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# **Trois Essais sur la Migration Internationale**

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# Contents

<b>Acknowledgements</b>	<b>iii</b>
<b>Contents</b>	<b>v</b>
<b>List of Figures</b>	<b>vii</b>
<b>List of Tables</b>	<b>ix</b>
<b>Résumé long de la thèse</b>	<b>1</b>
<b>Introduction</b>	<b>7</b>
<b>1 Occupation-Skill Mismatch and Selection of Immigrants: Evidence from the Portuguese Labor Market</b>	<b>11</b>
1.1 Introduction . . . . .	12
1.2 Related Literature . . . . .	14
1.3 Methodology . . . . .	17
1.3.1 Theoretical Framework . . . . .	17
1.3.2 Data and Descriptive Statistics . . . . .	19
1.3.3 Occupation-Skill Mismatch and its Determinants . . . . .	21
1.3.4 The Effects of Mismatch on Selection of Immigrants . . . . .	23
1.4 Results . . . . .	24
1.4.1 Occupation-Skill Mismatch and its Determinants . . . . .	24
1.4.2 Mismatch and Selection of Immigrants . . . . .	27
1.5 Conclusion . . . . .	29
1.A Appendix . . . . .	31
1.A.1 Definition of Variables . . . . .	31
1.A.2 Incidence of Mismatch by skill group in 2002-2009 (native workers) . . . . .	32
1.A.3 Number of Workers . . . . .	32
<b>2 Understanding Willingness to Migrate Illegally: Evidence from a Lab-in-the-Field Experiment</b>	<b>33</b>
2.1 Introduction . . . . .	34
2.2 Country Context . . . . .	39
2.3 Methodology . . . . .	41
2.3.1 Survey and Sampling Framework . . . . .	41

2.3.2	Lab-in-the-field Experiment . . . . .	42
2.3.3	Descriptive Statistics . . . . .	44
2.4	Econometric approach and main empirical results . . . . .	48
2.4.1	Estimation strategy . . . . .	48
2.4.2	Empirical Results . . . . .	49
	Main Results: Willingness to Migrate Illegally . . . . .	49
	Heterogeneous effects: expectations . . . . .	54
	Are experimental subjects behaving rationally? . . . . .	55
2.4.3	Willingness to pay to migrate and willingness to receive to forgo migration . . . . .	58
2.4.4	Do lab migration decisions reflect actual migration decisions? .	58
2.5	Conclusion . . . . .	60
2.A	Appendix . . . . .	62
2.A.1	Flows of Illegal Migrants into Europe . . . . .	62
2.A.2	Lab-in-the-Field Experiment Framing . . . . .	62
2.A.3	Show Cards . . . . .	65
<b>3</b>	<b>Polygamy, Sibling Rivalry and Migration</b>	<b>67</b>
3.1	Introduction . . . . .	68
3.2	Related Literature . . . . .	70
3.3	Country Context: Mali . . . . .	73
3.4	Data and Descriptive Statistics . . . . .	74
3.5	Empirical Framework . . . . .	79
	3.5.1 Empirical Methodology . . . . .	79
	3.5.2 Identification Strategy . . . . .	80
3.6	Empirical Results . . . . .	81
	3.6.1 Polygyny and Migration . . . . .	81
	3.6.2 Mechanisms . . . . .	85
3.7	Conclusion . . . . .	89
3.A	Appendix . . . . .	91
	3.A.1 Figures . . . . .	91
	<b>Conclusion</b>	<b>93</b>
	<b>Bibliography</b>	<b>95</b>



# List of Figures

1.1	Estimated probability (in percentages) that a worker is overeducated in 2002 . . . . .	26
2.1	Total Flow of Migrants Crossing the Central Mediterranean Route (2009-2017) . . . . .	62
2.2	Total Flow of Migrants Crossing the Central Mediterranean Route by Top 10 countries of origin (2009-2017) . . . . .	62
2.3	Total Flow of Migrants as a Percentage of Origin Population Crossing the Central Mediterranean Route in 2017 by Top 10 countries of origin	63
2.4	Total Flow of Gambian Migrants Crossing the Central Mediterranean and Western Mediterranean Routes (2009-2017) . . . . .	63
2.5	Total Flow of Gambian Migrants by Routes (2009-2017) . . . . .	64
2.6	Show Cards . . . . .	65
3.1	Estimated Probability of Being in a Polygynous Union by Maternal Language in 1987 . . . . .	91
3.2	Share of Married Men in a Polygynous Union in 1987 . . . . .	92



# List of Tables

1.1	Sample Means of Selected Variables . . . . .	21
1.2	Incidence of Mismatch by skill group in 2002-2009 . . . . .	22
1.3	Multinomial Logit Model Estimates of Occupation-skill Mismatch . . . . .	25
1.4	Impact of Overeducation on Selection . . . . .	28
1.5	Impact of Correct Match on Selection . . . . .	29
1.7	Incidence of Mismatch by skill group in 2002-2009 . . . . .	32
1.8	Number of workers . . . . .	32
2.1	Summary Statistics: Sampled Participants in the Experiment . . . . .	45
2.2	Summary Statistics: Statistical Differences . . . . .	49
2.3	Willingness to Migrate Illegally - Results from the Experiment . . . . .	50
2.4	Willingness to Migrate Illegally - Results from the Experiment . . . . .	52
2.5	Predictors of Experimental Subjects' Responsiveness to Information Provided in the Lab Experiment . . . . .	53
2.6	Heterogeneous Effects Based on Expected Permit . . . . .	55
2.7	Heterogeneous Effects Based on Expected Dead . . . . .	56
2.8	Willingness to Migrate Illegally and Expected Net Gain of Migration . . . . .	57
2.9	Regression Results from Experiment - Willingness to Pay and Receive . . . . .	59
2.10	Descriptive Statistics from Follow-up Survey . . . . .	60
2.11	Lab Willingness to Migrate Illegally and Follow-up Actual Migration Decisions and Intentions . . . . .	60
3.1	Summary Statistics . . . . .	76
3.2	Summary Statistics: Statistical Differences between Migrants and Non- migrants . . . . .	78
3.3	Mother Polygynous and Migration . . . . .	82
3.4	Mother Polygynous and Internal Migration . . . . .	83
3.5	Mother Polygynous and International Migration . . . . .	84
3.6	Mother Polygynous and Migration - Bivariate Probit . . . . .	85
3.7	Probability of being a Migrant, Depending on Number of Siblings with Migration Experience . . . . .	86
3.8	Mother Polygynous and International Migration - OLS . . . . .	88
3.9	Mother Polygynous and International Migration - IV . . . . .	89



*To my parents and migrant brothers*



# Résumé long de la thèse

Les dix dernières années ont été marquées par une intensification des flux migratoires tant à l'intérieur des pays qu'entre les pays. Le nombre de migrants internationaux a atteint 244 millions (3,3% des population mondiale) en 2015 contre 222 millions en 2010, 191 millions en 2005 et 173 millions en 2000 (Nations unies, 2015). Les données les plus récentes sur les migrations internes estiment quant à elles à 780 millions le nombre de personnes résidant dans une autre région que celle dans laquelle elles sont nées (PNUD, 2009), un chiffre qui sous-estime très largement la réalité puisqu'il néglige toutes les mobilités circulaires, les migrations de transit et les migrations de retour. Si la plupart des migrants internationaux empruntent des canaux légaux pour migrer, certains candidats au départ font le choix de migrer de manière illégale et courent ainsi un risque élevé de mort et d'exploitation. L'augmentation de la mobilité humaine a suscité un intérêt accru de la part de la communauté internationale et dans le monde académique. Cela s'est traduit par une littérature abondante sur les migrations, et notamment sur leurs conséquences économiques et non économiques pour les migrants eux-mêmes, pour leurs familles restées au pays, pour les pays d'origine et pour les pays d'accueil. Lorsque l'on adopte le point de vue du pays d'origine, nombre de travaux insistent sur les changements induits par la migration sur les conditions de vie des familles à travers les envois de fonds que réalisent les migrants depuis leur lieu de résidence ou à travers les nouvelles idées et normes qu'ils véhiculent au moment de leur retour. Leurs auteurs ont ainsi mis en évidence l'impact positif de la migration et des transferts sur des variables aussi diverses que l'investissement en capital physique ou humain, la démocratie ou le fonctionnement des institutions, les normes sociales en faveur d'une plus grande autonomie ou responsabilisation des femmes, etc. L'immigration a également un impact sur les pays de destination. L'arrivée de migrants peut en effet agir sur les

salaires des autochtones, l'innovation, l'investissement direct étranger, la composition de la main-d'œuvre productive, les comptes sociaux, etc.

Pour comprendre les retombées de la migration et agir de façon à en tirer le meilleur parti, il importe au préalable d'identifier les facteurs qui agissent sur la décision de migrer des individus et sur la composition des flux migratoires. L'objectif de cette thèse est d'apporter des éléments de réponse à cette question, dans le contexte de mobilité internationale. Le premier chapitre, intitulé « Inadéquation entre profils et emplois occupés et sélection dans la migration : une analyse à partir de données sur le marché du travail portugais », examine comment la façon dont les immigrants s'insèrent sur le marché du travail agit sur les pratiques d'auto-sélection dans la migration. Le point de départ de l'analyse est le constat que les immigrants occupent souvent des postes aux exigences inférieures à leur niveau d'éducation. Plusieurs facteurs peuvent en être à l'origine : les immigrants peuvent se heurter à des obstacles comme le manque d'expérience professionnelle et de contacts sur le marché du travail, ils peuvent aussi rencontrer des difficultés pour faire reconnaître leur expérience et les titres qu'ils ont acquis à l'étranger, ils peuvent ne pas posséder les connaissances linguistiques nécessaires, etc. La conséquence est donc qu'ils occupent des emplois pour lesquels ils sont surqualifiés. Dans ce chapitre, nous supposons que les travailleurs se répartissent dans deux groupes de compétences : le groupe des hautement qualifiés (dans lequel on va trouver tous les individus ayant fait des études supérieures) et le groupe des peu qualifiés. En mobilisant les données issues d'une enquête employeurs-salariés avec suivi longitudinal conduite au Portugal sur la période 2002-2009, nous estimons d'abord, pour chaque année, la probabilité qu'un travailleur immigré originaire d'un pays donné soit sur-qualifié, sous-qualifié ou qu'il ait le niveau de qualification exactement adapté aux besoins en compétences de la profession qu'il occupe, selon son appartenance à la catégorie des hautement qualifiés ou des peu qualifiés. Nous avons pour cela recours un modèle logit multinomial. Dans une seconde étape, nous utilisons ces probabilités estimées pour analyser dans quelle mesure l'inadéquation entre profils et emplois occupés influence les pratiques d'auto-sélection dans la migration des personnes originaires d'une quarantaine de pays. Pour ce faire, nous estimons un modèle dans lequel



la variable expliquée est le rapport entre le nombre d'immigrés hautement qualifiés originaires d'un pays donné sur le nombre d'immigrés peu qualifiés originaires de ce même pays observés à l'année  $n$ , et dans lequel l'une des variables explicatives est la différence entre la probabilité estimée d'être surqualifié chez les hautement et les peu qualifiés. Les résultats de nos estimations suggèrent qu'une probabilité forte d'être sur-qualifié entraîne une sélection négative des immigrants sur le marché du travail portugais. Autrement dit, plus la différence entre la probabilité d'être sur-qualifié chez les hautement qualifiés et chez les peu qualifiés est importante, plus la part des hautement qualifiés parmi les migrants est faible. A l'inverse, une bonne adéquation entre profils et emplois occupés entraîne une sélection positive dans la migration. Ces résultats impliquent qu'à côté des politiques sélectives mises en place par les pays d'accueil pour attirer des immigrants hautement qualifiés, des mesures devraient parallèlement être prises pour limiter le phénomène de surqualification des immigrants, à travers notamment une meilleure reconnaissance des diplômes étrangers, en collaboration avec les pays d'origine. Le chapitre 2, intitulé « Information et aspiration à migrer illégalement. Quelques enseignements tirés d'une expérimentation sur le terrain » et co-écrit avec Catia Batista, s'attache lui aussi à analyser les facteurs qui agissent sur la décision de migrer en se focalisant sur un groupe particulier d'individus : les jeunes hommes gambiens âgés de 18 à 25 ans. L'attention est ici portée sur les facteurs qui conduisent ces individus à faire le choix de migrer illégalement en Europe depuis la Gambie. Le choix de ce groupe est justifié par le fait que l'émigration illégale vers l'Europe, bien qu'excessivement risquée, y constitue l'une des options les plus prisées, à l'instar de ce qui peut être observé dans d'autres pays subsahariens mais à une moindre échelle. Pour comprendre le processus de décision, nous avons mis en œuvre une expérimentation sur le terrain (lab-in-the-field experiment) dans plusieurs régions rurales de Gambie qui enregistrent des taux d'émigration vers l'Europe extrêmement élevés. Concrètement, 406 jeunes hommes âgés de 18 à 25 ans ont été invités à participer à un jeu avec incitations monétaires. Ce dernier a été conçu pour comprendre comment les joueurs révisent leur choix de migrer ou non vers l'Europe en fonction de l'information qui leur est donnée sur la probabilité de périr en route d'une part, et sur la probabilité d'obtenir un statut de résident légal en Italie d'autre part. A chaque tour du

jeu (dont l'ordre était aléatoire), il était attendu des joueurs qu'ils choisissent entre deux options : migrer illégalement vers l'Europe ou ne pas migrer étant donné des probabilités de périr en route et d'obtenir un statut de résident légal en Italie à chaque fois différentes (les probabilités de périr en route et d'obtenir un permis de résidence légale ou le statut de réfugié en Italie pouvant prendre 4 valeurs : 0%, 10%, 20%, and 50% pour la première et 0%, 33%, 50% et 100% pour la seconde). Il était également demandé aux joueurs d'indiquer pour quel montant d'argent ils seraient prêts à renoncer à migrer, le cas échéant. En parallèle de ce protocole expérimental, une enquête a été menée pour collecter des informations sur les joueurs, leur expérience migratoire ainsi que celle de leurs proches, etc. Cette recherche a débouché sur plusieurs résultats. Les entretiens menés auprès des jeunes gambiens ont tout d'abord montré que ces derniers avaient tendance à sur-estimer le risque de périr en route, ainsi qu'à sur-estimer la probabilité d'obtenir un statut de résident légal en Italie. Le protocole expérimental a quant à lui révélé que la décision de migrer illégalement vers l'Europe était influencée par les informations fournies sur les probabilités de périr en route et d'obtenir un permis de séjour légal. Plus précisément, lorsque la probabilité de périr en route augmente de 1%, la probabilité de migrer diminue de 0,12 point de pourcentage. Elle augmente en revanche de 0,13 point de pourcentage lorsque la probabilité d'obtenir un statut légal en Italie augmente de 1%. Fournir des informations précises sur ces deux dimensions est donc susceptible de modifier les choix de migration. Les données recueillies par une enquête de suivi réalisée un an après l'expérimentation sur le terrain auprès de 263 joueurs montrent finalement l'existence d'une corrélation positive significative entre les intentions de migrer déclarées à l'occasion du jeu et les départs effectifs en migration dans l'année qui a suivi, même si le coefficient de corrélation est faible.

Pour finir, le chapitre 3, intitulé « Polygamie, rivalité fraternelle et migration » et co-écrit avec Flore Gubert, s'intéresse à la relation entre la structure des ménages et la migration. Plus précisément, l'attention est portée sur un échantillon de jeunes adultes maliens et le type d'union dans lequel se trouve leur mère (monogame, et donc sans co-épouse.s, ou polygame, avec une ou plusieurs co-épouses) pour voir dans quelle mesure celui-ci influence leur probabilité de migrer. Pour conduire cette analyse, nous utilisons les données issues d'une enquête représentative auprès des

ménages conduites au Mali en 2016, que nous combinons avec des informations issues des différents recensements de population. Le choix du Mali est justifié par l'importance et l'ancienneté du phénomène migratoire en provenance de ce pays, ainsi que par la très forte prévalence de la polygamie dans la plupart des groupes ethniques qui compensent sa population. En restreignant l'échantillon à l'ensemble des hommes âgés de 15 à 40 ans dont la mère est encore en vie (et pour laquelle nous avons donc des informations sur le type d'union), nous estimons un modèle de migration dans lequel la probabilité de migrer est régressée sur un certain nombre de variables dont le type d'union (polygamie vs monogamie) de la mère biologique. Afin de surmonter les défis d'identification liés au caractère endogène de la variable relative au type d'union, nous instrumentons cette dernière par la prévalence de la polygamie à l'échelle du district mesurée en 1987. Nos résultats suggèrent que la probabilité de migrer est plus forte chez les hommes dont les mères sont dans une union polygame. Nous poussons plus loin l'analyse pour comprendre les mécanismes à l'œuvre. Les résultats de nos investigations nous conduisent à pencher pour l'hypothèse d'une rivalité fraternelle (sibling rivalry). Il semble donc que la rivalité entre coépouses, documentée dans plusieurs articles récemment publiés, ait des répercussions sur leurs enfants qui se retrouvent en rivalité en matière de migration.



# Introduction

The last decade has witnessed a growing flow of human mobility both internally and internationally. The number of international migrants reached 244 million (3.3% of global population) in 2015 compared to 222 million in 2010, 191 million in 2005, and 173 million in 2000 (United Nations, 2015), and stock of internal migrants are estimated at 780 million people (UNDP, 2009). While most of the international migrants move legally, some migrate illegally, facing high risk of death and exploitation. The increase in human mobility has led to greater interest in the topic.

Indeed, it is documented in the literature that migration has economic and non-economic implications for migrants themselves, their families left behind, their home countries, and their host countries. From the home country perspective, migrants and returnees are changing lives and livelihoods by sending remittances to help finance the needs of their households and communities, thereby increasing foreign direct investment and human capital investment, improving democracy, shaping political institutions, and changing social norms that empower women and foster economic development<sup>1</sup>. At the same time, immigrants have impacts on receiving countries. The inflow of migrants affects wages of natives, net fiscal benefits, innovation, foreign direct investment, and productive labor diversity<sup>2</sup>. Harnessing the

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<sup>1</sup>See Ratha et al. (2011) for a review on the impacts of remittances. Javorcik et al. (2011) find that migrants attract foreign direct investment in home countries. McKenzie and Rapoport (2006) and Batista et al. (2012b) show that migration affects educational outcomes. Docquier et al. (2011a), Batista and Vicente (2011a), Chauvet and Mercier, 2014, and Batista et al. (2016) show that migration improves political institutions and voting behaviors. Beine et al. (2013), Tuccio and Wahba (2015), and Bertoli and Marchetta (2015) document how migration affects fertility norms.

<sup>2</sup>In the United States, Borjas (2003) shows that immigration flows reduce wages, especially low skilled, while Ottaviano and Peri (2012) show that immigrants and natives are imperfect substitutes and find an overall positive average effect of immigration flows on wages of natives. Docquier et al. (2011b) document zero to positive overall impact in OECD countries. Dustmann and Frattini (2014) show that immigrants contribute to substantial net fiscal benefits and provide savings to the taxpayers by migrating with educational qualifications paid by their home countries. Hunt and Gauthier-Loiselle (2010) document that increases in college educated immigrants increases the host country's patent per capita. Buch et al. (2006) show that states with more immigrants attract more foreign direct investment in Germany. Alesina et al. (2016) document positive impacts of labor diversity on economic prosperity due to immigration.

benefits of migration requires our understanding of not only what affects the decision to migrate but also what determines who migrates. The objective of this thesis is to contribute to our understanding of these questions in the context of international migration.

The first Chapter examines the effect of occupational placement of immigrants relative to their educational qualifications on their self-selection. The movement of people from their home countries to host countries is associated with poor occupation-skill match; a labor market phenomenon in which workers take up jobs for which they are overqualified relative to the normal educational requirements. We assume that workers self-select themselves into two skill groups; high skilled (those with post-secondary education) and low skilled. Using an administrative matched employer-employee data set for Portugal for the years 2002-2009, we first estimate the probability that an average worker from a particular country is overeducated, matched, or undereducated relative to the skill needs of the occupation he takes upon immigration. Second, using these estimated probabilities, we analyze how overeducation and appropriate skill-occupation matches affect selection of immigrants from 40 origin countries. The results suggest that overeducation leads to negative self-selection of immigrants into the Portuguese labor market. Furthermore, the evidence suggests that appropriate occupation-skill matches affect migration selection positively. These results imply that receiving countries' selective policies aimed at attracting high skilled immigrants should also focus on reducing occupation-skill mismatch, probably through degree recognition and standardization in collaboration with sending countries.

