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BRIEF

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Proximity to African Agricultural Markets, Down to the Last Kilometer

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A substantial share of African farms are subsistence or semi-subsistence operations, consuming much of what they or their near neighbors produce (World Bank 2008, Berg et al. 2016). Thus, with just 37.9 percent of the 2015 population in sub-Saharan Africa (hereafter SSA) residing in urban areas (United Nations 2015), agricultural consumption is largely a rural affair. But that is changing, with the share of population living in urban areas projected to grow to 54.8 percent by 2050. With agricultural consumption moving off-farm at a rapid rate, getting produce from farms to (sometimes distant) settlement areas will become an increasingly pressing problem. Developing a more refined sense of the structure of the time-to-market impediments has obvious and increasingly important investment and policy value.

Much of agricultural production in SSA is characterized by highly fragmented, small-scale farming operations (most less than 5 hectares) with limited and uneven participation in off-farm market transactions (Fafchamps 2004, de Janvry et al. 1991). Many of the factors affecting agricultural production decisions, not least the frequency, extent and nature of off-farm market participation, vary spatially. Improved market accessibility for farmers makes it easier and more profitable to obtain yield-enhancing inputs, such as chemical fertilizer and improved seed, and promotes commodity market participation that can help mute commodity price volatility for consumers and producers alike. Measures of market accessibility help determine the nature of effective (farm gate) prices and the farm input and output decisions influenced by these prices.[1]

We use rasterized data on travel time to markets of varying size to characterize the spatial proximity to markets for agricultural producers in sub-Saharan Africa.[2] The 30 arc-second resolution (approximately 1 kilometer at the equator) time-to-market estimates measure the minimum time cost of traveling from the centroid of each cropped pixel to the nearest market or service location. Markets were defined as the centroid of a human settlement that met one of five population thresholds (specifically, either 20K, 50K, 100K, 250K or 500K people or more).[3] We examine multiple market sizes to address the variety of market participation decisions confronting farmers. For example, staple foods, such as maize and cassava, are likely often sold into smaller domestic markets, while cash crops are more often sold internationally from larger markets (e.g., Iimi et al. 2015). It was assumed that travel occurred either off-road by walking or on-road by driving (at three different speeds according to which of three classes of roads was being traversed, and calibrated according to slope and elevation).

Cropland Proximity to Markets of Varying Sizes

As might be expected, travel time increases as market size increases. The average cropped pixel throughout SSA is within 6.8 hours of a market of at least 20K people, 8.3 hours of a market of at least 100K and 11.5 hours of a market of at least 500K.[4] Figure 1 shows a comparison of the proximity to markets of varying sizes. While 86.2 percent of the cropland pixels in SSA are within 12 hours of a 20K market, only 67.3 percent are within 12 hours of a 500K market. Although, 97.8 percent of SSA's population lives within one day of travel to a city of at least 20K people, just 54.6 percent of the continent's population can reach these small urban markets in 3 hours or less, thus undermining much agricultural trade (especially of perishable or fragile farm produce) and off-farm market participation.[5]

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[1] Market proximity data are increasingly being used to investigate input and output choices by SSA farmers. See, for example, Mather et al. (2011), Minten et al. (2013), Deininger et al. (2015) and Ali et al. (2015, 2016).

[2] There are various sources of market proximity data, including global estimates from the European Commission's Joint Research Council, JRC, (Nelson 2008) and Verburg (2011) and estimates for the Horn of Africa from the IGAD LPI initiative (Pozzi et al. 2008). For this brief we use the HarvestChoice series (Guo 2014) for SSA, combined with the JRC series (Nelson 2008) for the rest-of-the-world. See the Technical Note for more details, and Joglekar et al. (2016) for documentation of the HarvestChoice series.

[3] Hereafter, when we refer to a 20K market or a 50K market, or similar, we mean a market of at least 20,000 people or at least 50,000 people.

[4] Since we are primarily concerned with understanding the nature of market isolation facing agricultural producers (specifically, crop producers) in SSA, only pixels with positive cropland, as defined by the IIASA-IFPRI (2015) cropland estimates for the year 2005, are considered in this analysis. Cropped pixels account for 31.4 percent of the total (28.9 million) land-based pixels in SSA.

[5] Gridded estimates of population are sourced from CIESIN (2016).

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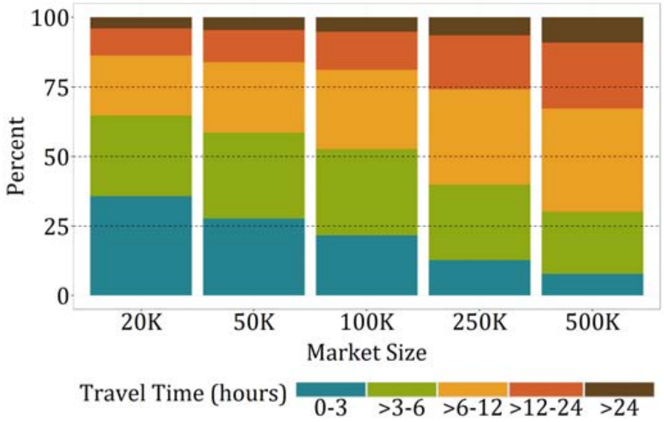
Figure 1: Comparison of cropped pixel proximity to markets of varying sizes



Source: Authors' construction based on travel time data from Guo (2014) and cropland data from IIASA-IFPRI (2015).
Note: Calculations only include pixels with positive cropland.

