 2005 with the holding of the country's first multi-party elections. The South Sudanese civil war also ended in 2005 with the signing of a peace agreement. The DRC signed peace agreements in 2002 and 2009, both resulting in a decline of armed activity in the eastern parts of the country.

[17]Matching is performed by applying the Mahalanobis metric, which minimizes the squared difference in these characteristics between treated and paired control city.

Table 4: Nearest Neighbour Matching

Variables	(1)	(2)
Border	-0.008 (0.006)	
Border x EAC 01-04	0.029** (0.013)	0.029** (0.013)
Border x EAC 05-09	-0.005 (0.010)	-0.005 (0.011)
Border x EAC 10-13	-0.000 (0.013)	-0.001 (0.013)
Market access controls	YES	YES
Rainfall controls	YES	YES
Country-year FE	YES	YES
City FE	NO	YES
Observations	882	882

Notes: Data based on a panel of 180 cities in Kenya, Tanzania, and Uganda from 1992-2013. The dependent variable is the annual change in log nightlights. Border is a dummy variable taking the value 1 for a city within 1.5 hours travel distance of an internal EAC border crossing. Matched by country, 1992 population, 1992 domestic market access, 1992 nightlights, travel time to the primate city (in 10h), and average annual rainfall between 1992-2013. Market access controls include log population in 1992, log domestic market access (DMA) in 1992, the annual change in $logDMA$, and travel time to the primate city (in 10h). Rainfall controls include average rainfall 1992-2013 as well as yearly changes. Robust standard errors adjusted for clustering at the city level in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% respectively. Robust standard errors adjusted for clustering at the city level in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% respectively.

5.3 Additional results

Table 5 presents results of an augmented specification allowing for heterogeneity in the treatment across space, city size and regional market potential. For the sake of simplicity we focus on the early years of the EAC between 2001 and 2004, for which we found strong border effects. We first investigate how the EAC impact varies with distance to the border. To this end, we include four dummy variables representing the distance bands 0-45 min, 45-90 min, 90-135 min and 135-180 min. In column 1, the EAC effect decreases in size the further away a city is located from the border, becoming insignificant beyond 90 minutes of travel time to the border. Therefore, we find that the EAC effect is highly localized, limited to a few cities close to the border.

In column 2 of table 5 we examine whether the impact of the EAC varies with city size. We establish three treatment categories - large, medium and small - depending on whether the city falls into the bottom, medium or top 1992 population tertile among the 21 treatment cities. In line with Redding and Sturm (2008) and Brülhart et al. (2015), we find that, within the treatment group, the EAC had a larger growth impact on the smaller cities close to the border: Small treatment group cities experienced an almost two times larger growth impact than large treatment group cities.

In column 3 of table 5 we shed further light on how the effect varied with treatment intensity. Specifically, we investigate whether the EAC had a stronger impact on those cities that gained a larger market after the establishment of the regional bloc, by dividing the sample of 21 treatment cities into three tertiles of high, medium, and low regional market potential (RMP). The results show that the treatment effect increases with regional market access. With the start of the EAC, treatment cities that had a large and medium regional market potential experienced a 4 percentage points larger annual growth impulse in the first four years of the EAC than treatment cities with a small regional market potential.

Finally, we check for heterogeneity in responses across countries re-estimating equation 2 for each country separately. Results are reported in Web Appendix 2 table A3. We find that the treatment effect is largest for Uganda, followed by Tanzania and then Kenya. However, when using the border cities' own pre-treatment growth rates as reference, the effects are very similar across the countries.

Table 5: Augmented baseline results - Heterogeneity across space and cities

Variables	(1)	(2)	(3)
City < 45min to border x EAC 01-04	0.044***		
	(0.012)		
City 45-90min to border x EAC 01-04	0.022*		
	(0.013)		
City 90-135min to border x EAC 01-04	0.012		
	(0.010)		
City 135-180min to border x EAC 01-04	0.010		
	(0.010)		
Small City < 90min to border x EAC 01-04		0.040***	
		(0.013)	
Medium City < 90min to border x EAC 01-04		0.030*	
		(0.016)	
Large City < 90min to border x EAC 01-04		0.021	
		(0.017)	
City with small RMP < 90min to border x EAC 01-04			0.004
			(0.013)
City with medium RMP < 90min to border x EAC 01-04			0.041**
			(0.019)
City with large RMP < 90min to border x EAC 01-04			0.045***
			(0.010)
4 distance bands FE x 2005-2009	YES		
4 distance bands FE x 2010-2013	YES		
Border city size tertiles FE x 2005-2009		YES	
Border city size tertiles FE x 2010-2013		YES	
Border city RMP tertiles FE x 2005-2009			YES
Border city RMP tertiles FE x 2010-2013			YES
Domestic market access controls	YES	YES	YES
Rainfall controls	YES	YES	YES
Country-year FE	YES	YES	YES
City FE	YES	YES	YES
Observations	3,780	3,780	3,780

Notes: Data based on a panel of 180 cities in Kenya, Tanzania, and Uganda from 1992-2013. The dependent variable is the annual change in log nightlights. Small, medium, and large towns are defined according to 1992 population tertiles. Small, medium, and large regional market potential are defined according to 1992 regional market potential (RMP) tertiles. Market access controls include log population in 1992, log domestic market access (DMA) in 1992, the annual change in $logDMA$, and travel time to the primate city (in 10h). Rainfall controls include average rainfall 1992-2013 as well as yearly changes. Robust standard errors adjusted for clustering at the city level in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% respectively.

5.4 Robustness checks

Our main results suggest that the establishment of the EAC had a strong localized impact on cities near the border, but that this effect dissipated over time. In order to assess the robustness of these results, we carry out a series of additional tests. All results are reported in Web Appendix 2.

We investigate the sensitivity of our results with respect to our choice of specification using growth in nightlights. To this end we repeat our baseline specification but use nightlight in levels rather than changes, and control for different trends between treatment and control cities. However, we are aware of the fact that the gradual impact of the EAC implies that the inclusion of a trend would attenuate our results, as demonstrated by Meer and West (2015). Hence, we estimate the impact of the EAC using the levels of log nightlights every fourth year between 1992 and 2004 as the dependent variable (i.e. 1992, 1996, 2000, 2004, 2008, 2012). This allows us to abstract form the gradualism in the impact observed between 2001 and 2004. The results are reported in Table A4 and are in line with our main specification. The trend variable is negative and highly significant, suggesting that before the EAC the level of nightlights in treatment cities shrunk by 5.4% every four years relative control cities. In the first four years after the establishment of the EAC, treatment cities then experienced a 13.0% increase in nightlights relative to the pre-EAC trend. Consequently the level of nightlights in treatment grew by around 6.8% relative to control cities over the first four years of the EAC. This implies that, on average, cities in border regions outgrew cities in interior regions by just under 2% annually, which is in line with results presented in table 2 (columns 4 to 6).

Finally, we account for the possibility of spatial auto-correlation, both over time and across cities, using Conley standard errors as proposed in Conley (1999). Table A5 reports regression results for our baseline specification using Conley standard errors with different distance thresholds. Standard errors are somewhat higher, yet our inferences remain unchanged.

6 Local vs regional effects of regional market integration

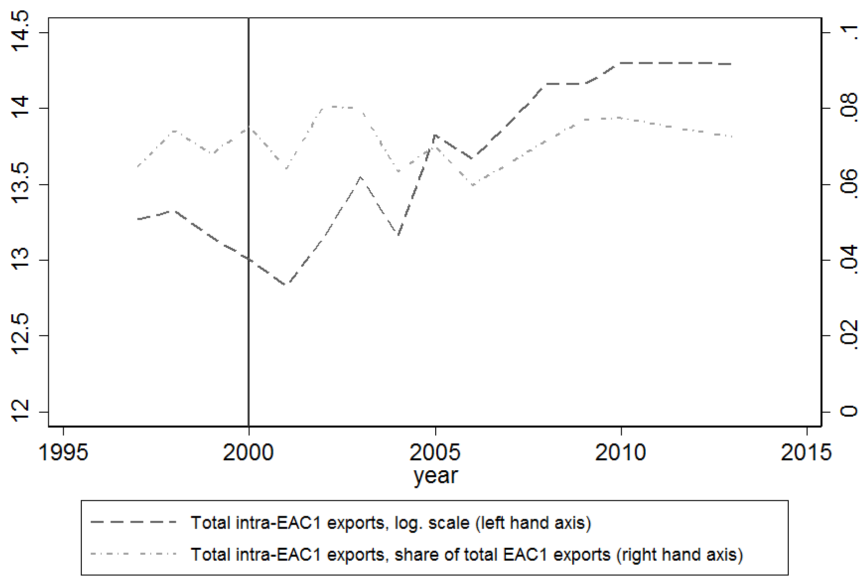
Our main finding implies that the EAC had a disproportionate positive impact on cities closer to the internal borders between Kenya, Tanzania and Uganda relative to cities further inland. Yet, why was it so locally concentrated in border regions and did not affect cities further inland? How much of the EAC effect can be explained by increased market access, locally and regionally? Where did the increase in local economic activity in the EAC's internal border regions come from? This section discusses these questions and shows that our results are consistent with the EAC having had a greater impact on local small-scale trade rather than on regional large-scale trade.