Chapter 2, a joint work with Catia Batista, improves our understanding of the determinants of the willingness to migrate illegally from West Africa to Europe. Illegal migration to Europe by sea, though risky, remains one of the most popular migration options for many Sub-Saharan Africans. We implemented an incentivized lab-in-the-field experiment in rural Gambia, the country with the highest rate of illegal migration to Europe in the region. Sampled male youths aged 15 to 25 were given hypothetical scenarios regarding the probability of dying en route to Europe, and of obtaining asylum or legal residence status after successful arrival. According to our data, potential migrants overestimate both the risk of dying en route to Europe and

the probability of obtaining legal residency status. The experimental results suggest that the willingness to migrate illegally is affected by information on the chances of dying en route and of obtaining a legal residence permit. Our estimates show that providing potential migrants with official numbers on the probability of obtaining a legal residence permit and the risk of dying en route affect the likelihood of migrating. Follow up data collected one year after the experiment show that the migration decisions reported in the lab experiment correlate well with actual migration decisions and intentions. Overall the results in this Chapter indicate that the migration decisions of potential migrants are likely to actively respond to relevant information.

In Chapter 3, coauthored with Flore Gubert, we examine the relationship between polygamy family structure and international migration. We use data from a rich representative household survey and census from Mali; a country with a long history of international migration and high polygamy rate to estimate the impact of the polygynous status of mothers on their children's migration decisions. To overcome the identification challenges due to the endogeneity relationship between polygamy and migration, we instrument polygyny status of mothers with historical polygamy rates at the sub-district level. Moreover, we identify the causal effect of sibling rivalry by instrumenting having a migrant sibling with the share of male siblings. We find a positive and statistically significant effect of polygyny status of mothers on children's migration decisions. We provide additional evidence supporting the effect due to sibling rivalry; having a migrant sibling increases the likelihood of migrating. Our evidence suggests that co-wives' rivalry as documented elsewhere trickles down to children's rivalry in migration. Our results in this chapter suggest that in addition to economic reasons, international migration is also driven by social reasons.





## Chapter 1

# Occupation-Skill Mismatch and Selection of Immigrants: Evidence from the Portuguese Labor Market

### Abstract<sup>1</sup>

This paper aims at investigating how the occupational placement of immigrants relative to their qualifications affect their self-selection. Using an administrative matched employer-employee data set for Portugal for the years 2002-2009, we first estimate the probability that an average worker from a particular country is overeducated, matched, or undereducated relative to the skill needs of the occupation he takes upon immigration. Second, using these estimated probabilities, we analyze how overeducation and appropriate skill-occupation matches affect selection of immigrants from 40 origin countries. The results suggest that overeducation leads to negative self-selection of immigrants into the Portuguese labor market. Furthermore, the evidence suggests that appropriate occupation-skill matches affect migration selection positively. These results imply that receiving countries' selective policies aimed at attracting high skilled immigrants should also focus on reducing occupation-skill mismatch probably through degree recognition and standardization in collaboration with sending countries.

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**JEL Codes:** F22, J24.

## 1.1 Introduction

Over the last 15 years, the number of international migrants has grown rapidly. The number of international migrants reached 244 million in 2015 compared to 222 million in 2010, 191 million in 2005 and 173 million in 2000 (United Nations, 2015). This growing number of migrants undoubtedly affects both receiving and sending countries. To understand how international migration affects these countries, several questions arise. What are the characteristics of these migrants? What is the quality of human capital these migrants possessed? Is this capital worthy in the international labor market? These are among the important questions that occupy the debate on international migration. Though there is consensus to some answers to these questions, others continue to be controversial.

On the one hand, the characteristics of international migrants remain very debatable. These characteristics include both observable characteristics such as age group, gender structure, education levels, and non-observable ones such as ability, risk and discount preferences. There are numerous studies that try to analyze the skills or educational levels of those who migrate. Most of the debate has been centered around the characteristics or selection of immigrants<sup>2</sup> especially from Mexico to the United States. To date, there is no consensus on the selection of immigrants. While studies such as Chiquiar and Hanson (2005), Orrenius and Zavodny (2005), and McKenzie and Rapoport (2010) find a positive selection of immigrants from Mexico to the United States, Borjas (1987), Moraga (2011), and Ambrosini and Peri (2012) concludes to a negative selection of immigrants.

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<sup>2</sup>We focus on selection by education levels. Negative (Positive) selection implies more low (high) skilled migrants migrating to the country than high skilled migrants.

On the other hand, it is well documented that there is less than perfect international transferability of immigrants' human capital into foreign labor market especially for the highly skilled (Mattoo et al., 2008; Kiker et al., 1997; Chiswick and Miller, 2009). The skills that immigrants acquired before migration are not fully utilized on the international labor market<sup>3</sup>. In particular when immigrants are compared to natives, the evidence reveals that given the same occupation, immigrants are mostly overeducated (brain waste or occupation-skill mismatch). This unfortunate reality has negative impacts on the returns to investment in education (Duncan and Hoffman, 1981; Verdugo and Verdugo, 1989; Kiker and Santos, 1991; Albaráñez and Segundo, 1995; Carneiro et al., 2012).

A combination of these pieces of evidence raises two important questions. First, does imperfect international transferability of human capital affects the decision to migrate? According to Sjaastad (1962), migration is an investment that individuals choose to realize when the expected return of migration exceeds its expected cost. The expected return crucially depends on wages earned in the destination country which are in turn a function of skills possessed and their market value. This is what makes the above question relevant. Second, does imperfect international transferability of human capital affects the migration decision of the highly-skilled and low-skilled differently?

In this paper, we aim at answering to this second question. The answer to this research question has important policy implications in that it can affect "brain drain" flows, which have been shown to be very relevant for the economic performance of both origin and destination countries of migration<sup>4</sup>. We introduce a fairly neglected factor into the literature on migration selection. Most of earlier research explains migration selection with earnings inequality at origin, costs of migration, differences of skill earnings premium between origin and destination (Borjas, 1987; Chiquiar and

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<sup>3</sup>Skill mismatch can be due to imperfect information in the labor market (Groot and Van Den Brink, 2000), trade-off between different types of human capital such as education and experience (Sicherman, 1991), and employers unwilling or able to screen foreign qualifications (Chiswick and Miller, 2009). See Aleksynska and Tritah (2013) for a review of evidence.

<sup>4</sup>This discussion is well informed by the traditional references such as Bhagwati and Hamada (1974) or Grubel and Scott (1966) on the losses implied by the brain drain for the migrant home countries. This negative view has however been balanced by more recent literature emphasizing the potential benefits of skilled migration on the country of origin, namely in terms of educational gains such as shown by Beine et al. (2001) and Beine et al. (2008) or Batista et al. (2012a), institutional improvements such as Batista and Vicente (2011b) or Batista et al. (2016), entrepreneurial gains and business investment such as Yang (2008) or Batista et al. (2017).

Hanson, 2005; Grogger and Hanson, 2011), and recently with migration networks and diaspora (McKenzie and Rapoport, 2010; Beine et al., 2011). We argue that the selection of immigrants can also be explained by occupation-skill mismatch. The effects of occupation-skill mismatch on wages have been well documented in the literature<sup>5</sup> but little or nothing is known about whether and how occupation-skill mismatch affects who migrates.

The main aim of this paper therefore, is to determine whether imperfect transferability of human capital or occupation-skill mismatch affects the selection of immigrants. To achieve this objective, we first augment the model of migration proposed in Beine et al. (2011) by including occupation-skill mismatch as another determinant of migration. Second, using Portuguese matched employee-employer panel data for the years 2002-2009, we compute the probabilities that an average worker from a particular country is undereducated, correctly matched, or overeducated. These probabilities reveal that highly-skilled immigrants (that is, immigrants with post-secondary education) are more likely to be overeducated and hence less likely to be correctly matched than the low-skilled.

Finally, we analyze how mismatch affects the selection of immigrants which we believe is the novelty of this paper. Our empirical analysis reveals that high-skilled migrants are less likely to migrate than low-skilled ones when the difference between the probability of over-education for the high-skilled and the low-skilled increases. Furthermore, we show that when the probability of correct skill match increases, the high-skilled are more likely to migrate compared to the low-skilled.

The remainder of the paper is organized as follows. In the next section, we (provide a) survey (of) the related literature. Section 3 discusses the theoretical model, the data sources and the empirical estimation. In section 4, we discuss the main results of the paper. Section 5 concludes and gives some policy implications.

## **1.2 Related Literature**

Since Roy (1951)'s well-known model of selection, understanding selection of immigrants has been at the forefront of research. The first work that formalizes selection

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<sup>5</sup>See Hartog (2000) for a meta analysis of occupation-skill mismatch and wages.

in the context of migration is the influential work of Borjas (1987) who applies Roy's model to analyze the selection of immigrants from Mexico to the United States. According to the predictions of Borjas (1987)'s theoretical model, the selection of immigrants depends crucially on earnings inequality in the origin and destination countries. In particular, migrants leaving from a country with high earnings inequality to a country with low earnings inequality will be negatively selected, that is migrants will be drawn from the lower half of the skill distribution. Borjas (1987)'s model, though influential, has been criticized because of its assumption that migration costs are constant across individuals.

Chiquiar and Hanson (2005) argue that selection of immigrants can be positive or negative depending on the cost of migration and its heterogeneity across skill groups. The cost of migration for the highly-skilled is likely to be lower than for the low-skilled due to destination migration policies such as visa policies aimed at attracting the high skilled. Their work compares Mexicans who migrated to the United States and those who stayed using census data of both Mexico and the United States. In a similar spirit, McKenzie and Rapoport (2010) show that migration networks play a crucial role in determining the selection of immigrants. In particular, they show that migrants from communities with high migration rate are negatively selected while those from communities without established migration networks are positively selected using data from the Mexican Population Project (MPP). This result confirms the important role of migration costs insofar as networks are expected to reduce the cost of migration.

Recently, Moraga (2011) and Ambrosini and Peri (2012) conclude to negative selection as predicted by Borjas (1987). The debate on the selection of immigrants, especially from Mexico to the United States, remains controversial as different authors conclude differently depending on the dataset used.

Elsewhere, the selection of immigrants to Europe and other countries has been less studied compared to the USA. However, it has recently attracted some attention probably because of the increase in migration flows over the last couple of decades. Beine et al. (2011) study how diasporas (measured by number of migrants) affect the selection of immigrants into 30 OECD countries in 1990 and 2002. Their analysis reveals that diasporas lower migration costs and hence increase migration flows,

especially for the low-skilled. As a result, they reduce the quality of immigrants in terms of educational attainment. Similarly, Grogger and Hanson (2011) study the selection and sorting of immigrants in OECD countries. They conclude that immigrants are positively selected when the absolute skill-related difference in earnings between destination and source countries is large.

Quinn and Rubb (2005) first study how education-occupation matches influence the migration decisions of Mexicans to the United States. Backed by a simple theoretical model, they show that indeed the decision to migrate is influenced not only by the actual years of education but also the occupation-education matching. Their results suggest that Mexican workers who are over-educated are more likely to migrate while under-educated ones are less likely to migrate. They argue that the desire to migrate by over-educated workers is driven by the potential of better matches and subsequent increase in earnings.

This work is broadly related to the brain drain literature. On the one hand, the brain drain literature such as argues about the negative welfare effects of high skilled emigration on those left behind (Bhagwati and Hamada, 1974), while Haque and Kim (1995) showed that brain drain has negative effects on economic growth of sending countries. On the other hand, the beneficial brain drain literature argues that migration prospects under uncertainty have a positive impact on the human capital development of the country of origin. The work of Beine et al. (2001) and Beine et al. (2008) offered important theoretical and empirical contributions of the macroeconomic implications of brain drain. Beine et al. (2001) theorized that the prospects of international migration motivates investment in education. Beine et al. (2008) offers empirical evidence that indeed high skilled emigration has positive benefits on human capital development of some source countries while negative effect for others.

The beneficial brain drain literature has been criticized for being overly optimistic. According to Schiff (2006), the impact of brain drain on growth and welfare has been greatly exaggerated. His theoretical analysis asserts that allowing for the possibility of brain waste and factoring out the additional cost of investment in education instead of investing in public good provision will result in smaller or zero gain in economic growth and welfare. Along similar line of reasoning, Pires (2015)

criticizes the model for not considering the role of brain waste or occupation-skill mismatch. He theoretically argues that brain waste reduces the incentive to invest in education, lowers the chances of positive self-selection, and thus reduces the possibility of beneficial brain gain.

The literature on the selection of immigrants though vast has neglected a famous phenomenon of labor market; occupation-skill mismatch also known as brain waste. With the exception of Pires (2015), who model how the risk of brain waste affects brain drain; to the best of my knowledge, the impact of mismatch on the selection of immigrants has never been studied. This paper aims at filling this void in the literature by introducing occupation-skill mismatch as a factor that affects the selection of immigrants.

## 1.3 Methodology

### 1.3.1 Theoretical Framework

Following the framework developed by Beine et al. (2011) and Grogger and Hanson (2011), we consider workers' decision to migrate governs by a simple linear utility maximization problem. Specifically, assume that utility of an individual with skill level  $h$  born in country  $i$  and staying in country  $i$  is given by:

$$U_{ii}^h = w_i^h + A_i + \epsilon_i, \quad (1.1)$$

where  $w_i$  is the wage in country  $i$ ,  $A_i$  is country  $i$ 's characteristics and  $\epsilon_i$  is an iid extreme value distributed error term. While, even those who stay at the country of origin can experience skill-mistach, we assume that this is relatively negligible. Additionally, we assume that individuals' utilities are affected by country  $i$ 's characteristics the same way irrespective of the skill level. If an individual migrated to another country  $j$ , the utility is given by:

$$U_{ij}^h = w_{ij}^h(M_{ij}^h) + A_{ij} + M_{ij}^h - C_{ij}^h + \epsilon_j, \quad (1.2)$$

where  $M_{ij}^h$  is the quality of the skill-job match of an immigrant with skill level  $h$  from country  $i$  in country  $j$ . We assume that the skill gathered by the worker before migrating might not be fully valued in the destination country. As shown in the literature, we also assume that wages are affected by the quality of the match. Moreover, we assume that individual's utility is directly affected by the quality of the skill-job match. Last,  $C_{ij}^h$  denotes the cost of migrating from country  $i$  to country  $j$ .

Denote  $N_i$  the number of individuals of migration age in country  $i$  and  $N_{ij}$  the number of people who actually migrated to country  $j$ . Under the assumptions that errors follow iid extreme value distribution, as shown by McFadden (1984), the log odds of skilled level  $h$  group from country  $i$  migrating to country  $j$  can be written as,

$$\left[ \frac{N_{ij}^h}{N_{ii}^h} \right] = (w_{ij}^h(M_{ij}^h) - w_i^h) + (A_{ij} - A_i) + M_{ij}^h - C_{ij}^h \quad (1.3)$$

Equation 3 implies that this odds ratio depends on the difference between the destination wage (which is a function of the skill-job match) and the origin wage. It also depends directly on the skill-job match, the cost of migrating, and the difference between the destination and the origin country characteristics.

Consider individuals endowed with two types of skills, either high or low, and denote  $h = 0$  and  $h = 1$  for low-skilled and highly-skilled individuals respectively. Thus, we can write the log odds of migrating from country  $i$  to country  $j$  as:

$$\ln \left[ \frac{N_{ij}^0}{N_{ii}^0} \right] = (w_{ij}^0(M_{ij}^0) - w_i^0) + (A_{ij} - A_i) + M_{ij}^0 - C_{ij}^0 \quad (1.4)$$

$$\ln \left[ \frac{N_{ij}^1}{N_{ii}^1} \right] = (w_{ij}^1(M_{ij}^1) - w_i^1) + (A_{ij} - A_i) + M_{ij}^1 - C_{ij}^1 \quad (1.5)$$

Following Grogger and Hanson (2011), using equations 4 and 5, we can analyze the selection of migrants from country  $i$  to country  $j$ . Taking the difference between equations 4 and 5 and rearranging, we obtain:

$$\ln \left[ \frac{N_{ij}^1}{N_{ij}^0} \right] = \left[ w_{ij}^1(M_{ij}^1) - w_{ij}^0(M_{ij}^0) \right] + (M_{ij}^1 - M_{ij}^0) - (C_{ij}^1 - C_{ij}^0) + \ln \left( \frac{N_{ii}^1}{N_{ii}^0} \right) - (w_i^1 - w_i^0) \quad (1.6)$$

Equation 1.6 indicates that the selection of migrants is determined by five terms. The



first term is the difference between the earnings of the two groups. The second term is the difference between the quality of the occupation-skill match. The third term gives the difference between the cost of migrating for highly-skilled and low-skilled individuals. The final two terms of Equation 6 are the log ratio of the number of highly-skilled individuals to the number of low-skilled individuals in country  $i$  and the differences in earnings of highly-skilled and low-skilled individuals in country  $i$ . We expect that there will be positive selection, translating into a higher propensity to migrate among highly-skilled individuals, if the wage gap in the destination country is positive. There will also be positive selection if the skills of the highly-skilled individuals are more valued in the destination country relative to those of the low-skilled.

### 1.3.2 Data and Descriptive Statistics

The primary data are taken from the *Quadros de Pessoal (QP)*. The QP is a rich data set of firms and employees collected yearly by the Portuguese Ministry of Labor and Social Solidarity. All firms that have at least 10 employees are mandatory required by law to provide data about their employees and main characteristics. The data on the employees provide each worker's unique social security identifier, as well as information on nationality, gender, age, tenure, education, earnings, hours worked, etc. The firm characteristics include its location, economic activity, number of employees, etc. While this data set is rich with individual and firm level characteristics, it's usage requires supplementing it with origin country level characteristics which is mostly unavailable or challenging to acquire. Moreover, the sample only cover workers who are legal residents, thus omitting especially illegal or irregular migrants. Illegal migration is pronounced especially from Eastern European countries as documented by 2001 regularization process. The number of permits granted to illegal migrants during the process amounted to 126,901 with 56 percent coming from Eastern European countries (Baganha et al., 2004). Additionally, some illegal migrants especially from Nepal, India, Thailand, Bangladesh, Pakistan and Vietnam work in the agricultural sector in the Alentejo region<sup>6</sup>.

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<sup>6</sup>Algarvedailynews.com (2017) "Export boom in agriculture due to illegal immigrant labour" (Last accessed 15 March 2019 at <https://algarvedailynews.com/news/11296-export-boom-in-agriculture-due-to-illegal-immigrant-labour>)

The data cover years ranging from 1986 to date, with the exception of 1990 and 2001. We restrict our analyses to the 2002 to 2009 period, as the nationality of workers was not recorded in the survey before 2000. The data set provides no information on the date of arrival of migrant workers in Portugal. However, following Cabral and Duarte (2013), we use the year when workers first appeared in the database as a proxy for their date of arrival. Thus, forming a panel data set of natives and foreign born workers, where foreign born workers are defined as workers who declare their nationality to be any other country apart from Portugal

The education years of workers are coded as: 0 years (less than 1st cycle) , 4 years (1st cycle) , 6 years (2nd cycle), 9 years (3rd cycle), 12 years (secondary), 13 years (post secondary but less than *Bacharelato*), 14 years (*Bacharelato*), 15 years (*Licenciatura*), 17 years (master), and 20 years (doctorate). In line with Beine et al. (2011) and Grogger and Hanson (2011), we define the high skilled as workers with those with post secondary level of education. Experience is defined as age less tenure less years of education and 6 years . Last, the occupational category that we use is the 3 *Classificação Nacional de Profissões* (CNP 94) which have a total of 276 occupations.

The final sample used for the econometric analyses is restricted according to the following rules. First, when workers appear more than once in the database of a given year, we keep the job associated with the highest wage. Second, we only include workers aged between 15 and 80 years. Third, since it is illegal by law to pay workers at a wage below 80 per cent of the minimum wage (Cabral and Duarte, 2013), only workers with reported earnings of more than 80 per cent of the 2002 minimum wage are included in the analyses . Finally, the analysis is restricted to the top 40 sending countries of immigrants into the country.

Table 1.1 below presents the descriptive statistics of some selected variables by skill group of the pooled sampled of migrants. Highly-skilled immigrants account for 36 per cent of the sample over the period under concern. On average, highly-skilled immigrants have 14.1 years of education while low-skilled ones have 7.2 years of education. Moreover, in comparison to the low-skilled, the highly-skilled have a higher proportion of females, higher hourly wages, less years of experience. They also have spent less years in Portugal.

TABLE 1.1: Sample Means of Selected Variables

Variable	Full Sample	High skilled	Low skilled	Difference
High skilled	0.36	-	-	-
Age	35.49	34.75	35.89	-1.13***
Education	9.64	14.10	7.19	-6.19***
Tenure	3.49	3.96	3.23	-0.73***
Experience	15.54	12.23	18.69	-6.46***
ln(Wages)	6.51	6.61	6.49	0.14***
Female	0.34	0.35	0.33	-0.02***
Years since migration	3.54	3.01	3.83	-0.82***
Observations	793,169	280,973	512,196	-

Source: *Quadros de Pessoal* database 2002-2009.

\*  $p < 0.1$ ; \*\*  $p < 0.05$ ; \*\*\*  $p < 0.01$ .