A natural question arises in this context: specifically, is agriculture in SSA substantially farther from the markets it serves than agriculture elsewhere in other regions of the world? Combining our SSA proximity estimates to a market of at least 50K with estimates of market proximity worldwide from Nelson (2008), suggests that average travel times for areas of crop production to markets in SSA are at the higher end of the spectrum, but not inordinately so (Table 1). For example, the average time spent traveling from a cropped pixel to a market of 50K people is 5.0 hours globally, 8.5 hours in East Asia and the Pacific, 6.6 hours in Latin America and the Caribbean, 4.5 hours in the Middle East and Northern Africa, 4.1 hours in South Asia, 3.8 hours in Europe and Central Asia and 3.6 hours in high-income countries. The corresponding average for SSA is 9.2 hours, although for major producing countries in the region such as South Africa and Nigeria the travel times are much lower, averaging 4.5 and 5.0 hours respectively. Within regions there are varying degrees of variation in travel time. While the high-income countries have the lowest average, they also have the highest coefficient of variation (1.8), whereas SSA has the largest average travel time coupled with one of the smallest coefficients of variation (1.1). Thus, notwithstanding the substantial variation in travel times within regions, travel times to SSA markets are relatively long and more uniformly so compared with those in high-income countries. For all regions, the distribution of travel time by pixel is positively skewed—i.e., the median values are anywhere from half to nearly three-quarters of their respective mean values—indicating some substantial areas with inordinately long travel times to market.

Table 1. Descriptive statistics on travel time to a market of at least 50K people, by region

Region	Median	Mean	Max	Standard Deviation	Coefficient of Variation
			(hours)		
East Asia & the Pacific	4.3	8.5	189.2	13.0	1.5
Europe & Central Asia	2.7	3.7	72.5	3.9	1.0
High-Income	2.4	3.6	197.9	6.5	1.8
Latin America & the Caribbean	3.6	6.6	229.1	9.5	1.4
Middle East & Northern Africa	3.1	4.5	63.5	4.6	1.0
South Asia	2.5	4.1	480.6	6.1	1.5
Sub-Saharan Africa	6.1	9.2	200.9	10.3	1.1
World	3.4	5.9	480.9	9.0	1.5

Source: Authors' construction based on SSA travel time data from Guo (2014) global travel time data (excluding SSA) from Nelson (2008), cropland data from IIASA-IFPRI (2015) and regional classifications from the World Bank (2016).
Note: Calculations only include pixels with positive cropland. All regions had a minimum of zero most likely because of the existence of peri-urban agriculture.

Market Proximity of Agricultural Land, Crop Value, People and Pixels

Different notions of agricultural market proximity are useful for different policy and research purposes. In some cases, the relevant attribute is the proximity of urban markets (of varying sizes) to agricultural areas. For others, it is the market proximity of agricultural production, and in some instances the proximity of the agricultural labor force to population centers of varying sizes that is of most value. The proximity of (African) agriculture to urban markets varies markedly when viewed through these various area, production and labor lenses. Comparing the stacked bar charts in Figure 2 of the percentage of SSA cropped pixels (Panel a) grouped into various travel time cohorts with similar plots of the percentage of cropland area (Panel b), value of production (Panel c) and population (Panel d), reveals that cropped area, crop value and "cropping population" are successively closer to a 20K market than are cropped pixels.[6]

One-quarter of the cropped pixels are within 2.2 hours of a 20K market, while one-quarter of cropped area, crop value and cropping population are within 1.8, 1.5 and 1.0 hours of a 20K market, respectively. Half of the cropped pixels, cropped area, crop value and cropping population in SSA are within 4.2, 3.3, 2.9 and 2.2 hours of a 20K market, respectively, while three-quarters of the region's cropped pixels, cropped area, crop value and cropping population are within 7.9, 5.8, 5.2 and 4.4 hours of a 20K market, respectively. These data indicate that, on average, cropping populations opt to live closer to urban markets relative to the location of crop production (by value), which in turn is closer to markets than where