6.1 Regional trade in the EAC

According to the available, official trade data from UN Commtrade, the launch of the EAC did not leave a marked imprint on regional trade flows. While intra-EAC exports were increasing, trade with non-EAC countries did so too, so that the share of intra-EAC exports to total exports remained relatively stagnant between 1997 and 2013, at around 7%, as illustrated in figure 2. However, a large share of cross-border trade does not involve formal firms but informal traders who seek to sell their produce in nearby markets across the border. This type of trade is often omitted in official trade statistics as it is unorganized, small-scale, and not recorded by customs authorities (World Bank, 2012b; World Bank and World Trade Organization, 2015).

Among the EAC countries, only Uganda conducts regular surveys to measure the extent of local trade. Between 2005 and 2013, as much as 20% of total Ugandan trade (i.e. imports plus exports) with Kenya and Tanzania occurred in this way. It is important to note that none of this local trade between Uganda and its neighbors constitutes smuggling, as it occurs in broad daylight, across official border posts, and does not seek to evade government agencies (Uganda Bureau of Statistics, 2009; Titeca and Kimanuka, 2012; Uganda Bureau of Statistics, 2014). Moreover, local cross-border trade is not frictionless. While small-scale traders do not comply with costly technical requirements, sanitary standards, and/or rules of origin regulations that affect formal trade flows, they do have to pay for taxes and costums duties, which are often settled informally when crossing the border.[18] This implies that formal and informal cross-border trade take place side-by-side but constitute distinct trade modalities facing a different set of cost, upon which the establishment of the EAC may have had an uneven impact.[19] We now turn to a more formal discussion of this hypothesis.

Figure 2: Total intra-EAC exports



Notes: Graph based on Commtrade data, showing the total value of intra-EAC exports between Kenya, Tanzania and Uganda expressed in logs (left axis) as well as ratio of intra-EAC exports to total exports (right axis).

[18]In a 2007 survey of 350 informal traders undertaken in Uganda the payment of taxes and customs duties was stated as the most important constraint for small-scale informal traders (Uganda Bureau of Statistics, 2009).

[19]This was confirmed in a series of interviews with representatives of the Ugandan authorities and the private sector conducted during two field visits in 2016. Interview transcripts can be availed upon request from the authors.

6.2 Theoretical framework for local vs regional market access shocks

Three major results emerge from our empirical analysis. First, only cities located near the border were affected by the establishment of the EAC. Second, among cities near the border, those with a smaller home market – as proxied by city population – experienced a larger increase in their nightlights growth rate. Third, the impact of the EAC was highest for those cities in border regions with a high regional market potential. These effects combined suggest that the impact of the establishment of the EAC materialised in form of a market access shock to cities close to the border. But why did it not affect cities further inland? The impact of a market access shock would indeed be expected to decline with distance to the border, as transport costs drive a wedge in the incidence of the shock between cities. Yet the fact that it is spatially concentrated on a relatively narrow travel distance band from the border raises the question whether it is transport costs alone that can explain the spatial pattern we find. Another possible channel for the spatial asymmetry in the incidence of the shock, is that the establishment of the EAC impinged more heavily on local small-scale cross-border trade and less on large scale region-wide trade. In this section we endeavour to examine this more formally.

Our point of departure is a widely used structural gravity set-up (Eaton and Kortum, 2002; Anderson and van Wincoop, 2003; Redding and Venables, 2004) which establishes total production Q in city i as a function of city i's state of technology k_i and its market access MA_i:

$$Q_i = k_i \times MA_i = k_i \times \sum_{n=1}^{N} \frac{X_n}{P_n^{-\theta}} \times \tau_{in}^{-\theta} \tag{3}$$

where X_n stands for total expenditure in market n and P_n is a price index, measuring the availability of cheap products in market n.[20] $\frac{X_n}{P_n^{-\theta}}$ thus defines the market opportunities

[20] The inverse price index $P_n^{-\theta}$ has also been referred to as Consumer Market Access (CMA), which can be represented as the weighted sum of productivity-adjusted cost of production in all origin markets that could supply market n, where weights decline with the cost of trading between origin markets and market n (Redding and Venables, 2004; Donaldson and Hornbeck, 2016).

available to city i at a destination n, and MA_i represents the sum of all market opportunities across N cities (including city i's own market), weighted by iceberg cost incurred in travelling from city i to destination city n, $\tau_{in} > 1$, where θ stands for the trade elasticity measuring the extent to which trade declines with increasing cost of trade. In our case, we use the population in each city as a proxy for market opportunities $\frac{X_n}{P_n^{-\theta}}$, as population has been shown to be highly correlated with more model dependent measures of $\frac{X_n}{P_n^{-\theta}}$ (Donaldson and Hornbeck, 2016; Baum-Snow et al., 2017). In line with our definitions of domestic market access (DMA_i) and regional market potential (RMP_i), we measure each city i's total market access as:

$$MA_i = POP_i + \underbrace{\sum_{d \neq i}^{D_i} \frac{POP_d}{e^{\theta \times \gamma travel_{id}}}}_{DMA_i} + \frac{1}{e^{\theta \times \beta_i}} \times \underbrace{\sum_{f \neq i}^{F_i} \frac{POP_f}{e^{\theta \times \gamma travel_{if}}}}_{RMP_i} = \sum_{n=1}^{N=180} \frac{POP_n}{\tau_{in}^{\theta}} \tag{4}$$

Equation 4 defines each city i's market access as the weighted sum of the population of all 180 cities in our sample, where the weight depends on the cost of trading between i and each possible city pair n, τ_{in}, and the trade elasticity θ. Given that our sample includes cities in different countries, we allow τ_{in} to vary depending on whether it involves crossing a border or not. The cost of trading between any city pair is thus defined as $\tau_{in} = e^{\gamma travel_{in}}$, when no border-crossing is involved, and $\tau_{in} = e^{\gamma travel_{in} + \beta_i}$, when there is. In line with our previous analysis, $travel_{in}$ stands for travel time between city i and city n, while $e^{\gamma} - 1$ defines the ad-valorem tariff equivalent of an additional hour of travel. The ad-valorem costs of crossing the border are given by $e^{\beta_i} - 1$.

A useful rearrangement of equation 4 is to express total market access in terms of city i's exposure to the regional market relative to the domestic market:

$$MA_i = \frac{1}{e^{\omega_i \times \theta \times \beta_i}} \times \sum_{n=1}^{N=180} \frac{POP_n}{e^{\gamma \theta \times travel_{in}}} \quad where \quad \omega_i = \frac{RMP_i}{POP_i + DMA_i + RMP_i} \tag{5}$$

The parameter ω_i is crucial in what follows. It measures city i's proportion of foreign to total market access at zero border-crossing costs, and defines each city i's exposure to the EAC by merging its own market size, its access to nearby domestic markets, and its access to more distant regional markets into one single metric.

Another important feature in our set-up is that we assume costs of crossing the border (β_i) to vary by city. We do so to capture differences in the two distinct set of cross-border trade modalities prevalent in East Africa: large-scale long-distance trade versus small-scale local trade. Traders face a trade-off when choosing between these modalities. While large-scale trade allows for containerization and takes advantage of scale economies minimizing per unit cost of transport, it typically comes at the expense of high border crossing costs due to the existence of tariffs and non-tariff measures.[21] When trading in small quantities, however, formal tariff and regulatory barriers are likely to play a much smaller role, particularly in countries where customs authorities are weak. Instead, small-scale traders face a different set of costs due to the existence of informal barriers to trade (e.g. petty corruption at the border, insecurity, regulatory uncertainty, etc.) and the much higher per unit transport cost associated when trading in small quantities. Therefore, which cross-border trade modality is used depends on whether the lower per unit transport cost from large-scale trade outweighs the higher costs of crossing the border when having to comply with formal customs requirements; a condition that is more likely met when traded goods have to travel long distances. Consequently, the proportion of small-scale traded goods in each city i should be strictly decreasing with distance to the border, eventually falling to zero after a certain threshold. Without loss of generality, we thus define the following threshold function for city i's cost of crossing the border:

$$\beta_i = \begin{cases} \alpha_i \beta^S + (1-\alpha_i)\beta^L & if \quad dist_i \leq \widetilde{dist} \\ \beta^L & if \quad dist_i > \widetilde{dist} \end{cases} \tag{6}$$

Equation 6 defines β_i as a function of a threshold value $\widetilde{dist}$, i.e. the distance to the border

[21] Note that such costs can be large even when free trade agreements or a customs union are in place.

beyond which trade in small quantities becomes too costly relative to large-scale trade. When the distance between city i and the nearest border surpasses the value of $\widetilde{dist}$, β_i is equal to the cost of large scale cross-border cost, which we define as β^L. However, when a city falls within the distance threshold of $\widetilde{dist}$, the cost of trading from city i is given by a weighted average of small-scale (β^S) and large-scale (β^L) border crossing costs. The weight is defined by $0 < \alpha_i \leq 1$, where α_i stands for the share of goods of city i that are traded in small quantities and is assumed to be declining in city i's distance to the nearest border $dist_i$, i.e. $\partial\alpha/\partial dist < 0$ for values of $dist_i < \widetilde{dist}$.