Additional data on GDP per capita and population is obtained from the World Bank development indicators and United Nations Population Division respectively.

### 1.3.3 Occupation-Skill Mismatch and its Determinants

In this paper, two methods of computing the occupation-skill mismatch are employed. The first method due Verdugo and Verdugo (1989) requires computing the mean and standard deviation of the education for each occupation. Under this method, overeducated (respectively undereducated) workers are defined as workers whose education level is more (respectively less) than one standard deviation above (respectively below) the mean for that occupation. The second method first proposed by Kiker et al. (1997) computes mismatch by using the modal years of education for each occupation. Workers are classified as overeducated (respectively undereducated) if their education attainment is higher (respectively lower) than the modal education attainment associated to their occupation<sup>7</sup>. While these two methods are largely used in the literature, the self-assessment method that relies on the respondent deciding whether they are mismatch or not is another method documented in the literature.

Following these methods, we compute our occupation-skill mismatch variables

<sup>7</sup>The minimum mode is selected for occupations with multiple modes.

using the three digit *Classificação Nacional de Profissões (CNP 94)*. The CNP is a standard detailed classification of occupations which contains four digits. Limiting ourselves to the third digit leaves us with 276 occupations. However, in order to minimize measurement errors, we follow Tsai (2010) and assume sector heterogeneity in valuating education. Therefore, for each year, the modal and mean education attainment is computed by occupation and by sector using the total sample of workers whatever their migration status .

Table 1.2 presents the incidence of job-skill mismatch disaggregated by skill level. The estimates show that depending on the method used (range method or modal procedure), the incidence of over-education for the full sample varies between 33 and 52 percent. They also show that the job-skill match is less likely among highly-skilled workers than among low-skilled ones. The modal approach report larger incidence of overeducation than the range approach. This is unsurprising as the range approach define correct matches as those within a range of one standard deviation while the modal approach only compares with the modal years of education. A comparison with Table 1.7 (shown in the appendix 1.A) show that indeed as expected, natives are more likely to experience better occupation-skill matches.

TABLE 1.2: Incidence of Mismatch by skill group in 2002-2009

Variable	Overeducated	Matched	Undereducated	Observations
<b>Mode</b>				
Low Skilled	38.24	38.96	22.88	512,196
High Skilled	80.72	14.60	4.68	280,973
Full Sample	53.29	30.33	16.38	793,169
<b>Range</b>				
Low Skilled	18.27	65.50	16.23	512,196
High Skilled	61.05	38.24	0.71	280,973
Full Sample	33.42	55.84	10.24	793,169

Source: *Quadros de Pessoal* database 2002-2009 and own calculation.

In order to compute the probability of being overeducated, correctly matched or undereducated by country and year, a multinomial logit model is employed. This model can be expressed as:

$$Prob(Y_{ij}|X_i) = \frac{e^{\beta_k X_i}}{\sum_{k=1}^3 e^{\beta_k X_i}}; i = 1, 2, \dots, n; k = 1, 2, 3. \quad (1.7)$$

where  $Y_i$  takes values  $k=1$  if the worker  $i$  is overeducated,  $k=2$  if he is correctly matched, and  $k=3$  if he is undereducated.  $X_i$  is a vector of worker's characteristics which includes job tenure, experience, gender, nationality, years since migration, and skill group.  $n$ =number of workers. After estimating the multinomial logit, the probabilities associated to each one of the three categories can easily be predicted for each year and country and for each skill group.

#### 1.3.4 The Effects of Mismatch on Selection of Immigrants

From the theoretical section, we observed that the selection of immigrants is determined by wages, occupation skill mismatch, and costs of migration. We can use equation 1.6 to analyze the effects of occupation-skill mismatch on the selection of immigrants by using the following econometric specification.

$$\ln S_{it} = \gamma \ln S_{it-1} + \alpha_0 OEdiff_{it} + \alpha_1 Wagediff_{it} + \beta' X_{it} + \eta_i + \mu_t + \epsilon_{it} \quad (1.8)$$

where  $S_{it}$  is the ratio of highly-skilled to low-skilled flows of migrants from country  $i$  in time  $t$ , and  $OEdiff_{it}$  is the difference between the probability of being overeducated for highly-skilled and low-skilled immigrants for each country  $i$  in time  $t$  computed from the multinomial regression estimates.  $Wagediff_{it}$  is the hourly wage difference between highly-skilled and low-skilled immigrants from country  $i$  in time  $t$  residing in Portugal. It is worth mentioning that, unlike Chiquiar and Hanson (2005), due to data limitations, wages and the log skilled ratios at origin country are excluded from the analysis.  $X$  is a vector of time-variant country characteristics that affects migration flows such as GDP per capita, population, while  $\eta_i$  and  $\mu_t$  are country fixed-effects and time fixed-effects respectively. Additionally, while the costs of migration is not explicitly observed in our data set, we proxy it by lagged diaspora, which is shown to reduce cost of migration especially for the low skilled migrants (McKenzie and Rapoport, 2010).

To estimate the above specification, we employ the system generalized method of moments (SGMM) proposed by Blundell and Bond (1998). Unlike the Arellano

and Bond (1991) first-differenced generalized method of moments (DGMM) estimator, the SGMM estimation technique uses both the level equation of Equation 1.8 and its first difference. According to Blundell and Bond (1998), compared to the DGMM estimator, the SGMM estimator improves efficiency especially when the dependent variable is highly persistent and the variance of the unobserved individual heterogeneity is high. Both the SGMM and DGMM estimators rely on the assumption that the first difference errors are autoregressive of order one.

Throughout the estimation, we assume that the lagged diaspora variable is predetermined while the rest of the variables in Equation 1.9 are endogenous thus requiring instruments for these variables. These instruments are obtained by using the lags of the variables in the model. Fortunately, the validity of these instruments can be tested using the Sargan overidentifying restriction test.

## **1.4 Results**

### **1.4.1 Occupation-Skill Mismatch and its Determinants**

Before computing the probabilities of occupation-skill mismatch, it is interesting to analyze the results from the multinomial logit model. Table 1.3 shows the results from the multinomial logit regression using the modal definition of mismatch. The coefficients tell how each of the variables affects the probability of being overeducated or under-educated compared to being correctly matched.

Column 1 of Table 1.3 shows that log odds of being overeducated compared to being correctly matched is a decreasing function of years of experience and tenure. The coefficient on experience shows that older workers in the labour market performs relatively better in terms of the probability of being correctly matched. We also observe that high skilled and female workers are more likely to be overeducated. Surprisingly, the coefficient on years since migration is positive and statistically significant, implying that workers who spent more years in the country are more likely to be overeducated. One possible explanation for this is that immigrants augment their education level after migration thus making them more skilled as documented in Beine et al. (2007) and thus more likely to be overeducated.

TABLE 1.3: Multinomial Logit Model Estimates of Occupation-skill Mismatch

Variable	Ln(OE/M)	Ln(UE/M)
Experience	-0.0304*** (0.0004)	0.0731*** (0.0004)
Experience square	0.000003 (0.000003)	0.00001*** (0.000004)
Tenure	-0.0590*** (0.0013)	0.0953*** (0.0012)
Tenure square	0.00001*** (0.000003)	-0.00002*** (0.000004)
Female	0.0279*** (0.0075)	-0.0290*** (0.010)
High skilled	2.5227*** (0.0087)	-2.3963*** (0.0242)
Years since migration	0.0501*** (0.0022)	-0.0816*** (0.0025)
Years since migration squared	-0.0035 (0.0001)	0.0023*** (0.0001)
Observations	703,864	
Pseudo R <sup>2</sup>	0.1816	
Log likelihood	-512704.29	
$\chi^2$ (154)	227472.40	

Source: *Quadros de Pessoal* database 2002-2009

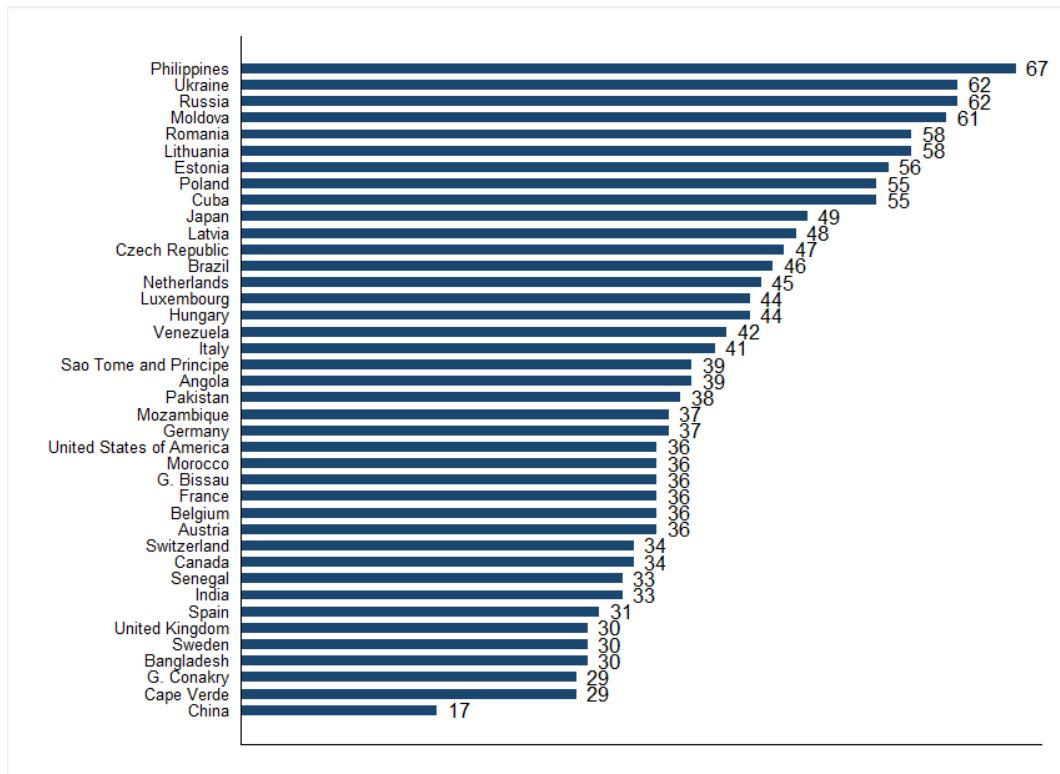
Notes: Other controls not reported includes country and time dummies, firm size, location, and sector of activity. Standard errors in parenthesis. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.

On the other hand, as shown in column 2 of Table 1.3, the odds of being undereducated increases with years of experience and tenure. The dummies on female and high skilled indicate that female and high skilled workers are less likely to be undereducated. Moreover, the years since migration reduce the probability of being undereducated.

Though the individual coefficient estimates from the multinomial logit model are somewhat less informative, the model allows us to predict the probability that an average worker from a particular country is over-educated, under-educated, or correctly matched. We can further compute these probabilities by skill group for each country. These estimates are very accurate especially for the average worker. In order to predict these probabilities, averages of the variables in Table 1.3 are employed for each country. Figure 1.1 below shows the predicted probabilities by

country that an average worker is over-educated in year 2002 using the modal definition of job-skill mismatch.

FIGURE 1.1: Estimated probability (in percentages) that a worker is overeducated in 2002



The results from Figure 1.1 show that the probability for an average worker to be over-educated is heterogeneous across countries with the Philippines recording the highest probability (67 percent) and China the lowest one (17 percent). One possible reason for the better job-skill match among Chinese immigrants is their high propensity to become entrepreneurs as shown in Oliveira (2003). After the Philippines, countries of the Eastern European region (Ukraine, Russia, Moldova and Romania) are among the countries with the highest estimated probabilities. With a few exceptions, Western European countries perform much better, with estimated probabilities ranging from 31 to 41 percent. Not surprisingly, immigrants from Portuguese-speaking countries with which Portugal has historical ties also perform relatively better, excepted Brazil which records quite a high probability (46 percent). The results from Figure 1.1 are consistent with Mattoo et al. (2008) who also found highly heterogeneous job-skill mismatch rates among immigrants in the United States depending on their country of origin.



### 1.4.2 Mismatch and Selection of Immigrants

Table 1.4 shows how occupation-skill mismatch affects the selection of immigrants. As mentioned earlier, both definitions of occupation-skill mismatch (range and mode) are employed. However, irrespective of the definition, we find a significant negative effect of mismatch on selection.

Specifically, column 1 of Table 1.4 shows how mismatch affects selection using the range definition. We observe that the coefficient of over-education differences as expected is negative and statistically significant at 5 percent. These results suggest that when the probability of overeducation is greater for the highly-skilled than for the lowskilled, the former are less likely to migrate compared to the latter (negative selection). Column 2 of Table 1.4 shows similar findings though with a coefficient of higher magnitude. These results are consistent with our theoretical predictions that indeed the selection of immigrants is also explained by skill mismatch.

The estimated coefficients of the control variables included in the estimation have the expected signs with the exception of the coefficient associated to the wage difference of the highly-skilled and low-skilled. The potential reason for the negative sign of the coefficient is due to omitting the wages prevailing in the country of origin. As shown in Grogger and Hanson (2011), estimating the selection equation using origin country wages is crucial. However, in this paper, we do not have data on wages in the origin countries. As observed elsewhere in Beine et al. (2011), diaspora leads to negative selection of immigrants. The reason for this negative effects stems from the established fact that diaspora provides networks assistance that tend to reduce the cost of migration especially for the unskilled. Moreover, from the coefficient of GDP per capita, the results suggest that immigrants from richer countries are positively selected.

As per the GMM assumptions of no serial correlation, the results suggest that indeed this assumption is satisfied. Moreover, the Sargan test shows that the overidentifying assumption is also satisfied with p-values of 0.1286 and 0.1063 for the range and mode definitions respectively.

Similarly, Table 1.5 shows how correct matches affects selection. The results from Table 1.5 are also consistent with our theoretical predictions. The coefficient of

TABLE 1.4: Impact of Overeducation on Selection

Variable	Ln(skill ratio) <i>Range Definition</i>	Ln(skill ratio) <i>Mode Definition</i>
Overeducation differences	-0.0135** (0.0067)	-0.0264** (0.0117)
Wage differences	-0.0086 (0.0166)	-0.0000 (0.0156)
Lagged diaspora (stock)	-0.0090 (0.0083)	-0.0152* (0.0085)
GDP Per Capita	0.0298*** (0.0054)	0.0325*** (0.0043)
Population	-0.0006* (0.0003)	0.0000 (0.0003)
Lagged skill ratio	0.1533** (0.0580)	0.1161** (0.0606)
Sargan P-Value	0.1420	0.2671
AR(1)	0.0002	0.0004
AR(2)	0.6817	0.9126
No of Instruments	119	117
Countries	40	40
Observations	262	262

Source: *Quadros de Pessoal* database 2002-2009

Notes: Regressions estimated using a system GMM. Ln(skill ratio) is log ratio of highly-skilled to low-skilled flow of migrants. Standard errors in parenthesis. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.

occupation-skill match differences between highly-skilled and low-skilled is as expected positive and statistically significant. This implies that when the probability of correct occupation-skill match is higher for the highly-skilled than for the low-skilled, the former are more likely to migrate; hence we have positive selection. Similar to the results provided in Table 1.4, with the exception of wages, the coefficients of the control variables have the expected signs.

The results from the post-estimation tests show that the GMM assumptions are satisfied. As expected, the results from the autocorrelation test show that we cannot reject the hypothesis of zero autocorrelation in first-differenced errors of order 2. Moreover, the results from the Sargan overidentifying restrictions test show that moment conditions are satisfied at p-values of 0.1168 for the range definition and 0.1615 for the mode definition.

TABLE 1.5: Impact of Correct Match on Selection

Variable	Ln(skill ratio)	Ln(skill ratio)
	Range Definition	Mode Definition
Occupation-skill match differences	0.0167** (0.0074)	0.0276** (0.0187)
Wage differences	-0.0111 (0.0131)	0.0001 (0.0156)
Lagged diaspora (stock)	-0.0057 (0.0085)	-0.0133 (0.0086)
GDP per capita	0.0290*** (0.0044)	0.0276*** (0.0044)
Population	-0.0015*** (0.0004)	-0.0000 (0.0000)
Lagged skill ratio	0.1636*** (0.0569)	0.1145** (0.0607)
Sargan P-Value	0.1168	0.3614
AR(1)	0.0001	0.0006
AR(2)	0.4753	0.9868
No of Instruments	92	117
Countries	40	40
Observations	262	262

Source: *Quadros de Pessoal* database 2002-2009

Notes: Regressions estimated using a system GMM. Ln(skill ratio) is log ratio of highly-skilled to low-skilled flow of migrants. Standard errors in parenthesis. \* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%.

## 1.5 Conclusion

Occupation-skill mismatch is a well-known labor market phenomenon especially for immigrants. The implications of this mismatch especially on wages have been extensively studied. However, little is known about the impact of mismatch on selection of immigrants. In this paper, using a panel data of immigrants from 40 countries in Portugal, we show that indeed occupation-skill mismatch affects the selection of immigrants. The results suggest that the probability of overeducation leads to negative selection of immigrants. Furthermore, we show that when probability of correct matches increases, the highly-skilled are more likely to migrate than the low-skilled (positive selection). This study has contributing to the existing literature by focusing on a fairly neglected factor (occupational-skill mismatch) in explaining selection of migrants.

The results from this paper have implications for sorting of immigrants. From the results, we observe that due to overeducation, the highly-skilled are less likely

to migrate compared to the low-skilled. This finding raises another interesting question for further research. How does occupation-skill mismatch affects the sorting of immigrants among different destination countries? That is, will migrants prefer migrating to countries with better skill matches? The framework developed in this paper can be extended to include more than one destination country. To answer this question, one would need data on not only one country as we have in this paper, but also data on immigrants in other destination countries.

From a policy perspective, these findings also have some implications. Receiving countries' selective policies aimed at attracting highly-skilled immigrants should also inculcate reducing occupation-skill mismatch probably through degree recognition and standardization in collaboration with sending countries.

## 1.A Appendix

### 1.A.1 Definition of Variables

<i>Multinomial Logit Model</i>	
<b>Dependent Variables</b>	Description
$Ln(OE_{it}/M_{it})$	log ratio of overeducation to matched of individual $i$ in time $t$
$Ln(UE_{it}/M_{it})$	log ratio of undereducation to matched of individual $i$ in time $t$
<b>Independent Variables</b>	Description
Experience	Age - 6 - tenure- years of education
Tenure (number of years in current firm)	Current year - year the worker started working for the firm
Female	Dummy variable equal 1 for female and equal 0 for male
High Skilled	Dummy variable equal for workers with more than 12 years of education and zero otherwise
Years since migration	This is a proxy for year the worker entered the country. Following Cabral and Duarte (2013), we proxy the year of migration with the minimum of the year the worker first appeared in the database. This is achieved by tracing back the worker ID number to the year that it appears from the data base starting from 1986.
<i>Selection Equation</i>	
<b>Dependent Variable</b>	Description
Ln(Skill Ratio)	log ratio of the flow of high skilled to low skilled immigrants.
<b>Independent Variables</b>	Description
Overeducation differences	Probability of overeducation for high skilled migrant - probability of overeducation for low skilled migrant.
Occupation-skill match differences	Probability of occupation-skill match for high skilled migrant - probability of occupation-skill match for low skilled migrant.
Wage differences	Average high skilled hourly wage - Average low skilled hourly wage.
Lagged Diaspora	number of immigrants from the origin in the previous year.
GDP per capita	Gross domestic product per capita of the country of origin.
Population	Total population of the country of origin.
Lagged skill ratio	log ratio of the flow of high skilled to low skilled immigrants in the previous.

### 1.A.2 Incidence of Mismatch by skill group in 2002-2009 (native workers)

TABLE 1.7: Incidence of Mismatch by skill group in 2002-2009

Variable	Overeducated	Matched	Undereducated	Observations
<b>Mode</b>				
Low Skilled	31.30	39.89	31.30	10,087,364
High Skilled	38.40	41.55	20.23	12,140,961
Full Sample	33.95	40.80	25.25	22,228,307
<b>Range</b>				
Low Skilled	11.83	71.09	17.04	10,087,364
High Skilled	14.93	75.24	9.83	12,140,961
Full Sample	33.95	40.80	25.25	22,228,307

Source: *Quadros de Pessoal* database 2002-2009 and own calculation.