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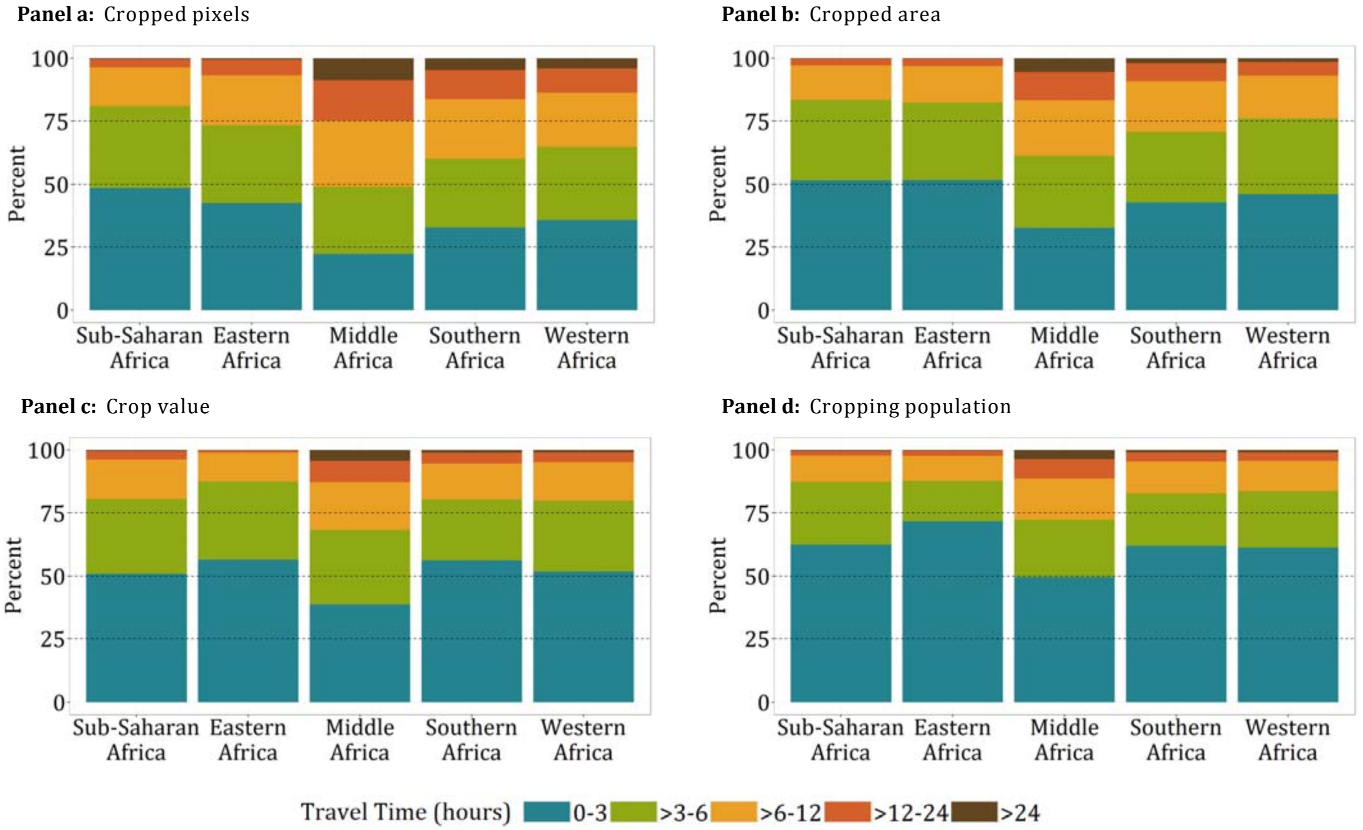
[6] "Cropping population" is estimated as the total number of persons living within a pixel with any land in crops. This does not necessarily mean that all of these individuals are involved in crop production. The estimates are likely to overstate the closeness to market of those involved in cropping activities given that all people within a cropped pixel may not be directly involved in cropping (e.g., those in (peri-) urban areas or those engaged in non-crop forms of agriculture), and especially so if the share of population within a pixel engaged in farming increases as the distance to market grows. Cropland area for the year 2005 is sourced from IIASA-IFPRI (2015), the 2005 value of crop production is from SPAM (You et al. 2016), and the 2010 population is from CIESIN (2016). See the Technical Note for more details on these data layers.

Figure 2: Comparative views of agricultural proximity to a market of at least 20K people


Panel a: Cropped pixels

Panel b: Cropped area

Panel c: Crop value

Panel d: Cropping population

Source: Authors' construction based on travel time data from Guo (2014), cropland data from IIASA-IFPRI (2015), value of crop production data from You et al. (2016) and population data from CIESIN (2016).

Note: Calculations only include pixels with positive cropland. Regional delineations are mapped in Figure TN-1.

cropped areas are located. These varying market proximity patterns are influenced by a complex combination of site-sensitive factors, including output-oriented factors such as the differential yield performance and unit values of each crop that influence the geography of crop production (by value). The related geography of input-oriented factors such as the cropping system (and cropping intensities, in both time and space) along with the amount and intensity of inputs (land, labor, capital and other inputs) used to produce the crops also differentially influence the location of people, crops and agricultural areas. These different market proximity patterns are not surprising given von Thünen's (1826) notion that agricultural land use decisions are a function of production costs, transportation and other transaction costs, and (implied) farm-gate prices.

