International Migration Intentions, Distance and Illegal Costs: Global Evidence from Africa-to-Europe Smuggling Routes*

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Abstract

Irregular migrants from Africa and the Middle East flow into Europe along land and sea routes. The demise of the Gaddafi regime in 2011 marked the opening of the Central Mediterranean Route for irregular border–crossing between Libya and Italy. This resulted in the immediate extension of the regional smuggling network, which produced an asymmetric reduction in bilateral distance between country pairs across the Mediterranean. We exploit this source of spatial and time variation in irregular migration routes to estimate the elasticity of migration intentions to illegal moving costs proxied by distance. We employ a novel dataset of geolocalized time-varying migration routes in the region, combined with cross-country survey data on individual intentions to move from Africa/Middle East into Europe. We find a large negative effect of distance along smuggling routes on individual migration intentions. Shorter distances increase the willingness to migrate especially for youth, (medium) skilled individuals and those with a network abroad. The effect is stronger in countries not too far from Libya and with weak rule of law.

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1 Introduction

Worldwide migration pressure is expected to rise with growing demographic and economic differences between developed and developing countries. Yet, legal migration channels are becoming increasingly scarce and congested, destination countries are investing in administrative and physical barriers, and irregular migration has become one of the most controversial public policy items in many of the destination countries, especially in Europe and in the U.S.

Apparently, building up barriers has done little to decrease people's willingness to move across international borders (Docquier et al., 2014); rather, a new multi-billion USD industry has emerged which engages in smuggling and trafficking migrants.[1]

The traditional migration push-and-pull factor framework fails to take into account the growing role of the smuggling industry, by now the third largest transnational crime, following drug and arms trafficking (Shelley, 2014; UNODC, 2011; Salt, 2003). Some progress has been made by incorporating the smuggling market in the theory on international migration (Friebel and Guriev, 2006, 2012; Tamura, 2010; Auriol and Mesnard, 2016), with drastic effects on policy conclusions about border controls, deportation and the provision of legal channels of migration. However, by its clandestine nature, reliable data on the supply of human smuggling are scarce. It is hence notoriously difficult to empirically assess the effect of illegal migration costs on the magnitude and composition of migration flows. Understanding how easing immigration barriers will affect the migration pressure from developing countries, though, is a key input to the migration policy debate.

We aim to contribute to filling this gap by estimating a gravity model of migration intentions while using novel variation that directly targets the cost of illegal migration, i.e. an exogenous time series shock to migration distance along smuggling routes. We isolate a causal effect by exploiting the demise of the Gaddafi regime in 2011 as a natural experiment through which the network of migration routes offered by the smuggling industry extended – in paticular by opening up the Central Mediterranean Route (CMR) – thus reducing the distance between pairs of origin and destination countries in a very large portion of the world, namely Africa, Near East and Europe. Distance is a proxy for the transport costs of moving (see for example Disdier and Head (2008) looking at trade and Lucas (2001) and Morten and Oliveira (2017) on migration) and the lenght of migration routes directly affects the costs of illegal border crossing. We use the Libyan exogenous shock to smuggling distance across contry-pairs as a source of identification of the impact of a change in the cost of migrating illegally on individual intentions to cross borders before and after 2011.

[1] Technically speaking, trafficking entails that migrants do not have agency but are subject to some coercion, while coercion is absent in smuggling. Yet, many crimes are committed against migrants during the smuggling process such that the distinction may have little bite. Furthermore, statistical data often do not clearly distinguish between irregular migration via trafficking or smuggling (UNODC, 2011). Hence, in our paper, we will use the term smuggling for the process of irregular migration, and the services provided and the crimes committed by the agents involved in the industry.

Our approach is similar to Feyrer (2009), who uses the closure of the Suez canal as an exogenous shock to sea distances to identify the effect of transportation costs on trade (see also Pascali (2017)). We thus employ a gravity framework and construct bilateral, time varying migration distances along smuggling routes between the global set of country pairs in the Mediterranean region. Time series variation in migration distance allows for the inclusion of pair fixed effects which account for all static differences or commonalities (including air distance) between country pairs. Hence, identification is achieved through changes in distance along irregular routes – which are fully controlled by smugglers in Africa – so that the effect is coming entirely through changes in the costs of irregular migration. We find a large negative effect of the distance connecting country pairs along illegal routes on individual migration intentions. Shorter distance, along an extended irregular smuggling network, increases the bilateral migration intentions especially for youth, (medium) skilled individuals and those with a close network abroad. The effect is stronger in countries more exposed to the exogenous shock to distance (i.e. not too far from Libya) and with weak rule of law.

Our approach relies crucially on the interpretation of the 2011 collapse of the Gaddafi regime, and in general the turmoil that hit North Africa in 2011, as a natural experiment whose unintended consequence was an extension of smuggling network. This interpretation warrants some more explanation and institutional background. High border-related bureaucracies and control, coupled with poor infrastructures, lack of transportation means and the complexity of the trip in Africa (e.g. passing through the desert or crossing the Mediterranean), make it very likely for prospective migrants to use smuggling services in the region. Smugglers transport migrants from the entire African continent to Europe, offering their services to irregular migrants only. Hence, the availability of smugglers is a necessary condition for South-North migration. At the same time, smugglers only go where customers are, i.e. along the network of smuggling routes: smugglers are therefore also a sufficient condition for illegal migration. This makes African irregular migration qualitatively different from the one occuring between Mexico and the US, where the smuggling market is concentrated mainly at the border and hence its spatial dimension plays a minor role.[2]

Major sea routes of Africa-Europe irregular migration include the CMR, the East and the West routes. While nothing happened to other routes in the time period under study, the CMR had been closed by the 2008 'Friendship Treaty' with Italy, which allocated significant funds to fight illegal migration, via the Mediterranean. However, border controls and migrants' retention in Lybia collapsed in 2011.[3] As documented by Micallef (2017), in the absence of policing and border controls on the Lybian side of the Mediterranean, a large-scale smuggling business emerged almost immediately. Africa-to-Europe migration routes form a network (with *hotspots* as nodes) and the

[2]Most of the literature on illegal migration has focussed on irregular crossing at the Mexico-US border (e.g., Spilimbergo and Hanson, 1999; Hanson, 2004; Gathmann, 2008; Dolfin and Genicot, 2010).

[3]On February 26, 2011, the Treaty on Friendship, Partnership and Cooperation signed between Italy and Libya on August 31, 2008 was actually suspended by the Italian government.

opening of the CMR made many nodes in the network closer than before, potentially easing the prospective migrants' chances to move northward.[4] According to official statistics, the number of people crossing the CMR was 4,500 in 2010, while in 2011 it increased by a factor of almost 15, reaching 64,300.[5] By using data from Frontex we show that the rise in migrantion flows across the CMR is not offset by a decling in migrants crossing other Mediterranean routes. It is crucial for our research design that we use this shock, but do not focus on the shock itself. In fact we exclude from the analysis the year in which the shock happened (2011), and, more importantly, the countries of the region that were directly involved in the Arab spring. We thus evaluate the global, country-pair, unintended effects of an exogeous shock to the cost of migrating illegally as a result of the opening up of the CMR.[6]

For our empirical analysis we combine a novel geocoded data set of irregular migration routes from Africa and the Middle-East towards Europe, with a large, repeated cross-country survey data from 2010 and 2012 on individual migration intentions from origin countries in Africa and the Middle East to destination countries in Europe. This dataset also includes a large set of household and individual-level characteristics, which allow us to test to what extent illegal migration costs are heterogenous across the population. Using intentions instead of actual migration, for our purpose, is likely to be an advantage because they include regular but also irregular potential migrants, while actual migration data have substantial measurement issues because of the clandestine nature of irregular border-crossing. Furthermore, several contributions have shown that there is a high correlation between intentions and actual migration worldwide (Creighton, 2013; van Dalen and Henkens, 2013; Docquier et al., 2014; **?**). By using Frontex data for the period under investigation we show that the number of irregular migrants arrived at European ports of entry (by country of origin and year) is highly correlated with the number of people willing to migrate reported by our global survey.

Formal identification is achieved by using the time variation in distance along smuggling routes between origin and destination countries, which resulted from the opening of the CMR, to estimate the impact on indivduals' intention to move from Africa and the Middle-East to European countries. The inclusion of country-pair fixed effects, together with country-by-time fixed effects, control for country specific push and pull migration determinants, as well as geographical distance, bilateral agreements, economic, language and cultural proximity. Therefore, the impact of the change in distance estimated in our analysis directly captures the impact of change in transport costs of moving along smuggling routes. We further By using interaction terms with time-invariant (air) distance from Libya, we further test the intensity to treatment effect and find that those living

[4]Hotspots are those cities, towns or places where the physical interactions between smugglers and migrants take place, such as getting in contact and paying the amount, starting a journey, changing the transportation mean, etc.

[5]http://frontex.europa.eu/trends-and-routes/centralmediterranean-route/

[6]To illustrate the magnitude of the effect of the shock, consider for instance that the distance along smuggling routes between Ethiopia and Norway decreased by more than 2,000 km between year 2010 and 2012.

closer to Libya have higher migration elasticity to the smuggling shock. Finally, we investigate heterogeneous effects of the change in illegal migration costs by interacting our measure of supply of human smuggling services (proxied by the time-varying migration distance) with individual-level characteristics. This is intended to shed light on the extent to which access to the smuggling network or the incentive for illegal migration affect the cost of migrating for some. By finding a negative average impact of distance on migration intentions, with heterogeneous effects across the population, our results are consistent with a model where the migration decision depends on transportation costs – when it is irregular, these are smuggling costs – which rise with distance. The cost of illegal border crossing, though, is heterogenous across the population so that individuals with a lower time-equivalent cost of moving (e.g. with higher human capital or social networks) are more willing to migrate.

In the global debate, "tackling the smuggling network" has become one of the most important priorities in curbing the flow of irregular migrants. This paper is the first to assess the role of the smuggling business in triggering – all else equal – the recent South-North immigration pressure. The chance of having access to an exogenous source of variation in the cost of illegal migration is rare, and perhaps unique, in the migration literature, since migration (enforcement) policies and the middlemen industry for illegal border crossing are typically symultaneously determined. As argued by Clemens (2014) while discussing the role of demand and supply factors in driving emigration from developing countries *"Creative empirical strategies are needed to identify supply effects and demand effects on the shape of the mobility transition"*. Since the lenght of migration routes directly affects the costs of illegal migration, we exploit spatial variation in irregular routes in the Mediterranean area and use the unique natural experiment of the opening of the CMR due to the demise of the Gaddafi regime as a source of identification. Our micro-level approach offers a way to isolate the relative importance of the human smuggling business in shaping individual migration decisions in developing conuntries where, even after controlling for all country-specific and bilateral factors, a considerable variation in migration costs and access to intermediaries remains, and is amenable to policy.Finally, we add to the relatively small literuare on illegal migration, which have been using mostly within–country variation (e.g on Mexico), by providing global evidence on the pervasiness of the (il)legal migration barriers and smugglling costs in the relocation decision across a broader range of countries and settings.