### 1.A.3 Number of Workers

TABLE 1.8: Number of workers

Year	Natives	Migrants
2002	2,543,691	95,792
2003	2,552,969	116,897
2004	2,604,026	125,956
2005	2,920,259	146,620
2006	2,859,951	146,190
2007	2,952,052	153,185
2008	2,005,729	168,552
2009	2,889,639	155,139

## Chapter 2

# Understanding Willingness to Migrate Illegally: Evidence from a Lab-in-the-Field Experiment

### Abstract<sup>1</sup>

Illegal migration to Europe through the sea, though risky, remains one of the most popular migration options for many Sub-Saharan Africans. This study aims at improving our understanding of the determinants of the willingness to migrate illegally from West Africa to Europe. We implemented an incentivized lab-in-the field experiment in rural Gambia, the country with the highest rate of illegal migration to Europe in the region. Sampled male youths aged 16 to 25 were given hypothetical scenarios regarding the probability of dying en route to Europe, and of obtaining asylum or legal residence status after successful arrival. According to our data, potential migrants overestimate both the risk of dying en route to Europe, and the probability of obtaining legal residency status. The experimental results suggest that the willingness to migrate illegally is affected by hypothetical information on the chances of dying en route and of obtaining a legal residence permit. Our lab-in-the field experimental set up allows us to estimate what would have happened to

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<sup>1</sup>This chapter is co-authored with Catia Batista. We are grateful for comments from Alex Coutts, Zack Barnett-Howell, Flore Gubert, David McKenzie, Julia Seither, Pedro Vicente, Abby Wozniak, and participants in seminars and conferences at the Notre Dame Kellogg Institute, Oxford CSAE 2018 Conference, PSE Casual Friday Development Seminar, DIAL-Dauphine Development Seminar, and the Stanford Eleventh International Conference on Migration and Development. We also gratefully acknowledge funding support from Nova School of Business and Economics and NOVAFRICA. The first author acknowledges the European Doctorate Degree in Economics - Erasmus Mundus (EDE-EM) Program for funding and support.

willingness to migrate if respondents knew the actual chances of dying and obtaining residence status. Comparing the round with the actual fact of risk of dying and obtaining residency status with the average expectations, our estimated elasticities show that providing potential migrants with official numbers on the probability of obtaining a legal residence permit decreases their likelihood of migration by 2.88 percentage points (pp), while information on the risk of migrating increases their likelihood of migration by 2.29pp – although the official risk information provided may be regarded as a lower bound to actual mortality. Follow up data collected one year after the experiment show that the migration decisions reported in the lab experiment correlate well with actual migration decisions and intentions. Overall, our study indicates that the migration decisions of potential migrants are likely to actively respond to relevant information.

**Keywords:** International migration; Information; Expectations; Illegal migration; Willingness to migrate; Lab-in-the-Field Experiment; The Gambia.

**JEL Codes:** F22, J24, O15, O55.

## 2.1 Introduction

Over the last decade, the world has witnessed a growing increase in the international movement of people. In 2015, the total number of international migrants worldwide reached 244 million (3.3 per cent of the world population), compared to 173 million in the year 2000 (United Nations, 2015).

While most people migrate legally, there are large and increasing numbers of irregular migrants. Illegal migration is a risky endeavor. Between 2000 and 2014, more than 22,400 migrants were recorded as having lost their lives trying to reach Europe (IOM, 2014)<sup>2</sup>. Illegal migrants traveling from West Africa to Europe face a variety of serious challenges, including abductions for ransom, slavery, torture and

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<sup>2</sup>Additional information from Missing Migrants project documented that between 2014 and 2018, 17,390 migrants died in the Mediterranean (Missing Migrants Project, 2018)



other ill-treatment during the migration process especially in Libya<sup>3</sup>. Notwithstanding these risks, the Libyan route to Europe continues to be the main entry point of irregular migrants from Africa. In 2017, 101,448 African migrants were recorded as reaching Italy through the sea<sup>4</sup>.

The main aim of our work is to understand what determines the willingness of individuals to migrate illegally from Western Africa to Europe. For this purpose, we implemented a lab-in-the field experiment among potential migrants in rural Gambia. The Gambia has an illegal emigration rate of 2%, making it the African country with the highest incidence of illegal migration relative to its total population (see Figure 2.3). Most of these emigrants come from the rural areas where our project took place.

Experimental subjects played an incentivized migration game designed to elicit willingness to migrate depending on varying chances of dying en route to destination, and of obtaining legal residency status. The experiment included 16 rounds, where each round provided different combinations of hypothetical probabilities of dying en route and of obtaining legal residency status in Europe upon arrival, while keeping hypothetical wages fixed depending on the migration circumstances faced. In each round, respondents made binary decisions about whether to migrate to Italy or stay in Gambia. They also reported their willingness to pay for the migration cost (out of their game endowment) and decided on how large a payment they were willing to accept in order to forgo migrating. While one of the rounds provides factual information on the risk of dying en route and the chances of obtaining residence status, this was unknown to respondents.

Our data show that 47 percent of the respondents are willing to migrate illegally. In addition, on average potential migrants overestimate both the chances of dying en route and of obtaining a legal residence permit. The expected probability of dying en route is 30pp higher than the actual probability reported by official numbers; while the expected chances of obtaining a residence permit are 7pp higher than the actual probability. Our experimental counterfactual results predict that providing

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<sup>3</sup>See Amnesty International (2015) and CNN (2017)

<sup>4</sup>The top country of origin includes Nigeria, Guinea, Côte d'Ivoire (see Figure 2.2)

potential migrants with accurate information on the probability of obtaining a legal residence permit would decrease their likelihood of migration by 2.88pp, while receiving accurate information on the risk of migrating would increase their likelihood of migration by 2.29pp – although official numbers may be regarded as lower bounds to actual mortality. Overall, our study suggests that the migration decisions of potential migrants actively respond to information about relevant facts regarding costs and benefits of migration. These findings are shown to be robust to concerns related to the interpretation of the experimental migration decisions as related to actual migration decisions and intentions. One year after the experiment, follow up data reveal that decisions in the lab correlates to actual international migration decisions. Additionally, we provide evidence suggesting that lab decisions are positively correlated with the expected net benefit computed for each round.

This paper contributes to the limited existing economics literature on illegal migration. While we are not the first to use experimental techniques to study the willingness to migrate, our work is, to the best of our knowledge, the first to implement a lab-in-the field experiment aimed at examining the determinants of illegal migration.

Our methodological contribution is related to a number of studies utilizing lab experiments. Batista and McKenzie (2018) conduct an incentivized laboratory experiment to test various theories of migration departing from the neoclassical migration model of net expected income maximization, and considering also additional and more realistic factors such as migrant-skill self-selection, credit constraints, incomplete information and multiple destination choices. Using a sample of potential migrants (graduating university students in Kenya and Portugal), their results suggest that adding these realistic features to the neoclassical model, especially uncertainty and imperfect information, brings migration decisions to levels much more consistent with reality than the ones implied by simpler income maximization considerations. In a recent complementary piece of work, Barnett-Howell (2018) used a migration video game in a lab experiment to examine how individuals in the United States and Ethiopia make migration choices. He also found an important role for imperfect information in explaining lack of movement. Relatedly, Lagakos et al.

(2018) conducted a discrete choice experiment in Bangladesh to understand the relative weights people place on migration related factors such as the quality of living, relative to wages or family separation in making internal migration decisions. Their setup allows respondents to hypothetically choose between staying put or migrating under two different scenarios. The options vary in terms of wages, unemployment rates, and amenities at destination (namely, availability of a latrine facility and regularity of family contacts). This study shows that unemployment risk and housing conditions are important determinants of (internal) migration decisions, while family separation seems to act as less of a deterrent to rural-urban migration. In our work, we follow this line of research in that we use an incentivized lab-in-the-field experiment to test for relevant determinants of the willingness to migrate, although our focus is more specifically on illegal migrants from West Africa and the extreme risks they face in their migration journey.

Our work is also related to the role of the access of information in determining international migration. The contributions of Shrestha (2017b) and Shrestha (2017a) highlight the importance of access to information for potential migrants' expectations and their subsequent migration decisions. Shrestha (2017b) offers evidence on how the deaths of migrants in a district affect the subsequent migration decisions for up to 12 months. He argues that migrants are not fully informed on risk of migration and thus update their beliefs after the occurrence of the dead within a district. Furthermore, Shrestha (2017a) conducted a randomized field experiment providing information on mortality rates during the migration journey and documented how this information affected subsequent migration decisions in Nepal. More specifically, and consistent with our own findings, these experimental findings show that providing information on mortality rates lowers expected mortality rates and providing information on wages at destination reduces expected wages especially for less experienced migrants.

Though the phenomenon of illegal migration from Africa to Europe has attracted a lot of media attention as of lately, most literature on illegal migration has focused on illegal migration from Mexico to the USA, and particularly on the consequences of immigration policies on illegal migration from the US to Mexico. Orrenius and Zavodny (2003) show no long term impact of amnesty programs on the flow of

undocumented migrants. Gathmann (2008) showed that stricter border control increased prices of border smugglers ('coyotes') by 17%, while the demand for smugglers remained unchanged. The strongest effect of tighter enforcement was a shift of illegal migrants to remote crossing places. Amuedo-Dorantes et al. (2013) show that tougher immigration measures such as E-verify that is a mandate obliging employers to check the work authorization of employees, have impact on deportation fears, interstate mobility, and reduces deportees' intentions to return to the US. Similarly, Amuedo-Dorantes and Lozano (2015) show that the SB1070 law in Arizona which made it crime for an alien not to carry proper documentation has little effect on reducing the share of undocumented immigrants.

There are only a few studies that study the willingness to migrate illegally from West Africa. Mbaye (2014) and Arcand and Mbaye (2013) provide the first papers describing the determinants of the willingness to migrate illegally in this context. They use data from a survey of about 400 individuals in Dakar to offer important contributions to the understanding of illegal migration from Senegal. Mbaye (2014) shows that potential migrants are willing to accept a high risk of dying en route and that they are mostly young, single, and lowly educated. Moreover, she argues that the price of illegal migration, migrant networks, high expectations, and tight immigration policy significantly explain willingness to migrate illegally. Arcand and Mbaye (2013) study how individual risk-aversion and time preferences affect the willingness to migrate illegally and to pay for smuggling services. They propose a theoretical model showing that the willingness to migrate and to pay a successful smuggler is influenced by risk aversion and time preferences. The empirical analysis confirms that the willingness to pay for a smuggler is an increasing function of an individual's intertemporal discount rate, and a decreasing function of risk-aversion. More recently, Guido et al. (2017) study the impact of distance on individual intentions to migrate from Africa into Europe. Using the demise of the Gaddafi regime in 2011 as an exogenous source of variation that affects the distance from Africa to Europe due to increase in the usage of the central Mediterranean route (Libya to Italy), they found negative effects of distance on the intentions to migrate. The effect is especially larger for educated youth with a migration network.

Our paper builds on these contributions by offering additional evidence on the

roles of the probability of dying en route and of obtaining permit on willingness to migrate illegally. Moreover, we conduct an incentivized lab-in-the-field experiment, which provides us with additional variation (relative to cross-section survey analysis) to power our empirical analysis. In addition, our experimental setup, while hypothetical, allow us to compare what would have happened to willingness to migrate illegally from a specific scenario to another.

Understanding the determinants of the willingness to migrate may have important consequences on economic development. Batista et al. (2012a), for example, show that the probability of own future migration has important positive effects on educational attainment in Cape Verde – even on those individuals that end up not actually emigrating. The evidence suggests that a 10 pp increase in the probability of own future migration increases the probability of completing intermediate secondary education by 4 pp for individuals who do not migrate. Additionally, Docquier et al. (2014) show a strong correlation between the intention to migrate and subsequent actual migration. The evidence from the follow up survey we conducted one year after the experiment is in line with this finding, in that both actual migration decisions and intentions correlate well to the lab migration decisions taken one year earlier.

The rest of the paper is organized as follows. Section 2 presents the country context in which we conduct our analysis. Section 3 discusses the survey and sampling framework, the lab-in-the field experiment, and descriptive statistics. Section 4 presents the econometric approach and main empirical results. Section 5 presents some robustness checks using follow up data on actual migration decisions and intentions measured one year after the lab experiment. Section 5 offers concluding remarks.

## **2.2 Country Context**

Sandwiched by Senegal, The Gambia is the smallest country in mainland Africa with a population of 2 million people. The country has an estimated GDP per capita of \$1700 ranking 176 out of 190 countries, making it one of the poorest countries in the

world. Over the last decade, the country registered an average growth rate of 2.8 percent per year with a high debt of 123 percent of GDP in 2017 (World Bank, 2018).

Since independence in 1965, the country has had three presidents: Dawda Jawara (1965-1994), Yaya Jammeh (1994-2016), and Adama Barrow from 2016 to date. Jammeh ousted Jawara through a bloodless coup. In December 2016, Jammeh's 22-year rule ended with Barrow's electoral victory making it the first democratic transition ever witnessed by the country.

Migration is an important phenomenon in The Gambia. The country attracts immigrants mostly from the sub region with Senegal dominating the flows. According to the 2013 census, immigrants constitute 5 percent of the population, while rural to urban migrants account for 7 percent. Additionally, emigration is a cornerstone aspect of the Gambian economy with remittances amounting to almost 20 percent of GDP (Ratha, 2016), which is equivalent to the whole contribution of the tourism sector to GDP.

Europe remains the main destination for many Gambians, who mostly migrate illegally ("Backway" as commonly called in The Gambia). In the early 2000s, many Africans embark on migration to Spain through Senegal and Mauritania. This route reached peak in 2006 during which more than 30,000 arrived in the Canary Islands with an estimated dead of 6000 migrants. In 2007, following bilateral agreements between Senegal, Mauritania, and Spain, arrivals through the route continue to plummet. Another route utilized by many is the western Mediterranean route (Morocco-Spain). The route attracted media attention when hundreds of migrants tried to scale the border fence in the Spanish enclave of Ceuta.

Perhaps the current most famous illegal migration route in Gambia is the Libya route, also known as the central Mediterranean route. Before the fall of the Gaddafi regime, many African migrants opted for Libya as a destination country with many job opportunities. However, the 2011 Libyan civil war crisis destabilized the region, subsequently making Libya as transit magnet for many economic migrants and refugees. Presently, this route is the riskiest option for many African migrants.

Gambian economic migrants continue to utilize the western and central Mediterranean route. This route mostly entails travelling from Gambia through Senegal, Mali, Niger and from there to Libya. There is no visa requirement for Gambians to

enter these countries with the exception of Libya. The smuggling starts from Niger to Libya. In 2017, the latest year for which data are available, about 42,000 Gambians arrived in Europe through the sea which represents about 2% of the country's total population, making Gambia the largest sender country of illegal migrants as a percentage of total population.

The number of Gambian migrants crossing to Italy reached peak in 2016 with more than 11,000 entries. However, this number has reduced to just more than 5000 in 2017 marking an almost 50 percent reduction (Frontex, 2016). This reduction is perhaps due to the combined increase in the risk of migrating through Libya making many attempting the Morocco - Spain route instead and change of government in The Gambia. Before 2013, Spain served as the leading destination of Gambian migrants with an estimated number of 22,000 (Kebbeh, 2013). However, the current trends suggest that Gambians favor an initial transit to Italy, and subsequently to Germany.

## 2.3 Methodology

### 2.3.1 Survey and Sampling Framework

The survey data used in our work were collected using a representative sample of 584 households across 60 enumeration areas in the Upper River Region of the Gambia. The enumeration areas were randomly chosen using population size proportional sampling based on the Gambia 2013 census. In each enumeration area, a random sample of 10 eligible households was drawn. Eligibility was determined by asking whether there is young man with ages 16-25 belonging to the household. If the household have more than one youth within the eligibility age category, one would be randomly selected. In each of these households, after surveying the household head, the sampled young males were also surveyed.

The households were sampled using a simple random walk within each EA. Enumerators surveyed every  $n$ th household, where the  $n$ th household depended on the size of the EA. Once they sampled the  $n$ th household, the participation criterion of the household was ascertained by asking the household whether the household had

at least one young man with ages between 16-25 years. Households that did not satisfy this criterion were replaced by the geographically closest household to the right. Following this sampling procedure, 595 households were finally surveyed. Out of these households, a sample of 584 male youths were also surveyed, of which 406 participated in the experiment. Initially, enumerators were instructed to pick every second household to participate in the experiment. However, this strategy was subsequently discarded to allow one sampled young to participate in each household. The fieldwork took place in May 2017.

### **2.3.2 Lab-in-the-field Experiment**

The experiment was implemented as a simple lab-in-the field game in which participants were hypothetically endowed with 100,000 Gambia Dalasis (GMD)<sup>5</sup>. We frame the participants' decisions as migration decisions with a 10-year time horizon. The precise framing of the experiment to players is provided in Appendix 2.A.2.

The experimental subjects must play 16 different rounds of an incentivized game in where migration-related decisions must be made, depending on different combinations of four different scenarios for the probability of dying en route to the migration destination and for the probability of obtaining legal residence status at the destination.

The four scenarios in the games were 0, 10, 20, and 50 percent probability of dying in the migration route, and 0, 33, 50, and 100 percent probability of obtaining a legal residence permit or asylum status at destination. These numbers were determined based on data from our pilot survey, and other official databases. According to the International Organization for Migration (2017), 181,436 migrants arrived in Italy through the sea while 4,581 migrants lost their life from January to December 2016. These figures provide a lower bound for the mortality rate at sea, estimated at 2.46% deaths of attempted migration journeys. In addition, we obtained the probability of dying en route by adding the probability of dying en route before reaching the sea. The MHUB (2017) survey reports the incidences of cases where migrants report dead bodies along the way (including the Sahara Desert, Libya, and Mediterranean Sea). According to the data from the January 2017 survey, 44% of respondents

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<sup>5</sup>Equivalent to 2,000 Euros (1 euro = GMD50 exchange rate)



reported witnessing one or more dead in Libya, 38% in the Sahara, 15% in the Sea, and 3% in transit countries such as Niger. Combining the probability of dying at sea of 2.5% and the incidences of witnessing migrant deaths en route of 15%, we estimated the overall probability of dying en route as 16.5%. In the experiment, we use 20% as a proxy for the actual death rate over the migration route given the likely undercount of fatalities. The 50% threshold for the probability of dying matches expectation data from our pilot survey. Our pilot survey elicited the expected probability of dying from 20 young males of ages 16 to 25 years from the region of the study. On average, the respondents expect that 5 out of 10 Gambians die along the “Backway”, corresponding to a 50 percent probability of dying. In addition, this survey also reported the expected probability of obtaining a legal residence or asylum status.

The official data on residence permits is obtained from the Asylum Information Database (2017). This database contains detailed numbers of migrants by nationality and by destination who applied for asylum and the final decision on the applications. In 2016, 8,930 migrants originating from the Gambia applied to asylum status in Italy. The rejection rate for these migrants was 67.5%. Using this rejection rate, we estimate at 33% the probability of obtaining asylum status or residence permit.

We therefore combined these two estimates (the first one based on existing data and the second one based on expectation from the pilot data) and two other extreme but interesting cases (0 and 10 percent chance of dying and 0 and 100 percent chance of obtaining residence or asylum status) to obtain the rounds for the game. For each round in the game, respondents were given showcards (shown in Figure 2.6) visually illustrating probabilities of dying en route and of obtaining residence status. Note that all rounds were framed as hypothetical scenarios and respondents were not informed that one of the rounds included the actual risk of dying and chances of obtaining residence/asylum permit.

Moreover, additional information on the corresponding wages was given. Specifically, we assumed, based on a pilot survey conducted in Italy among Gambian immigrants, that once migrants successfully reach Europe, they face two possible

wages: a wage of 1000 Euros for those with legal residence status, and of 500 Euros for those without permit. This setting is consistent with the findings of Dustmann et al. (2017), who show that undocumented migrants consumed about 40% less than documented migrants in Italy, and about one quarter of these differences in consumption is due to undocumented migrants earning less than documented migrants.

In each round, given the respective information provided verbally by the interviewer and visually by the showcard given to the experimental subject, participants had to make three decisions: (1) willingness to migrate, (2) willingness to pay for the cost of migration using the endowment provided, and (3) willingness to be paid in order to forgo migrating. The order of the 16 rounds was randomized.

Once the experimental subjects finished playing the game, their payoffs within the game were determined by randomly selecting one of the rounds played. In the selected round, the payout was made using the corresponding probabilities. The average payoff payment was GMD 100, the equivalent to the pay for two days' work, using our survey data. This relevant monetary pay and the framing script were included in our design to incentivize experimental subjects to seriously consider the decisions made in the game. Note that while the hypothetical wages are fixed across rounds, the expected payoffs vary across rounds. For example, the expected payoff in terms of wages in a round with 0 percent probability of dying and 0 percent probability of obtaining residence/asylum permit corresponds to 250 euros. Similarly, the round with 0 percent probability of dying and a 100 percent probability of obtaining residence/asylum permit corresponds to an expected monthly wage of 1000 euros. The expected wage was not specifically indicated in each round; only hypothetical endowment, wages, and the number of deaths and asylum permits granted per 10 migrants were showed.

