Landmines and Spatial Development
Appendix VIII
Details and Sensitivity Analysis, Market Access Analysis*

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Abstract

This Appendix first discusses the theoretical insights of the market access approach. Second, we provide detailed information on the creation of the network database and the calculation of bilateral transportation costs we use to derive the market access measures. Third, the Appendix presents sensitivity checks and graphical illustrations of the relationship between aggregate development and market access.

*Additional material can be found at www.land-mines.com

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1 Theoretical Background

In this subsection, we detail the Ricardian model of inter-district trade that underpins the market-access analysis. The model is almost identical to Donaldson and Hornbeck (2016), who perturb the Eaton and Kortum (2002) to a within-country setting allowing for labor mobility. Our discussion in this section follows closely Donaldson and Hornbeck (2016), as well as Alder (2017), who look at the case of mobile labor. Donaldson (2015) provides an eloquent review of this body of research and our discussion follows his synthesis. While there is nothing new on the theoretical side, it is useful sketching the model to connect it to our application and discuss estimation.

1.1 Model Set-Up

1.1.1 Consumers

The (Mozambican) economy consists of many trading regions (localities). Subscript o denotes the origin locality, while d denotes the destination.

Consumers have "love-for-variety" preferences over differentiated goods, indexed by j. Given a constant elasticity of substitution (CES) aggregation, $\sigma > 0$, the utility is:

$$U_o = \left(\int x_o^{\frac{\sigma-1}{\sigma}} dj \right)^{\frac{\sigma}{\sigma-1}} \tag{1}$$

$x_o(j)$ denotes consumption of good j in the origin district o. Consumers maximize utility subject to the budget constraint:

$$\int p_o(j) x_o(j) dj = y_o \tag{2}$$

where y_o denotes income per capita in the (origin) locality. The demand for variety j is:

$$x_o(j) = \frac{y_o}{P_o} \left(\frac{p(j)}{P_o} \right)^{-\sigma} \tag{3}$$

where P_o is the aggregate "ideal" price index in locality o over the continuum of varieties.

$$P_o = \left(\int p_0(j)^{1-\sigma} dj \right)^{\frac{1}{1-\sigma}} . \tag{4}$$

The "indirect" utility of a consumer residing in locality o reads:

$$V\left(P_o, Y_o\right) = \frac{Y_o}{P_o} \tag{5}$$

1.1.2 Production

Each locality produces varieties using land (L), labor (H), and capital (K). Land is immobile, capital is mobile, while labor can either be mobile or immobile. We discuss the case of mobile labor, as this is more realistic in our setting. As Alder (2017) shows, the link between income and market access is qualitatively similar when labor is immobile. We return to this issue below.

Production for each variety j is:

$$X_o = z_o \left(L_o\right)^{\alpha} \left(H_o\right)^{\gamma} \left(K_o\right)^{1-\alpha-\gamma} \tag{6}$$

$z_o(j)$ is an exogenous (Hicks-neutral) productivity shifter that captures differences across localities in the efficiency of production. Given the Cobb-Douglass aggregation, marginal costs for variety j are:

$$MC_o(j) = \frac{q_o^{\alpha} w^{\gamma} r^{1-\gamma-\alpha}}{z_o(j)}, \tag{7}$$

where q, w, and r denote the agricultural land rental rate, the wage rate, and the interest rate, respectively.

Following Eaton and Kortum (2002) and the significant literature that followed, Donaldson and Hornbeck (2016) assume that each locality draws its productivity (for each variety j) from a Frechét distribution; the CDF is

$$F_o(z) = \Pr[Z_o < z] = \exp(-A_o z^{-\theta}). \tag{8}$$

A_o reflects the district's (log) level of technology/efficiency, its absolute advantage. Parameter θ captures the strength of comparative advantage, as it reflects the variability (log standard deviation) of the distribution. A high (low) value of θ implies a low (high) dispersion. Ricardian incentives to trade are increasing with dispersion in productivity (when θ is low).

1.1.3 Transportation Costs

Cross-locality trade is potentially costly. A remote region (say without road-railroad connectivity and/or heavily contaminated by landmines) has to pay higher prices for varieties produced elsewhere. At the same time, remote districts get low prices for the varieties that they produce, as this is the only way that locally-produced goods can reach the other localities at competitive prices. Trade costs between localities o and d take an "iceberg" formulation: for one unit of good sold to the destination producers in the origin need to ship $\tau_{od} > 1$ units. [As consumers purchase the cheapest variety, the distribution of productivity shapes the distribution of prices.]

1.2 Solving the Model

1.2.1 Prices and Consumer Market Access

The "iceberg" trade cost parametrization implies that the price of a good (variety j) produced at origin, o, and sold to destination, d, sells at $p_{od}(j) = p_{oo}(j)\tau_{od}$, where p_{oo} denotes the price of variety j sold in the locality it is produced. Competition implies that prices equal marginal costs:

$$
\begin{aligned}
p_{oo(j)} &= MC_o(j) = \frac{q_o^{\alpha} w^{\gamma} r^{1-\gamma-\alpha}}{z_o(j)} && (9) \\
p_{od(j)} &= MC_o(j)\tau_{o,d} && (10)
\end{aligned}
$$

Eaton and Kortum (2002) show that when consumers purchase the cheapest variety and prices reflect marginal costs plus transportation costs, the consumer price in the destination locality d is:

$$
P_d^{-\theta} = \kappa_1 \sum_o A_o (q_o^{\alpha} w^{\gamma})^{-\theta} \tau_{o,d}^{-\theta} \equiv CMA \quad (11)
$$

Following Redding and Venables (2004), Donaldson and Hornbeck (2016) refer to the price index as "consumer market access" [CMA]. CMA reflects locality's d access to cheap goods from all other localities; this is reflected in low wages and low rents for agricultural land, $(q_o^{\alpha} w^{\gamma})^{-\theta}$. κ_1 is a constant capturing the common to all localities rate of capital and parameters. [$\kappa_1 = r^{-(1-\alpha-\gamma)\theta} \Gamma \left[\frac{\theta+1-\sigma}{\theta}\right]^{\frac{1}{1-\sigma}}$, where Γ denotes the Gamma function]. This is not important in our application, as our estimation will always include period fixed-effects that absorb common to all localities factors.

1.2.2 Trade Flows and Gravity

Eaton and Kortum (2002) derive the fraction of expenditure in locality d spent on goods produced in (and imported from) locality o to be:

$$\frac{X_{o,d}}{X_d} = \frac{A_o(q_o^{\alpha} w^{\gamma} r^{1-\alpha-\gamma})^{-\theta} \tau_{o,d}^{-\theta}}{\sum_o A_o(q_o^{\alpha} w^{\gamma} r^{1-\alpha-\gamma})^{-\theta} \tau_{o,d}^{-\theta}} \tag{12}$$

Assuming that aggregate expenditure equal aggregate income and cancelling the interest rate, the value of trade (exports) from o to d, is

$$X_{o,d} = \kappa_1 A_o(q_o^{\alpha} w^{\gamma})^{-\theta} \tau_{o,d}^{-\theta} CMA_d^{-1} Y_d \tag{13}$$

Trade between origin and destination reflects: (i) origin's endowments, absolute and relative productivity, wages, and agriculture land rates $[A_o(q_o^{\alpha} w^{\gamma})^{-\theta}]$; ($ii$) aggregate income $[Y_d]$; and (iii) consumer market access $[CMA_d^{-1}]$ and trade costs $[\tau_{o,d}^{-\theta}]$.Trade between locality o and other districts is higher when the origin is relatively more productive [higher A], when the origin produces more cheaply (low wages and low agricultural land rents $[(q_o^{\alpha} w^{\gamma})^{-\theta}]$, when transportation costs are lower $[\tau_{o,d}^{-\theta}]$, and when the destination has low consumer market access $[CMA_d^{-1}]$, as in this case producers in origin face less competition from producers in destination. Trade costs affect trade both directly (inversely), but also indirectly (positively) as they affect the consumer market access of destination.

The above "gravity equation" seems to characterize trade across and within countries quite well.[1] Trade flows are higher when the origin district is more productive and when the destination district is richer. Trade flows decline as production or/and trade costs increase and when consumer market access in the destination increases.

1.2.3 Consumer Market Access and Firm Market Access

Summing across trade flows (expenditure), we get

[1] Monopolistic competition models with firm heterogeneity and fixed costs in production, like Melitz (2003) or Eaton, Kortum, and Kramarz (2011) or Chaney (2008), also yield a similar expression. In these models θ is the parameter of the Pareto distribution shaping firm productivity (lower values imply higher heterogeneity).

$$
\begin{aligned}
Y_o &= \sum_d X_{o,d} \\
&= \kappa_1 A_o (q_o^{\alpha} w^{\gamma})^{-\theta} \tau_{o,d}^{-\theta} \underbrace{\sum_d \tau_{o,d}^{-\theta} CMA_d^{-1} Y_d}_{FMA_o}
\end{aligned} \tag{14}
$$

Donaldson and Hornbeck (2016) label the summation term as "firm market access" [FMA_o]. Consumer and firm market access are linked:

$$
FMA_o = \sum_d \tau_{o,d}^{-\theta} CMA_d^{-1} Y_d \tag{15}
$$

The market access for firms (producers) in origin district o, FMA_o, is the sum of its "proximity" (captured by the transportation costs $\tau_{o,d}$) to all other destination districts d, scaled by their income (Y_d) and consumers' market access (CMA_d). Alternatively, market access for a given district is the sum of the income of all other districts (which are potential trading partners), discounted by bilateral trade costs and by the destination's district market access. Consumers' and producers' market access are related ($FMA_o = \rho CMA_o$) as they both decline in trade costs and increase in a district's proximity to large markets (the "gravity equation").

When trade costs are symmetric, then consumer and market access are proportional to a scalar, $\rho > 0$

$$
FMA_o = \rho CMA_o \equiv MA_o \tag{16}
$$

The market access [MA_o] for origin district, o, is a weighted sum of the market access of all destination regions.

$$
MA_o = \rho \sum_d \tau_{o,d}^{-\theta} MA_d^{-1} Y_d \tag{17}
$$

The market access for origin district o is high when it is "close" (low transportation costs, $\tau_{o,d}^{-\theta}$) to localities with high income (Y_d). Market access in the origin is lower when it "close" to localities with high market access (with low MA_d), as producers in origin face competition. This reflects general equilibrium effects as a decline in trade costs will not only affect positively origin's market access but also negatively as it will raise competing regions' market access.

1.2.4 Agriculture Land, Population, Income and Market Access

Agriculture Land Donaldson and Hornbeck (2016) do not observe county-level incomes in late 19th century United States; rather they have data on the value of agricultural land. Hence, with perfect labour mobility, $w_o = \overline{U} P_o$, as well as the relationship between consumer-market access and the price index: $P_o^{-\theta} = CMA_o$ they solve the model for the price of agricultural land.

$$q_o = \left(\kappa_1 \alpha \overline{U}^{-\gamma\theta} \rho^{-\gamma}\right)^{\frac{1}{1+\alpha\theta}} \left(\frac{A_o}{L_o}\right)^{\frac{1}{1+\alpha\theta}} MA_o^{\frac{1+\gamma}{1+\alpha\theta}}, \tag{18}$$

[2]

Taking logs, they obtain an estimation equation that connects agriculture land rental rates to market access.

$$\log q_o = \kappa_2 + \frac{1}{1+\alpha\theta} \log\left(\frac{A_o}{L_o}\right) + \frac{1+\gamma}{1+\alpha\theta} \log MA_o$$

The first constant term collects various parameters; the second term reflects productivity and land endowments of the origin district; and the third term reflects (endogenous) market access.

Population Using similar derivations, Donaldson and Hornbeck (2016) obtain the link between population, N, and market access

$$\log N_o = \kappa_3 + \frac{1}{1+\alpha\theta} \log A_o - \frac{2+\alpha\theta}{1+\alpha\theta} \log L_o + \frac{1+\theta(1+\gamma+\alpha)}{(1+\alpha\theta)\theta} \ln MA_o. \tag{19}$$

κ_3 collects various parameters; the second and third term reflect origin's productivity and land endowment, while the forth term captures the role of market access.

Income Similarly to Donaldson and Hornbeck (2016) we do not observe real income, as, due to warfare and the high levels of poverty, data from Mozambique in the 1990s is scant. We thus proxy income using satellite imagery on light density at night. [As we show in Appendix IV, luminosity correlates strongly with education and proxies of wealth both across Mozambican localities and over

[2]for brevity we omit the algebra (see Donaldson and Hornbeck (2016) for the intermediate steps).

time]. In this regard, our approach is similar to Alder (2017), who quantifies the role of India's large highway system on regional development in the 2000s proxying regional income with luminosity.