Combining equation 4, 5 and 6 we attain the following expression for the increase in production after the establishment of the EAC:

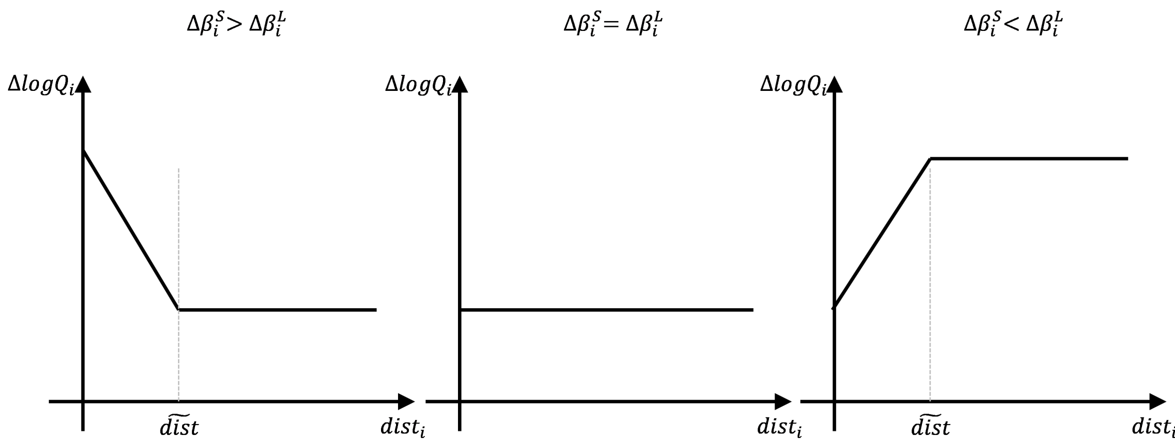
$$\frac{Q_{i,postEAC}}{Q_{i,preEAC}} = \begin{cases} e^{\omega_i \theta[\alpha_i \triangle\beta^S_{i,EAC} + (1-\alpha_i)\triangle\beta^L_{i,EAC}]} & if \qquad dist_i \leq \widetilde{dist} \\ e^{\omega_i \theta \triangle\beta^L_{i,EAC}} & if \qquad dist_i > \widetilde{dist} \end{cases} \tag{7}$$

Equation 7 establishes that city i's relative increase in production due to the formation of the EAC rests on three factors. First, it depends on the size of ω_i, i.e. city i's exposure to the regional market across the EAC. Second, it depends on the relative decline in the cost of crossing the border for small-scale ($\triangle\beta^S_{i,EAC}$) vis-a-vis large-scale ($\triangle\beta^L_{i,EAC}$) trade. Third, it depends on the location of city i relative to the distance threshold $\widetilde{dist}$.

Equation 7 predicts that, conditional on a constant exposure to the EAC (ω_i), cities located near the border (i.e. where $dist_i \leq \widetilde{dist}$) would experience a higher increase in Q_i than cities further away (i.e. where $dist_i > \widetilde{dist}$). On the contrary, if the reduction in costs were to be larger on border-crossing costs for large scale traders than for small-scale traders, the EAC impact would be larger for cities far away from the border. In figure 3 we illustrate these different scenarios after taking logs of equation 7. As shown, the growth impact of the EAC varies in very distinct ways with distance to the border, depending on which type of trade modality experiences a stronger reduction in costs. For $\triangle\beta^S_{i,EAC} > \triangle\beta^L_{i,EAC}$, the impact of the EAC declines with distance to the border until threshold $\widetilde{dist}$ due to $\partial\alpha/\partial dist < 0$.

Beyond this point, a city's distance to the border does not lead to an additional decline in the EAC impact and changes in log production of city i would only occur due to a city's exposure to the EAC market (ω_i), which is held constant in figure 3. The opposite is true for $\triangle\beta^S_{i,EAC} < \triangle\beta^L_{i,EAC}$, where the EAC impact on city i's production is increasing with distance to the border until $\widetilde{dist}$, after which it remains constant. Finally for $\triangle\beta^S_{i,EAC} = \triangle\beta^L_{i,EAC}$ distance to the border does not matter for the EAC impact; changes in Q_i would be entirely explained by differences in ω_i.

Figure 3: EAC growth impact with distance to border



Notes: This figure illustrates how the change in city i's log production varies with city i's distance to the border when the establishment of the EAC causes different cost reductions in border crossings for small-scale and large-scale trading modalities $\triangle\beta^S_{i,EAC}$ and $\triangle\beta^L_{i,EAC}$, respectively. All other factors are held constant.

6.3 Revisiting the empirical analysis

From our results in section 5, we know that the establishment of the EAC resulted in higher growth for cities in border regions but not for cities located beyond a 90 minutes travel band from the border. This corresponds well with the scenario demonstrated on the left hand panel of figure 3, where cost for local small-scale trade fell more strongly than for large-scale long-distance trade (i.e. $\triangle\beta^S_{i,EAC} > \triangle\beta^L_{i,EAC}$) with a threshold value of $\widetilde{dist} \approx 90min$. We can test this empirically using nightlights as our measure of production in city i. The following empirical specification is a corollary to equation 7 expressed in logs:

$$\begin{gathered} logNL_{i,postEAC} - logNL_{i,preEAC} = \eta_0 + \eta_1\omega_i + \eta_2(\omega_i \times Border_i) + \epsilon_i \\ with \\ \eta_1 = \theta \triangle \beta^L_{i,EAC} \\ \eta_1 + \eta_2 = \theta[\alpha_i \triangle \beta^S_{i,EAC} + (1-\alpha_i) \triangle \beta^L_{i,EAC}] \end{gathered} \tag{8}$$

and where $Border_i$ is a binary variable equal to one when $dist_i \leq \widetilde{dist}$. Specification 8 would test whether differences in exposure to the regional market, as proxied by ω_i, explain changes in log nightlights across cities after the establishment of the EAC, and whether a structural break in this relationship takes place when $dist_i \leq \widetilde{dist}$. Our premise is that the establishment of the EAC led to a reduction in the cost of crossing the border but that this reduction was stronger for small-scale traders. This would require finding both a significant and positive η_2. We implement a very similar version of specification 8 but adapt it slightly to our multi-period empirical set-up:

$$\begin{gathered} \triangle logNL_{it} = \eta_1(\omega_i \times EAC_{01-04}) + \eta_2(\omega_i \times EAC_t \times Border_i) \\ +X_{it}\delta + city_i + \varphi_{ct} + \epsilon_{it} \end{gathered} \tag{9}$$

Equation 9 builds on the same difference-in-difference approach as before. We only focus on the 2001-04 period, for which we found the strongest growth effect. Our coefficients of interest are η_1 and η_2. η_1 measures whether cities with a high ω_i grew faster in the first four years of the EAC relative to the pre-EAC period. η_2 tests whether this impact of ω_i was significantly stronger or weaker for cities located in border regions ($Border_i = 1$), defined as within 90 minutes travel distance to the border as before. We calculate ω_i based on 1992 population levels, to abstract from potential endogeneity problems. ω_i also depends on the assumed value for the decay parameter $\gamma\theta$. We use a value of 8.4 for θ, as this is in line with the literature. We set γ to 0.005, an estimate we derive from monthly petrol prices for seven Ugandan cities between 2005 and 2015.[22] Lastly, we include controls for changes in log domestic market access over time and annual rainfall estimates for each city, and account for city fixed effects $city_i$ and country-year fixed effects φ_{ct}. ϵ_{it} is the error term.

Table 6: The EAC - A local market access shock

Variables	(1)	(2)	(3)
$\omega \times EAC_{01-04}$	0.039 (0.061)	0.023 (0.063)	0.035 (0.061)
$\omega \times EAC_{01-04} \times Border0-90min$	0.050*** (0.015)		0.146** (0.074)
$\omega \times EAC_{01-04} \times Border0-45min$		0.065*** (0.020)	
$\omega \times EAC_{01-04} \times Border45-90min$		0.044** (0.022)	
$\omega \times EAC_{01-04} \times Border90-135min$		0.018 (0.018)	
$\omega \times EAC_{01-04} \times Border135-180min$		0.014 (0.017)	
$EAC_{01-04} \times Border0-90min$			-0.059 (0.047)
Market access controls	YES	YES	YES
Rainfall controls	YES	YES	YES
Country-year FE	YES	YES	YES
City FE	YES	YES	YES
Observations	2,160	2,160	2,160

Notes: Data based on a panel of 180 cities in Kenya, Tanzania, and Uganda from 1992-2004. The dependent variable is the annual change in log nightlights. ω measures the exposure of each city to the regional market based on a decay parameters of $\gamma\theta$=0.042. EAC 01-04 is a dummy variable taking the value 1 for the post-EAC years 2001-04. Robust standard errors adjusted for clustering at the city level in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% respectively.

We report results for specification 9 in column 1 of table 6. We find very strong evidence for the existence of a structural break in the relationship between regional market exposure and city growth after the establishment of the EAC. The same increase in ω is associated with over twice as large a growth response for cities in border regions than for cities further away. In fact, albeit positive, ω is not significantly associated with higher post EAC growth

[22] See Web Appendix for a more detailed discussion of data sources and construction.

outside the 90 minutes travel band that defines our border regions. This is consistent with a stronger reduction in border-crossing cost for small-scale trade but not for large-scale trade, i.e. when $\triangle\beta^S_{i,EAC} > \triangle\beta^L_{i,EAC}$. We shed further light on this in column 2, where we allow the impact of ω to vary with distance to the border. The growth impact of a high regional market exposure decreases monotonically the further cities are located from the border becoming insignificant after 90 minutes of travel time to the border, which suggests that $\widetilde{dist} \approx 90min$ is correct. Furthermore, this result is exactly in line with the predictions of our theoretical set-up when $\triangle\beta^S_{i,EAC} > \triangle\beta^L_{i,EAC}$, which established that for $dist < \widetilde{dist}$ the impact of ω would be decreasing with distance to the border, as the share of small-scale cross-border trade (α_i) in total cross-border trade is assumed to decline the further away a city is located from the border.