### 2.3.3 Descriptive Statistics

Table 2.1 shows the descriptive statistics of the data on the 406 sampled young males who participated in the experiment. On average, the interviewed young is 20 years old with a monthly income of GMD 2,061. In terms of formal education, 32% of the young have some formal education with an average of 8 years of education. 38%

of the respondents reported that they had already migrated outside their village for more than 6 months. The duration of the migration spell averages 23 months. Almost all of the sampled young (82%) know at least one person (be it a relative, a family member, or a friend) who has migrated outside their village (migration network). On average the size of migration network is 2.8 per young. We also elicited data on the number of migrants known by the respondent, that successfully travelled to Europe through the “Backway” and also the number of people who died along the way. The data indicates that on average, respondents know 11 persons who successfully reached Europe through the “Backway” and an average of 3.7 persons who lost their life en route to Europe.

TABLE 2.1: Summary Statistics: Sampled Participants in the Experiment

Variable	Mean	Std. Dev.	# of Obs.
Age	20.12	3.26	406
Formal education [Yes =1, No=0]	0.42	0.36	406
Years of formal education (if any)	8.17	2.35	172
Monthly income (GMD)	1696	3369	258
Has migrated before [Yes =1, No=0]	0.39	0.48	406
Duration of migration (if any) in months	21.75	24.14	159
Has relatives or friends abroad (migration network) [Yes =1, No=0]	0.76	0.42	406
No of relatives or friends (youth with migration network)	2.79	2.24	309
No of known successful migrants	9.88	11.74	406
No of known dead migrants en route	3.75	4.45	406
Has intention of migrating within the country [Yes =1, No=0]	0.81	0.39	406
Has intention of migrating outside the country [Yes =1, No=0]	0.92	0.26	406
Has intention of migrating illegally [Yes =1, No=0]	0.46	0.50	406
<i>Top preferred destination (if intending to migrate illegally)</i>			
Italy	0.29	0.45	208
Germany	0.27	0.4	208
Spain	0.16	0.37	208
United States	0.06	0.25	208
United Kingdom	0.04	0.19	208
Willingness to forgo migrating (GMD)	26232	35770	208
Expected cost of migration (GMD)	79274	97414	208
Expected monthly wage in destination (EUR)	1338	1598	208
Expected probability of dying en route	0.48	0.25	406
Expected probability of obtaining a permit	0.38	0.28	406
<b>Household characteristics</b>			
Household head age	50.03	15.39	406
Household size	10.52	7.29	406
Has internal migrants [Yes =1, No=0]	0.52	0.40	406
Has international migrants [Yes =1, No=0]	0.64	0.48	406
Has at least one illegal migrant [Yes=1, No=0]	0.43	0.49	260

Source: Authors calculations on the survey data.

Data on willingness or intention to migrate both internally and externally were

elicited. To measure willingness to migrate, we asked the following question: Ideally, if you have the opportunity, are you willing to migrate elsewhere inside the Gambia? This question corresponds to intention or willingness to migrate internally. For those who answered in the affirmative, a follow-up question of their preferred destination was asked. The intention to migrate outside the Gambia was elicited in a similar way. The results from the data indicate an overwhelming majority of 82% willing to migrate within the Gambia while 91% of the respondents expressed a willingness to migrate outside the Gambia. This indicates the fact that indeed a majority of young males within the age category of 15 to 25 years desire to migrate and live elsewhere, outside their current settlements. Similarly, to elicit willingness to migrate illegally, we ask the following question: Ideally, if you have the opportunity, are you willing to migrate through the “Backway” /Illegal way? We used the name “Backway” as the illegal migration route is commonly known such in the Gambia. Almost half of the sampled young (47%) responded in the affirmative. The top 5 intended destinations are Italy (29%), Germany (27%), Spain (16%), the United States of America (6%) and the United Kingdom (4%). These statistics are consistent with the current top destination countries of migrants from the Gambia. In addition to their intended destination, we collected information on expected cost of migrating, expected monthly wages in destination country, and how much they were willing to accept per month in order to forgo migrating. The average expected cost of migration amounts to GMD 85,394. In order to forgo migrating, respondents on average are willing to accept GMD 28,370 (about 525 euros) per month. This indicates that young males are willing to accept a substantial risk of dying en route instead of receiving a substantial amount compared to their current monthly earnings. This is in line with their average expected wage of 1478 Euros per month in Europe, which corresponds to more than GMD 70,000.

Furthermore, we elicited other expectations from the sampled young. Specifically, in addition to the expected cost of migrating, expected wage at destination and willingness to forgo migrating illegally, we elicited the expected probability of dying en route and the expected probability of obtaining a residence or asylum permit. Expected probabilities were collected using the following simple questions: Out

of every 10 Gambian migrants, how many people do you think die on the way migrating to Europe through the “Backway”/illegal way? Out of every 10 Gambian migrants, how many people do you think obtain residence or refugee status in Europe? The answers to these questions represent the expected probabilities of dying en route and obtaining residence or asylum status. On average, respondents estimate at respectively 49% and 40% the probability of dying en route and of obtaining a permit. According to current estimates, the probability of dying is 20% while the probability of obtaining a permit is 33%, indicating that young on average overestimate the risk of dying en route while underestimating the probability of obtaining residence status.

Furthermore, we elicited time and risk preferences. Respondents were asked how much they are willing to invest in lottery with 50% chance of doubling their investment and 50% chance of losing half of the investment out of a D1000 hypothetical endowment. The percentage of the endowment they were willing to invest in the lottery is our proxy for risk preference. On average, respondents were willing to invest 38% of the D1000 endowment. Similarly, to elicit time preference, we asked respondents suppose that we won D100,000 in a lottery, and they could choose either to wait for one year to be paid the full amount, or pay to receive the amount immediately. Using this information, the discount factor can be calculated as one minus the fraction they are willing to pay to receive the money immediately. The average discount factor is 0.90. See the appendix for the exact framing of the risk and time preference.

Who are those young willing to migrate illegally and who are those young not willing to migrate? Table 2.2 provides brief summary statistics on these groups of people. Out of the 406 sampled young, 380 (91%) express willingness to migrate outside the country, while the remaining 63 have no intention to migrate. Though the data suggest that more than 90% of the respondents aspire to migrate outside the country, however, a fewer fraction (46%) are willing to migrate illegally. This raw statistic is consistent with Mbaye (2014). Aspiring illegal migrants are relatively younger, with an average age of 19.92 years compared to 20.28 years for those not willing to migrate illegally. Those that are willing to migrate have 8.46 years of education compared to 8.56 for those not willing to migrate illegally. In addition,

the former earn an average monthly income of GMD 1,517 compared to an average of GMD 2,130.21 for the latter. While the share of individuals with past migration experience is the same in both groups, (38%) potential illegal migrants have more migration experience in terms of number of months than those unwilling to migrate illegally (24.8 versus 21.6 months). In addition, both groups share the same fraction (82%) of having migration network, however, those willing to migrate illegally has larger average network of 3.01 persons versus 2.76 migrants for those not willing to migrate. Furthermore, potential illegal migrants know on average more people who successfully migrated illegally (11.6) compared to those not willing to migrate illegally (8.3). Comparing the number of people known by the two groups that lost their lives en route, we observe those who are not willing to migrate illegally know more people who lost their lives en route to Europe compared to potential illegal migrants (3.83 versus 3.67). The expected probability of dying en route for those willing to migrate averages 45% compared to 53% for non-potential illegal migrants. This implies that while both groups expect a higher probability of dying compared to the actual estimated probability (20%), however those willing to migrate expect lower risk of dying. Finally, potential illegal migrants expect a higher chance of obtaining residence status of 47% versus 33% for those not willing to migrate illegally. Finally, those willing to migrate illegally on average willing to invest 44% of their hypothetical endowment versus 32% for those not willing to migrate implying that they are less risk averse.

## 2.4 Econometric approach and main empirical results

### 2.4.1 Estimation strategy

In order to analyze how the probability of successfully reaching Italy and the probability of obtaining a legal residence permit affect migration related outcomes such as the willingness to migrate, the willingness to pay for migration, and the willingness to receive to forgo migrating, we can estimate the following model:

$$O_{ir} = \alpha + \beta_1 PD_{ir} + \beta_2 PP_{ir} + \delta_i + \theta_r + \epsilon_{ir} \quad (2.1)$$

TABLE 2.2: Summary Statistics: Statistical Differences

VARIABLES	Willing to migrate Illegally N=189		Not willing to migrate Illegally N=226		Test of Differences N=406
	Mean	SD	Mean	SD	P-Value
<b>Individual characteristics</b>					
Age	19.86	3.23	20.40	3.27	0.0875
Years of formal education (if any)	8.18	2.33	8.18	2.37	0.9929
Monthly income (GMD)	1516	3118	2130	3448	0.0827
Has migrated before [Yes =1, No=0]	0.38	0.48	0.38	0.48	0.9951
Duration of migration (in months)	24.77	29.89	21.56	17.56	0.3365
Has relatives or friends abroad (migration network) [Yes =1, No=0]	0.77	0.41	0.75	0.43	0.5658
No of migration network	2.17	1.44	2.00	1.13	0.3164
No of known successful migrants	11.69	12.94	8.52	11.64	0.0086
No of known dead migrants en route	3.77	4.91	4.55	3.57	0.1482
Expected probability of dying en route	0.43	0.24	0.53	0.25	0.0002
Expected probability of obtaining a permit	0.46	0.29	0.29	0.25	0.0000
<b>Household Characteristics</b>					
Household head age	52.81	15.73	50.31	14.78	0.1323
Household size	10.14	6.4	9.94	6.9	0.7518
Has internal migrants [Yes =1, No=0]	0.60	0.48	0.59	0.49	0.7307
Has international migrants [Yes =1, No=0]	0.70	0.45	0.60	0.49	0.0213
Received remittances [Yes =1, No=0]	0.36	0.48	0.31	0.46	0.3014

Source: Authors calculations on the survey data.

where  $O$  denotes our three outcomes of interest: willingness to migrate, to pay, and to forgo migrating.  $PD$  is the probability of dying en route an  $PP$  is probability of obtaining a permit.  $\delta_i$  is individual fixed effects and  $\theta_r$  is round fixed effects. Our estimates of interest are  $\beta_1$  and  $\beta_2$ .  $\beta_1$  gives us the effect of probability of success on the three outcomes. While  $\beta_2$  gives us the effect of probability of obtaining a residence permit on our outcome of interest. The advantage of our design is that due to the two variations of both within individuals and across individuals, we can include individual fixed effects which will allow us control for potential omitted variables.

## 2.4.2 Empirical Results

### Main Results: Willingness to Migrate Illegally

Table 3 below shows the regression results from the lab-in-the field experiment. Respondents were given different hypothetical information on the probability of dying

en route, the probability of obtaining residence permit and wages in destination country and given this hypothetical information, they made hypothetical decisions to migrate illegally or not. Thus, the dependent variable is whether individuals are willing to migrate illegally or not. We are interested in understanding how different factors affect the decisions to migrate illegally or not with special interest in the probabilities of dying en route and of obtaining asylum or residence permit.

We present results from a linear probability model with various specifications. Irrespective of the specifications, we observe that increasing the probability of dying en route reduces the probability of individuals' willingness to migrate. The coefficient is statistically significant at the 1% level. On the other hand, the chance of obtaining residence or asylum permit is positively correlated with the odds of migrating. This implies that potential migrants care about the likelihood of obtaining asylum status once they reach Europe. Columns (1) and (3) provide parsimonious correlations, while columns (2) and (4) estimate the model by including individual and round order fixed effects.

TABLE 2.3: Willingness to Migrate Illegally - Results from the Experiment

VARIABLES	(1) Migrate Illegally	(2) Migrate Illegally	(3) Migrate Illegally	(4) Migrate Illegally
Prob. of permit	0.1894*** (0.0240)	0.1301*** (0.0165)	0.4936*** (0.0445)	0.4181*** (0.0384)
Prob. of dying	-0.1561*** (0.0441)	-0.1175*** (0.0253)	-0.3545*** (0.0998)	-0.3789*** (0.0393)
Constant	0.3609*** (0.0244)	0.34991*** (0.0072)	0.4638*** (0.0427)	0.3951*** (0.0211)
Individual Fixed Effects	No	Yes	No	Yes
Round Order Fixed Effects	No	Yes	No	Yes
<i>N</i>	6478	6478	2259	2527
<i>n</i>	406	406	115	115
R-squared	0.0236	0.8200	0.1667	0.5462

Source: Authors calculations on the survey data.

Notes: Regressions estimated using a Linear Probability Model. Migrate illegally is a binary variable taking value 1 if the respondent is willing to migrate illegally and 0 otherwise. Prob. of permit is the hypothetical probability of obtaining a residence permit (or asylum status) in Italy. Prob. of dying is the hypothetical probability of dying en route to Italy. *N* represents the total number of observations and *n* is the total number of respondents. Each individual has a maximum of 16 observations. In columns (3) and (4), estimation is conducted by dropping those who are willing to migrate in all rounds (102) and those that are not willing to migrate in any round (189). Estimates obtained using a linear probability model. Standard errors in the parentheses, clustered at the individual level. \*Significant at 10%; \*\*significant at 5%; \*\*\*significant at 1%.



In column (1) of Table 2.3, the results show that a 1 percent increase in the probability of obtaining a residence permit increases the willingness to migrate by 0.19 pp highlighting that potential migrants care about the likelihood of obtaining residence permit once they reach Europe. Similarly, increasing the hypothetical mortality rate by 1 percent reduces the willingness to migrate illegally by 0.16pp. Once we control for both individual and round order fixed effects in column 2, the magnitude of effect reduces to 0.13 percent for the residence permit effect and 0.12 percent for the mortality effect. Note that this magnitude is very similar to the 0.15pp mortality effect estimated by Shrestha (2017a) in Nepal.

In columns (3) and (4) of Table 2.3, we restrict the sample by dropping respondents who do not to migrate and those who always migrate irrespective of the round. The resulting estimates double in magnitude. The coefficient on the legal permit increases to 0.42 pp, while the mortality effect also increases to 0.38 pp. The experimental setup allows us to evaluate changes in the willingness to migrate if potential migrants had accurate information about the chances of dying en route and obtaining residence permit. Table 2.4 presents results comparing the willingness to migrate of experimental subjects, when moving from their current expectations on migration risks to different probabilities of dying en route and of obtaining legal residence status. Column (1) of Table 2.4 shows that the expected 50 percent probability of dying en route and 50 percent probability of obtaining residence permit corresponds to 37 percent of all experimental subjects being willing to migrate, and 47 percent when including only the experimental subjects in the responsive sub-sample.

As is reported in column (1) of Table 2.4, we find that reducing the probability of dying to 0 percent increases the likelihood of migrating by 6.5 pp and increasing the increasing the probability of obtaining permit to 100 percent increases migration by 3.7 pp.

Recall that (based on the official numbers described above) the actual probability of dying en route is 20 percent and the probability of obtaining a legal residence permit is 30 percent. Our results suggest that knowing the probability of dying en route to be 20 percent instead of the average 50 percent expectation increases migration by 2.3 pp. Similarly, adjusting the probability of obtaining residence permit from 50 percent to 30 percent reduces migration by 2.9 pp. The difference between these

coefficients is statistically different at the 1% significance level.

Column (2) in Table 2.4 shows that the willingness to migrate of responsive experimental subjects is reduced by 9.4pp when moving from the 50 percent expected probability to the actual 30 percent probability of obtaining a permit. In the same way, we observe that the willingness to migrate increases by 7pp when the probability of dying en route changes from the expected probability of 50 percent to the 20 percent actual probability of dying en route. The difference between these coefficients is also statistically different.

TABLE 2.4: Willingness to Migrate Illegally - Results from the Experiment

VARIABLES	(1) Migrate Illegally	(2) Migrate Illegally
0% Prob. of permit	-0.0985*** (0.0139)	-0.3154*** (0.0370)
30% Prob. of permit	-0.0288** (0.0092)	-0.0935** (0.0292)
100% Prob. of permit	0.0370*** (0.0093)	0.1196*** (0.0276)
0% Prob. of dying	0.0648*** (0.0129)	0.2097*** (0.0368)
10% Prob. of dying	0.0353*** (0.0102)	0.1101*** (0.0322)
20% Prob. of dying	0.0229** (0.0115)	0.0709** (0.0300)
Constant	0.3745*** (0.0154)	0.4742*** (0.4742)
Individual Fixed Effects	Yes	Yes
Round Order Fixed Effects	Yes	Yes
<i>N</i>	6478	1835
<i>n</i>	406	115
R-squared	0.8219	0.8157

Source: Authors calculations on the survey data

Notes: Regressions estimated using a Linear Probability Model. Migrate illegally is a binary variable taking value 1 if the respondent is willing to migrate illegally and 0 otherwise. Prob. of permit is the hypothetical probability of obtaining a residence permit (or asylum status) in Italy. Prob. of dying is the hypothetical probability of dying en route to Italy. *N* represents the total number of observations and *n* is the total number of respondents. Each individual has a maximum of 16 observations. The omitted category corresponds to the average expected probabilities of dying en route (50%) and of obtaining a permit (50%). In column (2), estimation is conducted by dropping those who are willing to migrate in all rounds (102) and those that are not willing to migrate in any round (189). Standard errors in the parentheses, clustered at the individual level. \*Significant at 10%; \*\*significant at 5%; \*\*\*significant at 1%.

Table 2.5 describes predictors of the experimental subjects' responsiveness (in terms of migration decisions) to the information provided in the various rounds of

the lab experiment. Column (1) in Table 2.5 describes how individuals who choose to never migrate in any of the experimental rounds are less likely to know current emigrants, and more likely to know past migrants who died en route to Europe. They tend to have relatively low expectations regarding the probability of obtaining a residence permit and expect that the probability of dying en route is relatively high. They are substantially more risk averse than those individuals who migrate in at least some of the experimental rounds. Column (2) shows a different story for experimental subjects who responded to the varying information provided across the different experimental rounds: these responsive subjects know few past migrants who died in route to Europe, and had relatively high expectations regarding the probability of obtaining a legal residence permit. Finally, column (3) of Table 2.5 showed that subjects who do not respond to the information provided in the different experimental rounds because they always chose to migrate tend to have a relatively low expectation about the probability of dying en route.

TABLE 2.5: Predictors of Experimental Subjects' Responsiveness to Information Provided in the Lab Experiment

VARIABLES	(1) Never Migrate	(2) Migrate Sometimes	Migrate Always
No of known migrants	-0.0064*** (0.0016)	0.0030 (0.0024)	0.0034 (0.0023)
No of known dead migrants	0.0107* (0.0054)	-0.0179*** (0.0039)	0.0073 (0.0057)
Expected permit	-0.0490*** (0.0079)	0.0495*** (0.0088)	-0.0005 (0.0081)
Expected dead	0.0252** (0.0095)	-0.0065 (0.0092)	-0.0187* (0.0083)
Risk preference	-0.2848*** (0.0816)	0.1781* (0.0813)	0.1067 (0.0737)
Constant	0.5120*** (0.1449)	0.0555 (0.1356)	0.4325** (0.1447)
<i>N</i>	359	359	359
R-squared	0.2032	0.1595	0.0510

Source: Authors calculations on the survey data

Notes: Regressions estimated using a Linear Probability Model. Never migrate is binary variable taking value 1 if respondent is not willing to migrate in all rounds and 0 otherwise. Migrate sometimes is binary variable taking value 1 if respondent expressed willingness to migrate in some rounds and 0 otherwise. Migrate always is binary variable taking value 1 if respondent is willing to migrate in all rounds and 0 otherwise. No of known migrants is the number of known migrants who migrated, no of known dead migrants is the number of known "backway" migrants who died en route to Italy. Expected permit is the expected probability of obtaining a residence/asylum permit. Expected dead is the expected probability of dying en route to Italy. Risk preference is measured as willingness to take a gamble (see appendix for the precise question). Robust standard errors in the parentheses. \*Significant at 10%; \*\*significant at 5%; \*\*\*significant at 1%.

**Heterogeneous effects: expectations**

One alternative interpretation of the migration choices made by potential migrants in our lab experiment is that they do not necessarily reflect migration decisions, and they can instead simply translate the experimental subjects' preferences for risky behavior. The implication would be that lab decisions would perhaps be similar if framed in a different context, such as tobacco use or gambling. In this section, we examine the robustness of our main empirical findings by presenting how experimental migration decisions vary with expectations about the probability of dying during the illegal migration journey, as well as expectations about the probability of acquiring legal status after successful arrival to Europe. These results show how these migration-related expectations are significantly linked to the experimental migration decisions made.

Results in Table 2.6 and 2.7 illustrate how, in addition to the expected effects of the probabilities of dying en route and of obtaining a legal residence permit, over-estimation of both of these probabilities also gives rise to the expected effects: over-estimating the probability of obtaining a legal permit after arrival in Europe has a positive significant effect on the probability of migration, whereas overestimating the probability of dying en route to Europe has a significant negative effect on the decisions to migrate.

Panel 2 of Table 2.6 further shows that for those who overestimate the probability of obtaining a legal permit, the impact of additional increases in the probability of a permit will have a positive significant effect, but lower than the impact on those who underestimate this probability. In this same instance where subjects overestimate the probability of a permit, an increase in the probability of dying en route seems to have a negative effects, but this cannot be statistically distinguished from the effect of this probability on those who underestimate the probability of obtaining a permit.