One can solve the model for income in equation (15). Substituting for agricultural land rental rate, q_o,and the wage rate, $w_o = \overline{U}P_o = \overline{U}CMA_o^{-\frac{1}{\theta}} = \overline{U}\left(\frac{1}{\rho}MA_o\right)^{-\frac{1}{\theta}}$, yields:

$$
\begin{aligned}
Y_o &= \kappa_1 A_o \left(q_o^{\alpha} w_o^{\gamma}\right)^{-\theta} MA_o \\
&= \kappa_1 A_o \left(\left[\left(\kappa_1 \alpha \overline{U}^{-\gamma\theta} \rho^{-\gamma}\right)^{\frac{1}{1+\alpha\theta}} \left(\frac{A_o}{L_o}\right)^{\frac{1}{1+\alpha\theta}} MA_o^{\frac{1+\gamma}{1+\alpha\theta}} \right]^{\alpha} \left[\overline{U} \left(\frac{1}{\rho} MA_o\right)^{-\frac{1}{\theta}} \right]^{\gamma} \right)^{-\theta} MA_o \\
&= \left(\frac{\kappa_1}{\alpha^{\alpha\theta} \rho^{\gamma} \overline{U}^{\gamma\theta}} \right)^{\frac{1}{1+\alpha\theta}} A_o^{\frac{1}{1+\alpha\theta}} L_o^{\frac{\alpha\theta}{1+\alpha\theta}} MA_o^{\frac{1+\gamma}{1+\alpha\theta}}. \qquad (20)
\end{aligned}
$$

Following Alder (2017), we divide with the price index. Using that $P_o = MA_o^{-\frac{1}{\theta}} \rho^{\frac{1}{\theta}}$ (equation 12) yields:

$$
\begin{aligned}
Y_o^r &\equiv \frac{Y_o}{P_o} \\
&= \rho^{\frac{1}{\theta}} \left(\frac{\kappa_1}{\alpha^{\alpha\theta} \rho^{\gamma} \overline{U}^{\gamma\theta}} \right)^{\frac{1}{1+\alpha\theta}} A_o^{\frac{1}{1+\alpha\theta}} L_o^{\frac{\alpha\theta}{1+\alpha\theta}} MA_o^{\frac{1+\gamma}{1+\alpha\theta}} MA_o^{\frac{1}{\theta}} \\
&= \rho^{\frac{1}{\theta}} \left(\frac{\kappa_1}{\alpha^{\alpha\theta} \rho^{\gamma} \overline{U}^{\gamma\theta}} \right)^{\frac{1}{1+\alpha\theta}} A_o^{\frac{1}{1+\alpha\theta}} L_o^{\frac{\alpha\theta}{1+\alpha\theta}} MA_o^{\frac{1+\theta(1+\gamma+\alpha)}{\theta(1+\alpha\theta)}}. \qquad (21)
\end{aligned}
$$

Taking logs, we get:

$$
\log\left[Y_o^r\right] = \underbrace{\kappa_5}_{\text{collecting constants}} + \frac{1}{1+\alpha\theta} \underbrace{\log\left[A_o\right]}_{\text{productivity}} + \frac{\alpha\theta}{1+\alpha\theta} \underbrace{\log\left[L_o\right]}_{\text{land}} + \frac{1+\theta(1+\gamma+\alpha)}{\theta(1+\alpha\theta)} \underbrace{\log\left[MA_o\right]}_{\text{Market Access}}. \qquad (22)
$$

Real income of origin district o is a log-linear function of market access, as well as features capturing the locality's land endowment and productivity. Effectively, the estimated elasticity in the market access section of the paper aims to approximate, $\frac{1+\theta(1+\gamma+\alpha)}{\theta(1+\alpha\theta)}$. As Alder (2017) shows the expression is quite similar when one assumes that labor is immobile. In the latter case the income - market access elasticity is $\frac{1+\theta(1+\gamma+\alpha)}{\theta(1+\theta(\alpha+\gamma))}$.

Importantly, the first term of the above equation is time-invariant, as it is a collection of parameters (trade elasticity, share of land and capital, etc.). The second and third terms are also time invariant in the model. Transportation infrastructure and land clearance affects income via altering origin's market access. In this setting, transportation infrastructure affects income via altering the district's market access, which itself reflects bilateral trade costs across all pairs of districts as well as endogenous population movements, scaled by the model's parameters.

However, compared to works looking at the role of railroads or roads on spatial development (e.g., Donaldson and Hornbeck (2016), Alder (2017)) in our application landmine clearance may also affect agriculture land usage. Therefore, landmine access may have both "direct" effects on income, via raising agricultural productivity and land usage, besides its impact via market access.

2 Construction of Market Access

2.1 Bilateral Transportation Costs

This section details the four steps involved in the bilateral transportation cost (τ_{od}) calculation.

2.2 Building the Network

The first step entails the creation of the transportation network that consists of railroads, paved roads, unpaved roads, trails, and navigable rivers during the three phases of demining.

The National Road Administration (ANE) kindly provided a georeferenced database of Mozambican roads in 2011 (Figure 1, Panel B) The database gives details on the segments of all paved and unpaved roads, as well as trails. ANE also shared maps delineating the condition and quality of roads for 1998 and 2003, which we digitized and merged with the digital map of 2011.

Information on the railways network comes from the Ministry of Transport and Communication. For each of the railways, we identify the name and the length of each segment. There are five main railways, all connecting the coastal areas in the Indian Ocean to inland: the Northern line links Nacala to Malawi (Niassa); the central line connects Beira to Zimbabwe; and the Southern routes connect capital Maputo to South Africa (Ressano line), Zimbabwe (Limpopo line), and Swaziland (Goba line).

We obtained data on navigable rivers from the Ministry of Transportation. We count 12 navigable rivers in Mozambique.[3] With the exception of the Zambezi river that crosses the country in the middle, Mozambican navigable rivers do not allow large or medium-sized boats to sail and are far less utilized compared to road and rail.

[3]Buzi, Chinde, Incomati, Limpopo, Lugenda, Lurio, Messalo, Pungwe, Ruvuma, Save, Tembe, Zambezi.

We then digitized the transportation network at the end of the colonial era to have a mapping of transportation before clearance. We accessed a map from the colonial archives in Maputo depicting the road and the railroad infrastructure in 1973, just two years before independence (Figure 1, Panel A). We complemented the maps from the colonial archives with information on railroad conditions and status (functioning or destroyed) at the end of the Civil War in 1992.[4] After retrieving information on the conditions of roads and railroads in 1973, we reconstructed the classification of the colonial road network into paved, unpaved or trail to be consistent with the post-colonial classification.

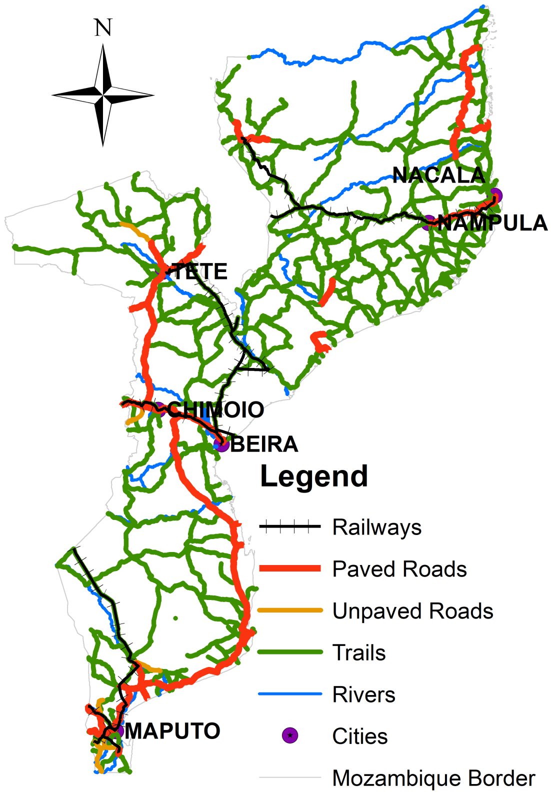
Figure 1, Panels A and B, depicts Mozambique's transportation network in 1973 and 2011. Since the end of the civil war, there have been significant improvements of the pre-existing road network (e.g., from trail to unpaved roads). Panels C and D of Figure 1 zoom in on the Central region surrounding the "Beira corridor". The rehabilitation of the three colonial bridges (Dona Ana, Samora Machel, Cahora Bassa) in 2010 allowed the Southern provinces to reconnect with the Northern ones. This connection was lost during the civil war, as RENAMO mined and damaged the bridges. The destroyed railway line from Sena to Moatize reopened in 2006 and further developed in 2010. The main National road ($N1$) was expanded to the North of Beira. Table 1 gives the statistics of the road network at 4 different points in time (1973, 1998, 2003, 2011) for each of the ten provinces.

We then connected the $1,187$ localities (admin-4 units) to the transportation network in each period (1973, 1998, 2003, and 2011). We linked the centroid of each locality to the closest feature of the transportation network (road, railway, and navigable river). Following Donaldson and Hornbeck (2016), we allow for the possibility of straight-line like connection on foot (walking) among localities' centroids, linking any two centroids within a distance of $300km$.[5] So, we do not allow travel/trade via Malawi in the North-East for connecting localities within Mozambique. We also do not allow for crossing the Zambezi river before 2010, as the three main bridges were closed.

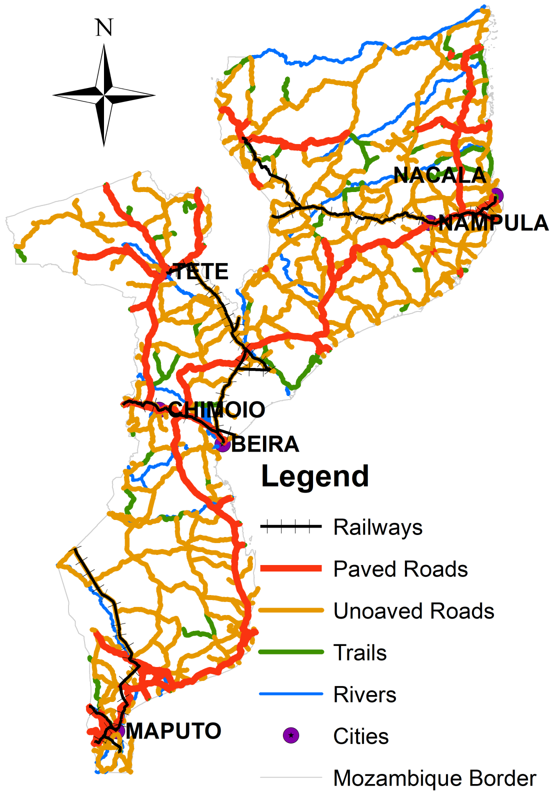
In late 2014, a new 715-meters long bridge connecting the city of Tete to Moatize opened up. Rendering the Zambezi river non-crossable splits the country in two subsets: a 499 x 499 set of connections across localities in the North; and a 688 x 688 South of the Zambezi. For the 2015 network, following the reopening of the bridges on the Zambezi, we have a full 1187 x 1187 matrix. We do not allow for

[4]We interviewed several experts and consulted the archives of the Ministry of Transportation in Maputo.

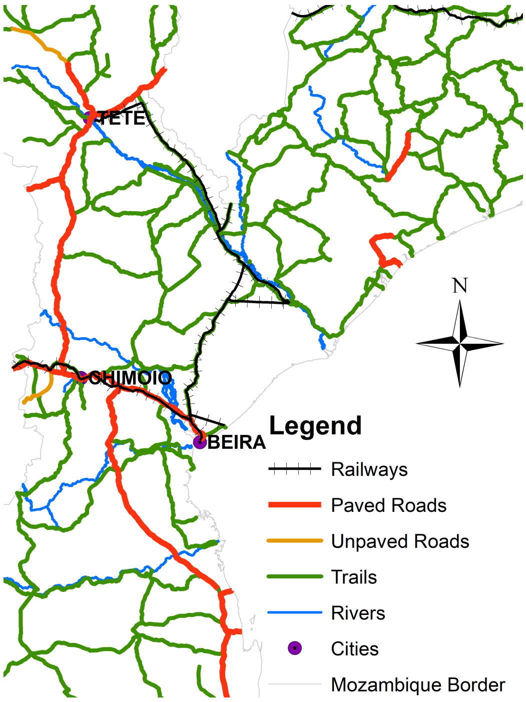
[5]Allowing for centroid to centroid connection is important in our application as landmines' presence often limits substantially connectivity via the transportation network. For example, a locality's centroid connection to all nearest network elements can be blocked by landmines. In our context, not allowing for a centroid-to-centroid connection would imply i) full isolation for 26 localities ii) 37 localities would be connected to less than 10 destinations iii) The maximum number of centroid-to-centroid connection for a given is 275 in the North of the Zambese and 588 South of the river.