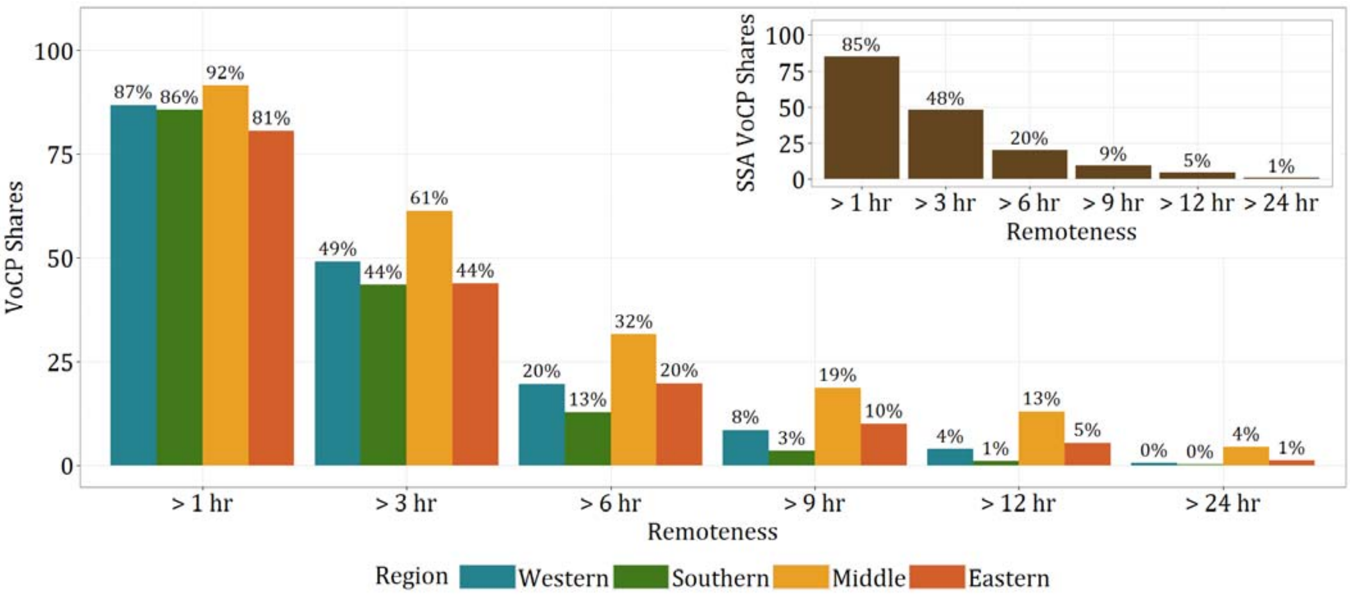
Agricultural Isolation

The mirror image of market proximity (or nearness) is market isolation. Looking at the isolation of agricultural production reveals significant regional differences in SSA. Regardless of the market access measure (distance to cropped pixels, cropped area, crop value or cropping population), Middle Africa is the most isolated region in SSA; 24.9 percent of its cropped pixels, 16.9 percent of its cropped area, 12.8 percent of its crop value, and 11.4 percent of its cropping population are located farther than half a day's travel to a 20K market (Figure 2). Figure 3 reveals the isolation of agriculture in regional markets as measured by the respective shares of regional crop value that is located at increasingly (left to right in the figure) distant travel time thresholds from a 20K market. Again, regardless of the time threshold, crop value in Middle Africa is the most remote: 91.5 percent of its value is located beyond an hour's travel, 31.5 percent is beyond six hours, and 4.3 percent is beyond a day's travel. The ranking between the other three regions varies among the isolation thresholds. While Eastern Africa has the smallest share of crop value further than one hour away from a 20K market (80.6 percent), it has almost the same share of crop value as Southern Africa located more than three hours from a 20K market (around 44 percent) and as Western Africa from markets further than six hours away (around 20 percent). Overall, crop value in Southern Africa is the least isolated of all the four plotted regions in SSA. For the sub-continent as a whole, 85.3 percent of crop value is located further than an hour's travel and nearly half of crop value is located beyond three hours of travel.

Off Road Travel: The Last Kilometer

Many producers in SSA do not have adequate access to transportation, and a good number of rural people live

Figure 3: Regional remoteness of crop value from a market of at least 20K people



Source: Authors' construction based on travel time data from Guo (2014) and cropland data from IIASA-IFPRI (2015).
Note: The figure inset reveals the remoteness of crop production value throughout SSA. Calculations only include pixels with positive cropland. Regional delineations are mapped in Figure TN-1.

quite far from an all-weather road (World Bank 2006). The tracks and pathways that connect individual farms to local road networks are often unrecorded, but their overall length in SSA is estimated to be "…one and a half to two times the local government road networks (Gwilliam et al. 2011, p. 22)." While the market participation implications of undocumented (local) roads and pathways cannot be explicitly assessed, we can parse the total time spent traveling from farms to urban markets into a pedestrian (off-road) and a vehicular (on-road) component.

Figure 4, Panel a maps the total travel time to a market of 20K for each of the cropped pixels in SSA. The majority (35.8 percent) of cropped pixels are located three hours or less from a 20K market (shaded an aqua blue). Table 2 shows that this share successively increases when considering the market proximity of cropped area (46.0 percent), crop value (51.8 percent) and cropping population (61.4 percent). Figure 4, Panel b parses this total travel time into the share spent traveling off-road. On average, cropped pixels are located 4.8 hours away from an established road. In SSA, 59.5 percent of the cropped pixels, 57.2 percent of the cropped area, 62.6 percent of crop value and 61.8 percent of cropping population are located in areas where at least half of the time spent traveling to a 20K market is spent off-road. Thus the biggest impediment for most farmers in accessing an urban market, even one as small as 20K people, is not the time spent travelling on more established roadways (albeit themselves of varying, and often poor, quality), rather it is a "last-kilometer" problem; that is, the time spent traversing off-road from their farms to the nearest measured road of any sort.