Similarly, in Table 2.7, we observe that for those overestimating the probability of dying en route, the marginal effects of increased probabilities of obtaining a permit and of dying en route have the expected signs but cannot be distinguished from the effect of those probabilities on the subjects who underestimate the probability of dying.

TABLE 2.6: Heterogeneous Effects Based on Expected Permit

VARIABLES	(1) Migrate Illegally	(2) Migrate Illegally
Prob. of permit	0.1172*** (0.0237)	0.0890*** (0.0182)
Prob. of dying	-0.1055*** (0.0364)	-0.0708*** (0.0221)
Overestimate prob. of permit	0.1425*** (0.0451)	
Overestimate prob. of permit $\times$ Prob. of permit	0.0774** (0.0360)	0.0883*** (0.0305)
Overestimate prob. of permit $\times$ Prob. of dying	-0.0734 (0.0582)	-0.1027** (0.0412)
Constant	0.2972*** (0.0305)	0.3722*** (0.0068)
Individual Fixed Effects	No	Yes
Round Order Fixed Effects	No	Yes
<i>N</i>	6478	6478
<i>n</i>	406	406
R-squared	0.0262	0.8237

Source: Authors calculations on the survey data

Notes: Regressions estimated using a Linear Probability Model. Migrate illegally is a binary variable taking value 1 if the respondent is willing to migrate illegally and 0 otherwise. Prob. of permit is the hypothetical probability of obtaining a residence permit (or asylum status) in Italy. Prob. of dying is the hypothetical probability of dying en route to Italy. Overestimate probability of permit corresponds to subjects with an expectation above the actual probability of obtaining a legal residence permit (30 percent). Standard errors in parentheses, clustered at the individual level. \*Significant at 10%; \*\*significant at 5%; \*\*\*significant at 1%.

### Are experimental subjects behaving rationally?

A final check on the robustness of our findings is to evaluate whether experimental decisions to migrate are rational in the sense of net income maximizing.

According to the neoclassical theory of migration initially put forward by Sjaastad (1962), the decision to migrate is governed by utility maximization based on expected net income flows. Individuals migrate if their expected net income from migration is positive. Using our experimental setup, we can compute the expected net income of migrating illegally. Our experimental set up assumes that individuals face two types of wages; 1000 euros of monthly wage for those who have a legal residence permit, and 500 euros for those without permit. To compute the expected benefit of migrating, for each round, we employed the respective probabilities of dying and chances of obtaining permit applied in each round. Similarly, we compute the expected benefit of staying in Gambia. We assume that individuals who chose to

TABLE 2.7: Heterogeneous Effects Based on Expected Dead

VARIABLES	(1) Migrate Illegally	(2) Migrate Illegally
Prob. of permit	0.1296*** (0.0376)	0.0980*** (0.0273)
Prob. of dying	-0.1288* (0.0656)	-0.1382** (0.0544)
Overestimate prob. of dying	-0.1330** (0.0598)	
Overestimate prob. of dying × Prob. of permit	0.0343 (0.0427)	0.0414 (0.0325)
Overestimate prob. of dying × Prob. of dying	-0.0110 (0.0730)	0.0232 (0.0585)
Constant	0.4718*** (0.0544)	0.3724*** (0.0067)
Individual Fixed Effects	No	Yes
Round Order Fixed Effects	No	Yes
<i>N</i>	6478	6478
<i>n</i>	406	406
R-squared	0.0452	0.8225

Source: Authors calculations on the survey data

Notes: Regressions estimated using a Linear Probability Model. Migrate illegally is a binary variable taking value 1 if the respondent is willing to migrate illegally and 0 otherwise. Prob. of permit is the hypothetical probability of obtaining a residence permit (or asylum status) in Italy. Prob. of dying is the hypothetical probability of dying en route to Italy. Overestimate probability of dying corresponds to subjects with an expectation above the actual probability of dying en route (20 percent). Standard errors in parentheses, clustered at the individual level. \*Significant at 10%; \*\*significant at 5%; \*\*\*significant at 1%.

stay in the country are faced with the existing labor market outcomes and earn their reported salary or the average national monthly salary of those who live in rural Gambia. Since those who stay within the country are also faced with a non-trivial risk of dying (0.35 percent, Gambia Bureau of Statistics (2013)), though negligible compared to the risk of dying en route, we employed this fatality rate to compute the benefit of staying put. Additionally, for computational purposes, we assume the cost of migration to be 2000 euros, the gain from dying en route or dying in the country corresponds to zero payoff, and the migration period lasts for 10 years. Finally, for discounting purpose, we utilized the average lending rate of 22.63% published by the central bank at the time of the survey (May 2017).

The computation exercise yields an average net present gain of migration of 29,311 euros if we assume the reported monthly salary of our respondents; 29,185 euros assuming the average monthly salary of GMD 2000; and 28,027 euros when we

utilize the national monthly average of GMD.

How does this affect experimental subjects' decisions to migrate illegally? In other words, are respondents behaving rationally, i.e., are respondents choosing to migrate when the net gain of migrating is positive? The descriptive results suggest that the respondents are indeed behaving rationally, in that all the 38 cases with negative net gain of migrating, only one case responded willing to migrate illegally (2 percent). When we analyze the cases in which the expected net gain of migration was positive, we observe a 41 percent rate of willingness to migrate illegally. Table 2.8 below shows the impact of the net gain of migration on the willingness to migrate. Depending on our assumption on computing the benefit of staying in the country, we observe for every 1 percent increase in the expected net gain of migration, an increase in the willingness to migrate of about 11 percent. It is worth highlighting that our assumption of zero payoff for the dead outcome renders our estimated net gain of migration as an upper bound.

TABLE 2.8: Willingness to Migrate Illegally and Expected Net Gain of Migration

VARIABLES	(1) Migrate Illegally	(2) Migrate Illegally	(3) Migrate Illegally
ln(NPV1)	0.1130*** (0.0160)		
ln(NPV2)		0.1144*** (0.0125)	
ln(NPV3)			0.1083*** (0.0118)
Constant	-0.7366*** (0.1643)	-0.7728*** (0.1282)	-0.7050*** (0.1209)
Individual Fixed Effects	Yes	Yes	Yes
Round Order Fixed Effects	Yes	Yes	Yes
<i>N</i>	4421	6478	6478
<i>n</i>	248	406	406
R-squared	0.8219	0.8157	0.8215

Source: Authors calculations on the survey data

Notes: Regressions estimated using a Linear Probability Model. Migrate illegally is a binary variable taking value 1 if the respondent is willing to migrate illegally and 0 otherwise. NPV1 is estimated using the individual reported monthly wage, NPV2 is done with the average monthly wage of GMD 2000, and NPV3 uses the national average monthly wage rate of GMD 3000. Standard errors in parentheses, clustered at the individual level. \*Significant at 10%; \*\*significant at 5%; \*\*\*significant at 1%.

### **2.4.3 Willingness to pay to migrate and willingness to receive to forgo migration**

As a final robustness check, we examine how the probabilities of dying en route and of obtaining a legal permit to stay in Europe affect the willingness to pay for illegal migration (through smugglers) and the willingness to receive a payment to forgo migrating illegally. Recall that in the experiment, subjects were hypothetically endowed with D 100,000 of which they can choose how much they are willing to pay in order to finance migration costs. The measures we use are obtained through this hypothetical, non-incentivized, experiment.

Column (1) of Table 2.9 describes how the risk of dying en route and the chances of obtaining a residence permit affect the willingness to pay for illegal migration costs and the opportunity cost of migrating. These results show that the hypothetical probabilities of dying en route have negative but insignificant effects on the willingness to pay for migration cost. However, the probability of obtaining a residence permit has a positive and significant effect on the amount potential migrants are willing to pay for the migration cost. A one percent increase in the chance of obtaining a permit increases the willingness to pay for migration by 5.6 pp. Furthermore, in column (2) of Table 2.9, we observe that both the risk of dying and chances of obtaining residence permit affect the opportunity cost of migrating. The elasticities suggest that for every one percent increase in the risk of dying, willingness to receive in order to forgo migration reduces by 9 pp. Similarly, respondents are willing to accept to 6 percent more for every one percent increase in the chances of obtaining residence permit.

### **2.4.4 Do lab migration decisions reflect actual migration decisions?**

An alternative interpretation of the migration choices made by experimental subjects in our lab experiment is that they may not translate into actual migration decisions. To check the robustness of our findings relative to this concern, we collected follow-up data via telephone calls. As is described in Table 2.10, the research team managed to re-contact 263 out of the initial 406 experimental subjects that participated in the



TABLE 2.9: Regression Results from Experiment - Willingness to Pay and Receive

VARIABLES	(1) log(Willingness to Pay)	(2) log(Forgo Migration)
Probability of obtaining a residence permit	0.0566** (0.0388)	0.0627* (0.0354)
Probability of dying en route	-0.0001 (0.0559)	-0.0903* (0.0517)
Constant	10.7625*** (0.0148)	9.5828*** (0.0154)
Individual Fixed Effects	Yes	Yes
Round Order Fixed Effects	Yes	Yes
<i>N</i>	2,733	2,731
<i>n</i>	205	205
R-squared	0.7352	0.9330

Source: Authors calculations on the survey data

Notes: Regressions estimated using OLS. Willingness to pay for migration is the hypothetical amount (in GMD) respondents are willing to pay for the cost of migrating illegally. Compensation to forgo migration is the amount (in GMD) per month respondents are willing to accept in order to forgo migrating illegally. *N* represents the total number of observations and *n* is the total number of respondents. Each individual has a maximum of 16 observations. Standard errors in the parentheses, clustered at the individual level. \*Significant at 10%; \*\*significant at 5%; \*\*\*significant at 1%.

lab experiment. This large attrition rate may mask the occurrence of more international migration than we could measure in the follow-up survey, as it is particularly difficult to track illegal migrants to Europe, even though the research team tried to contact these experimental subjects via social media, in addition to telephone contacts.

Of those we could re-interview, 22% had actually migrated, although only 3% had migrated internationally – and mostly to Senegal. In terms of intentions to migrate, 77% of re-interviewed experimental subjects intended to migrate in the future, although only 33% in the following year, and also 33% expressed an intention to emigrate illegally.

The actual decisions and intentions to migrate correlate very significantly with the experimental migration decisions, although the magnitude of this correlation is small. As displayed in Table 2.11, reporting experimentally to migrate is associated with an increase by 1.75pp in the probability of actual migration, and with an increase of 10.8pp in the intention to migrate illegally.

TABLE 2.10: Descriptive Statistics from Follow-up Survey

VARIABLES	N	Mean	SD	Min	Max
Migrated	263	0.2243	0.4179	0	1
Migrated internally	263	0.1901	0.4007	0	1
Migrated internationally	263	0.0304	0.2016	0	1
Migrated to Senegal	263	0.0342	0.1910	0	1
Intent to migrate	248	0.7661	0.4241	0	1
Intent to migrate next year	248	0.3266	0.4699	0	1
Intent to migrate illegally	248	0.3306	0.4718	0	1

Source: Follow-up survey and own calculations.

Notes: Migrated is a binary variable taking value 1 if the respondent migrated and 0 otherwise. Migrated internally takes value 1 if respondent migrated within the country and 0 otherwise. Migrated internationally takes value 1 if the respondent migrated outside the country and 0 otherwise. Intent to migrate takes value 1 if the respondent is willing to migrate.

TABLE 2.11: Lab Willingness to Migrate Illegally and Follow-up Actual Migration Decisions and Intentions

	(1) Migrated internationally	(2) Intent to migrate	(3) Intent to Migrate next year	(4) Intent to migrate illegally
Lab Willingness to Migrate	0.0213*** (0.0073)	0.0392*** (0.0136)	0.0704*** (0.0154)	0.1071*** (0.0155)
Constant	0.0336** (0.0144)	0.7550*** (0.0275)	0.3010*** (0.0306)	0.2913*** (0.0309)
Round order fixed effects	Yes	Yes	Yes	Yes
<i>N</i>	3356	3912	3912	3912
<i>n</i>	243	243	243	243
<i>R</i> <sup>2</sup>	0.003	0.002	0.005	0.012

Source: Authors calculations on the follow-up survey data

Notes: Regressions estimated using a Linear Probability Model. Lab willingness to migrate is binary variable taking value 1 if respondent is willing to migrate illegally in the lab-in-the-field experiment, and 0 otherwise. *N* represents total number of observations and *n* is the total number of respondents. Each individual has maximum of 16 observations. Standard errors in the parentheses, clustered at the individual level. \*Significant at 10%; \*\*significant at 5%; \*\*\*significant at 1%.

## 2.5 Conclusion

This study aims at improving our understanding of the determinants of the willingness to migrate illegally from West Africa to Europe. To this end, we implemented an incentivized lab-in-the field experiment using a sample of 406 households in rural Gambia, a country with the largest intensity (as percent of population) of illegal migration to Europe. In the incentivized experiment, subjects faced scenarios with differing probabilities of successfully reaching Europe, and of obtaining asylum or other residence status that will allow them to travel and work legally upon arrival.

In each scenario, respondents made choices on whether to migrate illegally, on their willingness to pay for migration, and on the amount, they were willing to accept in order to forgo migrating.

Our results suggest that potential migrants overestimate the risk of dying en route to Europe, and the probability of obtaining legal residency status. Moreover, on average, we found evidence of youth willing to reject a substantial amount of money per month than forgo migrating illegally. Our findings suggest that the willingness to migrate illegally is not only driven by the risk of dying en route, but also by the chances of obtaining asylum or a legal residence permit. Additional evidence also shows that prior expectations may act as important determinants of the willingness to migrate illegally. Overall, our study suggests that the migration decisions of potential migrants actively respond to information about relevant facts regarding costs and benefits of migration.

## 2.A Appendix

### 2.A.1 Flows of Illegal Migrants into Europe

FIGURE 2.1: Total Flow of Migrants Crossing the Central Mediterranean Route (2009-2017)

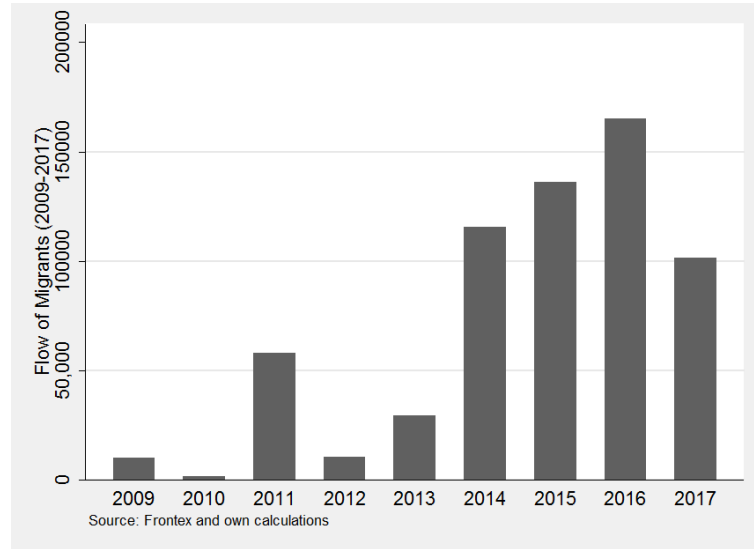
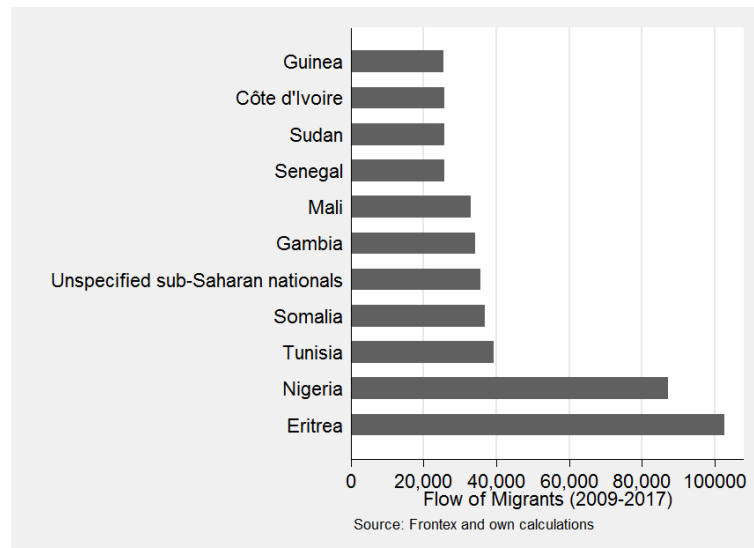


FIGURE 2.2: Total Flow of Migrants Crossing the Central Mediterranean Route by Top 10 countries of origin (2009-2017)



### 2.A.2 Lab-in-the-Field Experiment Framing

Imagine that you have/given 100,000 Gambian Dalasis. You can decide what to do with the money. You can either keep it or use it migrate to Europe through the “Backway”. Now I will give you 16 different scenarios, and for each scenario, you

FIGURE 2.3: Total Flow of Migrants as a Percentage of Origin Population Crossing the Central Mediterranean Route in 2017 by Top 10 countries of origin

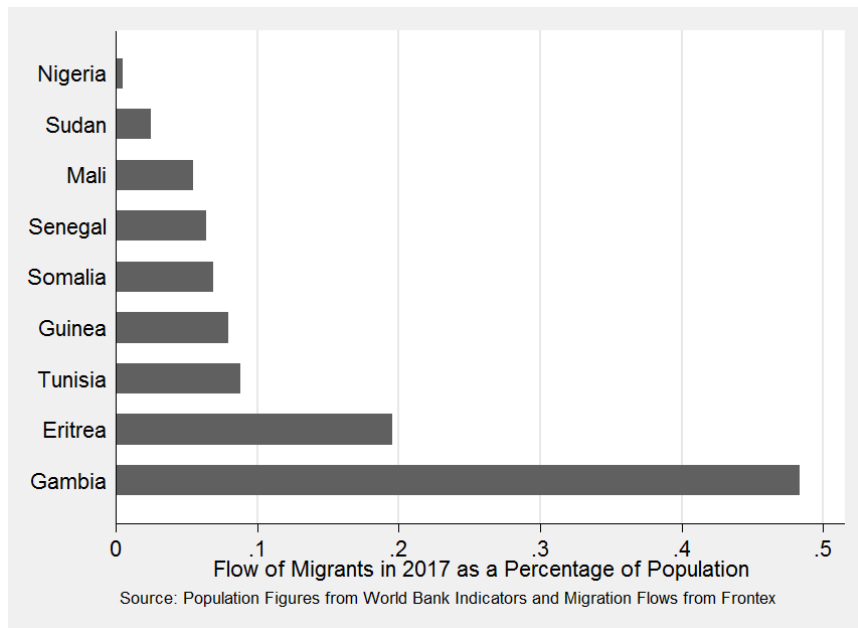
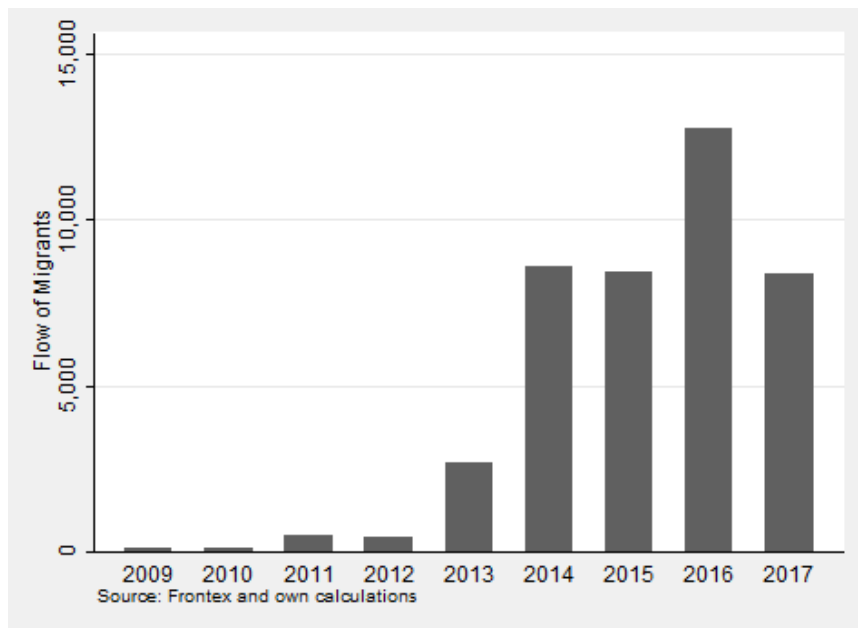
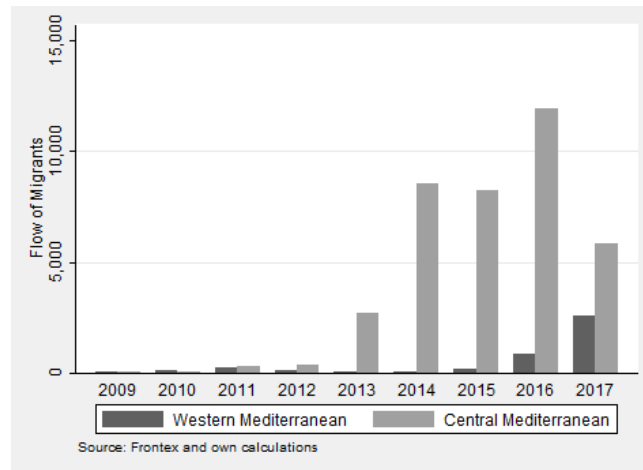


FIGURE 2.4: Total Flow of Gambian Migrants Crossing the Central Mediterranean and Western Mediterranean Routes (2009-2017)



will decide whether you will migrate or not, how much you are willing to pay for migration cost, and how much you are willing to accept in order to stop migrating. In this game, depending on what you choose to do, you stand the chance to win real money at the end of the game.