The paper unfolds as follows. Section 2 and 3 describe the background context. Data are presented in Section 5 while Section 6 describes analytically the aggregate setting. Section 7 presents the empirical model and identification strategy while results are reported in Section 8. Section 9 concludes.

2 Background literature

Migration is a process that is costly both in terms of money and time. Such a decision depends on supply and demand factors, and individual specific characteristics. On the supply side, the migration choice is driven by sizeable cross-country disparities in economic (and non-economic) opportunities (Sjaastad, 1962; Borjas, 1999; Clemens, 2011). On the demand side, cross-border flows are shaped by access to legal migration opportunities and enforcement of migration policies at destination, such as border controls, employer sanctions, deportation policies, amnesties (e.g., Spilimbergo and Hanson, 1999; Ortega and Peri, 2013; Mayda, 2010). By taking an aggregate perspective, the extant literature is consistent in showing that both supply and demand factors, measured by cross-country and bilateral characteristics, significantly drive international migration flows – even though economic incentives and labor market conditions at destinations appear to matter significantly more than restrictive policies to migration (Dao et al., 2018; Docquier et al., 2014). Yet, the latter include measures to control legal border crossing but do not exclude the possibility of migration through illegal channels. In fact, over the last decades legal channels for migration have dried up giving rise to irregular migration flows, which are made possible by a concomitant rise of a profitable intermediate market for migration (Hanson, 2007; Friebel and Guriev, 2006; Gathmann, 2008). Hence, the push and pull framework may not suffice to analyze modern irregular migration without considering the role of the smuggling market on the decision to migrate irregularly.

Due to the longstanding phenomenon and relative data availability, most of the literature on illegal migration has focused on the irregular crossing of the Mexico-US border, where both border enforcement (Hanson, 2004) and illegal migration (measured by different proxies) have been rising over the period 1970-200o. Spilimbergo and Hanson (1999) use data on alien apprehensions by the U.S. Border Patrol to estimate the elasticity of illegal migration to both border enforcement (measured by border patrol linewatch hours) and Mexico/US wages. Orrenius and Zavodny (2005) study unauthorized Mexico-US migration to show that improvement in economic conditions, both at origin and destination, are associated with a negative migration selection in terms of education, while stricter border eforcement is associated with higher average skill levels of migrants. In addition, there is evidence that among those who illegally cross borders, the demand for smugglers has grown commensurate with rising border control. The share of unauthorized U.S.-Mexico border crossers using intermediaries or smugglers has been estimated at about 80 percent in 1990 to over 90 percent in the mid to late 2000s (Jandl, 2007; Dolfin and Genicot, 2010; Martin and Miller, 2000).

According to theory, expected lifetime benefits from migration, net of moving costs, are not homogeneous across individuals such that some people 'self-select' into migration more than others. Indeed, migrants differ from non-migrants with respect to their personal characteristics (e.g. age,

gender), skills, education and socio-economic background. These differences affect their ability to bear migration costs and to match potential immigration policy requirements in the host country (Borjas, 1987; Chiquiar and Hanson, 2005; Beine et al., 2011). In particular, there is evidence that individuals with higher observed and unobserved skills have lower (time-equivalent) migration costs. This is due to the existence of either licit or illicit migration intermediaries. On the one hand, individuals migrating legally must satisfy many bureaucratic requirements, involving extensive paperwork and repeated interactions with origin service providers and destination immigration authorities. More educated individuals may be able to meet these requirements more easily. On the other hand, there is a large industry for illegal migration that provide smuggling services to cross the border, including physical transportation to a (safe) location at destination and counterfeit residency documents (Orrenius, 2014; Micallef, 2017). Again, relatively skilled or higher-wage individuals may require fewer effective labor hours to migrate through illegal channels between developing and developed countries. Overall, the existence of a market for migration services suggests that the time-equivalent cost of migration will be higher for individuals with lower hourly wages (since it takes them higher labor hours to pay for these services) (Chiquiar and Hanson, 2005). Hence, to what extent changes in the supply of smuggling services affect the size and composition of cross-country relocation depend on differentials in the elasticity of demand for such services across heterogeneous individuals.

Despite the growing interest and policy concerns on irregular migration, there is a small economic literature on the role and structure of the clandestine migration industry. Friebel and Guriev (2006) examine the interaction between deportation policies and debt-financed illegal immigration in a model where wealth constrained individuals repay their debt to smugglers by entering into contracts that are easier to enforce in the illicit sector. Hence, they show that deportation and border control policies may have a significant effect on the size and compositiong of illegal migrants through the response of the smuggling market (see also Tamura, 2010; Auriol and Mesnard, 2016, on the interaction between the smuggling market and policy measures) .

From an empirical standpoint, the main challenge to the analysis is the lack of data on illicit phenomena that are, by their own nature, unobservable. While focusing on human trafficking, (Mahmoud and Trebesch, 2010) use IOM household survey data from Belarus, Bulgaria, Moldova, Romania and Ukraine to show that migrant families are more likely to have trafficking experience in regions with large emigration flows. They argue that this is the case because in such regions recruitment costs for traffickers are lower and self-selection of customers (migrants) is likely to be negative. Other papers examine the interplay between human trafficking, law enforcement and the level of corruption in both origin and destination countries, pointing however to traffiking victims as coming from middle-income countries rather than poor contexts (Akee et al., 2014; Cho et al., 2014). Most recently, by using unique survey data from Senegal, Arcand and Mbaye (2013) investigate how individual preferences, i.e. risk and time preferences, influence illegal migration intentions and the

willingness to pay a smuggler in an African context. The study is based on direct interviews to 400 individuals in Dakar, which involve choices in hypothetical situations, and finds that the likelihood to choose illegal over legal migration is an increasing function of the intertemporal discount rate, an ambiguous function of risk-aversion and a decreasing function of the price of illegal migration.[7]

Overall, there is still paucity of systematic and rigorous evidence on the extent to which, all else equal, the supply of smuggling services affects the individual likelihood to respond to the incentive for irregular migration. This is of interest since, both on a theoretical and empirical ground, the effects of economic factors or policy measures on the migration decision problem depend crucially on whether or not the actual market for migration is considered.

3 South-North illegal migration

With rising border controls and immigration enforcement activities, economic returns to the smuggling business have been growing over the last decades and South-North migration routes have increased in lenght, difficulty and riskiness in different part of the world (Jandl, 2007; Gathmann, 2008). For African migrants without European travel visas, the most viable way to move northward is that of travelling through the trans-Saharan and maritime routes.[8] Migration routes are typically shaped on old ones used by caravans and during transhumance through the desert, while new routes have been slowly developing based on smuggling competition and human exploitation.[9]

Libya remains the major hub of people migrating towards Italy and the main spot of departure for the European dream. During the Gaddafi regime until 2010, the central Mediterranean route was essentially a closed route for irregular migration, since Libyan borders were heavily patrolled by local and international police. In 2008, Italy signed the Friendship Treaty with Libya with the aim of investing in border control and fighting irregular migration, especially via sea. Article 19 of the Treaty, signed by prime ministers Berlusconi and Gaddafi, called for two things in particular. On the one hand, the approximately 2000 km of Libyan coast were to be patrolled by mixed crews on patrol boats provided by Italy. Six patrol boats were supposed to enter into operation in May 2009. On the other hand, Libyan land borders were to be controlled by a satellite detection system jointly financed by Italy and the European Union.

In 2011, though, a wave of sudden protests and uprisings, known as the Arab Spring, shook up the socio political environment of some African Mediterranean countries. Popular revolts started

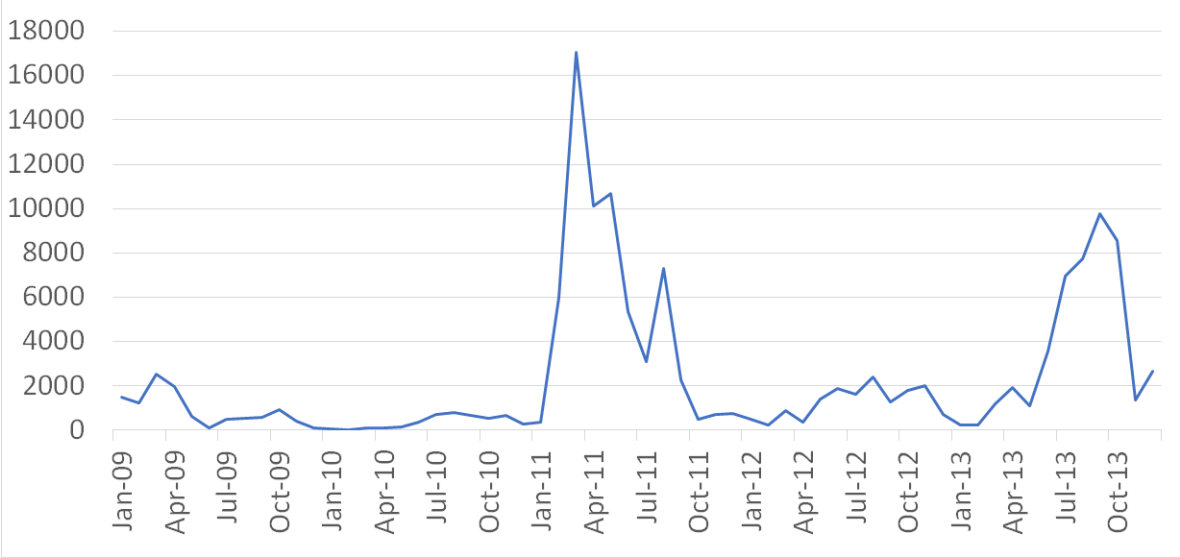
[7] They further show that potential illegal migrants place a high monetary value upon migration and have a high utility gap between migrating and remaining in Senegal (the willingness to pay for smuggling is an increasing function of the lump-sum payment necessary to make the individual stay put in Senegal).

[8] According to Europol-INTERPOL 2016, more than 90% of the migrants coming to the EU are facilitated, mostly by members of a criminal network. Not all migrants are actually able to go beyond North Africa, putting their journey to an end in one of the Mediterranean coastal countries (especially in Libya and in Maghreb, where nowadays almost 2 millions of irregular migrants live). Yet, an increasing share of the migration stream uses Mediterranean sea routes.

[9] see iMap website (http://www.imap-migration.org/.