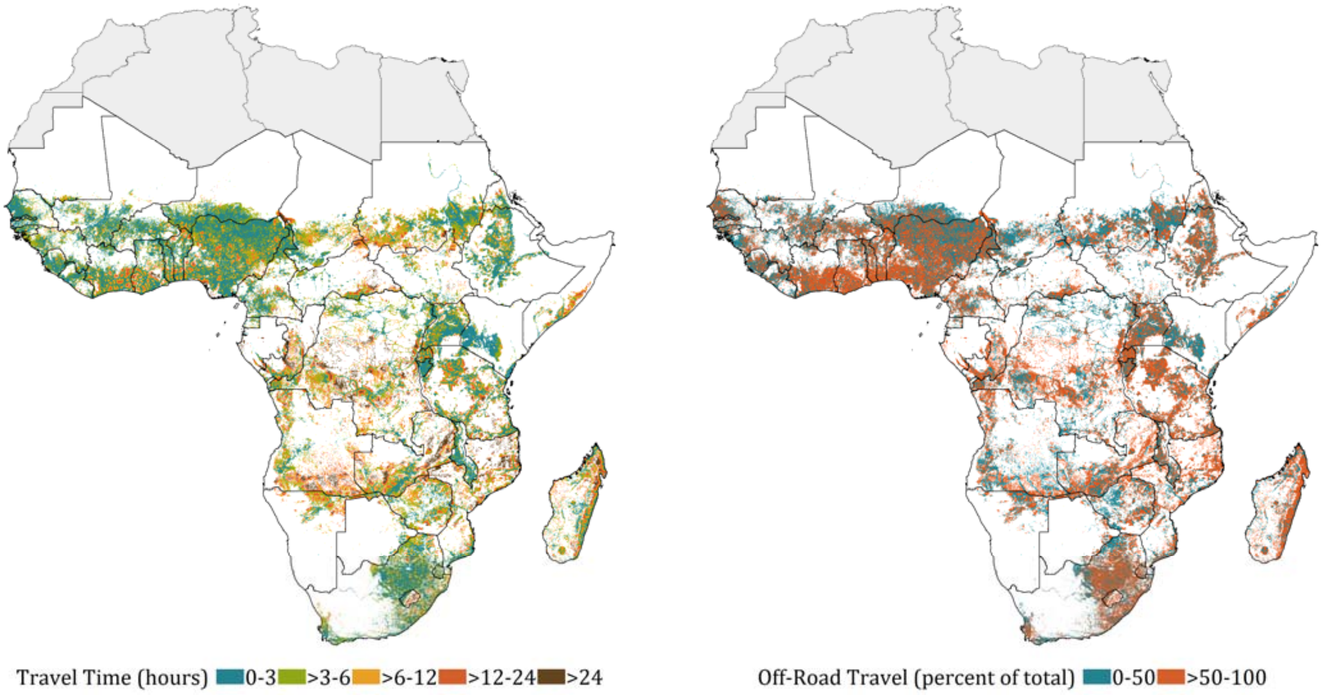
Table 3 emphasizes the pervasive nature of the "last-kilometer" problem, irrespective of the level of market proximity or the market access measure. With the exception of agriculture located in close proximity to a 20K market (i.e., three hours or less), the average share of off-road travel (weighted or unweighted) is greater than fifty percent (ranging from 54.1 to 92.7 percent). The average time agriculture spends traveling off-road to a market of at least 20K people increases as market proximity decreases. For example, 38.2 percent, on average, of the travel from pixels located three hours or less from a 20K market is off-road; increasing to 89.3 percent from pixels located more than a day from a 20K market. The

Table 2. Agricultural proximity to a market of at least 20K people, by market access indicator share

	Market Access Indicator Share			
Market Proximity	**Cropped pixels**	**Cropped area**	**Crop value**	**Cropping population**
(hours)		(percent)		
0-3	35.8	46.0	51.8	61.4
>3-6	29.0	30.0	28.0	22.3
>6-12	21.4	17.1	15.3	12.0
>12-24	9.8	5.4	4.0	3.3
>24	4.0	1.5	0.9	0.9
Total	100.0	100.0	100.0	100.0

Source: Authors' construction based on travel time data from Guo (2014), cropland data from IIASA-IFPRI (2015), value of crop production data from You et al. (2016) and population data from CIESIN (2016).
Note: Calculations only include pixels with positive cropland.

Figure 4: Maps of travel time to a market of at least 20K people



Panel a: Total travel time

Panel b: Off-road travel time

Source: Authors' construction based on travel time data from Guo (2014) and cropland data from IIASA-IFPRI (2015).
Note: Calculations only include pixels with positive cropland. The high measured extent of off-road time in the northeasterly part of South Africa is likely due to the absence of rural "feeder roads" in Guo's (2014) road network compilation used to form the travel time estimates reported in this brief.

average time agriculture spends traveling off-road to a 20K market increases when weighted by cropping area, crop value or cropping population. The average population-weighted share of off-road travel from pixels located three hours or less from a 20K market is 21.4 percent greater than its unweighted counterpart.

Table 3. Agricultural proximity to a market of at least 20K people, by average off-road travel share

	Average Off-Road Travel Share			
Market Proximity	**Cropped pixels**	**Cropped area[a]**	**Crop value[a]**	**Cropping population[a]**
(hours)		(percent)		
0-3	38.2	38.9	42.9	46.4
>3-6	54.1	58.0	66.8	68.2
>6-12	67.0	71.9	80.0	79.7
>12-24	78.7	81.8	87.6	86.9
>24	89.3	89.6	92.4	92.7
Total	55.0	53.3	57.5	57.0

[a] Shares weighted by market access indicator.
Source: Authors' construction based on travel time data from Guo (2014), cropland data from IIASA-IFPRI (2015), value of crop production data from You et al. (2016) and population data from CIESIN (2016).
Note: Calculations only include pixels with positive cropland.

The proportion of travel spent off-road varies by region. In Eastern, Middle and Southern Africa, approximately three-fifths of crop value is situated in areas where the majority of travel to access a 20K market is off-road; in Western Africa, it is two-thirds of production value. The largest fraction of time spent traveling off-road was along the coast of Western Africa, in the Congolese forests, and through the eastern regions of Zambia, Mozambique and Madagascar.