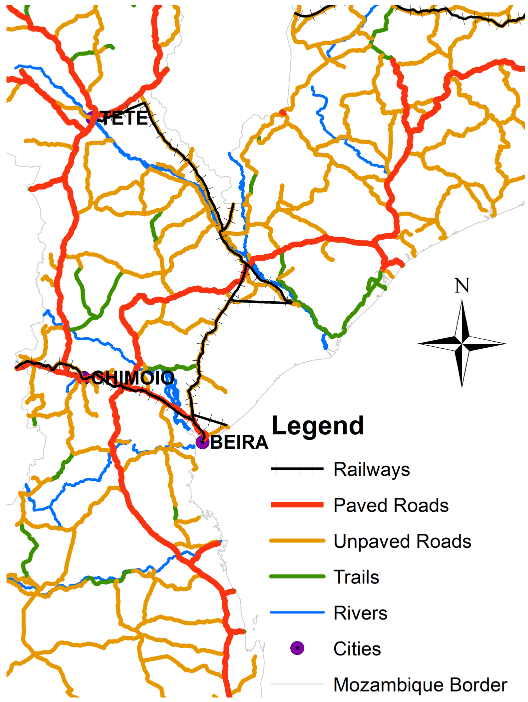
Panel A: Infrastructure Network 1973



Panel B: Infrastructure Network 2011



Panel C: Infrastructure Network 1973



Panel D: Infrastructure Network 2011

Figure 1: **Evolution of Transportation Network: 1973 and 2011**

maritime transportation across coastal districts, as Mozambican port data, historical evidence, and our interviews with officials of the Ministry of Transportation all suggest the limited importance of sea connectivity. As there are no commercial ports along navigable lakes, which could be relevant for localities around lake Niassa/Malawi in the North-West, we do not allow for transportation/trade across by-the-lake localities.

2.3 Network Parametrization

Second, we parameterize the relative cost of the network's elements. To calculate the cost of each network element, we multiply the length in kilometer with the corresponding relative-cost parameter. We tie our hands following closely earlier and parallel works (Donaldson (2018), Donaldson and Hornbeck (2016), Alder (2017), and Jedwab and Storeygard (2018)).

- As in Donaldson (2018), the most efficient (trade) technology is the railway, whose cost is normalized to 1.
- As earlier and parallel works, we distinguish between paved and unpaved roads. World Bank reports (e.g., Raballand and Teravaninthorn (2009)) suggest that road condition is an important determinant of trade costs. Storeygard (2016) also underlines the importance of paved versus unpaved road for oil shock propagation within African countries, while Jedwab and Storeygard (2018) also distinguish between paved and unpaved roads in their careful examination of their role on African urbanization post independence.
  - Paved roads are the second most efficient means of transportation and trade. Following Donaldson (2018), we impose a (relative-to-railway) cost of 2.
  - We assign a relative-to-rail cost of 4 to unpaved roads. This builds on works calculating that the cost of transportation via unpaved roads is often double than that of paved road (Kim, Molini, and Monchuk (2012)). This relative cost parameterization is also consistent with studies on the Mozambique maize market in early 2000s (Alemu and Van Schalkwyk (2008)).
- We set the relative costs of trails to 10. This is similar to Jedwab and Storeygard (2018) and Alemu and Van Schalkwyk (2008), who reports a relative cost that is 2.5 higher than unpaved

roads. Even today, trails -that typically connect roads to villages and small towns are in poor conditions, impeding commerce.

- Following Donaldson and Hornbeck (2016), we assign a relative cost of 20 to the least efficient technology, namely walking. This parameter is assigned to centroid-to-centroid connections as well as to the centroid to the transportation network elements.
- The last component of the network are navigable rivers, which play a tiny role on local commerce.[6] Given the absence of ports, and the poor conditions of boats, we impose a relative cost of 15.[7]

The exact values of the cost parameterization are not particularly important. But the relative costs (of say using a paved road versus a trail) are and therefore we explore the stability of our estimates to alternative parameter settings in the sensitivity analysis below.

2.4 Landmines and Transportation Cost

Third, regarding the role of landmines, we assume that the presence of a confirmed hazardous area (CHA) within 100 meters of a road/railroad/trail and a navigable river is blocking access to that particular segment. The 100-meters buffer is motivated by the fact that there is non-trivial measurement error both in the coordinates found in the demining reports and in the exact location of the digitized colonial and post-colonial transportation network.[8]

The assumption that landmine contamination prevents the usage of transportation elements is widely shared among practitioners. For example, mined transport routes increase massively the cost of the humanitarian operations all around the world (Landmine Monitor (2015)). In several instances, the only alternative to a mined road for the distribution of relief aid is air shipping, raising the cost by as much as 10 to 20 times. The Red Cross report argues: *"In areas where road access has been cut off by AV (Anti-Vehicle) mines the population cannot trade, cannot purchase supplies and do not have access to medical facilities. [..] At best people have to walk miles to collect any basic provisions which they cannot produce themselves"*, ICRC (2002).

[6]As river transportation is almost absent in Mozambique, we abstract from modeling transshipment costs across railways and river transportation modes.

[7]The fact we impose the Zambesi is uncrossable until 2015 restrict the possibility of sailing to the 11 medium-small rivers.

[8]In the earlier draft of the paper we used a wider 250 meter radius, finding similar results.

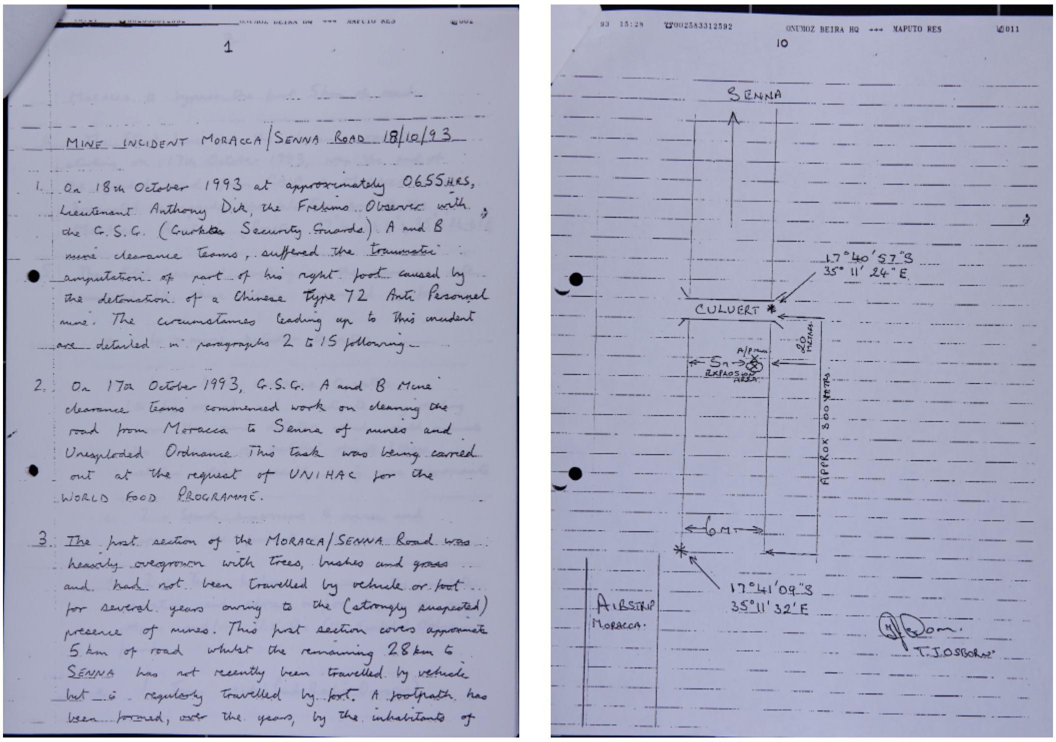
Isolation is a common phenomenon of landmine-ridden areas. According to the UN Mine Action Programme for Afghanistan, mined roads remained unusable for 9 years *on average*. Our interviews suggest that Mozambique was no different. For example, according to HALO Trust, a mined road linking two district capitals, Milange and Morrumbala in the Zambezia province, was not used for 10 years, ICRC (2002). The alternative trail that locals were using was flooded during the rainy season, cutting off the districts from the rest of the country during this period every year. Only once HALO Trust cleared the main road, people in the towns of Milange, Marrumbala, Chire, and Morire had a reliable connection to the transportation network throughout the year, ICRC (2002).

Another example comes from the 1993 *GSG* interventions that cleared 33 kilometers of road connecting Sena with Moracca in the central provinces. The report, reproduced below (Figure 2), states that *"the road had not been travelled by vehicles or foot for several years owing to the presence of mines"*.

In light of this, we assume that mines render the road segment between two successive nodes (entry points) unusable, and hence it is not used in the calculation of the lowest-cost route. Figure 3 provides an illustration zooming in 2007 on the provinces of Manica and Tete and focusing on the main road connecting the city of Tete (province capital in the Zambezi river) with Chimoio (a district capital on the Beira corridor). Panel A of Figure 3 depicts road conditions and landmine contamination as of 2007; Panel B Figure 3 visualizes road segments blocked by landmines in 2007. Landmine contamination along a road ($100m$ radius) blocks the particular road segment between two successive nodes. The same reasoning applies to railways. Landmine contamination blocks the segment of railways between two train stations. We retrieve and georeferenced the distribution of railway stations in all periods.

Table 2 tabulates the lenght of roads blocked for each province in each period. In 1992, under the assumption that mines block the respective transportation segments implies that $11,225$ km (47% of the total $23,501$ km) of roads were not usable. Specifically, (i) 2013 km (63% of the total $3,213$ km) of paved road are blocked, (ii) 168 km (42% of the total 399 km) of unpaved road are blocked and (iii) $9,043$ km of trails (45% of the total $19,888$ km) are not used in the algorithm.

In the sensitivity analysis we experiment with different distance thresholds beyond which a CHA does not impede access to the transportation network and also relax the blocking assumption.



1

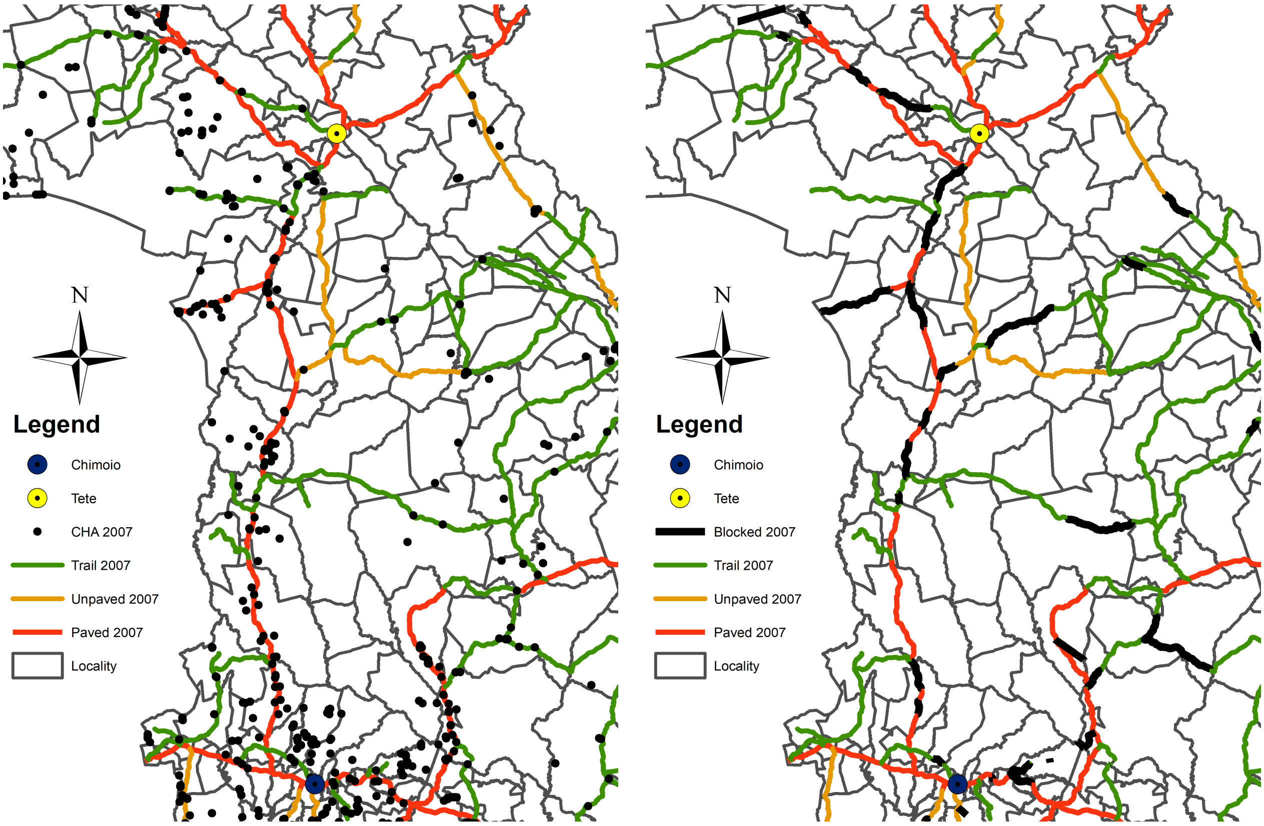
MINE INCIDENT MORACCA/SENNA ROAD 18/10/93

1. On 18th October 1993 at approximately 0655HRS, Lieutenant Anthony Dik, the Frelimo Observer with the G.S.G. (Gurkha Security Guards) A and B mine clearance teams, suffered the traumatic amputation of part of his right foot caused by the detonation of a Chinese Type 72 Anti Personnel mine. The circumstances leading up to this incident are detailed in paragraphs 2 to 15 following.