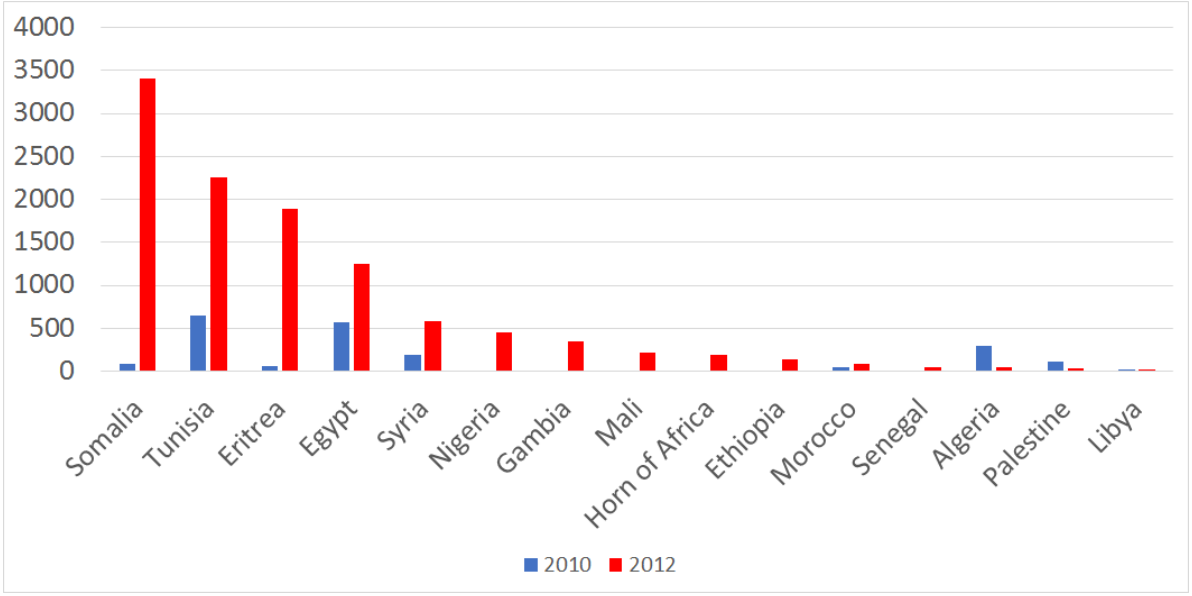
in Tunisia in December 2010 and in 14 months rulers in Tunisia, Egypt, Libya and Yemen had been forced from power. In particular, in 2011 a significant amount Tunisian people left the country through the central Mediterranean route, while as from late 2011, the Gaddafi autocratic regime collapsed and Libyan borders suddenly become available to undocumented migrants.

Figure 1: Monthly pattern of illegal migration across the Central Mediterranean Route



Notes: The figure shows the monthly number of detected illegal migrants (i.e. detected border crossing) arriving in European territory across the Central Mediterranean Route in the period 2010-2012. The shaded area represents year 2011, which will not be used in the econometric analysis. Source: Frontex)

Figure 2: Detected illegal migrants across the Central Mediterranean Route by country of origin

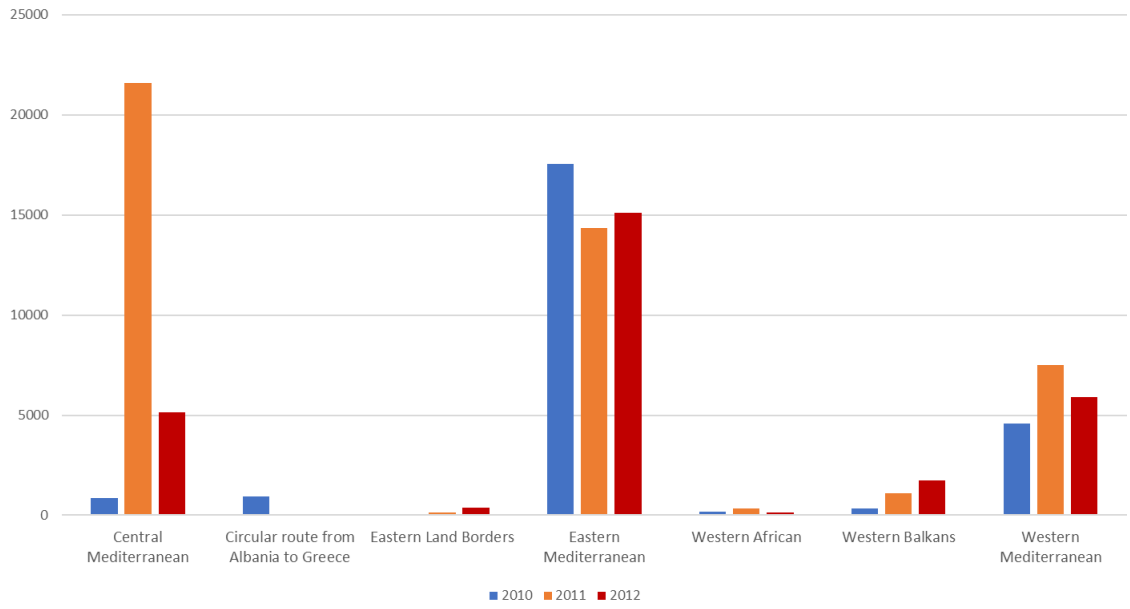


Notes: The figure shows the number of detected illegal migrants (i.e. detected border crossing) arriving in European territory across the Central Mediterranean Route from selected origin countries in years 2010 and 2012. Source: Frontex)

By using data collected by Frontex[10] on detected migrants across the CMR, Figure 1 shows a

[10]Frontex is the European Authority in charge of border management and control of the European Schengen

Figure 3: Number of detected illegal migrants by migration routes



Notes: Source: Frontex and own calculations.

flat and close to zero pattern in irregular migration across that route for the year 2010, a large spike in 2011 and a lower average level in 2012, which is still around three times larger than that in 2010. In particular, the spike in 2011 comes from many people from sub-Saharan Africa who originally left their country of origin to work in Libya and have fled from the country to Europe as soon as the regime collapsed and sea routes were no more patrolled. This was made possible by a significant liberalization of the smuggling market in the aftermath of Libya's revolution, as a result of the collapse of law and order along with the economy, which provided both the environment and incentive for the intensification of the mass exploitation of migrants and asylum seekers in the area (Micallef, 2017).

Figure 2 shows variation in detected illegal migrants by origin country crossing the central Mediterranean route before and after the collapse of Libyan regime. For many countries in the sample we observe large and increasing absolute numbers. Importantly, some of these countries are not close to Libya (see for example Somalia, Eritrea, Syria and Nigeria), suggesting that Libya, since 2011, became plausibily the main human smuggling hub connecting African countries to Europe.[11]

Area, in coordination with the border and coast guards of Schengen Area member states. They collect montly data on irregular migrants arriving in Europe through major South-North migration routes, which are Central Mediterranean, Circular route from Albania/Greece, Eastern Land Border, Eastern Mediterranean, Western African, Western Balkans, Western Mediterranean. See http://frontex.europa.eu/

[11] In Figure A1 in Appendix we report detected illegal migrants by origin countries between 2009 and 2012 in order to show the high variation and lack of persistency in migrants' origin over time

Finally, in Figure 3 we employ Frontex data to compare the use of different smuggling routes from Africa and Middle East, as measured by detected illegal migrants. The figure shows that migrants from this region make use of essentially three routes, i.e. Central, East and Western Med routes. While there is a signifcant and three-fold increase in the use of the CMR after 2010, though, there is no much time variation in the use of the remaining migration routes over the same period.[12] Overall, qualitative evidence reported above points to the fact that, after the demise of the Lybian regime and the associated spike in migration in 2011, CMR re-opened while no major shocks occurred in the rest of the region. Yet, we provide more compelling evidence in Section 6 on this. This evidence suggests that the kind of shock we are considering, which translated in the opening of CMR, indeed increased the supply of smuggling services in the whole region, with a potential concomitant decline in the average smuggling market prices.

4 Theoretical Framework

We here provide a framework meant to provide guidance for the empirical research carried out in the next sections. Our empirical analysis absorbs the push and pull factors that are predominantly considered in the literature by the country–pair fixed effects and the origin– and destination–country–by–time fixed effects. We have a focus that is different and which can be summarized in three questions: (i) Who is more likely to utter intentions to migrate? (ii) How would a reduction of distance as brought about by an exogenous extension of the smuggling network affect migration decisions? (iii) How would the reduction of distance interact with household and individual factors?

Model description: To shed light on what to expect empirically, consider the decision of a potential irregular migrant as determined by the following objective function:

$max(1-M)(w_o + B_o(HH)) + Mw_d(H,N) - Mc(H,G,D)$

$s.t. W \geq kDs$

Here, M is an indicator variable which is 1 if the individual migrates and zero otherwise. The first term represents the utility of a person when deciding not to migrate, and follows standard assumptions in the literature on migration. At the origin country o, the individual receives a utility of his or her labor income w_o (here, index o stands for the origin country) which is assumed not to differ much in terms of individual characteristics, for a number of reasons. In many African countries, (i) unemployment is high, (ii) returns to education low, and (iii) much of the labor income stems from self-employment or agricultural employment. [13]

Benefit, B_o, is meant to capture the compensating differentials that would be lost upon mi-

[12] It is worth noting that number of fatalities is significantly higher along CMR than for the other sea-routes, so that the number of detected illegal migrants along CMR may be a more severe undercount with respect to other sea-routes.

[13] In principle, one could hence omit w_o from the equation as most of it will be soaked up in the country fixed effect.

gration, in particular, those related to social networks in the origin country. It is also meant to capture the benefits of using time for household work, which would be lost upon migration. B_o can in sum be positive or negative, but from the discussion above it seems likely that the term is positive, however it is reasonable to assume it to be a function of household characteristics HH. For instance, we would expect it to be larger in households with a high ratio of dependent household members over household members in working age.

The second term stands for the labor income w_d of the individual upon migration, i.e. in a destination country d. While the time varying country factors are soaked up by fixed effects, we consider the level of education H, and whether or not the migrant can rely on a social network in the destination country (N is a binary variable). The latter reflects the importance of social connection as emphasized in the literature. In principle, one could also consider the wage to depend on personal characteristics, like age or gender, however these proles tend to be rather depressed for migrants in destination countries, in which most migrants, if at all integrated in the labor market, earn similar wages in the low-skilled sector.[14]

While all of the above ingredients would be present in an analysis of legal migration, the costs associated with irregular migration (the third term in the equation) are more intricate. The cost term, and the budget constraint (see below) are also likely to bear most potential for interesting heterogeneous effects. As in any rational choice theory of migration there are monetary costs that are reasonably assumed to be increasing, and, potentially, concave in the distance between origin and destination country. However, the clandestine nature of irregular migration brings to the forefront the non-monetary components of the cost of migration for which a number of personal characteristics may play a role, in particular, education (H), and gender (G). Different types of people may not only be exposed to different types of risks when they migrate, but they may also associate different degrees of importance to these risks. While we are agnostic about potential hypotheses about the partial derivatives of the cost function with respect to individual characteristics and would rely on the empirical analysis to learn more, we assume that c is (at least in some range) decreasing in education because educated people may have better information. They may, for instance, be able to secure less risky routes, or have better contacts to administrations.[15]

The budget constraint is another element that is important for our understanding of irregular migration. Costs of migration are high, they are often debt-financed, and migrants must pay part of the costs upfront. Hence, wealth W must be larger or equal the costs of migration. We assume that the costs of migration are proportional to the distance D by a factor s, and that a proportion k

[14]Note that we fully abstract from very-high skilled people, i.e. those with a human capital which is fully valuable also in destination countries, for two main reasons. First, they are irrelevant in the empirical analysis, so any findings about them is likely to be not statistically significant. Second, they are more likely to migrate legally, and the determinants driving such choice are fully controlled by our large set of fixed effects.