FIGURE 2.5: Total Flow of Gambian Migrants by Routes (2009-2017)



For every 20000 Euros (D1,000,000) you win, we will pay you 1-real euro (D50). You have the opportunity to win a minimum of D5 up to a maximum of D300.

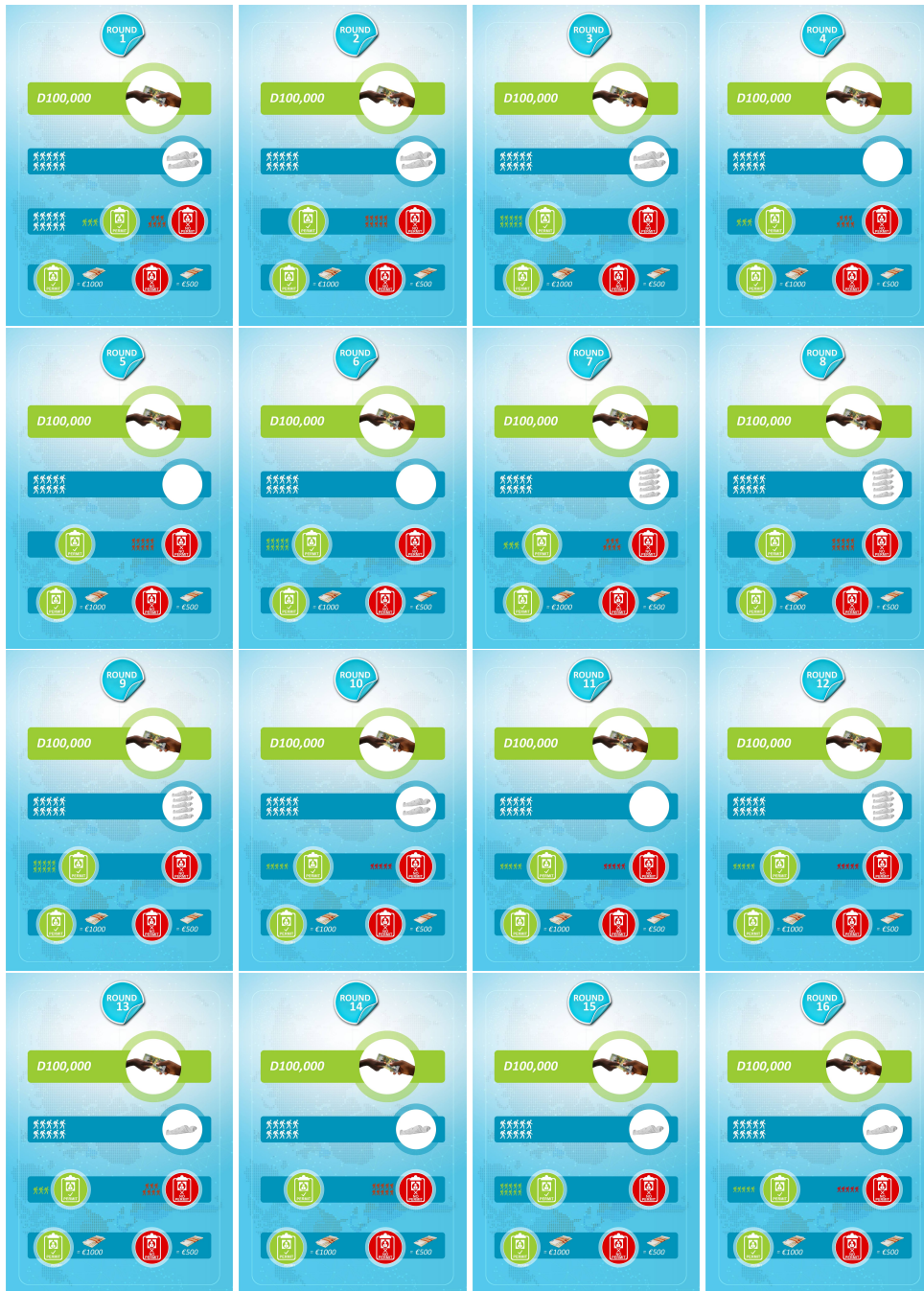
For example, people who choose not to migrate can keep the gift of D100,000 which is equivalent to a payoff of D5. While those who choose to migrate can either win D0 if they die along the way, D150 if they reach but do not obtain a permit/asylum. And finally those who migrate and obtain a permit wins D300.

Before playing the game, as you may know, migration to Europe while profitable can also be risky. The rules of the game are as follows: If you choose to migrate, you can either successfully reach to Europe or you will die along the way. This depends on the chances we will be providing. All those who successfully reach in Europe, some will have residence permit/asylum papers, while others will not. Those who obtain the permit have the opportunity to earn more money compared to those who do not. Moreover, the people who obtain the permit will also have the opportunity to come visit their family back in Africa.

At the end of the game, we will randomly choose one scenario from the sixteen scenarios to pay you. The case that we choose will determine how much you will earn; therefore we advise that you take each decision equally seriously. We will play the chances of dying en route and the chances of obtaining a residence permit for that chosen round.

2.A.3 Show Cards

FIGURE 2.6: Show Cards







## Chapter 3

# Polygamy, Sibling Rivalry and Migration

### Abstract<sup>1</sup>

This paper examines the relationship between polygamous family structure and international migration. We use data from a rich representative household survey and population censuses from Mali, a country with a long history of international migration and a high polygamy rate to estimate the impact of the polygynous status of mothers on their children migration decisions. We find a positive and statistical significant effect of polygyny status of mothers on children migration decisions. We provide additional evidence supporting the idea that the effect is due to sibling rivalry: having migrant siblings increases the likelihood of migrating. Our evidence suggests that co-wives' rivalry as documented elsewhere trickles down to children rivalry in migration. Our overall results suggest that, in addition to economic reasons, international migration is also driven by social reasons.

**Keywords:** Polygamy; Sibling rivalry; International migration; Mali.

**JEL Codes:** F22, J12, J13, O15, O55.

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### 3.1 Introduction

The last decade has witnessed a growing flow of human mobility both internally and internationally. The estimated number of international migrants reached 244 million (United Nations, 2016) and stock of internal migrants are estimated at 780 million people (UNDP, 2009). The increase in human mobility has led a greater interest in especially why people migrate. The macro evidence determinants of international migration flows<sup>2</sup> include income per capita (Ortega and Peri, 2009), wage differentials (Grogger and Hanson, 2011), geographic distance (Mayda, 2010), cultural distance (White and Buehler, 2018), diasporas or migration networks (Beine et al., 2011), and immigration policy (Ortega and Peri, 2013). At the micro (individual or household) level, the drivers of migration include earning differentials (Kennan and Walker, 2011; Bertoli et al., 2013), expected remittances (Chort and Senne, 2015; Chort and Senne, 2018), risk and patience preferences (Gibson and McKenzie, 2009), and sibling migration (Stöhr, 2015).

While the previous contributions highlighted the role of the family in the migration decision, little do we know about the implications of the family structure itself on individuals' migration decisions. In many Sub-Saharan African countries, polygyny<sup>3</sup> is widely practiced even though it has declined overtime. According to some recent estimates, about 25 percent of married women are in polygynous unions in the whole region (Arthi and Fenske, 2018). Indeed, polygamy is associated with low savings and economic growth (Tertilt, 2005), and low fertility rates of women in polygynous marriages (Rossi, 2018) but an increase in aggregate fertility (Cahu et al., 2014).

This paper aims at understanding how family structure, polygamy in particular, affects the migration decisions of children raised in such settings. In particular, we aim at answering the following questions: (1) Are children from polygynous households more likely to migrate? and (2) Is the underlining mechanism due to sibling rivalry transmitted from co-wives' rivalry? Answering these two questions is not an

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<sup>2</sup>See Beine et al. (2016) for a recent review of evidence.

<sup>3</sup>The term refers to marriage with one husband and multiple wives. In this paper, we use polygyny and polygamy (marriage practice with more than one wife (polygyny) or more than one husband (polyandry)) interchangeably as polygyny is the one practiced in our setting.

easy task. In addition to the usual identification problem, such investigation is extremely demanding in terms of data as we need to observe both the entire household migration history and the detailed structure of the family including the biological links between household members. Mali provides an ideal context to study these questions as it is characterized with a long history of international migration and a high polygamy rate: 35 percent of mothers in our sample are in polygynous unions. In this paper, we use data from the 2016 EMOP survey ("*Enquête Modulaire et Permanente auprès des Ménages*") conducted on a large sample of Malian households, that we combine with the 1987 and 2009 Malian population censuses. In this edition of the EMOP survey, great care was put on the identification of blood ties and marital relationships between household members, and all male adults were asked about their marital trajectory, so that men in a polygamous union can easily be identified even if all their spouses are non-coresiding. To overcome the identification problem due to the endogeneity of the relationship between polygamy and migration, we instrument the polygynous status of mothers with historical polygamy rates at the sub-district level. We also instrument having a migrant sibling with the share of male siblings to identify the causal effect of sibling rivalry.

We find a positive relationship between the polygyny status of mothers and children migration decisions. Additionally, we provide suggestive evidence supporting the idea that the effect is due to sibling rivalry: having migrant siblings (either full or half) increases the likelihood of migrating. Our evidence suggests that co-wives' rivalry as documented in the anthropological and economic literature trickles down to children rivalry in migration. The results suggest that, in addition to economic reasons documented in the migration literature, international migration is also driven by social reasons.

The rest of the chapter is structured as follows. Section 2 provides an overview of the related literature. Section 3 describes the data. Section 4 presents our empirical framework and identification strategy. Section 5 provides the results. Section 6 summarizes and concludes.

## 3.2 Related Literature

This work is mainly related to the microeconomic literature that focuses on the determinants of migration. The classical economic theory of migration explains migration as a human capital investment decision. Individuals choose to migrate or not by comparing the expected costs and benefits of moving (Sjaastad, 1962). This early theory of migration has been followed by the New Economics of Labor Migration (NELM) pioneered by Stark and Bloom (1985). By contrast to the standard classical model which considers migration as the result of an individual decision, the NELM regards migration as a family decision taken in order to minimize risks and overcome either temporary or more permanent liquidity constraints. Migration in this setting is expected to result in remittances that will allow subsequent increase in consumption, health, business investment and educational outcomes among recipient households (Edwards and Ureta, 2003; Amuedo-Dorantes and Pozo, 2006; Hildebrandt and McKenzie, 2005; Yang, 2008).

While the NELM literature stresses the important role of the family in migration decisions, little is known about how the family structure itself affects individuals' migration decisions. Exceptions include Bratti et al. (2016), Stöhr (2015) and Chort and Senne (2015) and Chort and Senne (2018). Bratti et al. (2016) study the impact of family size and sibling rivalry on migration from Mexico to the United States. Using the ENADID dataset, a representative survey conducted in Mexico, they study the impact of sibling size, birth order and sibling composition on migration decisions. While they find no statistically significant effect of having more siblings on individuals' migration decisions, their results suggest that migration is not uniformly distributed among siblings, with older siblings being more likely to migrate (especially firstborn males), and having older brothers relative to sisters reducing the likelihood of migrating. Stöhr (2015) study the interaction of siblings' migration decision in Moldova, a country where children are expected to provide care and financial support to their elderly parents. According to the author, two opposing effects may arise from this interaction. On the one hand, migrant family members can support each other abroad and hence make migration more profitable, increasing the likelihood that other siblings migrate as well. On the other hand, with more family members

migrating, the marginal utility of staying and providing care to the elderly increases. The results suggest that within the Moldavian context, the migration of siblings actually reduces individuals' migration propensities, suggesting that the need to stay at home to provide care to the elderly outweighs the network benefit that is due to having siblings abroad. Last, Chort and Senne (2015) and Chort and Senne (2018) focus on the selection process of migrants within their origin household using data on Senegal. They find that households are more likely to select into migration members with the highest remittances potential, which translates into individuals with koranic schooling or being the eldest child or sibling of the household head being more likely to migrate.

While some of the above studies highlight the impact of family size on migration, none to our knowledge has ever assessed the implications of a polygynous family structure on migration outcomes. There exists however a literature offering some insights on the causes and consequences of polygyny. On the causes, variables explaining polygyny include distorted sex ratios (Becker, 1974), income inequality (Grossbard-Shechtman, 1978), female agricultural productivity (Jacoby, 1995), the slave trade (Dalton and Leung, 2014; Edlund and Ku, 2011), son preference (Milazzo, 2014), and colonial education (Fenske, 2015).

Regarding impact, the literature is composed of both macroeconomic and microeconomic analyses. On the macro side, several authors have investigated the interaction between marriage systems and economic growth (Edlund and Lagerlof, 2004; Gould et al., 2008; Lagerlöf, 2005; Tertilt, 2005). According to this literature, polygamy may hurt growth by reducing either human capital accumulation, as in Edlund and Lagerlof (2004), or physical human accumulation (Tertilt, 2005).

On the micro side, the evidence suggests that polygyny may have impact on household efficiency, savings and fertility decisions. Similar to monogamous households, polygamous households are inefficient in intra household allocation (Akresh et al., 2012; Dauphin, 2013). Laiglesia and Morrisson (2008) and Boltz and Chort (2016) show that polygyny affects households' and wives' saving behavior and Cudville et al. (2017) show that polygyny affects female labour force participation. Laiglesia and Morrisson (2008) provide descriptive evidence showing that polygynous households have lower savings or asset holdings in Ghana, Côte d'Ivoire,

and Indonesia. They argued that this is due to spending in bride price that divert savings in other assets and high dependency ratio that lower disposable income and thus savings. Boltz and Chort (2016) test another channel for the impact of polygamy on saving decisions based on the strategic behaviors of monogamous wives “at risk” of polygamy in Senegal. Using original individual panel data from a nationally representative survey, they first predict the risk of transiting into a polygamous union for individuals in a monogamous union. They then assess the impact of the predicted risk of polygamy on wives’ savings. Their results suggest that a higher risk of polygamy has a positive impact on both wives’ stock of savings, especially formal savings, and on their probability to save. Last, Cudeville et al. (2017) estimate the impact of being in a polygynous union on labor force participation of women in Senegal. They instrument polygynous status of women with district level polygamy rates and show a positive impact of polygynous status of women on labor force participation. They propose two explanations for this effect. They argue that higher labor force participation of polygynous women is a strategic choice to increase autonomy and secondly, women in polygynous union benefit from domestic labor sharing.

The impact of polygyny on fertility has been well documented especially in the demographic literature. The empirical evidence suggests a negative relationship between polygyny and fertility of women at the individual level (Garenne and Walle, 1989; Pebley and Mbugua, 1989) but a positive one at the aggregate level (Cahu et al., 2014). The main reason for the low fertility of polygynous women as highlighted by the literature is due to low frequency of intercourse as wives have to rotate bed time (Anderton and Emigh, 1989), overrepresentation of childless women (Timæus and Reynar, 1998), increased age gaps between spouses especially for late unions which lead to a growth of infertile unions (Garenne and Walle, 1989), and “favoritism” arising from unequal rotation of bed time (Lardoux and Walle, 2003). The positive aggregate effect of polygamy on fertility as pointed by Cahu et al. (2014) is due to an increase in the number of marriages, and the contagious aspect of fertility: women who live in polygynous neighborhoods have been found to have a higher fertility, irrespective of their polygynous status.

Furthermore, the literature offers interesting contributions on the interaction of

wives in polygynous family structures. Qualitative evidence suggests co-wives' conflict and reproductive rivalry (Jankowiak et al., 2005; Bove et al., 2014) which is also associated with higher child mortality rates (Strassmann, 1997; Kazianga and Klöner, 2006). The contribution of Rossi (2018) offers the first quantitative evidence that the competition between co-wives drives fertility upwards in Senegal. Theoretically, the author highlights different mechanisms that explain how polygamy may affect fertility: competition effect between co-wives, substitution effect from the husband side as he cares about the total number of children; and natural effect due to less frequent intercourse and hence longer birth spacing. While these mechanisms have some opposite effects, the empirical evidence suggests that the overall effect of polygamy is a reduction in fertility, even though co-wife reproductive rivalry is a strong upward force, meaning that the natural effect outweighs the competition effect. Additionally, the author provides evidence on interesting strategic responses between co-wives: first, second wives shorten their birth spacing when they face a more fertile co-wife; second, wives respond to the gender composition of their children and co-wives' children. The higher the incentive (as measured by husbands' wealth), the more pronounced these strategic responses.

### **3.3 Country Context: Mali**

Mali is a landlocked country with an estimated population of 18 million people. The country is classified as a poor country with a GDP per capita of \$2,200 in 2017 and a low human development index, positioning it at 182 out of 188 countries (UNDP, 2018). Economic growth resulting from good results in the secondary and service sectors was estimated at 5.4 percent in 2017, while growth in the primary sector deteriorated due to decreased rainfall (World Bank, 2019).

The 2012 military coup combined with the occupation of the Northern regions by armed groups led to political instability in the country. In 2013, upon the request by the government, France intervened militarily and in 2015, a peace agreement was signed between the government and the Tuareg separatists. The 2012 instability led to an internal displacement of more than 300,000 people and more than 185,000 fled to neighboring countries as refugees (IOM, 2013).

Mali has a long history of international migration and serves as transit point for many migrants, especially Sub-Saharan Africans. The current population of its diaspora is debatable with estimates greatly varying between sources. According to United Nations (2017) and Migration, DRC (2007), the number of number of emigrants in year 2000 are estimated at 722,660 and 1,578,695 respectively. More than half of Malian migrants reside in Côte d'Ivoire and Nigeria, while about 10 percent reside in the European Union (Urso, 2017).

Like many Sub-Saharan African countries, polygamy is legal and widely practiced in the country. The 2011 family code recognizes religious and civil marriages. The civil marriage law allows couples to decide between polygamy and monogamy (Dissa, 2016). About 35 percent of married women in our sample are in polygynous unions with the majority (28 percent) having one co-wife. The typical polygamous household structure is composed of a male household head, his wives, his children and his grandchildren. Note that co-wives sometimes reside in different households.

### 3.4 Data and Descriptive Statistics

The main source of data used in this study comes from the 2016 EMOP survey ("*Enquête Modulaire et Permanente auprès des Ménages*"). The EMOP survey is a nationally representative survey conducted in four waves on an annual basis by the Malian National Statistics Office (NSO). It general covers a large sample of households from all the regions of the country, except when security reasons prevent the NSO from doing so as in the Kidal region in the latest editions. While the questionnaires remains roughly the same from one year to another, the 2016 edition has added modules that have been designed with the technical support of some researchers from DIAL.<sup>4</sup> They were included in order to provide a comprehensive description of households' structure and to collect detailed information on both the marital history of all adults and the complete birth history of all married women. A total of 6,132 households were surveyed in this edition. The EMOP data set is thus rich, with demographic

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<sup>4</sup>These modules have been added in order to feed the POLECOMI research project coordinated by Sandrine Mesplé-Soms and Lisa Chauvet funded by ANR (Grant agreement ANR-11-BSH1-0012) and the European Union under the 7th Research Framework Programme (Grant agreement 290752). One of the objectives of this project is to assess the impact of migration on fertility and gender norms.



information of all household members (be they residents or migrants) and their migration history. Given the complexity of family structure in Mali, establishing family links between all household members and filiations in particular is challenging. However, the survey contains several questions of interest that allow us to identify the descendants and relatives in the ascending line of all resident individuals, provided they reside in the household (“Is your mother/father alive?”, “If yes and if she/he lives in the household, give her/his name”). The survey questionnaire also contains a module on the fertility history of all married women aged 15 and above. This gives us the unique opportunity to know the total number of descendants of all women, be they alive or not, and living in the household or not. Moreover, this fertility rooster is very useful for identifying the biological parents of household members who were in migration at the time of the survey. This is achieved by matching migrants’ names reported in the migration module with the names of the children listed by their mothers. Namesakes being common within a given household, we condition the matching procedure with the age reported in both modules. Combining those information enables us to ascertain how household members and current migrants are related biologically. Last and importantly for our analysis, the data set gives the marital status and type (monogamous versus polygamous) of all married men and women in the household. Married women who have at least one co-wife (co-residing or not) are defined as women in a polygynous marriage.