2. On 17th October 1993, G.S.G. A and B Mine clearance teams commenced work on clearing the road from Moracca to Senna of mines and Unexploded Ordnance. This task was being carried out at the request of UNIHAC for the WORLD FOOD PROGRAMME.

3. The first section of the MORACCA/SENNA Road was heavily overgrown with trees, bushes and grass and had not been travelled by vehicle or foot for several years owing to the (strongly suspected) presence of mines. This first section covers approximate 5 km of road whilst the remaining 28 km to SENNA has not recently been travelled by vehicle but is regularly travelled by foot. A footpath has been formed, over the years, by the inhabitants of

Figure 2: **GSG report 1993**

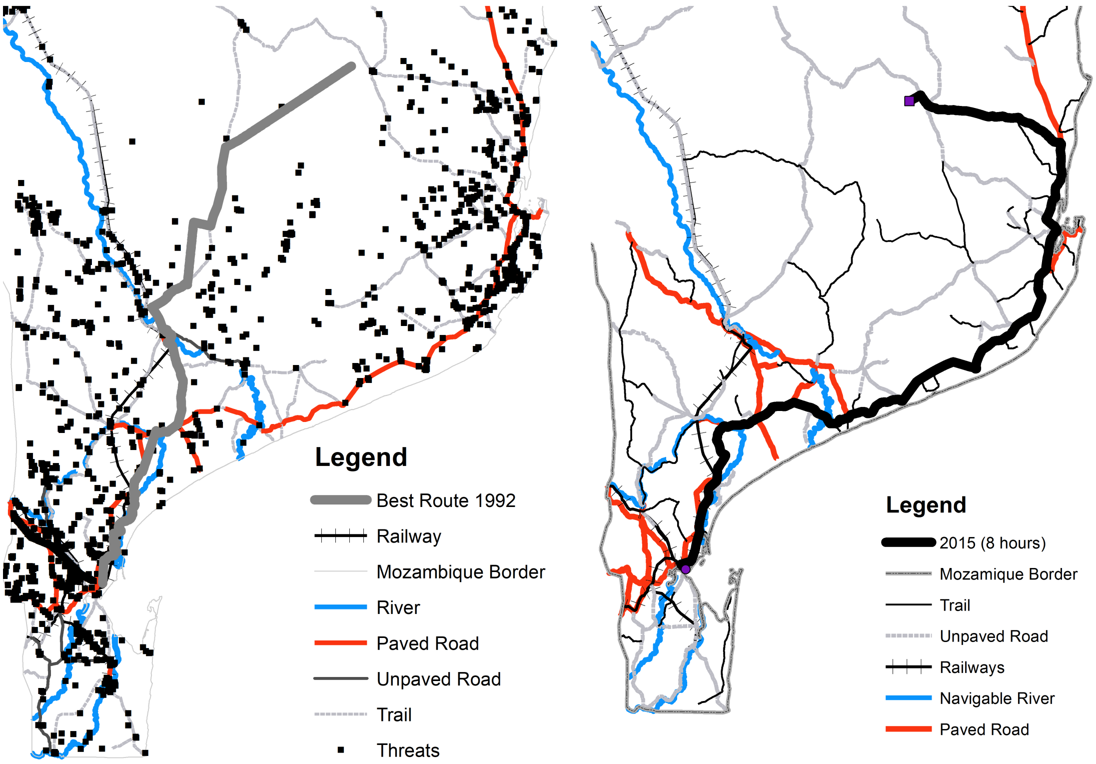


Panel A: CHAs Distribution in 2007 **Panel B: Blocked Roads in 2007**

Figure 3: **Land mines contamination and Blocked Roads**

2.5 Lowest-Cost Calculation

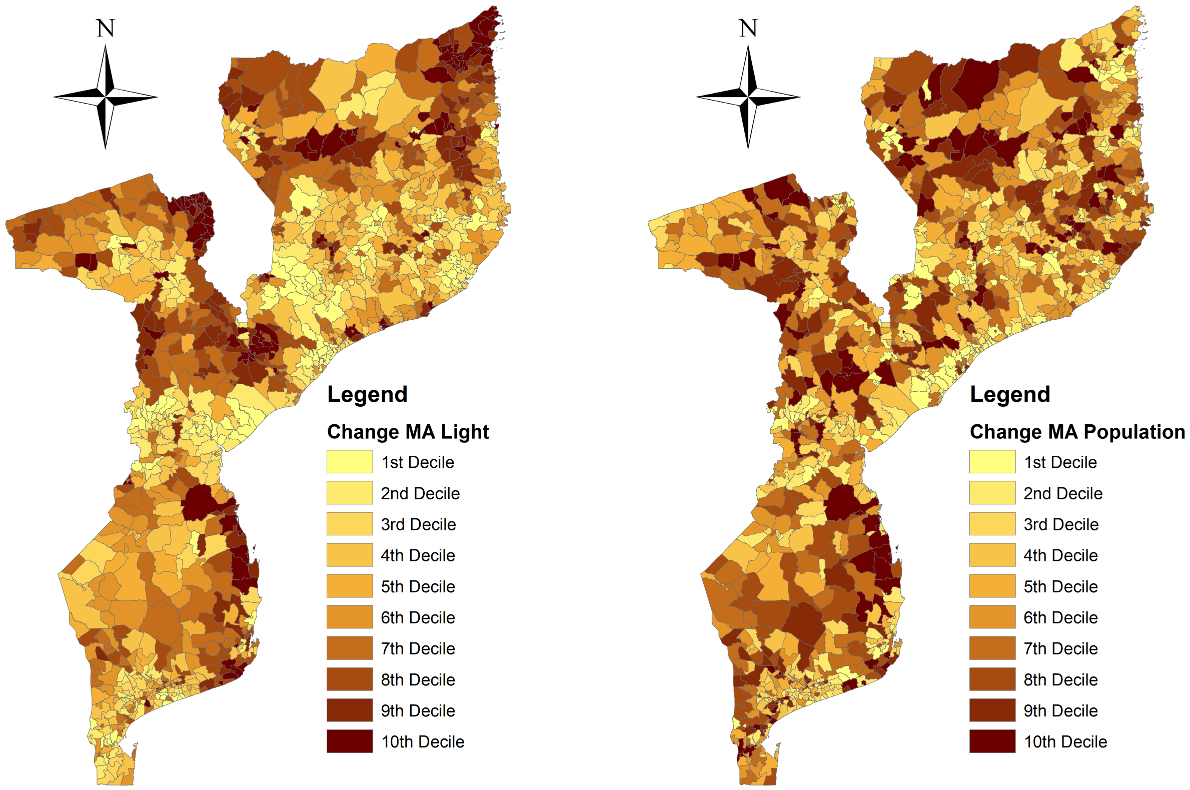
Fourth, we construct the time required to travel from each locality to any other locality using Dijkstra's algorithm. This algorithm that has been recently used by many empirical applications assessing the role of transportation infrastructure (e.g., Alder (2017), Donaldson and Hornbeck (2016), Donaldson (2018), Dell (2015)) solves for the lowest-cost path between any two localities' centroids. We compute the shortest paths in: (i) 1992 using the 1973 transportation network and the universe of CHA (as no clearance intervention had taken place); (ii) in 1999, the end of the first phase of demining using the 1998 transportation network and clearance operations up until that year; (iii) in 2007 using the 2003 transportation network and all intervention up until the end of the second phase of demining; and (iv) in 2015 when all CHA had been cleared using the 2011 infrastructure network.



Panel A: Optimal Route 2015 **Panel B: Optimal Route 1992**

Figure 4: **Least-Cost Route according to Dijkstra's Algorithm**

Figure 4 illustrates the algorithm-derived optimal route between Maputo and Funhalouro (Muchuhuine), a locality 600 km north of the country's capital. Figure 3B shows the optimal path in 2015. As all hazardous areas have been cleared, the algorithm employs the most efficient network elements, yield-



Panel A: Change in Log MA1 (Luminosity) **Panel B: Change in Log MA2 (Population)**

Figure 5: **Change in Contemporaneous Market Access**

ing a cost of 6272.325. Reassuringly, the solution to the algorithm is identical to the one obtained by Google Map, yielding a 9-hours journey. The route for 1992, illustrated in Figure $3A$, is very different. As the main primary road (highway $N1$ connecting the capital to the Central districts along the Indian Ocean and the secondary road linking Funhalouro to $N1$ are blocked by dozens of minefields, the algorithm relies on unpaved roads and trails, resulting into a significantly costlier (lengthier) route. The shortest-path algorithm suggests an almost four-fold increase in the estimated cost or roughly 32 hours.

2.6 Changes in Contemporaneous Market Access

Mirroring Figure 8 in the main body, Figures $5a - b$ plot changes in the market access measures over the period $1992 - 2015$, darker colors indicate larger increases. The correlation of changes in the two market access measures is 0.50. The mean (median) of long-run changes in the luminosity-based market access measure is 5.55 (5.53) and the standard deviation is 2.12. The average (median) of changes in the population-based market access measure is 2.90 (2.8) and the standard deviation 1.26. There is considerable variation in changes in market access, even within provinces. Province constants explain just 19% and 5% of the overall variability. Even when we add admin-2 constants, there is still sizeable variability, as the R^2 is far from one, 0.57 and 0.32 with the luminosity and the population-based market access, respectively.

3 Sensitivity

In this section we report the results of the various sensitivity checks examining the robustness of the within-locality, over time relationship between luminosity, and its "market access".

3.1 Trade Elasticity

First, we use alternative values for the trade elasticity (θ) that quantifies the role of transportation costs. For our baseline estimates (reported in the paper), we used a value of 3.88 that closely follows the similar-to-the Mozambique agriculture-based setting of India during the late colonial times, Donaldson (2018), and that of the United States during the late 19th century, Donaldson and Hornbeck (2016). Our baseline parameterization is also almost identical to the one of Jedwab and Storeygard (2017), who look at the role or African roads on urbanization.

We explored the sensitivity of our results (3.88) to other parameterization relying on recent works that calculate the trade elasticity parameter. Simonovska and Waugh (2014a,b) report trade elasticity estimates around 4 for agriculture-based comparative advantage theoretical models of trade. They also report a range from 2.7 to 5.23 (where lower values imply stronger comparative advantage across regions). We thus repeated the analysis using their low and high values. Table 3 reports the results. Panel A gives estimates parameterizing the trade elasticity to 2.7. Panel B reports analogous estimates using 5.23. The luminosity - market access elasticity is positive and highly significant across all perturbations. The luminosity-based-market-access measures focusing on the pre-civil-war transportation networks (in columns (5)-(6)) the standardized "beta" coefficient is around 0.20, quite close to the baseline estimates. Table 3 - Panel C gives analogous estimates using an even higher value of trade elasticity, 8.22, a value that follows the sensitivity analysis of Donaldson and Hornbeck (2016). While this parametrization is more suitable for mostly-manufacturing based models with high degree of differentiation (Simonovska and Waugh (2014a,b)), our results remain intact.