[15]Note also that we have included all the foregone benefits and opportunity costs associated with migration in the first term of the objective function, and hence do not account for them here.

of these monetary costs must be paid upfront. The monetary costs may or may not include a profit component. Importantly, the costs that are relevant for the budget constraints are the monetary costs only, and we assume that these are proportional to the distance travelled.

Predictions: In this framework, the following predictions follow in a straightforward way: migration intentions should be, ceteris paribus, higher for people (i) with higher education, (ii) from households with more members in working age, and less dependent members, (ii) with networks abroad, (iv) who have more wealth and can hence pay the down payment needed. We should also expect people who are dissatisfied with their living conditions to be more likely to migrate (following from a reinterpretation of B_o).

Predictions about the effect of a decrease in distance D are a bit more involved but still unambiguous. The net benefit of migration increases, because the physical cost of migration decreases. Furthermore, the budget constraint is relaxed. Consequently, migration intentions should increase in general.

In terms of interactions between a decrease in D and personal characteristics, we have no a priori knowledge about the sign of the cross-derivatives of c with respect to personal characteristics. However, there is an unambiguous effect through the budget constraint. When D decreases, the level of wealth needed to pay the upfront costs of migration decreases, which should lead to an increase of relatively less wealthy people's migration intentions. Wealth is often badly measured in developing economies, while education is a good proxy for wealth. Through the relaxed budget constraint, the decrease in D should hence increase the intentions to migrate of less educated people. There is however a countervailing effect if the cross derivative of c with respect to D and H were negative. In this case there is no clear prediction on how D and education should interact. Hence, interaction effects between personal characteristics and the reduction in D remain an empirical question we turn to in the next section.

5 Data

We use information on potential migrants from two waves of the Gallup's World Poll (GWP) which is a repeated cross-section, nationally representative individual-level dataset covering more than 150 countries over several years.[16] GWP builds on yearly surveys of residents older than 15 years of age in more than 150 countries and represents more than 98 per cent of the world's adult population (e.g. see Docquier et al. (2014), Dustmann and Okatenko (2014) or **?** for papers using the same dataset).[17] While the GWP contains data from 2005 onwards, we limit our sample to

[16]The survey covers each country comprehensively, including rural areas. See further details on the dataset and a full list of available variables in Esipova et al. (2011) and Gallup (2012).

[17]The information is collected from randomly selected, nationally-representative samples of about one thousand individuals per country. In some countries, larger samples are collected in major cities or areas of special interest. Additionally, in some large countries, such as China and Russia, sample sizes increase to at least two thousand respondents. The survey covers each country comprehensively, including rural areas, with the country samples being

years 2010 and 2012, excluding year 2011 because of the Arab Spring and the associated spike in migration across the Mediterranean sea. The reason for not using other years from the survey is that we do not want confounding factors to bias our analysis. Indeed, before and after the period we consider, other bilateral and multilateral (EU) agreements or migration-policy measures have been put in place systematically– also due to the same change of environment we are considering, i.e. the opening of the CMR and the booming of irregular flows (e.g. the Mare Nostrum Operation was launched at the end of 2013 and the Triton operation the following year). We limit our sample to South-North migration to Europe but we exclude Libya from our estimation sample, since this country is affected by both the opening up of the CMR and the demise of the Migration Treaty with Italy (i.e. a pair–specific shock). For the same reason, we further exclude its neighbouring countries, Tunisia and Egypt, as right in 2011 they experienced an internal revolution which led to radically different governmental settings that in turn may generate bilateral–specific shocks. [18]

By its clandestine nature, irregular migration is not observable and it is empirically difficult to account for its size and composition. An advantage of using intentions to migrate instead of actual migration is that intentions are likely to be a primary determinant of the supply side of international migration flows. Indeed, intentions provide a measure of migration propensities also including potential illegal migrants, which are omitted from most migration statistics. On the other hand, a common concern when using intentions is whether intentions are "mere words or true plans" (van Dalen and Henkens, 2008). Other studies have been conducted using migration intentions from GWP show that there is a high correlation of cross-country data on intentions with actual migration flows (see for example (Docquier et al., 2014)). In this paper, we use a rather strict definition of migration intentions by considering positive answers to the three GWP questions altogether, i.e. whether respondents would like to move abroad and whether they plan to do so in the following year.[19]

Key to our study, after answering the individual intention to migrate, GWP survey asks respondents to indicate a preferred country of destination, which allows us to exploit the bilateral

probability based (i.e. the weights applied in the survey are used in the empirical analysis of this paper).

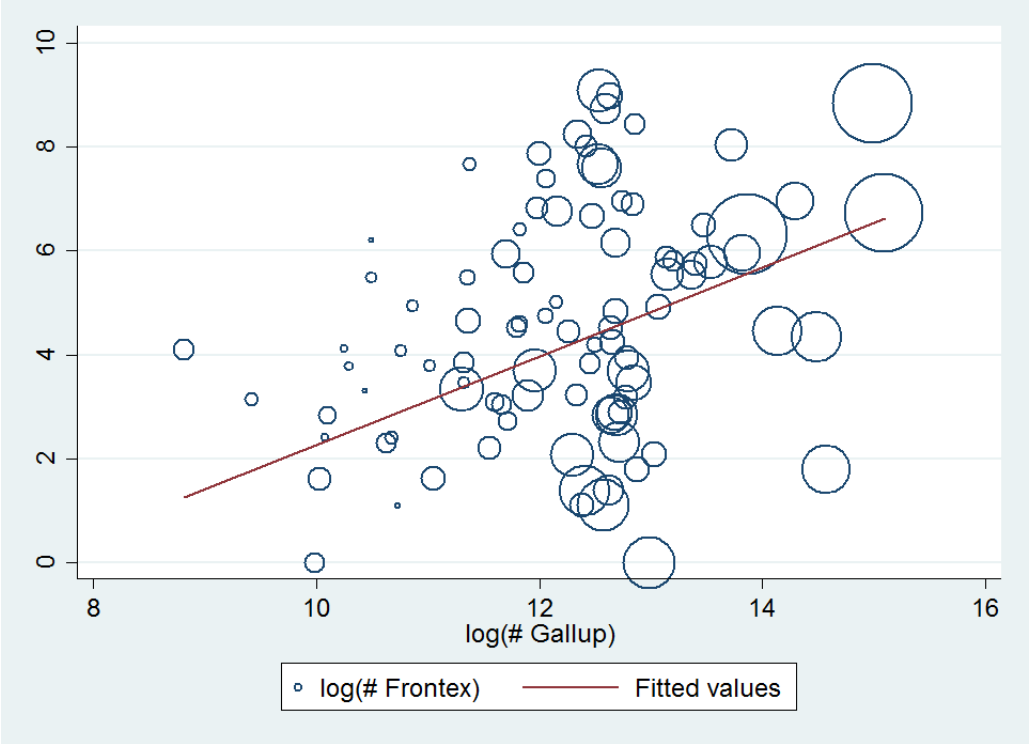
[18] Ultimately, our sample of origin countries include Marocco, Algeria, Benin, Burkina Faso, Botswana, Central African Republic, Cameroon, Congo (DR), Congo, Comoros, Djibouti, Gambia, Ghana, Guinea, Kenya, Liberia, Mali, Mauritania, Malawi, Niger, Nigeria, Rwanda, Sudan, Senegal, Sierra Leone, Somalia, Chad, Tanzania, Uganda, South Africa, Zambia, Zimbabwe, Iraq, Israel, Jordan, Lebanon, Syria, Yemen. Among destination countries, our sample includes Albania, Austria, Belgium, Bulgaria, Czech Republic, Croatia, Serbia, Switzerland, Denmark, Germany, Spain, Estonia, Hungary, Finland, France, Greece, Italy, UK, Ireland, Luxembourg, Latvia, Montenegro, Norway, Sweden, Poland, Romania, Netherlands, Slovenia, Turkey.

[19] Migration intention is measured by using the answer to the following questions: (i) "Ideally, if you had the opportunity, would you like to move permanently or temporarily to another country, or would you prefer to continue living in this country?"; (ii) In the next 12 months, are you likely or unlikely to move away from the city or area where you live?"; (iii) Are you planning to move permanently to another country in the next 12 months, or not?"; (iv) "To which country would you like to move?. In particular, question (iii) is asked only starting from the 2010 and only to those who respond positively to question (ii). Hence, while we use all survey questions above as to drop inconsistent responses across them, we focus on question (ii) to identify individuals willing (i.e. planning) to migrate in the following year, out the relevant population that is defined by respondents to question (ii).

nature of migration intentions and combine them with georeference data on origin–destination pair distance. We focus on the area across the Mediterranean sea (i.e. Africa, Middle East and Europe) so that our final dataset consist of micro-level information from a representative sample of individuals living in 39 origin countries in Africa and the Middle-East, reporting 29 European countries as preferred destination, in the years 2010 and 2012.

In order to check to what extent our variable on international migration intention can be a proxy for actual irregular migration flows for the period under investigation, we merged our data with Frontex data on the number of irregular migrants arrived at European ports of entry, by source country and year. Figure A1 shows there is a positive correlation beween official arrivals recorded by Frontex and the number of individuals willing to migrate from the same country of origin as reported by GWP.[20]

Figure 4: Gallup World Poll data vs Frontex Actual flows



Notes: Source: Frontex and own calculations. The size of the plotted circles are proportional to the size of the population.

[20] As an extra check for validation, we merged our data with two different datasets containing actual migration. Since these datasets are at aggregate level (country-level instead of individual-level), we aggregated our data using actual population data and survey weights. First, we used bilateral migration flows from OECD (these contain some missing country-pairs), second, we used bilateral migration stock from (Brücker et al., 2013). The migration stock data provide the number of migrants in the destination country originating from a given country based on census data for the years 1980–2010 for every five years. From this we calculated the yearly average net bilateral flows (by taking the difference between the stocks) and match this to our data. The correlation between our data on international migration intentions and the actual migration flows obtained from both datasets for 2010 is around 0.71-0.72. See also (Creighton, 2013; van Dalen and Henkens, 2013; Docquier et al., 2014) for other evidence on the correlation between intentions and actual migration worldwide.

Table 1 reports average emigration rates based on migration intentions for our sample (i.e. aggregate migration intentions as a share of total population). On average, migration intentions increase from 0.71 percent of the population in 2010 to 0.88 percent in 2012. In our sample, migration intentions are mainly concentrated in the youth and male population. Indeed, the share of males in total population with migration intentions is 0.43% in 2010 (0.29% for females), which increase to 0.59% in 2012. Similarly to males, the share of young people with migration intentions in total population also increases during the period. Moreover, aggregate data reveal a decrease in migration intentions among low-skilled individuals (i.e. those with no more than primary education) which represent more than half of the total population of potential migrants. Instead, migration intentions increase among those with more skills (i.e. secondary education and above) with the share of high-skilled with migration intentions rising from 0.31% to 0.55%.