In column 3 of table 6, we then add an interaction term between the $Border_i$ dummy for each city i and the treatment period EAC_{01-04}. This allows us to corroborate whether our regional market exposure variable ω_i in cities less than 90 minutes to the border does indeed explain why we find a higher post-EAC growth response in border region cities relative to other cities. As shown, the effect of EAC_{01-04} on border regions becomes negative and is no longer significant, implying that the post-EAC effect on cities in border regions is now fully being captured by ω.

6.4 Examining alternative hypotheses

In this section we present more evidence on what happened on the ground and explore alternative explanations for our baseline results.

One might be concerned that the asymmetric increase in nightlights is due congestion rather than a more vibrant local economy due to increased trading opportunities. As a first test, we eliminate cities that represent border crossings from our treatment group, because those cities are most affected by the pass-through of goods which did not originate in the region close to the border. Our results in table A6 show that the overall growth impact is only marginally smaller in magnitude than for our baseline estimation in Table 2, column 5.

We next present evidence that the launch of the EAC was accompanied by increased firm creation near the border. We use the 2002 Ugandan Business Register (UBR) that enumerated all formal and informal firms with a fixed location across Uganda recording each firm's geo-location and year of establishment.[23] Taking account of the informal sector is particularly important, because of its size and its association with small-scale local trade. We use the UBR to test whether we find an unusual and disproportionate share of firms located near the border and created in 2001. We estimate the following linear probability model:

$$Firm_{Border} = \alpha_{2000} + \lambda_t Year_t + \mu \tag{10}$$

regressing $Firm_{Border}$, a dummy variable equal to one, if a firm in Uganda is less than 90 minutes of travel from a border post to Kenya or Tanzania, on $Year_t$, dummies t for the year of establishment, with $t = 2000$ as reference category. We are primarily interested in $\lambda_{2001} > 0$, or in other words, whether at the time of the survey in year 2002 we observe a higher proportion of border firms established in 2001 than in 2000 (α_{2000}).

One concern here is that border firms differ in dimensions other than location and that this may affect the proportion in 2001. Firm survival, for example, has been associated with firm size and productivity (Bigsten and Söderbom, 2006). If survival rates are *generally* lower for firms in the border region, we would obtain a decreasing proportion of border firms by year of establishment. To alleviate this concern, we examine the proportions of border firms established in 1999 and 1998. If they are similar to the year 2000, but significantly deviate in the year 2001, we take it as indicative that the effect of 2001 is not spurious. This is equivalent to examining pre-treatment trends.[24]

[23] Unfortunately, no data on informal cross border trade exist for the time when the EAC was established.

[24] For example, the share of firms with zero employees is indeed larger in the border region. However, this difference remains constant throughout aging and selection of firms 1998-2000. See Web Appendix 2 Table A7.

Results are reported in Table 7. Column 1 shows a significantly higher proportion of firms near the EAC border founded in 2001 as compared to 2000 as well as the years 1999 and 1998. Were the proportion in 2001 the same as in 2000, there would have been 650 (27%) firms created less.[25] Columns 2 to 8 report results for different sectors as defined by ISIC4 sector codes. Across all sectors we find that dispoportionately more firms were founded in the border region in 2001 - when the EAC took effect. The effect is particularly large for sectors one would expect to gain from increased localized trade, such as manufacturing, wholesale and retail. Border firms active in non-tradable services (e.g. hospitality and other household services) also experienced a disproportionate increase in the number of firms. While this could have been driven by increased congestion at the border due to higher overall trade, the effect is smaller than in other sectors. Therefore, although we cannot exclude the possibility that some congestion may have occurred at the border, these results are consistent with an increase in local trade as the main channel for the asymmetric response to the establishment of the EAC. Finally, note how the non-border to border firm proportions pre-EAC do generally not significantly differ from 2000 - with the exception of the retail sector in 1999.

[25] Taking the proportion in 1999 as a basis, there would still have been 430 firms (16%) created less in the border region.

Table 7: Firm creation in EAC border regions

	(1) All	(2) Manu-facturing	(3) Whole-sale	(4) Retail	(5) Hospi-tality	(6) Social Services	(7) HH Services	(8) Business Services
Est. 2001	0.029***	0.041**	0.045***	0.030***	0.022***	0.022	0.026***	0.050**
	(0.003)	(0.019)	(0.016)	(0.005)	(0.008)	(0.021)	(0.009)	(0.022)
Est. 1999	0.010**	-0.014	0.019	0.010*	0.015	0.006	0.015	0.010
	(0.004)	(0.021)	(0.017)	(0.005)	(0.011)	(0.023)	(0.012)	(0.024)
Est. 1998	-0.001	-0.030	-0.006	0.002	-0.002	-0.011	-0.016	0.031
	(0.004)	(0.021)	(0.018)	(0.006)	(0.012)	(0.023)	(0.012)	(0.027)
Constant	0.107***	0.142***	0.078***	0.119***	0.087***	0.113***	0.068***	0.084***
	(0.003)	(0.014)	(0.010)	(0.003)	(0.006)	(0.015)	(0.007)	(0.015)
Observations	54,548	2,362	2,249	33,480	7,328	1,634	4,842	1,205

Notes: This table estimates the proportion of firms established in border regions 1998-2001 as compared to the year 2000 (the constant). Data based on 2002 Uganda Business Register. The dependent variable is a dummy variable indicating a firm located within 90 minutes travel time of an internal EAC border between Uganda and Kenya, and between Uganda and Tanzania. The explanatory variables are dummy variables for the year of establishment. The omitted category represents firms established in 2000. Column (1) uses the complete sample of firms, whereas column (2)-(8) limits the sample to firms of corresponding ISIC4 sectors, omitting the residual category "Other" from the table. Robust standard errors in parentheses, where ***, **, * indicates significance at the 1%, 5% and 10% respectively.

Overall, our results also suggest that effects occurred on account of new economic activity rather than a reorganization of economic activity across space. Moreover, a mere shift of economic activity across space would have come hand in hand with a reduction of economic activity in cities further away from the border. Yet, the results in columns 1 of table 5 show that cities falling into a 90-135 and a 135-180 minutes travel band did not experience a reduction in their nightlights growth rate after the establishment of the EAC. In fact, as column 2 of table 6 indicates, the slight increases in lights in cities further away are in line with the increased regional market potential that the EAC offered. However, as column 2 in table 6 showed, nightlights in cities within a 90 minutes distance band increased disproportionately, which we explained by differential costs reductions for local and regional trade at the border.

7 The persistence of spatial equilibria and city systems

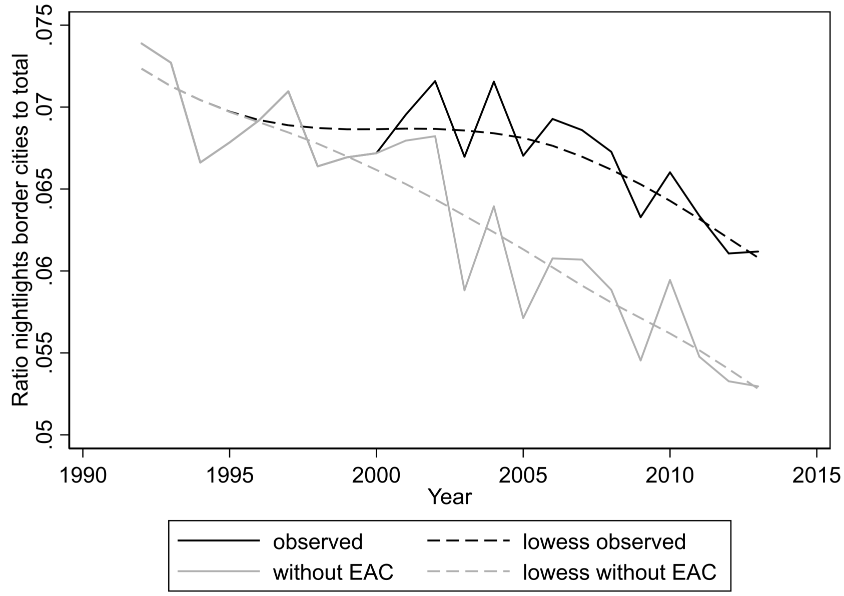
Was the effect large enough to leave an imprint on the spatial concentration of economic activities across the region and countries' city systems? First, we estimate how large the effect was overall - for the border regions and the EAC as a whole. Second, we study the concentration of economic activity in the primate cities. Third, we show changes in city rankings. All estimations are based on column 5, table 2, which is our preferred estimate for this exercise.

The compounded difference in nightlights growth rates after the establishment of the EAC implies that by 2013 total nightlights in the EAC's border regions were 17% brighter than they would have been without the launch of the EAC. Based on the observed variation in border region cities' nightlights in 2013 this corresponds to 1.95 standard deviations or alternatively, when using the nightlights elasticity of GDP of 0.329 as estimated by Henderson et al. (2011)[26], this translates into a 5.6% higher GDP in border regions.

These large local effects, however, do not necessarily imply a substantial change in the relative contribution of cities to economic activity in the region. First, we note that cities in the border region account for a rather modest share of total economic activity. Second, the growth performance of cities in the periphery tended to fall below the one of the economic core 1992-2000. Third, the EAC provided a temporarily limited growth impulse over 4 years. Figure 4 illustrates the overall effect. In 1992, cities near the EAC internal borders accounted for 7.4% of total nightlights. This share declined to 6.7% in 2000. We find that in the absence of the EAC this share would have decreased further to 5.2% by 2013, whereas the estimated growth effect of the EAC kept it at 6.1%.