The box and whisker plots in Figure 5 show that as market proximity decreases the share of total travel time spent traveling off-road increases.[7] The median share of time spent traveling off-road from cropped pixels located three hours or less from a 20K market is 34.3 percent. For those pixels located in more remote areas (i.e., greater than one day of travel), the median share of time spent off-road is 91.6 percent. However, the variation in the share of off-road travel (represented by the height of the boxes in Figure 5) is directly related to market proximity. The interquartile range is 46.6 percentage points for

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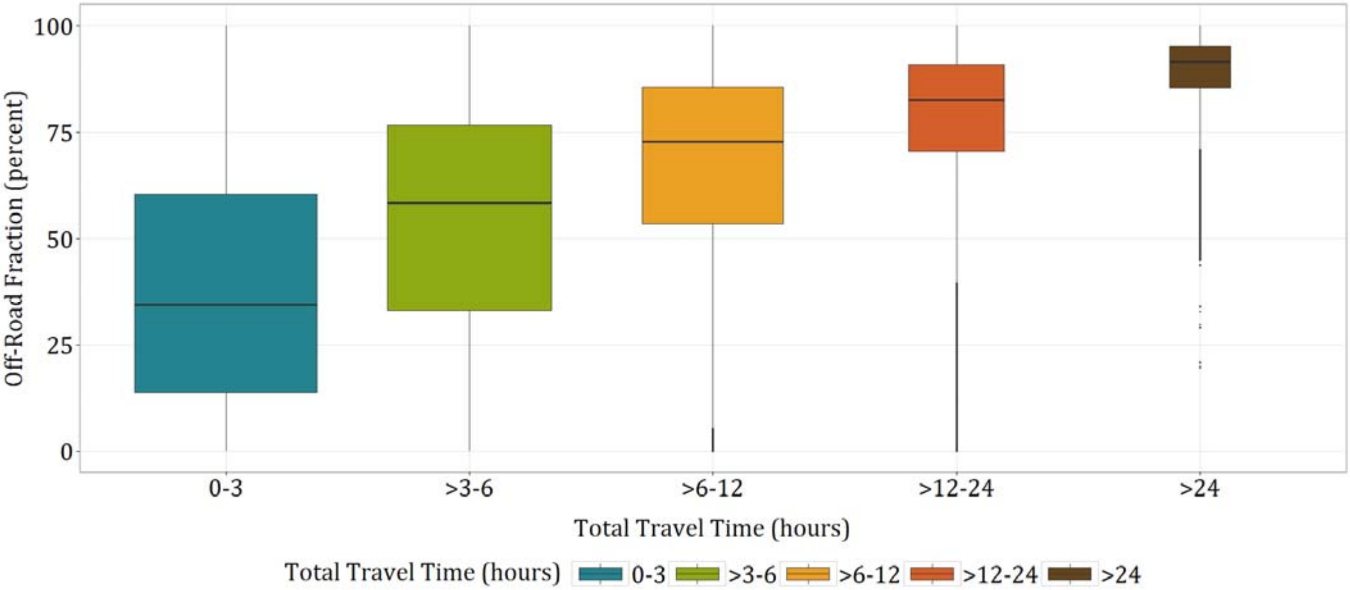
[7] The length of each box delineates the interquartile range, extending from the first quartile (bottom of box) to the third quartile (top of box) along the range of pixels measuring the share of off-road travel within each travel time category. Each box is intersected by a line that indicates the median off-road share across all the pixels within a travel time category. Thus, half of the data falls below the median, half falls above and half falls within the interquartile range. The lower and upper whiskers extend to the lowest/highest values within one and a half times the interquartile range. Any values beyond the whiskers are considered outliers.

Figure 6: Off-road travel and proximity of cropped pixels to a market of at least 20K people



Source: Authors' construction based on travel time data from Guo (2014) and cropland data from IIASA-IFPRI (2015).
Note: Calculations only include pixels with positive cropland.

cropped pixels located 3 hours or less from of a 20K market and just 9.8 percentage points for those located in areas greater than 24 hours away. So while nearly all production traveling from pixels in remote areas will spend the majority of its time off-road, a quarter of the production from pixels located relatively close to urban settlements (i.e., with a total travel time to a 20K market of at least 3 hours) will still spend approximately 60 percent or more of its time off-road.

The World Bank (2006) uses a Rural Access Index (RAI) to identify rural populations with inadequate access to transport access. This index measures the share of rural population who live within 2 kilometers (approximately a 20 to 25 minute walk) from an all-weather road. The World Bank's estimated RAI for sixteen countries in sub-Saharan Africa was 30.0 percent.[8] According to our travel-time estimates, just 20.3 percent of cropped pixels, 24.5 percent of cropland area, 24.8 percent of crop value and 32.5 percent of the cropping population are located within 25 minutes of a (documented) road. Thus a significant portion of the cropping activity throughout SSA takes place in isolated areas that are often overlooked by both policy analysts and practitioners, a phenomenon Chambers (1983, pp. 13-16) dubbed "tarmac bias." Moreover, trading intermediaries may be less willing to serve these remote populations, and those that do likely have greater bargaining power with farm households that may be less knowledgeable about current market prices and have limited other off-farm market opportunities.

Conclusion

Increasing market participation is critical for economic growth and poverty reduction, especially for small-scale farmers (Barrett 2008). Since market participation is tied to the transaction costs of accessing these markets, the location of farms and their physical and economic proximity to markets have a whole host of agricultural production and consumption implications that profoundly affect the economic circumstances of farm families. Understanding the spatial nuances of these potential transaction costs will help tailor future strategies aimed at transforming agriculture.