Table 1: Emigration intention rates as % of population (Gallup World Poll, 2010-2012)

	2010	2012
Emigration rate	0.71	0.88
Male emigration rate	0.43	0.59
Youth emigration rate (<30)	0.44	0.59
Low-skilled emigration rate	0.40	0.33
High-skilled emigration rate	0.31	0.55

Note. Emigration rate is the population weighted average across our sample of country-level emigration rates (which are defined as the share of population with migration intentions). Low-skilled is defined as primary education, high-skilled is defined as secondary education and more.

Table 2 reports migration intentions for the top ten countries with highest emigration intention rates (all these countries are above the sample average). Table 3 provides further details on where people from the top five highest emigration countries would like to migrate, listing the two most important destinations for each country. The preferred destinations by country are only a few, with most respondents willing to go to a few selected destination countries in Europe.

5.1 Bilateral Distance

We construct a matrix of bilateral distances from each country of origin (o) to each destination (d) by mapping migration routes between Africa, Middle East and Europe. Unlike air distance, land and sea migration routes change over time, hence we construct the matrix D_{odt} where t is year 2010 and 2012.[21] The assembling process follows several steps. First, the patterns of international migration routes from countries in Africa/Middle East to Europe have been geolocalized from the maps provided by the iMap platform[22], which has been developed by ICMPD, Europol and

[21] We constructed a full matrix for each African and European country pair but the coverage in the GWP defines the number of country pairs used in the regression analysis.

[22] http://www.imap-migration.org/

Table 2: Migration shares- Top ten origin countries (GWP, 2010-2012)

Rank	2010		2012	
	Origin country	Emigration rate	Origin country	Emigration rate
1	Senegal	6.58	Comoros	4.17
2	Djibouti	3.78	Sengal	3.49
3	Comoros	2.81	Sudan	2.33
4	Somalia	2.12	Ghana	2.07
5	Mali	1.98	Guinea	1.72
6	Mauritania	1.45	Algeria	1.68
7	Morocco	1.28	Mauritania	1.64
8	Sudan	1.05	Congo Rep.	1.29
9	Ghana	1.02	Morocco	1.29
10	Algeria	0.87	Nigeria	1.18

Table 3: Bilateral migration shares- Top-five origin countries with top-two destinations (Gallup World Poll, 2010-2012)

Rank	2010			2012		
	Origin	Top-2 destination	Emigration rate	Origin	Top-2 destination	Emigration rate
1	Senegal	Spain	2.36	Comoros	France	3.99
		Italy	1.86		Germany	0.177
2	Djibouti	France	2.39	Senegal	France	1.44
		UK	0.48		Spain	1.30
3	Comoros	France	2.48	Sudan	UK	1.25
		UK	0.14		France	0.58
4	Somalia	UK	1.42	Ghana	UK	1.20
		Sweden	0.25		Spain	0.60
5	Mali	France	0.82	Guinea	France	0.76
		Spain	0.60		UK	0.43

Frontex jointly (an sample map of overland and oversea routes from iMap is reported in Figure A2 the Appendix). Each country is represented by the coordinates of its capital city, as the migration routes usually go through it and because the location of the capital city is often a good proxy for the center of mass of each country in terms of population. The structure of migration routes represent the network connecting all of the countries in our sample [23]

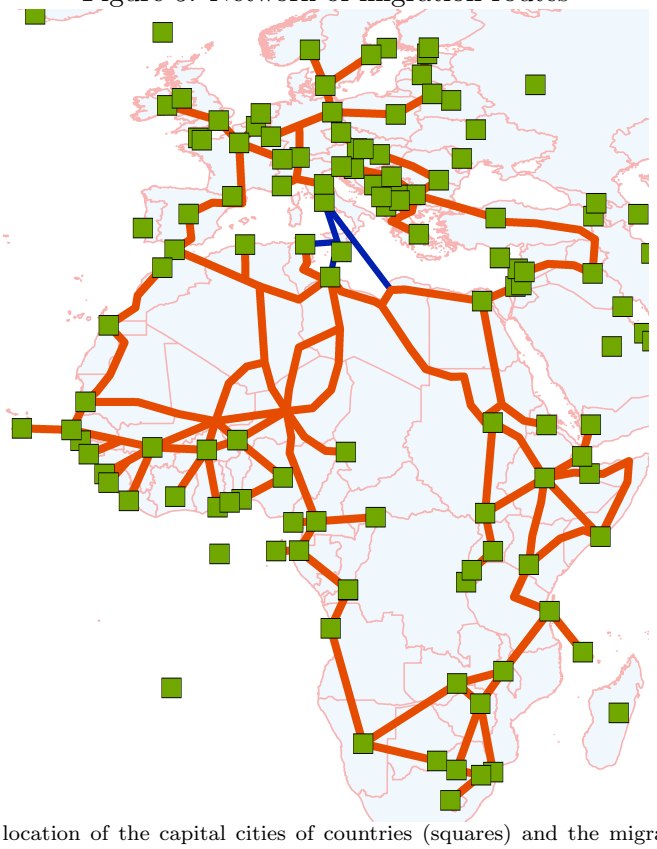
In Figure 5 the network of migration routes in 2010 is represented by the red segments connecting the (capitals of) African and European countries. The blue segments represent the sea routes that after the Arab Spring, and in particular after the end of the Gaddafi's regime, became available again since the end of 2011. Hence, the CMR has been added to the 2010 network to obtain the new structure as of 2012.

The distance associated with each origin-destination pair is the minimal geodesic distance cal-

[23]Those off the migration routes have been connected to their closest neighbouring country using the shortest straight link.

culated by means of a Djkstra algorithm along the segments of the network.[24] Hence, we can measure the effect of the opening of CMR in 2011 on a given origin-destination pair as the difference between the shortest migration route between two countries not crossing the CMR and the shortest path between two countries along all of the routes (including CMR). In order to avoid too much arbitrariness, we do not impose differential transit costs depending on altitude, ruggedness or other geomorphological characteristics (e.g. rivers, desert, vegetation etc.), so that the cost of moving between nodes maps one to one with the distance[25].

Figure 5: Network of migration routes



Notes: The figure shows the location of the capital cities of countries (squares) and the migration routes connecting them (lines). Countries not connected are excluded from the sample. Red migration routes relative to year 2010 are obtained from iMap website, while blue ones are those added to construct the network in 2012.

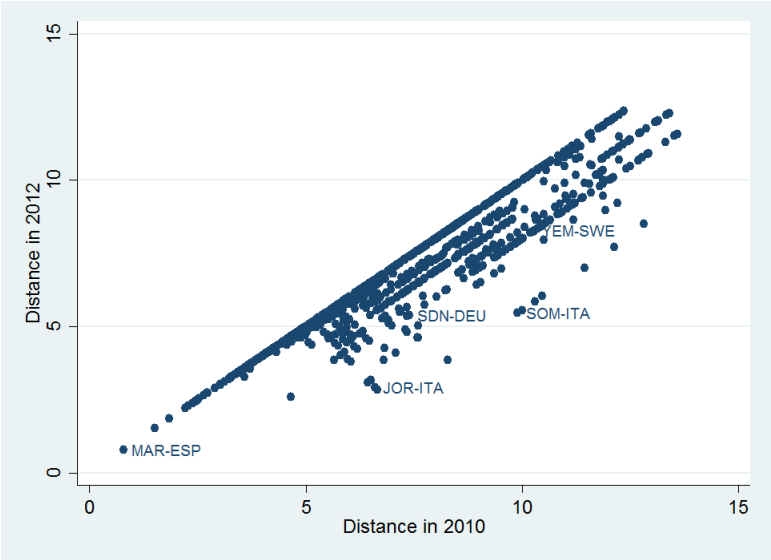
The resulting matrix can be represented in Figure 6, where each dot is an origin-destination country pair and the axes report the distance along smuggling routes in 2010 and 2012. It is worth noting that, by construction, the addition of links in the network (the 2011 CMR opening) make

[24] The implicit assumption here is that the cost of connecting two nodes off the migration routes is infinite.

[25] We obtain almost identical results by recoding sea routes being one fifth cheaper than land routes, i.e. rescaling the length of segments across sea by a factor of 0.2. The fact that this modification has little effect on the results can be rationalized as, first, the length of the average route connecting a country pair is in the order of magnitude of thousands of kilometers and the maximum sea distance (between Libia and Italy) is of less then 300 kilometers. Second, the important change between distances across the two periods is the emergence of central Mediterranean route, with its length playing a minor role in the overall change. It is therefore the possibility of finding shorter paths across the network (by means of additional nodes) rather than the shortening of existing segments that mostly contribute to the variation in distances across the two periods.

the minimal distance between country pairs either unchanged or shorter, particularly for those country-pairs close to the new links. Note that the lower the dots from the 45-degree line, the closer the country pairs get between year 2010 and 2012. Some country-pairs have been labelled as examples, such as Morocco-Spain (the closest pair, which however does not change its bilateral distance over time), Jordan-Italy (the pair experiencing the largest reduction in distance), Yemen-Sweden (a pair made of very distant countries which experienced a sizeable reduction in distance, more than 2000 kilometers).

Figure 6: Distance between pairs of countries

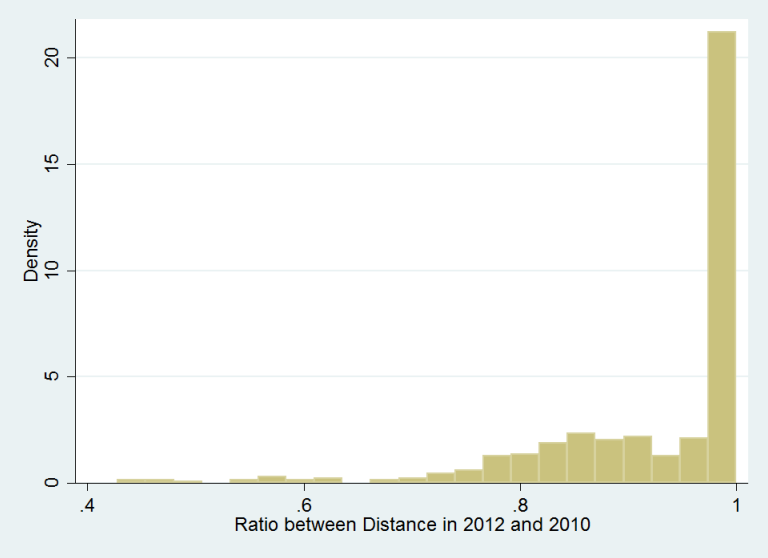


Notes: The figure shows the distances, in 1,000 Kilometres, between country pairs in 2010 and 2012.