[26]Using subnational regions as unit of observation Hodler and Raschky (2014) estimated an elasticity of 0.38 for Africa. They also confirm a linear relationship.

Figure 4: Impact of the EAC on the share of nightlights emanating from border region cities



Notes: This graph shows the proportion of lights attributable to cities located within 90 minute travel distance to an EAC border crossing. "observed" refers to observed light values, "without EAC" subtracts the effect estimated in Column 5, Table 2. "Lowess" plots a smoothed fit.

Primate cities dominate urban systems in Africa. This is also true for Kenya, Tanzania and Uganda where Nairobi, Dar es Salaam and Kampala accounted for 48%, 25% and 59% of the 1992 satellite nightlights respectively.[27] As shown in Web Appendix Figure B1 there is a trend towards more concentration of lights in the primate cities. Our estimates suggest that the EAC mitigated concentration, but the effect is too small to counter the increasing dominance of the primate cities (50.0% vs 50.1% for Nairobi, 30.3% vs 30.7% for Dar es Salaam, and 64.0% vs 64.5% for Kampala in 2012).

This leaves the possibility of some momentum at the lower tail of the city size distribution. We plot observed city ranks as measured by nightlights in 2001 and 2012 and compare this to hypothetical city ranks in 2012 when subtracting the EAC effect (Web Appendix Figure B2). Cities at the internal EAC border are on average 2.2 ranks better off than

[27]The urban literature frequently expresses primacy in terms of the share of the largest city in national urban population, employment, etc. (e.g. Henderson, 2003). We find a highly significant and positive correlation between urban population and nightlights in 1992 when expressed as a percentage of total; even though primate cities account for a disprortionately large share of lights, excluding them yields a coefficient of 0.9 and not significantly different from 1.

otherwise. This compares well to a standard deviation of 4.8 based on the remaining sample of cities. However, the city systems are extremely stable (Jedwab et al., 2017; Jedwab and Moradi, 2016): City rank in 2001 is the best predictor of the rank 2012. Hence, we interpret our result as evidence for the existence of large local effects for cities near the internal EAC border with little effect on the regional distribution of urban agglomerations. Overall, our finding of a level effect in nightlights of border cities is in line with what trade theory would let us expect (Winters, 2004), much less so with strong agglomeration economies that are able to cause longer-run growth effects.

8 Summary

Across sub-Saharan Africa many countries have embarked on extensive regional trade agreements and liberalisation agendas. Yet the extent to which the opening of regional borders has distributional consequences within countries remains little understood. In this paper we address this gap by investigating the changes in the spatial concentration of economic activities after the EAC between Kenya, Tanzania, and Uganda was launched in 2001.

Measuring economic activity using satellite imagery of lights emanated out into space at night for a panel of 180 cities, we show that after the establishment of the regional block cities near the EAC's internal border grew more strongly than cities further inland. Consistent with the occurrence of a positive market access shock due to a one-off reduction in cross-border trade costs, the growth effect lasts for about four years. In addition, we demonstrate that the effect is spatially concentrated only on cities located less than 90 minutes from the border. Borrowing from the new economic geography literature on market access, we show that high transport costs, which drive a wedge in the incidence of the shock between cities, are insufficient to explain this spatial pattern. Rather, our results are consistent with an asymmetric impact on two different trade modalities which co-exist in many parts of Sub-Saharan Africa, local small-scale trade and regional large-scale trade, with a strong reduction in trade costs for the former but not for the latter. The resulting local effect on cities near the border is rather large, equivalent to 5.6% of GDP between 2001 and 2013. However, the overall effect is insufficient to have a lasting impact on cities' relative contribution to total economic activity in the region. Consequently, we find little evidence that the EAC significantly altered the region's city system. We therefore conclude that in terms of city growth the EAC's establishment had strong short-run local effects but limited long-run regional effects.

References

Ades, A. F. and E. L. Glaeser (1995). Trade and circuses: Explaining urban giants. *The Quarterly Journal of Economics 110*(1), 195–227.

Alix-Garcia, J., S. Walker, A. Bartlett, H. Onder, and A. Sanghi (2018). Do refugee camps help or hurt hosts? the case of Kakuma, Kenya. *Journal of Development Economics 130*(Supplement C), 66–83.

Alonso-Villar, O. (1999). Spatial distribution of production and international trade: A note. *Regional Science and Urban Economics 29*(3), 371–380.

Alonso-Villar, O. (2001). Large metropolises in the third world: An explanation. *Urban Studies 38*(8), 1359–1371.

Anderson, J. E. and E. van Wincoop (2003). Gravity with gravitas: A solution to the border puzzle. *The American Economic Review 93*(1), 170–192.

Anderson, J. E. and E. van Wincoop (2004). Trade costs. *Journal of Economic Literature 42*(3), 691–751.

Baum-Snow, N., V. Henderson, M. A. Turner, Q. Zhang, and L. Brandt (2017). Highways, market access and urban growth in China. *Mimeo*.

Baum-Snow, N. and B. F. Lutz (2011). School desegregation, school choice and changes in residential location patterns by race. *The American Economic Review 101*(7), 3019.

Bensassi, S., J. Jarreau, and C. Mitaritonna (2017). Determinants of crossborder informal trade: The case of Benin. *Mimeo*.

Bigsten, A. and M. Söderbom (2006). What have we learned from a decade of manufacturing enterprise surveys in Africa? *The World Bank Research Observer 21*(2), 241–265.

Bleakley, H. and J. Lin (2012). Portage and path dependence. *The Quarterly Journal of Economics 127*(2), 587–644.

Booth, D., D. Cammack, T. Kibua, J. Kweka, and N. Rudaheranwa (2007). East African integration: How can it contribute to East African development? *ODI Briefing*.

Bosker, M., S. Brakman, H. Garretsen, and M. Schramm (2007). Looking for multiple equilibria when geography matters: German city growth and the WWII shock. *Journal of Urban Economics 61*(1), 152–169.

Bouët, A., L. Cosnard, and D. Laborde (2017). Measuring trade integration in Africa. *IFPRI Discussion Paper 01667*.

Brülhart, M. (2011). The spatial effects of trade openness: A survey. *Review of World Economics 147*(1), 59–83.

Brülhart, M., C. Carrere, and F. Robert-Nicoud (2015). Trade and towns: Heterogeneous adjustment to a border shock. *Mimeo, University of Lausanne and University of Geneva*.

Brülhart, M., C. Carrère, and F. Trionfetti (2012). How wages and employment adjust to trade liberalization: Quasi-experimental evidence from austria. *Journal of International Economics 86*(1), 68–81.

Buys, P., U. Deichmann, and D. Wheeler (2010). Road network upgrading and overland trade expansion in sub-saharan africa. *Journal of African Economies 19*(3), 399–432.

Caliendo, L. and F. Parro (2015). Estimates of the trade and welfare effects of nafta. *Review of Economic Studies 82*(1), 1–44.

Conley, T. (1999). GMM estimation with cross sectional dependence. *Journal of Econometrics 92*(1), 1–45.

Davis, D. R. and D. E. Weinstein (2002). Bones, bombs, and break points: The geography of economic activity. *American Economic Review 92*(5), 1269–1289.

Davis, D. R. and D. E. Weinstein (2008). A search for multiple equilibria in urban industrial structure. *Journal of Regional Science 48*(1), 29–65.

Davis, J. C. and J. V. Henderson (2003). Evidence on the political economy of the urbanization process. *Journal of Urban Economics 53*(1), 98–125.

Donaldson, D. (2018). Railroads of the raj: Estimating the impact of transportation infrastructure. *American Economic Review 108*(4-5), 899–934.

Donaldson, D. and R. Hornbeck (2016). Railroads and American economic growth: A market access approach. *The Quarterly Journal of Economics 131*(2), 799–858.

Dorosh, P., H. G. Wang, L. You, and E. Schmidt (2010). Crop production and road connectivity in Sub-Saharan Africa: A spatial analysis. *World Bank Policy Research Working Paper No. 5385*.

East African Community Secretariat (2015, 28/11/2015). Ports of entry & border points, 2015.

Eaton, J. and S. Kortum (2002). Technology, geography, and trade. *Econometrica 70*(5), 1741–1779.

Eberhard-Ruiz, A. (2016). Measuring urban economic activity using nightlights. *Mimeo*.

Faber, B. (2014). Trade integration, market size, and industrialization: Evidence from china's national trunk highway system. *The Review of Economic Studies 81*(3), 1046–1070.

Government of Tanzania (2000). March 9th 2000 letter of intent of the Government of Tanzania to the International Monetary Fund.

Government of Tanzania (2003). November 2nd 2002 letter of intent of the Government of Tanzania to the International Monetary Fund.

Government of Uganda (2001). March 9th 2001 letter of intent of the Government of Uganda to the International Monetary Fund.

Hanson, G. H. (1996). Localization economies, vertical organization, and trade. *The American Economic Review 86*(5), 1266–1278.

Hanson, G. H. (1997). Increasing returns, trade and the regional structure of wages. *The Economic Journal 107*(440), 113–133.

Hanson, G. H. (2005). Market potential, increasing returns and geographic concentration. *Journal of International Economics 67*(1), 1–24.

Harris, D. C. (1954). The markets as a factor in the localization of industry in the united states. *Annals of the Association of American Geographers 44*, 315–348.