Then, we experiment with Harris' (1954) "market potential" measure that equals $\sum_{d=1}^{D} \tau_{o,d}^{-1} N_d$; effectively this is the market access measure with a trade elasticity of 1, implying strong specialization across localities. Table 4 reports the results. The luminosity - market potential nexus is highly significant. The elasticity is more than three standard errors larger than zero both when we use the contemporaneous transportation network (in (1)-(2)) and when we use the 1973 transportation network (in (3)-(4)). The standardized "beta" coefficient is $0.3 - 0.5$, larger than with the baseline market access trade elasticity parametrization.

3.2 Average Transportation Cost

We also ignored demand effects, reflected in the size of a locality's population or income-luminosity in the market access measures and focused only on changes in transportation costs; we do so, using a simple measure that captures a locality's connectivity to all other localities. At each point in time (in 1992, 1999, 2007, and 2015), we set the trade elasticity to one and we calculate the average cost of each locality across all shortest bilateral paths via the accessible transportation infrastructure. By not taking into account market size (population or luminosity), this approach isolates the impact of landmine clearance from the role of population-income.

Table 5 reports the panel estimates, associating localities luminosity with transportation costs and the log number of cleared hazardous areas that captures the local effect of demining. The log number of cleared threats enters with a positive and highly significant estimate, that is quite similar to the baseline estimates. On top of the direct effect of landmine clearance, there is a significant negative association between localities' average transportation costs (to all other localities) and development. This finding reveals that the estimates derived in the main paper are neither driven by the particular parameterization of the market access measure nor contingent upon the underlying theory-imposed structure. Improving accessibility and connectivity via demining the contaminated transportation network entails a strong positive influence on local luminosity.

3.3 Inflating Luminosity of the Largest Cities

Given the importance of Maputo, Beira, and Nampula-Nacala for Southern, Central, and Northern Mozambican trade, we inflate the population/luminosity of the port cities adding the values of Johannesburg (South Africa), Harare (Zimbabwe), and Lilongwe (Malawi), respectively. Each of the three port cities is linked to the corresponding capital of the neighboring country by a transportation corridor. Following Donaldson and Hornbeck (2016), we assume that the benefits of being connected are enjoyed by the terminal large city of the corridor. For each period, we computed the total luminosity (population) of all administrative divisions of Johannesburg, Harare, and Lilongwe and we added them to Maputo, Beira, and Nacala, respectively. Then we recalculated the market access measures using the inflated values for the three cities and repeated estimation.

Table 6 gives the results. The estimates on the market access and corresponding standardized coefficients are quiet similar to the baseline estimates in Table 5 of the paper's main body. This is because connectivity to these three big cities is already quite important, given their relatively high levels of luminosity and population. The log number of cumulated CHA also continue entering with a highly significant positive estimate suggesting that landmine clearance entails both local and economy-wide effects.

3.4 Parameterization of Transportation Routes (Jedwab and Storeygard, 2018)

We examine robustness to alternative parameterization of transportation costs. We have performed various checks. In Table 7 we report the one where we closely follow the concurrent work of Jedwab and Storeygard (2017). Their parameterization is somewhat different than ours. The most efficient means of transportation are highways, normalized to 1. The relative cost for railroads and paved roads is 1.33; the relative cost (vis a vis highways) for unpaved roads is 2; the relative costs for trails (earthen roads) is 6.66, and the relative cost of walking in places with no roads/trails is 13.33. The main difference between our parameterization and theirs is that in their case railroads are somewhat costlier than primary paved roads. Table 7 gives the results. The luminosity - market access elasticity is positive and significant in all but one specification (with the population-based market access measures that does not reflect developments in the last phase of demining as the population data stop in 2007). Most importantly, the market access coefficients are highly significant when we look at the pre-independence transportation network and fix the distribution of lights/population in the end-of-war period (in 1992 and 1980, respectively) that allows isolating the market access role of landmine clearance. The log number of cumulated CHA variable also retains its economic and statistical significance.

3.5 Removing Railways

Since given alternative parametrizations in the literature (see Jedwab and Storeygard (2018)) on whether railways or primary roads is the most efficient transportation mean in Africa and in Mozambique, we examined the relationship between luminosity and market access, erasing railways from the transportation network. Dropping railways is also useful, as their role on intra-country trade is limited. Table 8 reports the results. The estimates on the market access proxies and the number of cleared hazardous areas are positive and highly significant, suggesting that the exact parameterization of railroads does not affect our estimates. This is because in most cases paved roads run in parallel to the main railroads.

3.6 Relaxing the Assumption of Blocking

Although the idea that landmine contamination renders transportation segments virtually inaccessible is consistent with the view of demining actors (we obtained from dozens of interviews we conducted) and that it was extremely unlikely that locals would use mined roads for commerce (or even regular commute), we estimate the relationship between luminosity and market access, relaxing the assumption that mines entirely block the use of an affected transportation segment (road, railway, and river). Specifically, we impose that the presence of landmines doubles the cost of using that particular segment (rail, paved and unpaved roads, trails). For example, suppose the contaminated road segment of a paved road is 5 kilometers. While in our baseline estimates, this road was inaccessible for commute and trade, now locals can use the road. The resulting cost from landmine contamination is 20 (2 (parameter for paved road) $\times$ 5 (kilometer length) $\times$ 2 (because of landmine presence)).

Table 9 reports the results. Columns (1)-(4) give estimates with the contemporaneous market access measures; columns (5)-(8) employ the perturbed market access measures fixing the transportation network and luminosity/population to the pre-clearance levels (in 1992 and 1980, respectively), as this allows examining the association between changes in luminosity and changes in market access stemming from the removal of landmines in the pre-war transportation network (in 1973) and looking in the pre-intervention distribution of development and population. The elasticity is positive and highly significant when we use the baseline luminosity-based market access measure. This applies to the contemporaneous estimates (in (1)-(2)) and when we fix initial conditions when calculating market access (transportation network and development).

The estimates remain positive but statistically insignificant when we use the contemporaneous population-based market access measure (in (3)-(4)), most likely because this measure does not capture development during the third phase of demining (last population census available is that of 2007). The estimates on the population-based market access measure turn highly significant when we solely examine changes due to the removal of landmines blocking the 1973 transportation network and imposing the pre-clearance distribution of population (using the 1980 census) in columns (7)-(8)). The log number of cumulative cleared hazardous areas enters with a highly significant estimate in all specifications, further showing that clearance entails both local and general equilibrium, indirect effects operating via improved accessibility to the transportation network.

3.7 Measurement Error

We also run various perturbations to minimize concerns arising from measurement error on landmine and UXO clearance data, though the market access aggregation may reduce classical error-invariables.

First, we restrict estimation to the four Norther provinces' (Cabo Delgado, Niassa, Nampula, and Zambezia). HALO Trust conducted more than 90% of clearance interventions in the Northern Provinces. HALO Trust kept records of all of its operations in electronic form since the onset of its operations in 1993-1994. The quality of the clearance reports is evidently of higher quality, as there are details on number of landmines and their type, information on the demining team and most repost provide eloquent descriptions of the intervention. Looking at the Northern provinces is also conceptually appealing for a market access analysis, as the North was isolated from the rest of the country till 2011, as the three Zambezi bridges were mined and destroyed and only opened after 2011. Table 10 replicates the baseline panel fixed-effects specifications in the 590 localities (49.7% of the total) of the country's Northern Provinces. Columns (1)-(4) report estimates using the (luminosity and population based) market access using contemporaneous values. Columns (5)-(8) report our preferred estimates using the market access measures that fix luminosity (population) and infrastructure to the pre-clearance levels (luminosity in 1992, population in 1980, and the transportation network just before independence). The coefficient of the initial market access is positive and highly significant across all permutations.

Second, we dropped the initial period of demining (1992-1999), when data quality is of lower quality. In this period that precedes the establishment of the National Institute of Demining (IND), the government was not collecting much information. As international standards were not established -Mozambique is the first country that experienced en masse with humanitarian demining- demining operators were not keeping good records (the exception being Halo Trust operating at the time only North of the Zambezi). The quality of the early reports is not great, as details on minefields, operations, and teams are missing. At the same time, in the early phase demining in the Southern provinces was scattered and fragmented among many small commercial operators. Omitting the initial period allows also accounting for the repatriation of the millions of refugees and internally displaced people that (mostly) occurred from 1992 till the October 1994 elections. Table 11 reports the results. The association between luminosity and market access retains statistical significance, though the coefficient drops somehow.

Third, given heterogeneity in reporting across demining operators, we run specifications adding operator-x-period fixed-effects. Table 12 report the results. Exploiting within-operator within-time variation has little impact on the estimates that preserve magnitude and precision.

3.8 Weighting by Population 1980

Following Donaldson and Hornbeck (2016), we also run weighted least squares specifications weighting with localities' population in 1980. By doing so, we account for concerns that the estimates are driven by regions with very low population that experience positive changes in luminosity between. Table 13 reports the WLS panel estimates. The association between regional luminosity and market access retains statistical significance. If anything, the implied economic magnitude is somewhat larger.

3.9 Differential Trends

We also run less parsimonious specifications that aim accounting for hard-to-observe differential trends in regional development (luminosity) and landmine removal. In this regard, we augmented the baseline market access specification with interaction terms between geography-location conditions and period specific indicators. First, we added interactions between the period indicators with a third-order latitude and longitude polynomial (as Donaldson and Hornbeck (2016), so as to account for hard-to-observe local dynamics. Table 14 presents the results. The positive association between luminosity and market access retains statistical significance at standard confidence levels. The magnitude of the market access coefficients is not much affected. The local effect estimate drops somewhat, but it retains statistical significance.

Second, in Table 15 we added interactions between the period indicators with time-invariant geographic locality characteristics, namely: distance of locality centroid to each of the six neighboring counties (Tanzania, Malawi, Zambia, Zimbabwe, Swaziland, and South Africa); elevation; agricultural suitability; and a malaria stability index. Table reports the results. The association between (log) luminosity and log market access retains significance at standard confidence levels, though the estimate drops somewhat. The coefficient on local landmine clearance also retains economic and statistical significance, showing that both local and spillover effects are at place.

Third, to further mitigate concerns about time-varying factors related to demining and development, we control for local time trends at a very fine level of aggregation. We substitute the province -period - fixed effects with districts-specific-period fixed effects. These are quite demanding specifications as there are 120 districts (admin-2 units). Table 16 reports the panel estimates. Both log market access and local clearance enter with significantly positive coefficients.

Table 1: **Evolution of Road Condintions by Province**

	Years			
Road Condition	**1973**	**1998**	**2003**	**2011**
	Cabo Delgado			
Paved (km)	411.556	435.065	393.673	464.446
Unpaved (km)	0	636.767	418.376	1754.83
Trail (km)	1692.03	782.002	1041.79	365.441
	Gaza			
Paved (km)	237.509	385.219	398.151	470.754
Unpaved (km)	59.4743	910.989	582.047	1355.54
Trail (km)	1719.18	526.885	842.895	26.2131
	Inhambane			
Paved (km)	610.911	560.746	560.746	616.039
Unpaved (km)	0	454.488	177.879	1521.17
Trail (km)	1677.57	914.635	1273.76	218.887
	Manica			
Paved (km)	482.335	516.373	517.403	488.135
Unpaved (km)	64.8113	766.44	601.621	1423.83
Trail (km)	1189.4	339.344	503.133	308.436
	Maputo			
Paved (km)	300.096	309.321	329.944	343.029
Unpaved (km)	191.942	361.879	237.232	839.279
Trail (km)	785.876	495.37	599.395	31.1848
	Nampula			
Paved (km)	180.997	333.129	299.588	317.687
Unpaved (km)	0	1134.78	711.315	3254.96
Trail (km)	3259.31	1580.26	2037.26	524.479
	Niassa			
Paved (km)	128.735	190.182	410.201	456.484
Unpaved (km)	0	460.566	148.696	2089.86
Trail (km)	1968.23	1391.65	1483.5	509.357
	Sofala			
Paved (km)	346.172	333.895	337.094	346.172
Unpaved (km)	0	117.519	227.434	1528.94
Trail (km)	1716.18	1292.79	1179.68	149.191
	Tete			
Paved (km)	351.162	670.049	652.268	719.574
Unpaved (km)	82.6195	487.17	515.547	1327.31
Trail (km)	2214.52	701.128	690.532	197.83
	Zambezia			
Paved (km)	164.22	294.292	488.085	504.09
Unpaved (km)	0	1051.65	389.483	3357.39
Trail (km)	3660.71	2091.17	2559.54	458.896

Notes. Table gives the statistics on evolution of paved roads, unpaved roads, and trails for 1973, 1999, 2007, 2015.