Figure 7: Distance between pairs of countries and its reduction

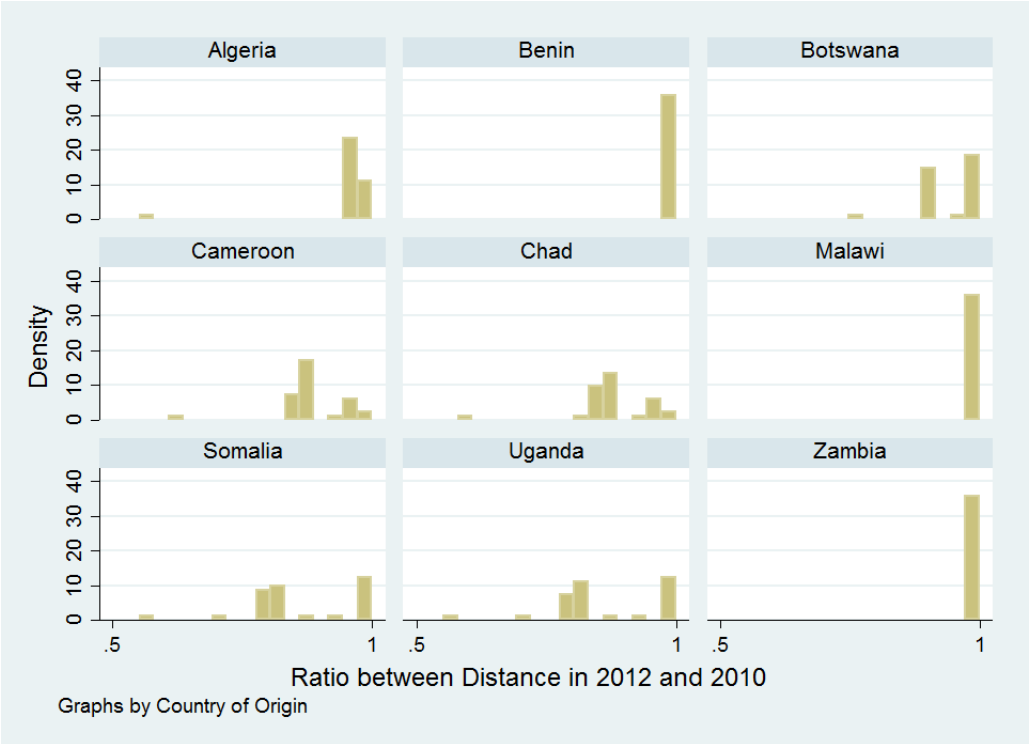
Notes: The figure shows, for each country pair, the ratio between distance in 2012 and 2010 against the distance in 2010, in 1,000 Kilometres.

Figure 8: Distance among country pairs and its reduction



Notes: The figure shows the distribution, calculated among country pairs, of the ratio between distance in 2012 and 2010.

Figure 9: Distribution of the drop in smuggling distance



Notes: The figure plots the distribution of the drop in smuggling distance from all European countries between year 2010 and 2012 by selected country of origin. Source: Frontex.

In Figure 7 we plot how the drop in distance between year 2010 and 2012 is distributed at given absolute distances (in 2010), showing that large drops are not only concentrated among those country pairs already close to each other. Figure 8 shows that there is a sizeable amount of country pairs for which distance dropped between 2010 and 2012. Finally, Figure 9 shows that

some countries (such as Benin, Malawi, or Zambia) did not experience any drop in distance, while others (such as Botswana, Chad or Somalia) got closer to many of the destination countries.[26]

6 Aggregate analysis of the empirical setting

Before turning to our main results on bilateral intentions to migrate, we further use Frontex data on migrant flows arriving at European borders in order to assess whether the opening of the CMR was coupled with any other major change in the region during the same period of time. This is important in order to rule out a general equilibrium effect whereby the direct effect of the CMR shock is offset by potential migrant relocation along other routes.[27] To do so, we assemble monthly data of arrivals of immigrants collected by Frontex, which classifies individuals in terms of (self-declared) nationality and hub of arrival, the classification of routes being the same proposed in Figure 3. Data is organized thus as a panel of monthly country-level flows arriving in Europe either through the CMR or any other routes. By using our smuggling distance matrix, we estimate migration flows as a function of a treatment dummy, which is equal to one if the country experienced a drop in distance from at least one European destination country for the months after December 2011. The empirical specification therefore is as follows:

$$M_{ot}^{R} = \gamma_1 T_{ot} + \delta_o + \tau_t + \epsilon_{ot} \tag{1}$$

where M_{ot}^{R} is the number of immigrants from country o arriving to Europe in month t using the smuggling route R, which can be either the CMR or any other route. T_{ot} is our treatment variable, which is equal to one since January 2012 for those countries o that get closer to at least one European destination country. δ_o are country fixed effects (or a dummy for the treated countries) and τ are month fixed effects or simply the usual pre-post dummy. ϵ_{ot} is an i.i.d. error term.

Results presented in the first three columns of Table 4 show that the opening of the CMR significantly increases irregular flows (arrivals) through the same CMR– this is so even after controlling for the lagged flow of migrants that take into account short-term network effects (second row). Importantly, once we use immigrant flows arriving through any other route as dependent variable, results on the coefficient of the treatment are small, negative and non-significant. This suggests that, in the period we consider, no diversion of flows has been triggered by the opening of the CMR. This aggregate empirical setting is reassuring once we implement our individual-level analysis as presented in the next section.[28]

[26] Figure 9 shows only selected countries to improve readability.

[27] This general equilibrium effect is mechanically muted in our empirical model, though, as outlined in the following section.

[28] Results hold even expanding the sample to months of years 2009 and 2013 and including year 2011 among the non-treated. Also, by using a stricter definition of treatment (i.e. countries that got closer to at least two destinations) results remain unchanged.

Table 4: The impact of CMR opening on monthly arrivals in Europe

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable	Migrants through CMR			Migrants through other routes		
γ_1	14.3542***	14.3542***	9.2879***	-0.1319	-0.1319	-1.7470
	[3.6010]	[3.6501]	[3.1716]	[12.9292]	[13.0729]	[9.4965]
Lagged Migrants			0.3688**			0.6943***
			[0.1698]			[0.1468]
Observations	864	864	864	864	864	864
Country FE	YES	YES	YES	YES	YES	YES
Post 2011 dummy	YES	NO	NO	YES	NO	NO
Month FE	NO	YES	YES	NO	YES	YES

Notes: The dependent variable is the monthly flow of migrants arriving in Europe using the CMR (columns 1 to 3) or any other routes (columns 4 to 6). The estimation sample is the 12 months of year 2010 and the 12 months of year 2012. Results are estimated by means of OLS. All regressions include a set of country fixed effects and a dummy for months in year 2012 (columns 1 and 4) or monthly dummies (other columns). Columns 3 and 6 include the one month lag of the dependent variable. Robust standard errors are reported in brackets. *** p<0.01, ** p<0.05, * p<0.1

7 The impact of smuggling distance on individual migration intentions: Empirical Strategy

In our empirical model we use a gravity-like specification. The gravity model has been extensively used to empirically model trade flows since Tinbergen (1962), and the theoretical foundations have been linked to different trade models (see an overview in Head (2014)). In addition, the gravity model has been also applied to other type of flows between countries, including migration flows.[29] We employ the gravity framework and exploit an exogenous shock to distance in migration routes to estimate the impact of the latter on individual-level migration intentions to country-specific destinations. Hence, the bilateral estimation equation is as follows:

$$M_{iodt} = \beta_0 + \beta_1 X_{iot} + \beta_2 \mathbf{D}_{odt} + v_{ot} + w_{dt} + u_{od} + e_{iodt} \tag{2}$$

where the outcome variable M_{iodt} is a binary indicator of migration intention of individual i to move from country of origin o to country of destination d at time t. The regressor of interest, D_{odt} is the time-varying (log of) distance, measuring the distance between the origin and destination country along migration routes. In addition, we control for a vector of individual covariates, X_{iot}, which include age, gender, education, household size, wealth, urban city residence, satisfaction with local amenities.[30] Importantly, we also include country-pair fixed effects (u_{od}) together with a full set of origin-by-year (v_{ot}) and destination-by-year (w_{dt}) fixed effects.[31] The latter control for all

[29] Beine et al. (2015) provide a good overview of the gravity model's application to international migration flows laying out also the theoretical basis

[30] Since recent empirical evidence shows that income considerations are not the only factor influencing migration decisions, our analysis also incorporates non-economic factors. In particular, we control for individuals overall contentment with own living standards and local amenities such as public services, security, or governance (see for example (Dustmann and Okatenko, 2014) or (**?**)).

[31] A similar empirical strategy has been used in Pascali (2017), that uses a time-varying (measure of) distance as explanatory variable in a standard gravity trade model.

static and dynamic standard socio-economic pull and push drivers of migration, including economic incentives at origin (e.g. economic downturn, conflict etc.) and migration policy at destination (e.g. new migration laws, change in enforcement, etc.). Country-pair fixed effects absorb all other (time-invariant) bilateral migration costs such as geographical and economic proximity, common language, shared tastes, social networks and bilateral migration policy.[32] Hence, the identification comes from short-run changes – i.e. a reduction – in the length of irregular migration routes, which translate into changes in smuggling services supply. Throughout, estimates allow for arbitrary correlation across both orgin and destination countries so that standard errors are two-way clustered. In particular, since we have individual observations which may be correlated (e.g. subject to the same shocks) within the home country (push factors) and the country pair (bilateral factors), we present robust results under within groups correlated errors.[33]

We further explore heterogeneity in the distance effect. In particular, in the spirit of a differences-in-differences strategy, we exploit time-invariant (air) distance from Libya to investigate treatment intensity effects. Indeed, living closer to Libya may entail higher marginal utility from the opening of CMR than it is the case for those living further away. This is so as, in the absence of CMR, those living close to Libya and willing to migrate irregularly to the EU should travel through longer migration routes in order to reach alternative hubs (e.g. western or eastern mediterranean routes). Hence, in additional specifications we exploit both time variation in smuggling distance (as above) and geographical variation across countries – in particular air distance from Libya (i.e. intensity of the treatment).

Finally, by estimating equation (1) we are able to uncover the average causal effect of access to shorter illegal migration routes on the individual-level intention to migrate. Hence, we investigate heterogeneous effects of the human smuggling shock by interacting our measure of availability of human smuggling services (proxied by the time-varying migration distance) with individual-level characteristics. This allows us to uncover the features of individuals who respond more (or less) to the incentive for irregular border crossings. In particular, since international migration is a high risk and costly process (even more along the central Mediterranean route), we interact our distance measure with individual level characteristics which proxy for differentials in (time-equivalent) migration costs, such as gender, age, education and social networks.

[32] Given that our time-frame is short, very little change (if any) would have taken place over the period in terms of bilateral migration policies.