Head, K. and T. Mayer (2011). Gravity, market potential and economic development. *Journal of Economic Geography 11*(2), 281–294.

Head, K. and T. Mayer (2014). Gravity equations: Workhorse, toolkit, and cookbook. In E. H. Gita Gopinath and K. Rogoff (Eds.), *Handbook of International Economics*, Volume 4, pp. 131–195.

Helpman, E. (1998). The size of regions. In D. Pines, E. Sadka, and I. Zilcha (Eds.), *Topics in public economics: Theoretical and Applied Analysis*, pp. 33–54.

Henderson, J. V. (1982). Systems of cities in closed and open economies. *Regional Science and Urban Economics 12*(3), 325–350.

Henderson, J. V., A. Storeygard, and U. Deichmann (2017). Has climate change driven urbanization in Africa? *Journal of Development Economics 124*, 60–82.

Henderson, J. V., A. Storeygard, T. L. Squires, and D. N. Weil (2016). The global spatial distribution of economic activity: Nature, history, and the role of trade. *NBER Working Paper No. 22145*.

Henderson, J. V., A. Storeygard, and D. N. Weil (2011). A bright idea for measuring economic growth. *The American Economic Review 101*(3), 194–199.

Henderson, J. V., A. Storeygard, and D. N. Weil (2012). Measuring economic growth from outer space. *The American Economic Review 102*(2), 994–1028.

Henderson, V. (2003). The urbanization process and economic growth: The so-what question. *Journal of Economic Growth 8*(1), 47–71.

Hodler, R. and P. A. Raschky (2014). Regional favoritism. *The Quarterly Journal of Economics 129*(2), 995–1033.

Iacovone, L., V. Ramachandran, and M. Schmidt (2014). Stunted growth: Why don't African firms create more jobs? *Center for Global Development Working Paper No. 353*.

International Monetary Fund (2002). Kenya: Selected issues and statistical appendix. *Country Report, No. 02/84*.

International Monetary Fund (2003). Tanzania: 2002 article IV consultation. *IMF Country Report, No. 03/01*.

Jedwab, R., E. Kerby, and A. Moradi (2017). History, path dependence and development: Evidence from colonial railroads, settlers and cities in Kenya. *Economic Journal 127*, 1467–1494.

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

Krugman, P. (1991). Increasing returns and economic geography. *Journal of Political Economy 99*(3), 483–499.

Krugman, P. and R. L. Elizondo (1996). Trade policy and the third world metropolis. *Journal of Development Economics 49*(1), 137–150.

Krugman, P. and A. J. Venables (1995). Globalization and the inequality of nations. *The Quarterly Journal of Economics 110*(4), 857–80.

Lee, J. Y. and G. Solon (2011). The fragility of estimated effects of unilateral divorce laws on divorce rates. *The B.E. Journal of Economic Analysis & Policy 11*(1), 1–11.

Little, P. D. (2010). Unofficial cross-border trade in East Africa. In A. Sarris and J. Morrison (Eds.), *Food security in Africa: market and trade policy for staple foods in Eastern and Southern Africa*, Book section 7, pp. 158–181. Cheltenham: Edward Elgar.

McIntyre, M. A. (2005). Trade integration in the East African Community: An assessment for Kenya. *IMF Working Paper, No. 05/14*.

Meer, J. and J. West (2015). Effects of the minimum wage on employment dynamics. *Journal of Human Resources 51*(2), 500–522.

Michaels, G. (2008). The effect of trade on the demand for skill: Evidence from the interstate highway system. *The Review of Economics and Statistics 90*(4), 683–701.

Miguel, E. and G. Roland (2011). The long-run impact of bombing Vietnam. *Journal of Development Economics 96*(1), 1–15.

NOAA National Geophysical Data Center (2016). Version 4 dmsp-ols nighttime lights time series. `https://ngdc.noaa.gov/eog/dmsp/downloadV4composites.html`.

Redding, S. J. (2010). The empirics of new economic geography. *Journal of Regional Science 50*(1), 297–311.

Redding, S. J. and D. M. Sturm (2008). The costs of remoteness: Evidence from German division and reunification. *The American Economic Review 98*(5), 1766–1797.

Redding, S. J. and A. J. Venables (2004). Economic geography and international inequality. *Journal of International Economics 62*(1), 53–82.

Rosenthal, S. S. and S. L. Ross (2015). Change and persistence in the economic status of neighborhoods and cities. In J. V. H. Gilles Duranton and C. W. Strange (Eds.), *Handbook of Regional and Urban Economics*, pp. 1047–120. Elsevier.

Rosenthal, S. S. and W. C. Strange (2004). Evidence on the nature and sources of agglomeration economies. pp. 2119–71.

Storeygard, A. (2016). Farther on down the road: transport costs, trade and urban growth in sub-saharan africa. *The Review of Economic Studies 83*(3), 1263–1295.

Tarnavsky, E., D. Grimes, R. Maidment, E. Black, R. P. Allan, M. Stringer, R. Chadwick, and F. Kayitakire (2014). Extension of the TAMSAT satellite-based rainfall monitoring over Africa and from 1983 to present. *Journal of Applied Meteorology and Climatology 53*(12), 2805–2822.

Titeca, K. and C. Kimanuka (2012). Walking in the dark: Informal cross-border trade in the great lakes region.

Uganda Bureau of Statistics (2009). The informal cross border trade qualitative baseline study 2008.

Uganda Bureau of Statistics (2014). Uganda bureau of statistics. the informal cross border trade survey report 2013.

United Nations Development Program (2011). *Regional Integration and Human Development: A Pathway for Africa.* New York: UNDP.

Wenban-Smith, H. (2014). Population growth, internal migration and urbanization in tanzania 1967-2012: A census based regional analysis. *International Growth Centre Working Paper, 2014*.

Winters, L. A. (2004). Trade liberalisation and economic performance: An overview. *The Economic Journal 114*(493), F4–F21.

Wolfers, J. (2006). Unilateral divorce laws raise divorce rates? A reconciliation and new results. *The American Economic Review 96*(5), 1802–20.

World Bank (2012a). *Africa Can Help Feed Africa: Removing Barriers to Regional Trade in Food Staples.* Washington, DC: World Bank.

World Bank (2012b). *De-fragmenting Africa: Deepening regional trade integration in goods and services.* Washington, DC: World Bank.

World Bank (2015). *World Development Indicators.* Washington, D.C.: World Bank.

World Bank and World Trade Organization (2015). *The Role of Trade in Ending Poverty.* Geneva: World Trade Organisation.

World Economic Forum (2013). *The Africa Competitiveness Report.* Washington, D.C.: World Bank.

Web Appendix 1 - Data Construction

Our nightlights dataset is constructed by overlaying stable average nightlights imagery available for each year between 1992 and 2013 which resulted in the identification of 1677 separate light clusters within the East African borders (including Burundi, Kenya, Rwanda, Tanzania, and Uganda). Of these 1677 separate light clusters, we then selected the 250 that were on average most intensely lit between 1992 and 2013. A closer examination of these 250 clusters revealed that not all of these lights originate from existing urban settlements (i.e. some sources were found to emanate from military camps, power stations, or former refugee camps) and were subsequently eliminated. A further reduction in the number of towns resulted from the decision to restrict our sample to Kenya, mainland Tanzania, and Uganda. This left us with 195 cities in our city nightlights sample.

In line with Henderson et al. (2017) we defined the boundaries of each of these 195 cities as the contiguous lit area at any time between 1992 and 2013 (i.e. this is the outer envelope of lights after overlaying the stable nightlights images for each year). We then calculated each city's yearly nightlight emissions by adding up the light intensity of each grid cell falling within each city's boundary. Yet, unlike most previous studies using nightlight data, we chose to use the light intensity data as captured by raw images of the DMSP and not the processed imagery containing only stable nightlights. Eberhard-Ruiz (2016) found that the processed stable nightlights data provided unreliable nightlight intensity estimates for smaller towns in Africa. More specifically, he showed that the use of stable nightlights data results in much larger standard deviations of nightlight intensity growth in smaller than in bigger cities and that this can be attributed to non-classical measurement error: Lights above 0 were set to 0 by the algorithm to create stable nightlights. While this may be appropriate for gas flames and rural areas where fire clearings emanate light - this approach is less useful for secondary towns. Hence we follow Eberhard-Ruiz (2016) and use the raw data images instead, to calculate light emissions of cities.

We then proceeded to link each of these 195 cities in our sample to its population estimate. We defined the population of each city as the sum of the population of all urban localities falling within the boundaries of one of our 195 city polygons. Thus, some of the larger cities in our sample comprise several urban localities (e.g. the population estimate of Kampala includes eight surrounding towns including Entebbe, Mukono, Nanssana, Kira, Wakiso, Kakiri, Lugazi and Mpigi).

We drew on the three most recent censuses for each of the three countries to establish each city's population (1989, 1999, and 2009 for Kenya; 1988, 2002, and 2012 for Tanzania; and 1991, 2002 and 2014 for Uganda). In order to minimise gaps in constructing the dataset we pursued an iterative data compilation process. First, we retrieve population figures for each town from official census reports. Second, we then filled remaining gaps in the dataset with information from secondary sources, such as the web portal www.citypopulation.de. In the case of Tanzania we also relied on Wenban-Smith (2014) who provides population estimates for a range of Tanzanian towns. Third, when sources were unavailable, population figures for towns were approximated assuming a constant urban-rural population ratio within districts wherever possible. Overall, this process allowed us to generate population estimates for a total of 180 cities in our sample.