Table 2: **Blocked Road by Province and Period**

Road Blocked Network 1973	Years 1992	1999	2007	2015
	Cabo Delgado			
Paved (km)	89.197	89.197	0	0
Unpaved (km)	0	0	0	0
Trail (km)	345.221	345.221	30.861	0
	Gaza			
Paved (km)	46.134	18.362	0	0
Unpaved (km)	0.836	0.836	0	0
Trail (km)	383.391	377.288	209.068	0
	Inhambane			
Paved (km)	424.142	393.620	222.491	0
Unpaved (km)	0	0	0	0
Trail (km)	443.215	437.280	310.042	0
	Manica			
Paved (km)	172.054	172.054	112.351	0
Unpaved (km)	0	0	0	0
Trail (km)	378.109	346.505	295.177	0
	Maputo			
Paved (km)	142.735	115.604	88.532	0
Unpaved (km)	71.734	65.648	35.657	0
Trail (km)	345.984	293.717	190.075	0
	Nampula			
Paved (km)	31.028	31.028	0	0
Unpaved (km)	0	0	0	0
Trail (km)	302.983	254.745	4.443	0
	Niassa			
Paved (km)	16.271	0	0	0
Unpaved (km)	0	0	0	0
Trail (km)	433.486	428.433	100.258	0
	Sofala			
Paved (km)	210.088	202.297	163.023	0
Unpaved (km)	0	0	0	0
Trail (km)	617.858	277.650	132.198	0
	Tete			
Paved (km)	121.612	85.624	85.624	0
Unpaved (km)	0	0	0	0
Trail (km)	252.836	200.538	101.666	0
	Zambezia			
Paved (km)	7.467	7.467	0	0
Unpaved (km)	0	0	0	0
Trail (km)	776.318	666.662	17.668	0

Notes. Table gives the statistics on evolution of blocked paved roads, blocked unpaved roads, and blocked trails for 1973, 1999, 2007, 2015.

Table 3: **Market Access. Alternative Paratemtrization of Trade Elasticity**

Demining-Phase Estimation (1992, 1999, 2007, 2015)

Panel A: $\theta = \mathbf{2.7}$

	Contemporaneous				Initial Conditions			
	Log Luminosity	Lit	Log Luminosity	Lit	Log Luminosity	Lit	Log Luminosity	Lit
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log Market Access, Light	0.370***	0.040***			0.385**	0.039**		
	(0.104)	(0.011)			(0.173)	(0.018)		
	[0.236]	[0.246]			[0.206]	[0.204]		
Log Market Access, Population			0.241**	0.024**			0.963***	0.089***
			(0.107)	(0.012)			(0.247)	(0.026)
			[0.104]	[0.102]			[0.353]	[0.317]
Cleared Threats	0.408***	0.051***	0.388***	0.050***	0.425***	0.053***	0.334***	0.045***
	(0.093)	(0.010)	(0.106)	(0.011)	(0.092)	(0.010)	(0.105)	(0.011)
	[0.093]	[0.114]	[0.089]	[0.112]	[0.097]	[0.119]	[0.077]	[0.102]
Number of Localities	1,187	1,187	1,077	1,077	1,187	1,187	1,077	1,077
Locality FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time x Province FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	.25	.232	.253	.234	.243	.226	.259	.237
Observations	4,748	4,748	4,308	4,308	4,748	4,748	4,308	4,308

Panel B: $\theta = \mathbf{5.23}$

	Contemporaneous				Initial Conditions			
	Log Luminosity	Lit	Log Luminosity	Lit	Log Luminosity	Lit	Log Luminosity	Lit
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log Market Access, Light	0.201***	0.022***			0.204**	0.018**		
	(0.044)	(0.005)			(0.083)	(0.009)		
	[0.234]	[0.247]			[0.206]	[0.183]		
Log Market Access, Population			0.152***	0.013***			0.490***	0.038***
			(0.046)	(0.005)			(0.132)	(0.014)
			[0.124]	[0.107]			[0.361]	[0.271]
Cleared Threats	0.385***	0.049***	0.368***	0.049***	0.420***	0.053***	0.338***	0.047***
	(0.094)	(0.010)	(0.108)	(0.012)	(0.093)	(0.010)	(0.107)	(0.012)
	[0.088]	[0.109]	[0.084]	[0.109]	[0.096]	[0.119]	[0.077]	[0.106]
Number of Localities	1,187	1,187	1,077	1,077	1,187	1,187	1,077	1,077
Locality FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time x Province FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	.254	.236	.255	.234	.243	.226	.259	.236
Observations	4,748	4,748	4,308	4,308	4,748	4,748	4,308	4,308

Table 1: **Market Access. Alternative Paratemtrization of Trade Elasticity**

	Panel C: θ = **8.22**							
	Contemporaneous				Initial Conditions			
	Log Luminosity	Lit	Log Luminosity	Lit	Log Luminosity	Lit	Log Luminosity	Lit
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log Market Access, Light	0.129***	0.014***				0.024**		
	(0.027)	(0.003)				(0.012)		
	[0.218]	[0.230]				[0.184]		
Log Market Access, Population			0.095***	0.052***	0.052***		0.643***	0.052***
			(0.028)	(0.018)	(0.018)		(0.173)	(0.018)
			[0.120]	[0.284]	[0.284]		[0.359]	[0.284]
Cleared Threats	0.375***	0.047***	0.374***	0.047***	0.047***	0.053***	0.334***	0.047***
	(0.094)	(0.010)	(0.107)	(0.012)	(0.012)	(0.010)	(0.106)	(0.012)
	[0.086]	[0.106]	[0.086]	[0.104]	[0.104]	[0.119]	[0.077]	[0.104]
Number of Localities	1,187	1,187	1,077	1,077	1,077	1,187	1,077	1,077
Locality FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time x Province FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	.253	.235	.255	.236	.236	.226	.259	.236
Observations	4,748	4,748	4,308	4,308	4,308	4,748	4,308	4,308

Notes: The table reports panel fixed-effects OLS estimates associating luminosity with market access, allowing for alternative value of Θ. We follow Simonovska and Waugh (2014) and set the following value of Θ: 2.7 (Panel A), 5.23 (Panel B), and 8.22 Panel (5). The dependent variable in columns (1), (3), (5), and (7) is the log of luminosity plus the half of the minimum value of luminosity. The dependent variable is columns (2), (4), (6), and (8) is an indicator that takes the value of one if the locality emits some detectable from the satellite light (lit). All specification report the (7-year) period estimates (1992-1999, 2000-2007, 2008-2015) that correspond to the three main phases of landmine clearance. In column (1)-(4), Market Access, Light and Market Access, Population is the logarithm of luminosity (population)-based market-access. In column (5)-(8), Market Access, Light and Market Access, Population is the logarithm of luminosity-based market-access fixing the transportation network to 1973 and holding all localities' luminosity (population) fixed in its 1992 (1980) level. In all specification we control for the Cleared Threats, that is the logarithm of one plus the number of cumulated cleared confirmed hazardous areas (CHA) in the locality in given period. All specifications include locality fixed-effects and province-specific period fixed effects (constants not reported). The table reports clustered at the district (admin 2) level standard errors (in parentheses) and standardized âœbetaâ coefficients (in square brackets). ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

Table 4: **Market Potential**

	Demining-Phase Estimation (1992, 1999, 2007, 2015)			
	Contemporaneous		Initial Conditions	
	Log Luminosity	Lit	Log Luminosity	Lit
	(1)	(2)	(3)	(4)
Log Market Potential	1.432***	0.162***	3.986***	0.402***
	(0.401)	(0.044)	(0.504)	(0.052)
	[0.306]	[0.337]	[0.570]	[0.561]
Cleared Threats	0.420***	0.052***	0.355***	0.046***
	(0.093)	(0.010)	(0.093)	(0.010)
	[0.096]	[0.117]	[0.081]	[0.103]
Number of Localities	1,187	1,187	1,187	1,187
Locality FE	Yes	Yes	Yes	Yes
Time x Province FE	Yes	Yes	Yes	Yes
R-squared	.244	.228	.26	.239
Observations	4,748	4,748	4,748	4,748

Notes: The table reports panel fixed-effects OLS estimates associating luminosity with market potential. The dependent variable in columns (1) and (3) is the log of luminosity plus the half of the minimum value of luminosity. The dependent variable is columns (2) and (4) is an indicator that takes the value of one if the locality emits some detectable from the satellite light (lit). All specification report the (7-year) period estimates (1992-1999, 2000-2007, 2008-2015) that correspond to the three main phases of landmine clearance. In column (1)-(2), Market Potential is the logarithm of measure (that equals $\sum\_d = 1^D \tau\_o, d^{-1} N\_d$). In column (3)-(4), Market Potential is the logarithm of measure (that equals $\sum\_d = 1^D \tau\_o, d^{-1} N\_d$), fixing the transportation network to. In all specification we control for the Cleared Threats, that is the logarithm of one plus the number of cumulated cleared confirmed hazardous areas (CHA) in the locality in given period. All specifications include locality fixed-effects and province-specific period fixed effects (constants not reported). The table reports clustered at the district (admin 2) level standard errors (in parentheses) and standardized âœbetaâ coefficients (in square brackets). ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

Table 5: **Average τ**

	Demining-Phase Estimation (1992, 1999, 2007, 2015)			
	Contemporaneous		Initial Conditions	
	Log Luminosity	Lit	Log Luminosity	Lit
	(1)	(2)	(3)	(4)
Log Average τ	-3.507***	-0.333***	-3.652***	-0.368***
	(0.518)	(0.059)	(0.542)	(0.054)
	[-0.397]	[-0.368]	[-0.333]	[-0.328]
Cleared Threats	0.437***	0.055***	0.405***	0.051***
	(0.095)	(0.010)	(0.093)	(0.010)
	[0.100]	[0.122]	[0.093]	[0.114]
Number of Localities	1,187	1,187	1,187	1,187
Locality FE	Yes	Yes	Yes	Yes
Time x Province FE	Yes	Yes	Yes	Yes
R-squared	.251	.231	.257	.236
Observations	4,748	4,748	4,748	4,748

Notes: The table reports panel fixed-effects OLS estimates associating luminosity with average cost of transportation. The dependent variable in columns (1) and (3) is the log of luminosity plus the half of the minimum value of luminosity. The dependent variable is columns (2) and (4) is an indicator that takes the value of one if the locality emits some detectable from the satellite light (lit). All specification report the (7-year) period estimates (1992-1999, 2000-2007, 2008-2015) that correspond to the three main phases of landmine clearance. In column (1)-(2), Average $isthelogarithmofaveragebilateraltransportationcostatthelocalitylevel.Incolumn(3) - (4), Average$ is the logarithm of average bilateral transportation cost at the locality level, fixing the transportation network to. In all specification we control for the Cleared Threats, that is the logarithm of one plus the number of cumulated cleared confirmed hazardous areas (CHA) in the locality in given period. All specifications include locality fixed-effects and province-specific period fixed effects (constants not reported). The table reports clustered at the district (admin 2) level standard errors (in parentheses) and standardized âœbetaâ coefficients (in square brackets). ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

Table 6: **Market Access. Inflating Luminosity and Population of Maputo, Beira, and Nacala**

	Demining-Phase Estimation (1992, 1999, 2007, 2015)							
	Contemporaneous				Initial Conditions			
	Log Luminosity		Lit		Log Luminosity		Lit	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log Market Access, Light	0.263***	0.028***			0.272**	0.026**		
	(0.061)	(0.006)			(0.108)	(0.011)		
	[0.235]	[0.245]			[0.213]	[0.197]		
Log Market Access, Population			0.170**	0.016**			0.617***	0.052***
			(0.068)	(0.007)			(0.176)	(0.018)
			[0.104]	[0.093]			[0.336]	[0.273]
Cleared Threats	0.398***	0.050***	0.381***	0.050***	0.421***	0.053***	0.340***	0.047***
	(0.094)	(0.010)	(0.107)	(0.012)	(0.093)	(0.010)	(0.105)	(0.011)
	[0.091]	[0.112]	[0.087]	[0.111]	[0.096]	[0.119]	[0.078]	[0.105]
Number of Localities	1,187	1,187	1,077	1,077	1,187	1,187	1,077	1,077
Locality FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time x Province FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	.253	.235	.253	.234	.244	.226	.258	.236
Observations	4,748	4,748	4,308	4,308	4,748	4,748	4,308	4,308