[33] More specifically, we use two-way clustered standard errors since we are interested in generalizing results to the whole population in the origin country willing to migrate across all possible country-pairs, beyond those in the sample (see Abadie et al.2017).

8 Results

We start by estimating the impact of changes in migration route distance on individual migration intentions, as specified in equation (2), controlling for individual-level characteristics, pair and country-time fixed effects. The latter sweeps out all (observable and unobservable) heterogeneity at the level of country of origin, destination and pair. In particular, they include air distance and time-invariant (between 2010-2012) common factors such as bilateral (visa) agreements, countries' proximity in terms of language, culture and living standards. Origin- and destination-country-by-time fixed effects control for static and dynamic push and pull factors of international migration at the country-level such as (origin and destination) GDP, wages, conflicts, climate shocks and migration policy. Finally, individual characteristics include a vector of controls typically affecting the migration decision including age, gender, marital status, family size (number of children), wealth indicators (two principal component indexes), a dummy for having a family member/friend abroad (migration network), a dummy for urban (city) area, and satisfaction for amenities. As for the wealth index, we use a principal component analysis based on ten survey questions including household income by quintiles, individual perception/satisfaction with income and standards of living, expectations about future standard of living, and assets ownership.[34] We retain the first two components, which jointly explain 59% of the underlying variation. While the first component, which we call 'wealth', mostly captures actual income and wealth, the second component, which we refer to as 'standard of living', is about the current, and more importantly expected standard of living.

Table 5 reports estimates with a linear probability model of the impact of distance on bilateral migration intentions. As not to impose a specific functional form for the distance effect, we use a logarithmic, linear and non-linear (quartile dummies) specification of the distance variable (reported in column (1), (2) and (3) respectively). Throughout, standard errors are two-way clustered at the level of country of origin and country-pair.

Results show a significant negative effect of the change in distance along illegal migration routes between country pairs on the individual intention to migrate bilaterally. The log-linear specification shows that a 10 percent decrease in migration distance increases the probability to be willing to

[34] By exploiting the unique richness of WGP, in order to measure wealth we include the following survey questions in the pricipal component analysis: Income quintile (household income within country quintiles); Perception of present income (Which one of these phrases comes closest to your own feelings about your household income these days?); Current standard of living (Are you satisfied or dissatisfied with your standard of living, all the things you can buy and do?); Changes in standard of living (Right now, do you feel your standard of living is getting better or getting worse?); Mobile phone at home (Does your home have a cellular phone?); Television at home (Does your home have a television); Internet access at home (Does your home have access to the Internet?); Money for food (Have there been times in the past 12 months when you did not have enough money to buy food that you or your family needed?); Money for shelter (Have there been times in the past 12 months when you did not have enough money to provide adequate shelter or housing for you and your family? Since many variables are binary, the analysis is done using polychoric principal component (see Kolenikov and Angeles, 2004). Yet, as a robustness check, we also run standard principal component analysis and results are not affected.

Table 5: The impact of distance on bilateral migration intentions

	(1)	(2)	(3)
Log smuggling distance	-0.0049*		
	[0.0027]		
Linear smuggling distance		-0.0004*	
		[0.0002]	
First quartile dummy			0.0031**
			[0.0015]
Second quartile dummy			0.0014
			[0.0010]
Third quartile dummy			0.0010
			[0.0008]
Female	-0.0001	-0.0001	-0.0001
	[0.0001]	[0.0001]	[0.0001]
Age	-0.0000**	-0.0000**	-0.0000**
	[0.0000]	[0.0000]	[0.0000]
Married	-0.0001***	-0.0001***	-0.0001***
	[0.0000]	[0.0000]	[0.0000]
Primary Education	0.0000	0.0000	0.0000
	[0.0001]	[0.0001]	[0.0001]
Household size	0.0000	0.0000	0.0000
	[0.0000]	[0.0000]	[0.0000]
Close networks abroad	0.0004***	0.0004***	0.0004***
	[0.0001]	[0.0001]	[0.0001]
Wealth	0.0002*	0.0002*	0.0002*
	[0.0001]	[0.0001]	[0.0001]
Standard of living	-0.0005***	-0.0005***	-0.0005***
	[0.0002]	[0.0002]	[0.0002]
Large city	0.0002	0.0002	0.0002
	[0.0002]	[0.0002]	[0.0002]
Satisfaction with the city/area	-0.0002***	-0.0002***	-0.0002***
	[0.0001]	[0.0001]	[0.0001]
Observations	1,217,159	1,217,159	1,217,159
OriginX2012 FE	Yes	Yes	Yes
DestinationX2012 FE	Yes	Yes	Yes
Pair FE	Yes	Yes	Yes

Notes: The dependent variable is a binary indicator for positive bilateral migration intention. Results are estimated with a linear probability model. All regressions include a set of individual-level controls plus country-pair and country-year fixed effects. Standard errors clustered at the level of origin country and country-pair are reported in brackets. *** p<0.01, ** p<0.05, * p<0.1

migrate to a specific destination by almost 0.05 percentage points (p.p.), which represents more than a doubling of the sample mean bilateral migration intentions rate (0.03 percent). According to the linear specification, a decrease in distance of 1000 Km (2500 Km, one standard deviation) increases the likelihood to migrate by about 12% (30%) at the sample mean. Finally, in the last column of the table we report results with a non-linear quartile-dummy specification of the distance variable, where the fourth quantile is the reference category. Results show that a drop in distance which makes an individual ending up being in the first quartile of the distance distribution significantly increases migration intentions by about 10% at the sample mean. Changes that entails longer distance (higher quartiles) are still positively associated to migration intentions but

less precisely estimated. These findings are robust to the inclusion of individual-level controls as well as aggregate – country-by-time and bilateral – fixed effects. Results on the individual level determinants of international migration intentions show the expected sign. In particular, young and married individuals are less likely to be willing to migrate, whereas being low-skilled (i.e. having no more than primary education) does not play a significant role in the migration intention. On the other hand, *ceteris paribus*, being better off in terms of wealth (and worse off in terms of expected living standards), living in a big city and having a network abroad (i.e. a friend or relative already migrated abroad) significantly increase migration intentions.

By using our estimate of the negative effect of distance, we can shed light on the relative importance of smuggling costs on prospective migration. Indeed, assuming no general equilibrium effects, the number of extra migrants moving from Africa to Europe due to a change in distance, $\widehat{IM}$, can be measured as

$$\widehat{IM} = \widehat{\beta}_2 \sum_o \left(pop_o \sum_d (\Delta dist_{od} \omega_{od}) \right) \tag{3}$$

where $\widehat{\beta}_2$ is the estimated coefficient in the linear specification, pop_o is the population of the country of origin o in year 2010 and $\Delta dist_{od}$ is the change in the irregular distance from country o to country d occurring between year 2010 and 2012. The latter is weighted by ω_{od}, which pertain to the actual bilateral stock of migrants as of 2010 (Brücker et al., 2013). Estimates of the number of emigrants from each source country range between 30 (Mali) and 30.000 (Kenya), with a total estimate of almost 180.000 migrants moving from African country to Europe as a result of the distance effect.[35]

8.1 The distance effect on migration intentions across countries

In order to futher explore the elasticity of migration intentions across different contexts or environments, we test the distance effect while grouping either origin or destination countries in different ways. First, we do so along an absolute geographical dimension, namely East vs West Africa and North vs Sub-Saharan Africa (SSA). Indeed, the opportunity cost (in terms of using alternative routes) of crossing Mediterranean through CMR may be different according to the individual's country of residence. Moreover, we exploit cross-country variation in air (time-invariant) distance from Libya to test whether people living in 'more intensively treated countries' (i.e. those closer to Libya) react more to the distance shock than individuals living further away. Indeed, if the CMR was closed, people living relatively close to Libya should travel much longer to reach the EU than their peers from other countries. Finally, in order to explore whether country-level characteristics do also play a role, we focus on whether the illegal nature of migration is associated

[35] We also use the reported destination country from Gallup data as to weight migration distance, i.e. our $M_{iod2010}$ variable, and we obtain an estimate roughly equal to 200.000 emigrants from all over Africa.

with country-specific legal enforcement or rule of law. Hence, we allow for differential effects of smuggling distance between (origin and destination) countries with low vs high levels of rule of law (data source is the World Bank).[36]

Results reported in Table 6 show that people living in East vs West Africa are not differentially affected by the distance shock (column 1). People living in Southern Africa, instead, are less sensitive to the shock than people living in the Northern area (column 2).[37] In order to explore this further, in column 3 we interact our smuggling distance measure with a dummy variable for countries being above the median distance from Libya –posing that those residing in countries closer to Libya are more 'intensively treated' by the change in the smuggling distance. Results on the interaction term show that the elasticity to the smuggling shock is decreasing (in absolute terms) with distance from Libya, delivering an effect which is not statistically different from zero for those origin countries far away from Libya. The latter results are consistent with the non-linear effects presented in Table 5 above.

Finally, in column 4 we allow countries of origin below the median of the distribution of the rule of law index to experience a differential effect of distance. In this case, the total effect of distance is negative and significantly different from zero only for individuals from country of origin with relatively low rule of law, suggesting that the smuggling industry may be more widespread in countries with poor governance and institutions.

9 Heterogenous effects across the population

In this section we examine the change in the composition of migrants due to the extension of the smuggling network by estimating differentials in the elasticity of demand for illegal migration across heterogeneous individuals. Hence, we investigate interacted effects in different sub-groups of the population, while controlling for unobserved heterogeneity through country-pair and country-by-time fixed effects. Results are presented in Table 7 where in the first column we report average estimates of the main regressors (we express some of the individual continuous controls above as binary variables); in the remaining columns we report estimates of the main regressors and interacted effects. Results are consistent in showing that a higher distance in migration routes decreases bilateral individual intention to migrate. Yet, the effect is heterogeneous across sub-groups of the population. In particular, the negative effect of distance is not statistically different between men and women but it is bigger in absolute value for youth (i.e. individuals less than 35

[36]The rule of law index comes from the 2010 WB Worldwide Governance Indicators and captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence.

[37]In our Sub-Saharan dummy, Southern Africa includes Benin, Burkina Faso, Botswana, Central African Republic, Cameroon, Congo (DR), Congo, Comoros, Djibouti, Gambia, Ghana, Guinea, Kenya, Liberia, Malawi, Nigeria, Rwanda, Senegal, Sierra Leone, Somalia, Chad, Tanzania, Uganda, South Africa, Zambia, Zimbabwe. Northern Africa includes Morocco, Algeria, Mali, Mauritania, Niger, Sudan, Chad, Iraq, Israel, Jordan, Lebanon, Syria, Yemen.