Web Appendix 2 - Additional Tables and Figures

Table A1: Cities and their population in EAC border regions 1992 and 2013

	City	1992 Population	2013 Population
Kenya			
	Malaba	3,671	22,823
	Rongo	4,067	16,305
	Sare	8,558	20,029
	Taveta	10,701	20,646
	Migori	16,307	65,315
	Busia	23,379	45,576
	Mumias	26,877	40,141
	Bungoma	31,143	61,357
	Webuye	36,657	63,433
	Kitale	58,240	81,467
Tanzania			
	Tarakea	1,397	11,485
	Namanga	4,060	9,611
	Mwanga	5,984	14,645
	Nyamongo	6,261	21,038
	Isibania	12,954	20,180
	Tarime	18,677	43,165
	Moshi	108,380	188,851
Uganda			
	Bugiri	3,853	27,755
	Tororo	27,429	41,263
	Busia	28,662	54,017
	Mbale	55,358	93,800

Notes: The EAC border region is defined as any location within 90 minutes of an internal EAC border crossing; population estimates are based on census data.

Table A2: Falsification test on non-EAC borders

Variables	(1)	(2)
Non-EAC Border	0.012	
	(0.010)	
Non-EAC Border 01-04	-0.008	-0.010
	(0.016)	(0.016)
Non-EAC Border 05-09	-0.019	-0.024
	(0.015)	(0.015)
Non-EAC Border 10-13	-0.054***	-0.060***
	(0.019)	(0.019)
Market access controls	YES	YES
Rainfall controls	YES	YES
Country-year FE	YES	YES
City FE	NO	YES
Observations	3,780	3,780

Notes: Data based on a panel of 180 citiess in Kenya, Tanzania, and Uganda from 1992-2013. The dependent variable is annual change in log nightlights. Non-EAC border defined as any external border crossing between any of the three EAC member states and its non EAC neighbours. Market access controls include log population in 1992, log domestic market access (DMA) in 1992, the annual change in $logDMA$, and travel time to the primate city (in 10h). Rainfall controls include average rainfall 1992-2013 as well as yearly changes. Robust standard errors adjusted for clustering at the city level in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% respectively.

Table A3: Augmented baseline results - Heterogeneity across countries

Variables	(1) Kenya	(2) Kenya	(3) Tanzania	(4) Tanzania	(5) Uganda	(6) Uganda
Border	-0.004		-0.010**		-0.035	
	(0.006)		(0.005)		(0.009)	
Border x EAC 01-04	0.019	0.019	0.029**	0.034	0.58***	0.58***
	(0.014)	(0.015)	(0.013)	(0.014)	(0.009)	(0.009)
Border x EAC 05-09	0.009	0.009	-0.005	0.004	0.019	0.018
	(0.007)	(0.008)	(0.010)	(0.011)	(0.013)	(0.014)
Border x EAC 10-13	-0.014	-0.014	0.029**	0.038**	0.43**	0.42**
	(0.011)	(0.011)	(0.012)	(0.013)	(0.017)	(0.017)
Market access controls	YES	YES	YES	YES	YES	YES
Rainfall controls	YES	YES	YES	YES	YES	YES
Country-year FE	YES	YES	YES	YES	YES	YES
City FE	NO	YES	NO	YES	NO	YES
Observations	1,323	1.323	1,848	1,848	609	609

Notes: Data based on a panel of 180 cities in Kenya, Tanzania, and Uganda from 1992-2013. The dependent variable is the annual change in log nightlights. Border is a dummy variable taking the value 1 for a city within 1.5 hours travel distance of an internal EAC border crossing. EAC 01-13, 01-04, 05-09 and 10-13 is a dummy variable taking the value 1 for the post-EAC years 2001-13, 2001-04, 2005-09 and 2010-13 respectively. Market access controls include log population in 1992, log domestic market access (DMA) in 1992, the annual change in $logDMA$, and travel time to the primate city (in 10h). Rainfall controls include average rainfall 1992-2013 as well as yearly changes. Robust standard errors adjusted for clustering at the city level in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% respectively.

Table A4: Levels Specification

Variables	(1)	(2)
Border	0.254	
	(0.221)	
Border x trend	-0.056***	-0.048***
	(0.019)	(0.018)
Border x EAC 2004	0.122***	0.113***
	(0.041)	(0.042)
Border x EAC 2008	0.134*	0.119**
	(0.069)	(0.064)
Border x EAC 2012	0.108	0.095
	(0.090)	(0.083)
Market access controls	YES	YES
Agro-climatic zone FE	YES	
Country-year FE	YES	YES
City FE	NO	YES
Observations	1,080	1,080

Notes: Data based on a panel of 180 cities in Kenya, Tanzania, and Uganda for the years 1992, 1996, 2000, 2004, 2008 and 2012. The dependent variable is log nightlights. Border is a dummy variable taking the value 1 for a city within 1.5 hours travel distance of an internal EAC border crossing. Market access controls include log population in 1992, log domestic market access (DMA) in 1992, the annual change in $logDMA$, and travel time to the primate city (in 10h). Rainfall controls include average rainfall 1992-2013 as well as yearly changes. Robust standard errors adjusted for clustering at the city level in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% respectively.

Table A5: Conley Standard Errors

Variables	(1) Distance≤50	(2) Distance≤100	(3) Distance≤200	(4) Distance≤300
Border	-0.010	-0.010	-0.010	-0.010
	(0.008)	0.009	(0.008)	0.008
Border x EAC 01-04	0.029***	0.029**	0.029**	0.029***
	(0.011)	(0.012)	(0.011)	(0.010)
Border x EAC 05-09	0.004	0.004	0.004	0.004
	(0.012)	(0.012)	(0.012)	(0.010)
Border x EAC 10-13	0.009	0.009	0.009	0.009
	(0.015)	(0.016)	(0.019)	(0.021)
Market access controls	YES	YES	YES	YES
Agro-climatic zone FE	YES	YES	YES	YES
Country-year FE	YES	YES	YES	YES
City FE	NO	NO	NO	NO
Observations	3,780	3,780	3,780	3,780
5 R-squared	0.849	0.849	0.849	0.849

Notes: Data based on a panel of 180 cities in Kenya, Tanzania, and Uganda from 1992-2013. The dependent variable is the annual change in log nightlights. Border is a dummy variable taking the value 1 for a city within 1.5 hours travel distance of an internal EAC border crossing. EAC 01-13, 01-04, 05-09 and 10-13 is a dummy variable taking the value 1 for the post-EAC years 2001-13, 2001-04, 2005-09 and 2010-13 respectively. Market access controls include log population in 1992, log domestic market access (DMA) in 1992, the annual change in $logDMA$, and travel time to the primate city (in 10h). Rainfall controls include average rainfall 1992-2013 as well as yearly changes. Conley standard errors are reported in brackets where distance thresholds of 50km, 100km, 200km, and 300km were used in column 1, 2, 3 and 4 respectively. ***, **, * imply respective significance at the 1%, 5% and 10% levels.

Table A6: Results excluding cities with border crossings

Variables	(1)	(2)
Border	-0.007*	
	(0.004)	
Border x EAC 01-04	0.024**	0.024**
	(0.010)	(0.011)
Border x EAC 05-09	0.003	0.005
	(0.006)	(0.006)
Border x EAC 10-13	0.002	0.004
	(0.010)	(0.011)
Market access controls	YES	YES
Agro-climatic zone FE	YES	
Country-year FE	YES	YES
City FE	NO	YES
Observations	3,612	3,612

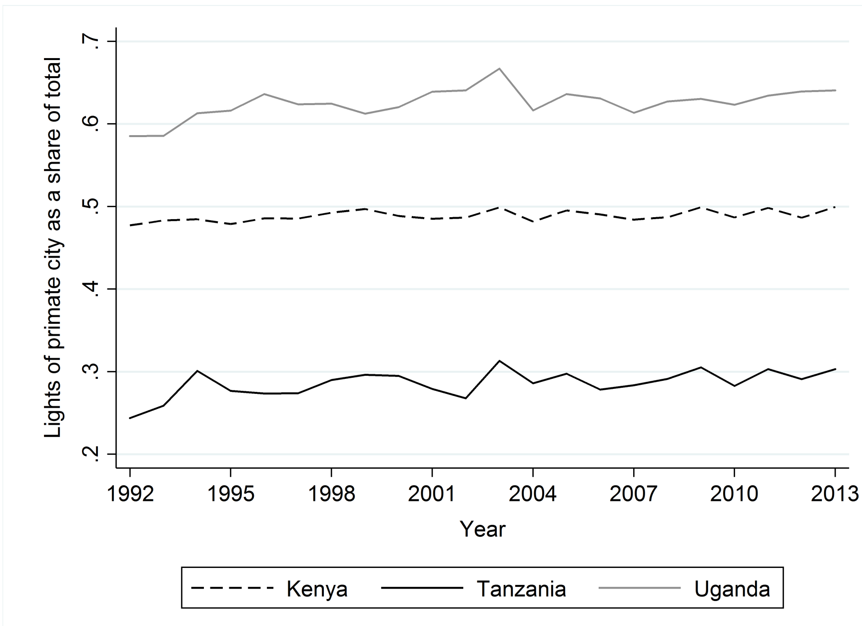
Notes: Data based on panel of 173 cities/towns in Kenya, Tanzania, and Uganda from 1992-2013. Border cities, defined as cities that are located less than 15 minutes from the border, are excluded from the sample. Border is a dummy variable taking the value 1 for a city within 1.5 hours travel distance of an internal EAC border crossing. EAC 01-13, 01-04, 05-09 and 10-13 is a dummy variable taking the value 1 for the post-EAC years 2001-13, 2001-04, 2005-09 and 2010-13 respectively. Market access controls include log population in 1992, log domestic market access (DMA) in 1992, the annual change in $logDMA$, and travel time to the primate city (in 10h). Rainfall controls include average rainfall 1992-2013 as well as yearly changes. Robust standard errors adjusted for clustering at the city level in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% respectively.