The estimates of farm-to-market travel times used here are based on several simplifying assumptions that need to be borne in mind when using these data. On balance these analytical simplifications are likely to result in estimated travel-to-market times that are shorter than reality—given they ignore the travel-time effects of congestion and (bad) weather—but they should yield estimates that are sufficiently robust for assessing overall (relative) patterns of proximity within countries or regions.

The HarvestChoice (Guo 2014) estimates reveal a sizable but varying time-to-market disconnect between where agriculture takes place and the small towns and growing cities where increasing amounts of agricultural consumption is projected to occur. In SSA, there is substantial spatial and functional variation in expenditures on road network construction and maintenance, both by country and class of road (Gwilliam et al. 2011). On average, countries spend twice as much on maintaining main road networks (that often connect main cities) than the rural networks (Gwilliam et

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[8] Data were drawn from household surveys conducted in sixteen SSA countries between 1994 and 2004. Survey data typically differentiated between rural and urban households, and in this instance the surveyed rural population constituted 58 percent of the region's total rural population. See World Bank (2006) for further details.

al. 2011) that are critical to connecting the preponderance of cropping activity throughout SSA to urban centers. Improving rural roads is a critical component of an agricultural development strategy for SSA. That is well known. The spatially-explicit market proximity analysis presented here (and the underlying data, analytical tools and framing) enable investors and policy makers to move beyond generalities that typically lack actionable insights, and begin developing a better understanding of precisely what road infrastructure in which locale may realize the larger development bang for the buck. In addition, strategies such as improved telecommunications infrastructure, community owned transport, low cost storage and processing technologies, or increased access to intermediate means of transport such as bicycles and motorcycles are also part of the agricultural logistics mix. In fact some of these strategies may be a more cost-effective means of alleviating the burdens of agricultural isolation and be more influential in bringing African agriculture "closer" to the market, at least in the near term (Porter 2002). But few if any of these strategies are lasting substitutes for the improved road and related logistics infrastructure that will be critical to feeding the growing and increasingly urbanized markets throughout the continent.

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Technical Note

Travel Time Statistics

SSA statistics on travel time were derived from the HarvestChoice (Guo 2014) 1 kilometer (equal area) estimates of travel time to markets of 20, 50, 100, 250 and 500 thousand people or more. The estimates were created using a cost-distance function to calculate the minimum 'cost' (in minutes) of traveling from the centroid of each grid cell to the centroid of the grid cell representing the market. Markets were defined as any human settlement with a population of at least 20,000, 50,000, 100,000, 250,000 or 500,000 people. Data on road networks, land cover type and elevation were used to estimate vehicular and pedestrian travel speeds for each pixel. Elevation and, consequently, slope were included as speed-reduction factors for foot-travel. See Joglekar et al. (2016) for technical documentation on the HarvestChoice travel time estimates for SSA.

Global statistics on travel time were derived from Nelson's (2008) 30 arc-second estimates of travel time to a market of 50,000 people or more. Nelson's estimates were formed using similar techniques to those described above.

Statistics on off-road travel were calculated for the HarvestChoice series (Guo 2014) by setting the speed of road travel inordinately high and then running the cost-distance model. Under this parametrization, the model returns estimates of the time spent traveling to a road, since time spent traveling on-road to an urban center is negligible.

Cropland Statistics

The data on the pixelated value of cropland introduced in Figure 1 and used throughout the brief were sourced from the IIASA-IFPRI (2015) 30 arc-second global cropland map for the year 2005. The IIASA-IFPRI cropland dataset is a composite of various land cover maps including Globcover2005 and MODIS v5 at the global level, Africover at the regional level, and national maps from multitude of mapping agencies. The cropland dataset designates the total cropland extent, but does not delineate the geography of specific crops. See Fritz et al. (2015) for technical documentation on the IIASA-IFPRI cropland estimates.

Crop Production Statistics

The data on the pixelated value of crop production introduced in Figure 2 and used throughout the brief were sourced from the HarvestChoice Spatial Production Allocation Model (SPAM) 2005 v2r3 estimates of global crop production. These data include estimates of physical area, harvested area, production and yield at a 5 arc-minute resolution for 42 crops and crop aggregates under irrigated and rainfed production. SPAM2005 spatially disaggregates national and sub-national level crop statistics on area and yield using a cross-entropy optimization approach. Value of crop production is calculated by multiplying the estimates of production by the Food and Agriculture's (FAO) 2004-6 average PPP agricultural prices. See Wood-Sichra et al. (2016) for technical documentation on the SPAM2005 estimates.