Table 6: Heterogeneous distance effect across countries

	(1)	(2)	(3)	(4)
Log Smuggling distance	-0.0057***	-0.0061**	-0.0059**	-0.0035
	[0.0016]	[0.0024]	[0.0029]	[0.0025]
Log Smuggling distance * East	0.0010			
	[0.0008]			
Log Smuggling distance * SSA		0.0019***		
		[0.0007]		
Log Smuggling distance * Far from Libya			0.0019**	
			[0.0007]	
Log Smuggling distance * Low ROL origin				-0.0022**
				[0.0008]
Direct effect + Interacted term	-.0047*	-0.0042	-0.0040	-0.0056**
	[0.0024]	[0.0027]	[0.0024]	[0.0027]
Observations	1,217,159	1,217,159	1,217,159	1,217,159
Individual level controls	Yes	Yes	Yes	Yes
OriginX2012 FE	Yes	Yes	Yes	Yes
DestinationX2012 FE	Yes	Yes	Yes	Yes
Pair FE	Yes	Yes	Yes	Yes

Notes: The dependent variable is a binary indicator for positertive bilater migration intention. Results are estimated with a linear probability model. All regressions include a set of individual-level controls plus country-pair and country-year fixed effects. Standard errors clustered at the level of origin country and country-pair are reported in brackets. *** p<0.01, ** p<0.05, * p<0.1

years of age (col 3)) and more educated people (i.e. those with more than primary education, col 4). Moreover, while wealth-poor (i.e. those below the second quintile of the wealth distribution) and non-poor individuals are not differentially affected by the distance shock (col 5), those who expect to be poor in terms of living standard do respond more to the smuggling services supply shock (col 6). Finally, those with close social networks abroad (friends or relatives) are also more sensitive to the decrease in distance along CMR (last column). This is consistent with the argument that the opening of the CMR may not decrease migration monetary costs (as human smuggling is an expensive business) while it may require some skill and social networks (human capital).

In Table 8 we explore even further the compositional effect along the skill dimension by interacting the change in distance with two indicators of secondary and tertiary education respectively (with primary education as reference category)[38]. Results show that shorter distance along smuggling routes increases the willingness to migrate especially for individuals with secondary education or university drop-out rather than those with higher education and above. Indeed, the smuggling market is not without costs so that some skills are needed in order to be aware of migration opportunities and be able to afford them in time-equivalent terms. Similarly, evidence shows that more skilled people are more 'migratory' than low-skilled inviduals, so that lower migration costs – even illegal ones, when legal migration is banned – increase the likelyhood to move for relatively more mobile workers.

[38]GWP defines three categories for educational achievment, namely primary education or less, secondary education completed and some years of university (university drop-out), university education completed and above as tertiary educaiton. Hence, the secondary education category includes relatively skilled individuals)

Table 7: Heterogenous distance effects across individuals

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Smuggling distance	-0.0049*	-0.0053*	-0.0045*	-0.0052*	-0.0051*	-0.0047*	-0.0047*
	[0.0027]	[0.0029]	[0.0025]	[0.0027]	[0.0027]	[0.0026]	[0.0026]
Female	-0.0001	-0.0078	-0.0001	-0.0001	-0.0001	-0.0001	-0.0001
	[0.0001]	[0.0052]	[0.0001]	[0.0001]	[0.0001]	[0.0001]	[0.0001]
Youth (<35)	0.0002***	0.0002***	0.0065*	0.0002***	0.0002***	0.0002***	0.0002***
	[0.0001]	[0.0001]	[0.0034]	[0.0001]	[0.0001]	[0.0001]	[0.0001]
Married	-0.0001**	-0.0001**	-0.0001**	-0.0001**	-0.0001**	-0.0001**	-0.0001**
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
Primary Education	-0.0000	-0.0000	-0.0000	-0.0046*	-0.0000	-0.0000	-0.0000
	[0.0001]	[0.0001]	[0.0001]	[0.0025]	[0.0001]	[0.0001]	[0.0001]
Household size	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]
Close networks abroad	0.0004***	0.0004***	0.0004***	0.0004***	0.0004***	0.0004***	0.0145**
	[0.0001]	[0.0001]	[0.0001]	[0.0001]	[0.0001]	[0.0001]	[0.0062]
wpoor1	-0.0001	-0.0001	-0.0001	-0.0001	-0.0028	-0.0001	-0.0001
	[0.0001]	[0.0001]	[0.0001]	[0.0001]	[0.0031]	[0.0001]	[0.0001]
wpoor	0.0001***	0.0001***	0.0002***	0.0002***	0.0002***	0.0048*	0.0002***
	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0026]	[0.0000]
Large city	0.0003*	0.0003*	0.0003*	0.0003*	0.0003*	0.0003*	0.0003*
	[0.0001]	[0.0001]	[0.0001]	[0.0001]	[0.0001]	[0.0001]	[0.0001]
Satisfaction with the city/area	-0.0003***	-0.0003***	-0.0003***	-0.0003***	-0.0003***	-0.0003***	-0.0003***
	[0.0001]	[0.0001]	[0.0001]	[0.0001]	[0.0001]	[0.0001]	[0.0001]
Distance*female		0.0009					
		[0.0006]					
Distance*Youth (<35)			-0.0007*				
			[0.0004]				
Distance*Primary education				0.0005*			
				[0.0003]			
Distance*Wealth poor					0.0003		
					[0.0003]		
Distance*Exp.Liv.Poor						-0.0005*	
						[0.0003]	
Distance*Network							-0.0016**
							[0.0007]
Observations	1,217,159	1,217,159	1,217,159	1,217,159	1,217,159	1,217,159	1,217,159
OriginX2012 FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
DestinationX2012	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pair FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The dependent variable is a binary indicator for positive bilater migration intention. Results are estimated with a linear probability model. All regressions include a set of country-pair and country-year fixed effects. Standard errors clustered at the level of origin country and country-pair are reported in brackets. *** p<0.01, ** p<0.05, * p<0.1

10 Conclusion

In a world in which income disparities between north and south diverge, and the legal opportunities for migration become increasingly scarce, a global multi-billion USD human smuggling industry has arisen. Understanding (and where possible) predicting migration flows and their composition has become impossible without taking the role of the smuggling industry into account and trying to estimate the impact of the supply of human smuggling.

We merge geocoded data about Africa-to-Europe smuggling routes and individual survey data

Table 8: Heterogenous effects by individual skill-level

VARIABLES	
Smuggling distance	-0.0047*
	[0.0026]
Secondary education	0.0050*
	[0.0026]
Tertiary education and above	0.0003
	[0.0022]
Distance*secondary education	-0.0006*
	[0.0003]
Distance*tertiary education	-0.0000
	[0.0002]
Observations	1,217,159
OriginX2012 FE	Yes
DestinationX2012 FE	Yes
Pair FE	Yes

Notes: The dependent variable is a binary indicator for positive bilater migration intention. Results are estimated with a linear probability model. All regressions include a set of individual controls as in Table 5 plus country-pair and country-year fixed effects. Standard errors clustered at the level of origin country and country-pair are reported in brackets. *** p<0.01, ** p<0.05, * p<0.1

on bilateral intentions to migrate into a gravity framework. Exploiting an exogenous shock that extended smuggling networks and hence shortened the distances between many country pairs, we provide estimates for the sensitivity of migration intentions to the supply of smuggling service. We find a large and negative effect of migration distance along smuggling routes on individual intentions to migrate from Africa/Middle East into Europe. We also detect interesting heterogeneous responses. While there are no significant differences between females and males, the migration intention of young people and people with moderate education levels responds more intensively to the extention of the smuggling industry, and so do people with social ties to people who have already migrated.

To our knowledge, we are the first to exploit spatial variation in irregular migration routes into Europe as to examine the role of the smuggling business in the recent emigration pressure from Africa. We use the unique natural experiment of the opening of the central mediterranean route in the course of the Arab spring and the demise of the Gaddafi regime as a source of identification, but the approach can be used for other important events as well, for instance the EU-Turkey agreements that led to the closure of the Balkan route.

By quantifying the effect of the smuggling distance on migration intentions, we provide evidence that illegal costs play a role in the relocation decision problem. If we neglect the importance of illegal migration and human smuggling, policies designed to manage and control migration may be less effective than they could otherwise be. They may even have negative unintended consequences, in terms of violence, crime, slavery and victims.

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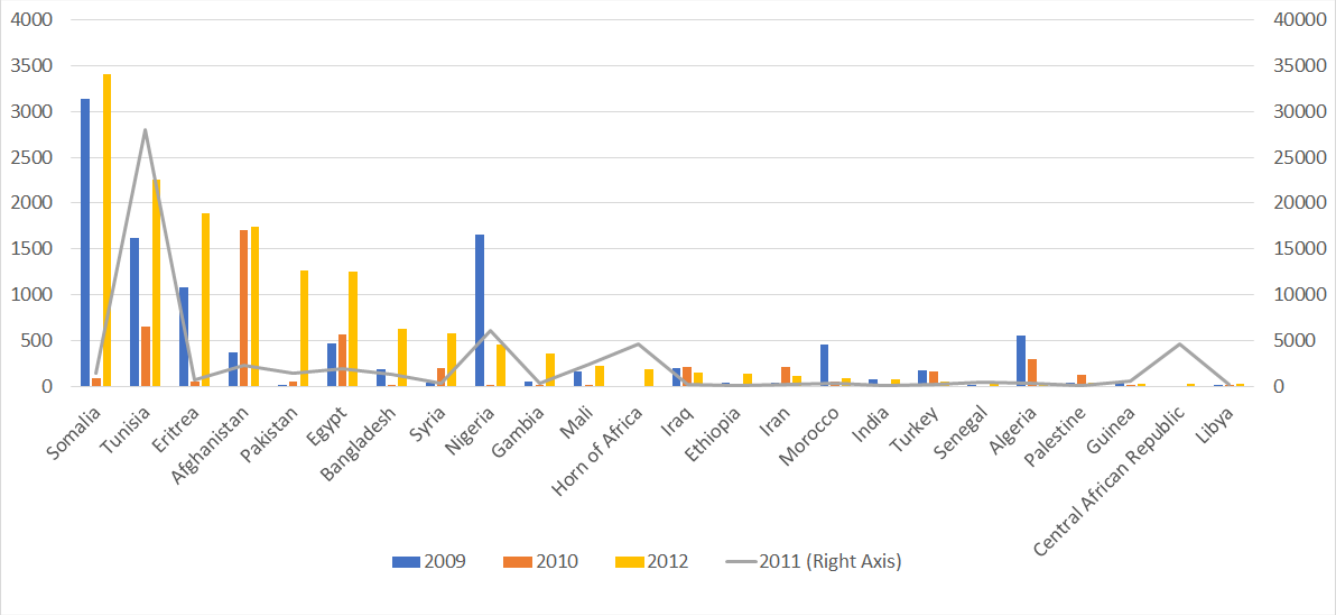
A Appendix

Figure A1: Detected illegal migrants across the Central Mediterranean Route by country of origin



Notes: The figure shows the number of detected illegal migrants (i.e. detected border crossing) arriving in European territory across the Central Mediterranean Route from selected origin countries in years 2009 to 2012. Arrivals for year 2011 are reported on a different scale (right). Source: Frontex)

Figure A2: Land and sea irregular migration routes from Africa

Source: iMap (http://www.imap-migration.org/)