Table A7: Size distribution Ugandan firms in 2002

	Year of establishment			
	2001	2000	1999	1998
Border Firms (Treatment group)				
Share with zero employees	0.63	0.60	0.56	0.53
Share with one to five employees	0.35	0.37	0.39	0.41
Share with more than five employees	0.03	0.03	0.05	0.06
Non-Border Firms (Comparison group)				
Share with zero employees	0.58	0.56	0.53	0.49
Share with one to five employees	0.40	0.41	0.41	0.44
Share with more than five employees	0.03	0.04	0.05	0.07
Difference in shares (border vs non-border)				
Firms with zero employees	0.05***	0.04***	0.02	0.04**
Firms with one to five employees	-0.05***	-0.04***	-0.02	-0.03
Firms with more than five employees	0.00	0.00	0.00	-0.01
Number of firms in border region	3,066	1,633	1,153	734
Number of firms in non-border region	19,452	13,640	8,691	6,179

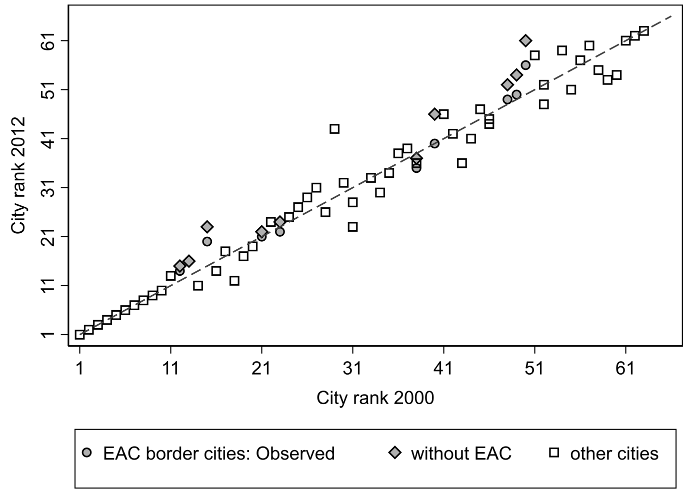
Notes: Data based on the 2002 Ugandan Business Register. This table shows the share of firms that fall into three categories i) 0 employees, ii) 1-5 employees, iii) more than 5 employees by year of establishment. Border firms are defined as located within 90 minutes travel time of an internal EAC border between Uganda and Kenya, and Uganda and Tanzania. The table shows that there is a higher share of firms with 0 employees close to the border as compared to the rest of Uganda. However, while the share of these small firms are declining by year of establishment indicating a higher exit rate of those firms, this is also true for firms located in the rest of Kenya. Thus, the difference in shares (border versus non borders) does not exhibit a trend.

Figure B1: Concentration of nightlights in primaty cities

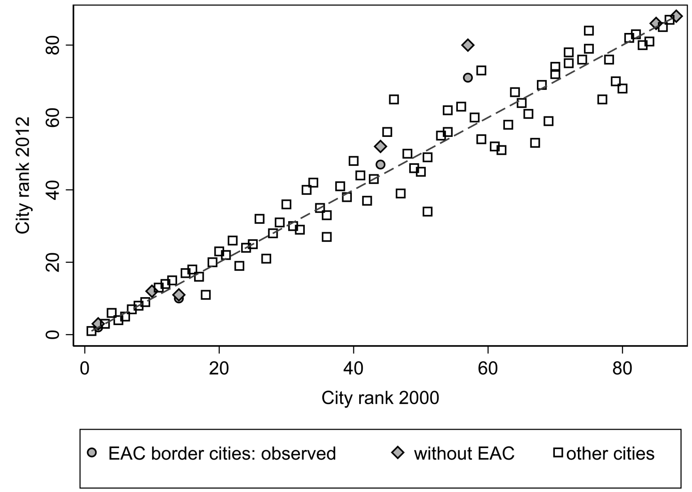


Notes: This figure shows the proportion of lights that the primate city emanates within a country. Primate cities are Nairobi, Dar es Salaam and Kampala for Kenya, Tanzania and Uganda, respectively.

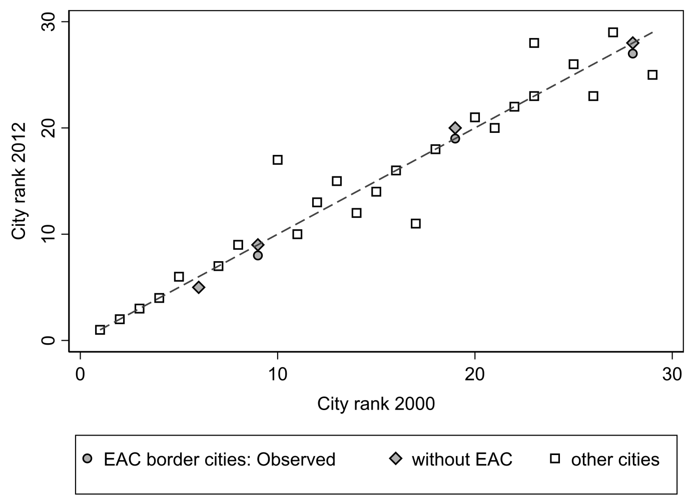
Figure B2: City ranks by nightlights in 2000 and 2012



(a) Kenya



(b) Tanzania



(c) Uganda

Notes: The figure shows city ranks in 2000 and 2012 in Kenya, Tanzania and Uganda. Cities within 90 minutes of a border crossing are marked in grey. Circles indicate observed city rank, whereas diamonds indicate city ranks in 2012 subtracting the effect attributable to the launch of the EAC in 2001. The dashed line shows the diagonal.

Web Appendix 3 - Estimating Trade Cost in the EAC

In this study we use population-based market access measures to establish each city's linkages to other markets:

$$MA_i = \sum_{i \neq j}^{N} POP_j / e^{\sigma \times travel_{ij}} \tag{11}$$

In addition to population estimates and travel time matrix between all cities, implementing equation (11) also requires an estimate for the decay parameter σ, which defines how demand linkages between two markets fall with distance. Structural gravity models show that σ is implicitly defined as $\sigma = \theta \times \gamma$, where θ stands for the trade elasticity and γ for the average per unit cost of transporting a representative good for one hour in the EAC (Anderson and van Wincoop, 2003, 2004; Eaton and Kortum, 2002). Whereas values for θ are provided in the literature, it still leaves γ to be estimated. For this purpose, (Donaldson, 2018) proposes comparing prices of a homogenous commodity across a country's different regions, when the origin of that good is clearly identifiable. Any differences in the retail prices of that commodity between the origin region and any other consuming region can then be attributed to the cost of trading between both regions. We pursue a similar approach by comparing the evolution of monthly petrol prices between 2005 and 2015 across seven Ugandan cities (Arua, Gulu, Jinja, Kampala, Masaka, Mbale, and Mbarara).[28] To date, Uganda does not produce any refined petroleum products, which thus need to be imported. Moreover, refined petroleum products are almost exclusively imported by road at the border-crossing of Busia located on the border with Kenya.[29] Given these characteristics, we estimate the following specification:

$$PetrolPrice_{it} = \nu_0 + \nu_1 TravelBusia_i + \delta_t + \epsilon_{i,t} \tag{12}$$

where $PetrolPrice_{it}$ is the local retail price measured in logs for one litre of refined petrol in city i during month t and $TravelBusia_i$ measures the distance between each city i and the border post of Busia in terms of hours of travel via the 1991 road network. δ_t are year-month fixed effects. The coefficient ν_1 tells us by how many percentage points the price of petrol increases in city i for each additional hour required to complete the journey between city i and the border post petrol is imported from in Uganda. ν_1 is thus directly comparable to γ.

Results are reported in column 1 of table A5. Each additional hour of travel on Uganda's road network results in an increase of 0.5% in the retail price for petrol. The regression in column 2 includes an interaction term between the travel time to Busia and yearly time trend, which does not alter the estimated coefficient of ν_1. Moreover, it indicates that between 2005 and 2015 ad-valorem transport cost did not experience a significant increase/decline.

[28] The data comes from the monthly CPI survey conducted by the Ugandan Bureau of Statistics.

[29] Some imports of petroleum products also pass through the nearby border post of Malaba. Yet this border post is only 30km away from the Busia border-crossing and would thus not change the interpretation of our results.

Table A8: Ad-valorem transport cost of petrol across Uganda

Variables	(1)	(2)
Travel time to Busia border	0.005***	0.005***
	(0.000)	0.001
Travel time to Busia border x yearly trend		-0.000
		(0.000)
Month-year FE	YES	YES
Observations	882	882

Notes: Data based on a panel of seven Ugandan cities in Uganda from July 2005 to December 2015. The dependent variable is the log retail price of petrol. Robust standard errors adjusted for clustering at the city level in parentheses. ***, **, * indicate significance at the 1%, 5% and 10% respectively.