Population Statistics

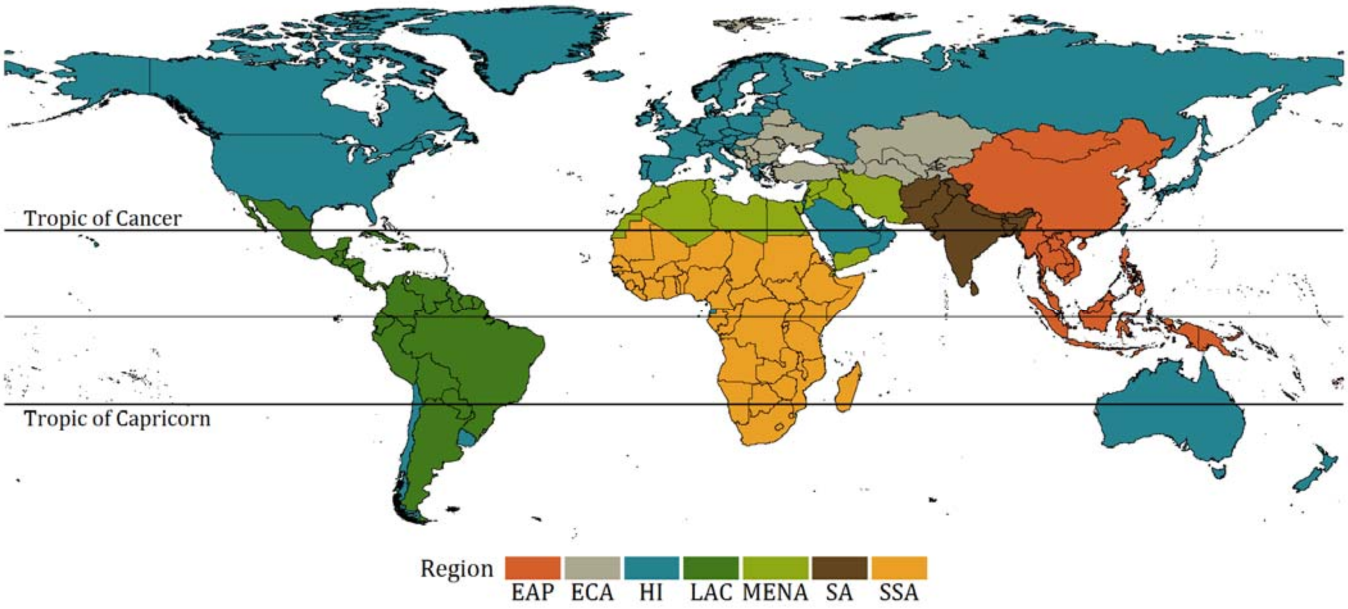
Pixelated data on population counts used to calculate the cropping population introduced in Figure 2 and used throughout the brief were sourced from CIESIN's (2016) Gridded Population of the World, version 4 (GPWv4) 30 arc-second population count estimates for 2005 as documented by Doxsey-Whitfield et al. (2015). These estimates were adjusted to reflect the 2015 revision of the United Nations World Population Prospects (WPP) country totals.

Geographical Classifications

Global Regions: The global regional classifications used to classify differences in travel time are based on the World Bank classification system (World Bank 2016), and are mapped in Figure TN-1.

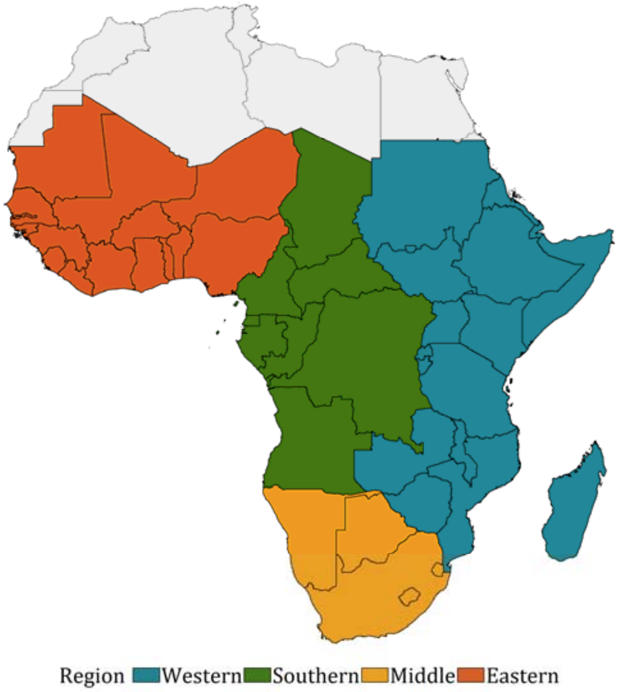
SSA Regional: The SSA regional classifications introduced in Figure 2 and used throughout the brief are based on the United Nations classification system (United Nations 2013), and are mapped in Figure TN-1. Sudan is considered part of Eastern Africa rather than Northern Africa.

Figure TN-1: World Bank regional classifications, 2013



Source: Authors' construction based on World Bank (2016).
Note: EAP – East Asia and the Pacific; ECA – Europe and Central Asia; HI – high income countries; LAC – Latin America and the Caribbean; MENA – Middle East and North Africa; SA – South Asia; SSA – Sub-Saharan Africa. The World Bank classifies Sudan as part of the Middle East and North Africa region; in this analysis Sudan is included in the sub-Saharan Africa region. Islands not classified by the World Bank were classified according to their geographic location. Disputed regions along the India/China border (e.g., Jammu, Kashmir, Arunachal Pradesh and Aksai Chin) were included in the South Asia region.

Figure TN-2: Sub-Saharan Africa sub-regional classifications, 2013



Source: Authors construction based on United Nations (2013).
Note: For this analysis Sudan is grouped with Eastern Africa rather than Northern Africa.

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ABOUT HARVESTCHOICE

HarvestChoice generates knowledge products to help guide strategic decisions to improve the well-being of the poor in sub-Saharan Africa through more productive and profitable farming. To this end, HarvestChoice has developed and continues to expand upon a spatially explicit, landscape-level evaluation framework. HarvestChoice's evolving list of knowledge products includes maps, datasets, working papers, country briefs, user-oriented tools, and spatial and economic models designed to target the needs of investors, policymakers, and research analysts who are working to improve the food supply of the world's poor.

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