Notes: The table reports panel fixed-effects OLS estimates associating luminosity with market access, inflating the luminosity of Maputo, Beira, and Nacala with those of Johannesburg, Harare, and Lilongwe, respectively. The Dependent variable in columns (1), (3), (5), and (7) is the log of luminosity plus the half of the minimum value of luminosity. The dependent variable is columns (2), (4), (6), and (8) is an indicator that takes the value of one if the locality emits some detectable from the satellite light (lit). All specification report the (7-year) period estimates (1992-1999, 2000-2007, 2008-2015) that correspond to the three main phases of landmine clearance. In column (1)-(4), Market Access, Light and Market Access, Population is the logarithm of luminosity (population)-based market-access. In column (5)-(8), Market Access, Light and Market Access, Population is the logarithm of luminosity-based market-access fixing the transportation network to 1973 and holding all localities' luminosity (population) fixed in its 1992 (1980) level. In all specification we control for the Cleared Threats, that is the logarithm of one plus the number of cumulated cleared confirmed hazardous areas (CHA) in the locality in given period. All specifications include locality fixed-effects and province-specific period fixed effects (constants not reported). The table reports clustered at the district (admin 2) level standard errors (in parentheses) and standardized âœbetaâ coefficients (in square brackets). ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

Table 7: **Market Access. Different Parameterization of Transportation Routes (Jedwab and Storeygard, 2018)**

	Demining-Phase Estimation (1992, 1999, 2007, 2015)							
	Contemporaneous				Initial Conditions			
	Log Luminosity	Lit	Log Luminosity	Lit	Log Luminosity	Lit	Log Luminosity	Lit
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log Market Access, Light	0.235***	0.025***			0.259**	0.024**		
	(0.058)	(0.006)			(0.103)	(0.011)		
	[0.213]	[0.226]			[0.199]	[0.177]		
Log Market Access, Population			0.120*	0.011			0.615***	0.048***
			(0.061)	(0.007)			(0.166)	(0.018)
			[0.075]	[0.066]			[0.332]	[0.252]
Cleared Threats	0.395***	0.050***	0.393***	0.051***	0.422***	0.053***	0.337***	0.047***
	(0.093)	(0.010)	(0.107)	(0.012)	(0.092)	(0.010)	(0.105)	(0.011)
	[0.090]	[0.111]	[0.090]	[0.114]	[0.097]	[0.119]	[0.077]	[0.105]
Number of Localities	1,187	1,187	1,077	1,077	1,187	1,187	1,077	1,077
Locality FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time x Province FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	.251	.234	.253	.233	.243	.226	.259	.236
Observations	4,748	4,748	4,308	4,308	4,748	4,748	4,308	4,308

Notes: The table reports panel fixed-effects OLS estimates associating luminosity with market access, employing an alternative relative costs parametrization from Jedwab and Storeygard (2018). The dependent variable in columns (1), (3), (5), and (7) is the log of luminosity plus the half of the minimum value of luminosity. The dependent variable is columns (2), (4), (6), and (8) is an indicator that takes the value of one if the locality emits some detectable from the satellite light (lit). All specification report the (7-year) period estimates (1992-1999, 2000-2007, 2008-2015) that correspond to the three main phases of landmine clearance. In column (1)-(4), Market Access, Light and Market Access, Population is the logarithm of luminosity (population)-based market-access. In column (5)-(8), Market Access, Light and Market Access, Population is the logarithm of luminosity-based market-access fixing the transportation network to 1973 and holding all localities' luminosity (population) fixed in its 1992 (1980) level. In all specification we control for the Cleared Threats, that is the logarithm of one plus the number of cumulated cleared confirmed hazardous areas (CHA) in the locality in given period. All specifications include locality fixed-effects and province-specific period fixed effects (constants not reported). The table reports clustered at the district (admin 2) level standard errors (in parentheses) and standardized âœbetaâ coefficients (in square brackets). ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

Table 8: **Market Access. Removing Railways**

	Demining-Phase Estimation (1992, 1999, 2007, 2015)							
	Contemporaneous				Initial			
	Log Luminosity		Lit		Log Luminosity		Lit	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log Market Access, Light	0.277***	0.030***			0.295***	0.029**		
	(0.063)	(0.007)			(0.110)	(0.012)		
	[0.245]	[0.257]			[0.228]	[0.216]		
Log Market Access, Population			0.190***	0.017**			0.691***	0.057***
			(0.067)	(0.007)			(0.178)	(0.019)
			[0.115]	[0.103]			[0.374]	[0.302]
Cleared Threats	0.391***	0.049***	0.374***	0.049***	0.420***	0.053***	0.331***	0.046***
	(0.094)	(0.010)	(0.108)	(0.012)	(0.093)	(0.010)	(0.107)	(0.012)
	[0.090]	[0.110]	[0.086]	[0.110]	[0.096]	[0.118]	[0.076]	[0.103]
Number of Localities	1,187	1,187	1,077	1,077	1,187	1,187	1,077	1,077
Locality FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time x Province FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	.254	.236	.254	.234	.244	.226	.259	.237
Observations	4,748	4,748	4,308	4,308	4,748	4,748	4,308	4,308

Notes: The table reports panel fixed-effects OLS estimates associating luminosity with market access, dropping railways from the transportation network. The dependent variable in columns (1) and (3) is the log of luminosity plus the half of the minimum value of luminosity. The dependent variable is columns (2) and (4) is an indicator that takes the value of one if the locality emits some detectable from the satellite light (lit). All specification report the (7-year) period estimates (1992-1999, 2000-2007, 2008-2015) that correspond to the three main phases of landmine clearance. In column (1)-(2), Market Access, Light is instrumented with the its counterpart when we fix the transportation network to 1973 and we hold all localities' luminosity fixed in its 1992 level. In column (3)-(4), Market Access, Population is instrumented with the its counterpart when we fix the transportation network to 1973 and we hold all localities' population fixed in its 1980 level. In all specification we control for the Cleared Threats, that is the logarithm of one plus the number of cumulated cleared confirmed hazardous areas (CHA) in the locality in given period. All specifications include locality fixed-effects and province-specific period fixed effects (constants not reported). The table reports clustered at the district (admin 2) level standard errors (in parentheses) and standardized âœbetaâ coefficients (in square brackets). ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

Table 9: **Market Access. Relaxing the Assumption of Blocking**

	Demining-Phase Estimation (1992, 1999, 2007, 2015)							
	Contemporaneous				Initial			
	Log Luminosity		Lit		Log Luminosity		Lit	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log Market Access, Light	0.276***	0.030***			0.681***	0.073***		
	(0.073)	(0.007)			(0.180)	(0.021)		
	[0.224]	[0.236]			[0.501]	[0.526]		
Log Market Access, Population			0.069	0.008			0.761**	0.085***
			(0.073)	(0.008)			(0.324)	(0.031)
			[0.041]	[0.049]			[0.412]	[0.447]
Cleared Threats	0.430***	0.053***	0.421***	0.053***	0.408***	0.051***	0.384***	0.049***
	(0.095)	(0.010)	(0.109)	(0.012)	(0.098)	(0.011)	(0.111)	(0.012)
	[0.098]	[0.119]	[0.097]	[0.119]	[0.093]	[0.114]	[0.088]	[0.110]
Number of Localities	1,187	1,187	1,077	1,077	1,187	1,187	1,077	1,077
Locality FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time x Province FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	.25	.232	.252	.233	.245	.228	.253	.234
Observations	4,748	4,748	4,308	4,308	4,748	4,748	4,308	4,308

Notes: The table reports panel fixed-effects OLS estimates associating luminosity with market access, relaxing the assumption that land mines impede the use of affected network elements. The dependent variable in columns (1), (3), (5), and (7) is the log of luminosity plus the half of the minimum value of luminosity. The dependent variable is columns (2), (4), (6), and (8) is an indicator that takes the value of one if the locality emits some detectable from the satellite light (lit). All specification report the (7-year) period estimates (1992-1999, 2000-2007, 2008-2015) that correspond to the three main phases of landmine clearance. In column (1)-(4), Market Access, Light and Market Access, Population is the logarithm of luminosity (population)-based market-access. In column (5)-(8), Market Access, Light and Market Access, Population is the logarithm of luminosity-based market-access fixing the transportation network to 1973 and holding all localities' luminosity (population) fixed in its 1992 (1980) level. In all specification we control for the Cleared Threats, that is the logarithm of one plus the number of cumulated cleared confirmed hazardous areas (CHA) in the locality in given period. All specifications include locality fixed-effects and province-specific period fixed effects (constants not reported). The table reports clustered at the district (admin 2) level standard errors (in parentheses) and standardized âœbetaâ coefficients (in square brackets). ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

Table 10: **Market Access. North.**

	Demining-Phase Estimation (1992, 1999, 2007, 2015)							
	Contemporaneous				Initial			
	Log Luminosity	Lit	Log Luminosity	Lit	Log Luminosity	Lit	Log Luminosity	Lit
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log Total Market Access, Light	0.315***	0.035***			0.424**	0.044**		
	(0.094)	(0.010)			(0.176)	(0.019)		
	[0.298]	[0.315]			[0.327]	[0.317]		
Log Total Market Access, Population			0.046	0.004			0.835**	0.066**
			(0.086)	(0.010)			(0.321)	(0.028)
			[0.030]	[0.027]			[0.454]	[0.335]
Cleared Threats	0.440***	0.051***	0.551***	0.062***	0.492***	0.057***	0.468***	0.056***
	(0.102)	(0.012)	(0.115)	(0.013)	(0.109)	(0.013)	(0.125)	(0.014)
	[0.114]	[0.123]	[0.144]	[0.151]	[0.127]	[0.138]	[0.123]	[0.136]
Number of Localities	590	590	546	546	590	590	546	546
Locality FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time x Province FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	.217	.218	.203	.203	.201	.203	.209	.206
Observations	2,360	2,360	2,184	2,184	2,360	2,360	2,184	2,184

Notes: The table reports panel fixed effects estimates associating luminosity with market access only in the localities belonging to the four Norther provinces (Cabo Delgado, Niassa, Nampula, Zambezia). The dependent variable in columns (1), (3), (5), and (7) is the log of luminosity plus the half of the minimum positive value of luminosity. The dependent variable is columns (2), (4), (6), and (8) is an indicator that takes the value of one if the locality is lit. All specifications focus on 4 years that correspond to the three main phases of landmine clearance, namely 1992, 1999, 2007 and 2015. Market Access, Light is the logarithm of luminosity-weighted market-access. Market Access, Population is the logarithm of population- weighted market-access. Columns (1)-(4) report OLS estimates, using contemporaneous values of the market access measures. Columns (5)-(8) report OLS estimates, using market access measures that impose pre-clearance transportation network (in 1973) and population (1980) and luminosity (1992). All specifications control for direct effect of demining activity and include locality-specific fixed-effects and province-year fixed effects (constants not reported). Standard errors in parentheses are clustered at the district (admin 2) level and standardized "beta" coefficients [in brackets]. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

Table 11: **Market Access. Dropping First Period.**

	Demining-Phase Estimation (1992, 1999, 2007, 2015)							
	Contemporaneous				Initial			
	Log Luminosity	Lit	Log Luminosity	Lit	Log Luminosity	Lit	Log Luminosity	Lit
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log Total Market Access, Light	0.190***	0.021***			0.220*	0.021*		
	(0.062)	(0.007)			(0.112)	(0.013)		
	[0.148]	[0.161]			[0.159]	[0.151]		
Log Total Market Access, Population			0.063	0.009			0.507***	0.047**
			(0.081)	(0.009)			(0.170)	(0.019)
			[0.035]	[0.048]			[0.261]	[0.234]
Cleared Threats	0.362***	0.046***	0.409***	0.052***	0.378***	0.048***	0.351***	0.048***
	(0.098)	(0.012)	(0.110)	(0.013)	(0.096)	(0.012)	(0.105)	(0.013)
	[0.082]	[0.102]	[0.093]	[0.116]	[0.086]	[0.107]	[0.080]	[0.107]
Number of Localities	1,187	1,187	1,077	1,077	1,187	1,187	1,077	1,077
Locality FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time x Province FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	.218	.197	.226	.204	.214	.194	.23	.207
Observations	3,561	3,561	3,231	3,231	3,561	3,561	3,231	3,231

Notes: The table reports panel fixed effects estimates associating luminosity with market access , dropping the first period (1992-1999) of demining. The dependent variable in columns (1), (3), (5), and (7) is the log of luminosity plus the half of the minimum positive value of luminosity. The dependent variable is columns (2), (4), (6), and (8) is an indicator that takes the value of one if the locality is lit. All specifications focus on 4 years that correspond to the three main phases of landmine clearance, namely 1992, 1999, 2007 and 2015. Market Access, Light is the logarithm of luminosity-weighted market-access. Market Access, Population is the logarithm of population- weighted market-access. Columns (1)-(4) report OLS estimates, using contemporaneous values of the market access measures. Columns (5)-(8) report OLS estimates, using market access measures that impose pre-clearance transportation network (in 1973) and population (1980) and luminosity (1992). All specifications control for direct effect of demining activity and include locality-specific fixed-effects and province-year fixed effects (constants not reported). Standard errors in parentheses are clustered at the district (admin 2) level and standardized "beta" coefficients [in brackets]. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

Table 12: **Market Access. Period × Operator.**

	Demining-Phase Estimation (1992, 1999, 2007, 2015)							
	Contemporaneous				Initial			
	Log Luminosity	Lit	Log Luminosity	Lit	Log Luminosity	Lit	Log Luminosity	Lit
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log Total Market Access, Light	0.276***	0.030***			0.256**	0.024**		
	(0.064)	(0.007)			(0.113)	(0.012)		
	[0.243]	[0.255]			[0.196]	[0.182]		
Log Total Market Access, Population			0.187***	0.017**			0.655***	0.053***
			(0.066)	(0.007)			(0.178)	(0.019)
			[0.113]	[0.100]			[0.354]	[0.281]
Cleared Threats	0.402***	0.050***	0.381***	0.048***	0.436***	0.054***	0.328***	0.045***
	(0.108)	(0.012)	(0.124)	(0.014)	(0.109)	(0.012)	(0.124)	(0.014)
	[0.092]	[0.111]	[0.087]	[0.108]	[0.100]	[0.120]	[0.075]	[0.100]
Number of Localities	1,187	1,187	1,077	1,077	1,187	1,187	1,077	1,077
Locality FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time x Province FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE x Operator (dummy)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	.255	.237	.255	.236	.244	.227	.26	.238
Observations	4,748	4,748	4,308	4,308	4,748	4,748	4,308	4,308

Notes: The table reports panel fixed effects estimates associating luminosity with market access , controlling for locality-specific operator (dummy) and interacting it with period fixed effects. The dependent variable in columns (1), (3), (5), and (7) is the log of luminosity plus the half of the minimum positive value of luminosity. The dependent variable is columns (2), (4), (6), and (8) is an indicator that takes the value of one if the locality is lit. All specifications focus on 4 years that correspond to the three main phases of landmine clearance, namely 1992, 1999, 2007 and 2015. Market Access, Light is the logarithm of luminosity-weighted market-access. Market Access, Population is the logarithm of population- weighted market-access. Columns (1)-(4) report OLS estimates, using contemporaneous values of the market access measures. Columns (5)-(8) report OLS estimates, using market access measures that impose pre-clearance transportation network (in 1973) and population (1980) and luminosity (1992). All specifications control for direct effect of demining activity and include locality-specific fixed-effects and province-year fixed effects (constants not reported). Standard errors in parentheses are clustered at the district (admin 2) level and standardized "beta" coefficients [in brackets]. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

Table 13: **Market Access. Population weighted Least Squares.**

	Demining-Phase Estimation (1992, 1999, 2007, 2015)							
	Contemporaneous				Initial			
	Log Luminosity	Lit	Log Luminosity	Lit	Log Luminosity	Lit	Log Luminosity	Lit
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log Total Market Access, Light	0.296***	0.031***			0.378***	0.033**		
	(0.068)	(0.007)			(0.130)	(0.015)		
	[0.191]	[0.226]			[0.225]	[0.227]		
Log Total Market Access, Population			0.211**	0.019*			0.575**	0.047*
			(0.085)	(0.010)			(0.234)	(0.026)
			[0.089]	[0.092]			[0.216]	[0.201]
Cleared Threats	0.436***	0.049***	0.451***	0.052***	0.449***	0.051***	0.439***	0.051***
	(0.118)	(0.014)	(0.132)	(0.016)	(0.128)	(0.015)	(0.132)	(0.015)
	[0.081]	[0.105]	[0.084]	[0.110]	[0.084]	[0.110]	[0.082]	[0.109]
Number of Localities	1,077	1,077	1,077	1,077	1,077	1,077	1,077	1,077
Locality FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time x Province FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	.279	.241	.267	.23	.27	.232	.271	.232
Observations	4,308	4,308	4,308	4,308	4,308	4,308	4,308	4,308

Notes: The table reports panel fixed effects estimates associating luminosity with market access, weighting for localities' population in 1980. The dependent variable in columns (1), (3), (5), and (7) is the log of luminosity plus the half of the minimum positive value of luminosity. The dependent variable is columns (2), (4), (6), and (8) is an indicator that takes the value of one if the locality is lit. All specifications focus on 4 years that correspond to the three main phases of landmine clearance, namely 1992, 1999, 2007 and 2015. Market Access, Light is the logarithm of luminosity-weighted market-access. Market Access, Population is the logarithm of population- weighted market-access. Columns (1)-(4) report OLS estimates, using contemporaneous values of the market access measures. Columns (5)-(8) report OLS estimates, using market access measures that impose pre-clearance transportation network (in 1973) and population (1980) and luminosity (1992). All specifications control for direct effect of demining activity and include locality-specific fixed-effects and province-year fixed effects (constants not reported). Standard errors in parentheses are clustered at the district (admin 2) level and standardized "beta" coefficients [in brackets]. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

Table 14: **Market Access. Period × Location.**

	Demining-Phase Estimation (1992, 1999, 2007, 2015)							
	Contemporaneous				Initial			
	Log Luminosity	Lit	Log Luminosity	Lit	Log Luminosity	Lit	Log Luminosity	Lit
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log Total Market Access, Light	0.292***	0.031***			0.254**	0.024**		
	(0.068)	(0.007)			(0.112)	(0.012)		
	[0.258]	[0.267]			[0.195]	[0.178]		
Log Total Market Access, Population			0.213***	0.019***			0.624***	0.050***
			(0.067)	(0.007)			(0.167)	(0.018)
			[0.129]	[0.113]			[0.337]	[0.263]
Cleared Threats	0.427***	0.051***	0.404***	0.050***	0.457***	0.055***	0.371***	0.048***
	(0.090)	(0.010)	(0.105)	(0.011)	(0.089)	(0.010)	(0.103)	(0.011)
	[0.098]	[0.115]	[0.093]	[0.113]	[0.105]	[0.123]	[0.085]	[0.108]
Number of Localities	1,187	1,187	1,077	1,077	1,187	1,187	1,077	1,077
Locality FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time x Province FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE x Location	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	.271	.247	.27	.246	.259	.237	.273	.247
Observations	4,748	4,748	4,308	4,308	4,748	4,748	4,308	4,308

Notes: The table reports panel fixed effects estimates associating luminosity with market access, controlling for locality-specific third order polynomial of latitude and longitude interacted with period fixed effects. The dependent variable in columns (1), (3), (5), and (7) is the log of luminosity plus the half of the minimum positive value of luminosity. The dependent variable is columns (2), (4), (6), and (8) is an indicator that takes the value of one if the locality is lit. All specifications focus on 4 years that correspond to the three main phases of landmine clearance, namely 1992, 1999, 2007 and 2015. Market Access, Light is the logarithm of luminosity-weighted market-access. Market Access, Population is the logarithm of population- weighted market-access. Columns (1)-(4) report OLS estimates, using contemporaneous values of the market access measures. Columns (5)-(8) report OLS estimates, using market access measures that impose pre-clearance transportation network (in 1973) and population (1980) and luminosity (1992). All specifications control for direct effect of demining activity and include locality-specific fixed-effects and province-year fixed effects (constants not reported). Standard errors in parentheses are clustered at the district (admin 2) level and standardized "beta" coefficients [in brackets]. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

Table 15: **Market Access. Period × Geography.**

	Demining-Phase Estimation (1992, 1999, 2007, 2015)							
	Contemporaneous				Initial			
	Log Luminosity	Lit	Log Luminosity	Lit	Log Luminosity	Lit	Log Luminosity	Lit
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log Total Market Access, Light	0.289***	0.031***			0.251**	0.023*		
	(0.062)	(0.006)			(0.109)	(0.012)		
	[0.255]	[0.265]			[0.192]	[0.173]		
Log Total Market Access, Population			0.253***	0.032***			0.601***	0.047**
			(0.070)	(0.008)			(0.181)	(0.019)
			[0.153]	[0.189]			[0.325]	[0.250]
Cleared Threats	0.540***	0.062***	0.503***		0.571***	0.065***	0.481***	0.059***
	(0.092)	(0.010)	(0.109)		(0.091)	(0.010)	(0.105)	(0.012)
	[0.124]	[0.138]	[0.115]		[0.131]	[0.146]	[0.110]	[0.132]
Number of Localities	1,187	1,187	1,077	1,077	1,187	1,187	1,077	1,077
Locality FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time x Province FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE x Geography	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	.285	.256	.284	.246	.273	.245	.286	.254
Observations	4,748	4,748	4,308	4,308	4,748	4,748	4,308	4,308

Notes: The table reports panel fixed effects estimates associating luminosity with market access, controlling for locality-specific geographic characteristics interacted with period fixed effects. Among the geographic features, we include: i) distance from each of the six neighboring counties (Tanzania, Malawi, Zambia, Zimbabwe, Swatziland, Sout Africa); ii) elevation; iii) agricultural suitability; iv) malaria stability index. The dependent variable in columns (1), (3), (5), and (7) is the log of luminosity plus the half of the minimum positive value of luminosity. The dependent variable is columns (2), (4), (6), and (8) is an indicator that takes the value of one if the locality is lit. All specifications focus on 4 years that correspond to the three main phases of landmine clearance, namely 1992, 1999, 2007 and 2015. Market Access, Light is the logarithm of luminosity-weighted market-access. Market Access, Population is the logarithm of population- weighted market-access. Columns (1)-(4) report OLS estimates, using contemporaneous values of the market access measures. Columns (5)-(8) report OLS estimates, using market access measures that impose pre-clearance transportation network (in 1973) and population (1980) and luminosity (1992). All specifications control for direct effect of demining activity and include locality-specific fixed-effects and province-year fixed effects (constants not reported). Standard errors in parentheses are clustered at the district (admin 2) level and standardized "beta" coefficients [in brackets]. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

Table 16: **Market Access. Period × District FE.**

	Demining-Phase Estimation (1992, 1999, 2007, 2015)							
	Contemporaneous				Initial			
	Log Luminosity	Lit	Log Luminosity	Lit	Log Luminosity	Lit	Log Luminosity	Lit
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log Total Market Access, Light	0.281***	0.028***			0.281*	0.018		
	(0.084)	(0.009)			(0.163)	(0.017)		
	[0.248]	[0.243]			[0.216]	[0.136]		
Log Total Market Access, Population			0.224**	0.017*			0.641***	0.045**
			(0.092)	(0.010)			(0.216)	(0.023)
			[0.135]	[0.102]			[0.346]	[0.236]
Cleared Threats	0.505***	0.062***	0.477***	0.061***	0.536***	0.066***	0.456***	0.060***
	(0.108)	(0.011)	(0.127)	(0.013)	(0.107)	(0.011)	(0.126)	(0.013)
	[0.116]	[0.139]	[0.109]	[0.136]	[0.123]	[0.149]	[0.104]	[0.134]
Number of Localities	1,187	1,187	1,077	1,077	1,187	1,187	1,077	1,077
Locality FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time x District FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	.307	.287	.315	.293	.301	.281	.317	.294
Observations	4,748	4,748	4,308	4,308	4,748	4,748	4,308	4,308

Notes: The table reports panel fixed effects estimates associating luminosity with market access, adding district-period fixed effects. The dependent variable in columns (1), (3), (5), and (7) is the log of luminosity plus the half of the minimum positive value of luminosity. The dependent variable is columns (2), (4), (6), and (8) is an indicator that takes the value of one if the locality is lit. All specifications focus on 4 years that correspond to the three main phases of landmine clearance, namely 1992, 1999, 2007 and 2015. Market Access, Light is the logarithm of luminosity-weighted market-access. Market Access, Population is the logarithm of population- weighted market-access. Columns (1)-(4) report OLS estimates, using contemporaneous values of the market access measures. Columns (5)-(8) report OLS estimates, using market access measures that impose pre-clearance transportation network (in 1973) and population (1980) and luminosity (1992). All specifications control for direct effect of demining activity and include locality-specific fixed-effects (constants not reported). Standard errors in parentheses are clustered at the district (admin 2) level and standardized "beta" coefficients [in brackets]. ***, **, and * indicate statistical significance at the 1%, 5% and 10% level, respectively.

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