Table 3.1 shows the descriptive statistics of our individuals of interest. We restrict the sample to male individuals aged 15 to 40 whose mothers were present in the household at the time of the survey.<sup>5</sup> The sample is composed of 2,808 males coming from 1,033 households. Age is defined as age at the time of the survey for non-migrants and age at which they migrated for migrants. Its average value in the sample is 22 years. In terms of education, 56 percent have attended formal education with an average of 4 completed years of education. On average, they have a total of 5 siblings, with 4 full-siblings (sibling with same mother and father) and 1 half-sibling (siblings with same father but different mother). The migrant sample is composed of current migrants who used to reside in the household and former migrants who

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<sup>5</sup>Unfortunately, when mothers are not in the household or are not alive anymore, the survey provides no information on them.

TABLE 3.1: Summary Statistics

Variable	N	Mean	SD	Min	Max
<b>Individual Characteristics</b>					
Age	2808	22.100	6.263	15	40
Formal education	2808	0.559	0.497	0	1
Years of education	2808	3.915	3.886	0	11
Total siblings	2808	5.432	2.788	1	17
Full-siblings	2808	4.211	1.948	1	15
Half siblings	2808	1.220	2.128	0	13
Migrated	2808	0.155	0.362	0	1
Migrated internally	2808	0.069	0.254	0	1
Migrated internationally	2808	0.086	0.280	0	1
Returnees	2808	0.039	0.193	0	1
<b>Parents' Characteristics</b>					
Fathers' no of wives	2808	1.408	0.615	1	4
Father migrated	2808	0.297	0.457	0	1
Father's age	2808	59.574	10.541	21	98
Father formal education	2808	0.210	0.407	0	1
Father's years of education	2808	1.416	3.066	0	11
Mother's age	2808	47.247	8.895	20	80
Mother formal education	2808	0.112	0.316	0	1
Mother's years of education	2808	0.636	2.009	0	11
<i>Mother's marital status</i>					
Monogamous	2808	0.654	0.476	0	1
Polygynous [1 co-wife]	2808	0.290	0.454	0	1
Polygynous [2 co-wives]	2808	0.050	0.218	0	1
Polygynous [3 co-wives]	2808	0.006	0.078	0	1
Mother is polygynous	2808	0.346	0.476	0	1
<b>Household Characteristics</b>					
Household head gender	1033	0.139	0.347	0	1
Household size	1033	8.718	4.990	2	44
Log(expenditure)	1033	10.763	0.601	8	13
Urban	1033	0.453	0.498	0	1
<i>Region</i>					
Kayes	1033	0.155	0.362	0	1
Koulikoro	1033	0.163	0.369	0	1
Sikasso	1033	0.153	0.360	0	1
Segou	1033	0.138	0.346	0	1
Mopti	1033	0.116	0.321	0	1
Tombouctou	1033	0.097	0.296	0	1
Gao	1033	0.054	0.227	0	1
Bamako	1033	0.124	0.330	0	1

Source: EMOP 2016 Survey and authors' calculations.

Notes: The sample includes only male household members aged 15-40 years whose mothers are living in the household. The sample comprises 2808 individuals from 1033 households.

were back in their origin household at the time of the survey. About 15 percent of the whole sample have had a least one migration experience in the sample. Internal migrants are individuals belonging to the household but currently residing within the country constitute about 7 percent of the whole sample. International migrants

on the other hand, are individuals belonging to the household but currently/were residing outside the country constitute about 7.8 percent of the whole sample. This sample include returnees, who constitute about 3.9 percent of the entire sample.

Table 3.1 also provides statistics on the parents' and household characteristics of the sampled individuals. Fathers have 1.4 wives on average, and 29 percent migrated at least once. Mothers are on average 47 years old and only 11 percent have formal education, while fathers have an average age of 60 years and 24 percent have attended at least one year of formal education. Importantly for our analysis, we observe that polygamy is relatively widespread. About 35 percent of the mothers in our sample have reported being in a polygynous marriage, with a majority (83 percent) having one co-wife, and 14 percent having 2 co-wives. The average household size is close to 9 and 14 percent of them are headed by a female. Almost half (46 percent) of the households reside in urban areas. Regionally, 17 percent of households in our sub-sample lives in Koulikoro, followed by Kayes (16 percent), Sikasso (15 percent), Segou (14 percent), Bamako (12 percent), Mopti (11 percent), Tombouctou (10 percent), and Gao (5 percent).

How different are migrants and non-migrants within our sample? Table 3.2 provides descriptive statistics of non-migrants (2364), internal migrants (193) and international migrants (240). Columns 3 report the p-values from mean comparison of individuals', parents' and household characteristics of non-migrants and internal migrants. While age is not significantly different between non-migrants and internal migrants, non-migrants are statistically more educated, have more siblings, and younger parents. Furthermore, the data suggests that there is no statistically significant difference in the polygynous status of non-migrants and internal migrants. Last, internal migrants are more likely come from smaller households and rural areas.

Column 3 of Table 3.2 shows perhaps a more interesting comparison between international migrants and non-migrants. This comparison reveals statistical differences between the two groups in terms of age, education, parents' characteristics, mothers' polygynous status and location. The international migrant sample is significantly older, less likely to be educated with less completed years of education on average, and has more siblings. Moreover, international migrants are statistically

TABLE 3.2: Summary Statistics: Statistical Differences between Migrants and Non-migrants

	Non migrants (1)	Internal Migrants (2)	International Migrants (3)	P-value (1-2)	P-Value (1-3)
<b>Individual Characteristics</b>					
Age	22.008	22.083	23.029	0.851	0.003**
Formal education	0.574	0.596	0.388	0.547	0.000***
Years of education	4.019	4.699	2.258	0.036*	0.000***
Total siblings	4.338	5.813	5.004	0.000***	0.000***
Full-siblings	3.174	4.596	3.875	0.000***	0.000***
Half siblings	1.165	1.218	1.129	0.719	0.783
<b>Parents' Characteristics</b>					
Fathers' no of wives	1.391	1.446	1.542	0.236	0.001**
Father migrated	0.271	0.347	0.517	0.033	0.000***
Father's age	59.712	57.523	59.871	0.003*	0.811
Father formal education	0.216	0.249	0.117	0.309	0.000***
Father's years of education	1.463	1.839	0.613	0.153	0.000***
Mother's age	47.516	45.249	46.204	0.001***	0.019*
Mother formal education	0.117	0.109	0.067	0.721	0.004**
Mother's years of education	0.662	0.705	0.325	0.802	0.000***
<i>Mother's marital status</i>					
Monogamous	0.669	0.617	0.537	0.150	0.000***
Polygynous [1 co-wife]	0.277	0.321	0.388	0.207	0.001***
Polygynous [2 co-wives]	0.047	0.062	0.071	0.398	0.165
Polygynous [3 co-wives]	0.007	0.000	0.004	0.000***	0.563
Mother is polygynous	0.331	0.383	0.463	0.150	0.000***
Household head gender	0.002	0.000	0.000	0.045*	0.045*
Household size	12.751	11.725	13.992	0.016**	0.012*
Log (expenditure)	10.574	10.567	10.486	0.856	0.011*
Urban	0.370	0.228	0.237	0.000***	0.000***
<i>Region</i>					
Kayes	0.171	0.155	0.417	0.561	0.000***
Koulikoro	0.173	0.062	0.042	0.000***	0.000***
Sikasso	0.210	0.503	0.342	0.000***	0.000***
Segou	0.126	0.098	0.021	0.229	0.000***
Mopti	0.105	0.161	0.154	0.044*	0.045**
Tombouctou	0.048	0.010	0.004	0.000***	0.000***
Gao	0.032	0.010	0.004	0.018*	0.000***
Bamako	0.135	0.000	0.017	0.000***	0.000***
Observations	2364	193	240	2557	2604

Source: EMOP 2016 Survey and authors' calculations.

Notes: The sample includes only male household members aged 15-40 years whose mothers are living in the household. The sample comprises 2808 individuals from 1033 households.

more likely to have mothers who are less educated, younger, and in a polygynous marriage (46 percent versus 38 percent) than non-migrants. Last, in terms of their geographic origin, migrants are more likely to come from rural areas and as shown in Azam and Gubert (2005), they are more likely to come from the Kayes and Sikasso regions.

In addition to the EMOP survey data, we mobilise the 1987 Malian census collected by Malian National Statistics Office (NSO) to compute historical polygamy rates at the sub-district level. This variable will be used as an instrument in our empirical analyses in order to identify a causal link between mothers' polygamous status and migration.

## 3.5 Empirical Framework

### 3.5.1 Empirical Methodology

We want to assess whether a polygamous family structure affects migration decisions. To this end, we consider the following regression specification:

$$Y_{ih} = \alpha_0 + \alpha_1 Poly_{ih} + \beta X_{ih} + \epsilon_{ih} \quad (3.1)$$

where  $Y_{ih}$  is the migration decision of an individual  $i$  from household  $h$  which is equal to 1 if the individual has ever migrated or is a current migrant and 0 otherwise. We further distinguish between internal migration and international migration.  $Poly_{ih}$  is  $i$ 's mother's polygynous status which equals 1 if the mother has at least one co-wife and 0 otherwise.  $X_{ih}$  is a vector of both individual characteristics (including age, age squared, number of siblings, birth order dummies, dummy for whether father has migrated before, years of education, father's years of education and mother's age) and household characteristics (including household size, sex of household head, log of household quarterly consumption expenditure, an urban area dummy, and regional dummies).  $\epsilon_{ih}$  is random error term.

Selection into polygamy remains an important concern. For example, men who are wealthier might afford marrying more wives or those who are subsistence farmers may be more likely to be polygamous in order have more children for labor supply. Moreover, polygamy has been shown to alter wives' saving decisions (Boltz and Chort, 2016) and fertility (Rossi, 2018) through competition among co-wives. All this evidence suggests that indeed the polygynous status of mothers can be endogenous to migration. This calls for an identification strategy to solve this endogeneity problem.

### 3.5.2 Identification Strategy

To identify the causal effect of polygyny on migration, we need some exogenous source of variation. The ideal source of variation is one that affects the polygynous status of mothers without affecting the subsequent migration decisions of their children. Following the migration literature that employs historical instruments<sup>6</sup> and Cudeville et al. (2017), we propose one variable that satisfies this condition: the historical polygamy rate at the sub-district level. Why would historical polygamy rates affect the current polygynous status of women? Boltz and Chort (2016) show that the polygamy status of a father affects the polygamy status of his children suggesting that living in places where polygamy is widely practiced might affect subsequent polygamy rates. We use the 1987 Malian census to calculate the polygamy rate at the sub-district level. It is computed by combining the share of married men who are polygamous with the ethnicity polygamous propensity. The ethnic propensities are computed using probit regression of polygamy status of married men on ethnicity dummies. Using these computed propensities for each ethnic group, we defined the polygamy rate at sub-district level as the sum across ethnic groups of the product of share of polygamous married men (see Figure 3.2) and the ethnic propensities. The logic for using this re-weighted polygamy rate instead of a simple share of married men in a polygamous union is because polygamy is heterogeneous across ethnic groups as illustrated in Figure 3.1.

While our instrument is a good predictor of the polygynous status of women, we still need to check if it meets the exclusion restriction according to which the historical polygamy rate should affect subsequent migration decisions only through its effect on the polygynous status of mothers. A plausible counter-argument could be that those sub-districts with high polygamy rates are the ones with high migration rates given that historical migration rates predict subsequent migration rates; we thus mitigate this threat by controlling for historical migration (number of returnees in the sub-district computed from 1998 census and dummy for whether father has migrated before). Another threat could be that sub-districts with high historical

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<sup>6</sup>McKenzie and Rapoport (2006) and McKenzie and Rapoport (2007) for example both employ historical migration rates to instrument migration in Mexico.

polygamy rates are those which are richer (since it is costly to support many dependents) or highly populated. To allow for this possibility, we include additional controls such as log of the sub-district population computed from the 1987 census and current household wealth proxy (household expenditure). Last, one might argue that migration changes social norms (polygamy included) as evidenced in the literature<sup>7</sup>, resulting in a threat of reverse causality. We argue that since we are interested in the migration decisions of children instead of their parents, this possibility is less likely. Additionally, we control for many confounding factors that could affect both polygamy and children migration decisions such as parents' characteristics including migration history, years of education, and age.

## 3.6 Empirical Results

### 3.6.1 Polygyny and Migration

The estimation is conducted through two stage least squares (2SLS) and bivariate probit. While the 2SLS estimator produces results that are easy to interpret, the estimation strategy only recovers the Local Average Treatment Effect (LATE). In other terms, the estimated effect is associated with the subset of the population whose decision to be in a polygamous union is affected by the instrument. Though the bivariate probit estimator mitigates this problem by recovering average treatment effects, estimates in this setting are sensitive to including more controls (Angrist and Pischke, 2008).

Table 3.3 presents the estimated impact of the polygamous status of mothers on their children's migration decisions, where migration is defined irrespective of whether it is internal or external. The first two columns offer correlations obtained from OLS estimation while the last column provides the results from the two stage least squares estimation. In column 1, we observe a positive and significant association between polygyny and migration. However, once we include individual and

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<sup>7</sup>Tuccio and Wahba (2015), Beine et al. (2013) and Bertoli and Marchetta (2015) show that migration affect gender norms in sending countries.

TABLE 3.3: Mother Polygynous and Migration

	(OLS)		(IV)
	Migrate (1)	Migrate (2)	Migrate (3)
Mother is polygynous	0.0659*** (0.0177)	-0.0398** (0.0192)	0.5240* (0.2800)
<i>First stage-Mother is polygynous</i> 1987 sub-district polygamy rate			1.8925*** (0.5209)
F-Statistic			13.54
Individual's controls	No	Yes	Yes
Household level controls	No	Yes	Yes
Regional indicators	No	Yes	Yes
Mean of dep.var	0.078	0.078	0.078
N	4010	2808	2808

Source: EMOP 2016 Survey and authors' calculations.

Note: Regressions estimated using ordinary least squares and two staged least squares. Migrate is a binary variable taking value 1 if the respondent is a migrant or migrated and 0 otherwise. Mother is polygynous is a binary variable taking value 1 if mother is in a polygynous union and 0 otherwise. 1987 sub-district polygamy rate is the share of married men in a polygynous union re-weighted by the ethnic propensity to be a polygamous union. Individual's controls include age, age squared, years of education, number of siblings, sibling order dummies, mother's age, father's years of education, and father's migration history dummy. Other controls include household head gender, household size, urban area dummy, regional dummies, 1987 sub-district log population, 1998 sub-district ratio of returnees to population. Standard errors in parenthesis are clustered at sub-district level. \*Significant at 10%; \*\*significant at 5%; \*\*\*significant at 1%.

household controls into the regression, the estimate turns negative and statistically significant (column 2)<sup>8</sup>.

In column 3, we instrument the polygynous status of mothers with the 1987 reweighted sub-district historical polygamy rate. The F-statistic from the first stage suggests that indeed historical polygamy rate predicts polygynous status. Results from the second stage show a positive relationship between mothers' polygynous status and migration decisions: individuals whose mothers are in polygynous marriage are about 52 percentage points (pp) more likely to migrate.

In Table 3.4, we consider the effect on polygamy on internal migration only because it is plausible to assume that the drivers of internal migration differ from the drivers of international migration. The dependent variable therefore is whether an

<sup>8</sup>The reason for the flip in the sign is potentially due to multicollinearity. Once we drop the age squared and father's years of education, the coefficient becomes positive and insignificant.



individual is/was a migrant within the country. We similarly estimate the effect using both OLS and 2SLS. We find that there is no statistically significant effect of polygamy on internal migration which suggests that polygamy only affects international migration.

TABLE 3.4: Mother Polygynous and Internal Migration

	(OLS)		(IV)
	Migrate (1)	Migrate (2)	Migrate (3)
Mother is polygynous	0.0247* (0.0149)	-0.0333** (0.0145)	0.2266 (0.1659)
<i>First stage-Mother is polygynous</i> 1987 sub-district polygamy rate			1.8639*** (0.5209)
F-Statistic			13.54
Individual's controls	No	Yes	Yes
Household level controls	No	Yes	Yes
Regional indicators	No	Yes	Yes
Mean of dep.var	0.070	0.070	0.070
N	4010	2808	2808

Source: EMOP 2016 Survey and authors' calculations.

Note: Regressions estimated using ordinary least squares and two staged least squares. Migrate is a binary variable taking value 1 if the respondent is a migrant or migrated within the country and 0 otherwise. Mother is polygynous is a binary variable taking value 1 if mother is in a polygynous union and 0 otherwise. 1987 sub-district polygamy rate is the share of married men in a polygynous union re-weighted by the ethnic propensity to be a polygamous union. Individual's controls include age, age squared, years of education, number of siblings, sibling order dummies, mother's age, father's years of education, and father's migration history dummy. Other controls include household head gender, household size, urban area dummy, regional dummies, 1987 sub-district log population, 1998 sub-district ratio of returnees to population. Standard errors in parenthesis are clustered at sub-district level. \*Significant at 10%; \*\*significant at 5%; \*\*\*significant at 1%.

In Table 3.5, we replicate the same specification using as dependent variable our main variable of interest, that is international migration. Our OLS estimates in column 1 suggest a positive association between polygamy and migrating internationally. Once we control for the endogeneity of polygamy, the magnitude of the estimate increases and is statistically significant at the 10 percent level. The estimated coefficient suggests that having a polygynous mother increases the likelihood of migrating internationally by about 36 percentage points. It is worth highlighting that our specification includes controls for individual, parents' and household level

characteristics and that standard errors are clustered at the sub-district level. Additionally, the F-statistic equals 13.54, which suggests that our instrument is strongly correlated with polygamous status.

TABLE 3.5: Mother Polygynous and International Migration

	(OLS)		(IV)
	Migrate (1)	Migrate (2)	Migrate (3)
Mother is polygynous	0.0443*** (0.0139)	-0.0020 (0.0162)	0.3659* (0.1947)
<i>First stage-Mother is polygynous</i> 1987 sub-district polygamy rate			2.0481*** (0.5566)
F-Statistic			13.54
Individual's controls	No	Yes	Yes
Household level controls	No	Yes	Yes
Regional indicators	No	Yes	Yes
Mean of dep.var	0.148	0.148	0.148
N	4010	2808	2808

Source: EMOP 2016 Survey and authors' calculations.

Note: Regressions estimated using ordinary least squares and two staged least squares. Migrate is a binary variable taking value 1 if the respondent is a migrant or migrated outside the country and 0 otherwise. Mother is polygynous is a binary variable taking value 1 if mother is in a polygynous union and 0 otherwise. 1987 sub-district polygamy rate is the share of married men in a polygynous union re-weighted by the ethnic propensity to be a polygamous union. Individual's controls include age, age squared, years of education, number of siblings, sibling order dummies, mother's age, father's years of education, and father's migration history dummy. Other controls include household head gender, household size, urban area dummy, regional dummies, 1987 sub-district log population, 1998 sub-district ratio of returnees to population. Standard errors in parenthesis are clustered at sub-district level. \*Significant at 10%; \*\*significant at 5%; \*\*\*significant at 1%.

Finally, we present the estimates of the impact of the polygynous status of mothers on children migration decisions using bivariate probit in Table 3.6. As expected, the results are similar to the ones obtained with the 2SLS estimator albeit differences in the magnitude of the effects. In column 1 of Table 3.6, the dependent variable is migration status whatever the destination, internal or external, of the migrant. The results suggest that having a mother in a polygynous marriage increases the probability of migrating by 35 percentage points. In column 2, we focus on only those who have migrated within the country. The estimated coefficient, while positive, is not statistically significant. Last, in column 3, the estimates suggest that the polygynous status of mothers indeed affects the likelihood of migrating internationally,

with a marginal effect of about 19 percentage points. In summary, we consistently observe that mothers' polygynous status affect the decision of their sons to migrate internationally. The question remains of why polygamy affects migration decisions. To provide answers to this question, we turn to an investigation of the underlying mechanisms in the following section.

TABLE 3.6: Mother Polygynous and Migration - Bivariate Probit

	(1) All Migration	(2) Internal Migration	(3) External Migration
Mother is polygynous	1.4173*** (0.1715)	0.4903 (0.5194)	1.0413*** (0.2689)
<i>Marginal Effects</i>	0.3585*** (0.0574)	0.0655 (0.0831)	0.1886*** (0.0696)
<i>First stage-Mother is polygynous</i>			
1987 sub-district polygamy rate	8.9379*** (1.3115)	8.8097*** (1.3148)	6.1238*** (1.3277)
Wald test of $\rho$ (p-value)	0.0000	0.1766	0.0008
Individual's controls	No	Yes	Yes
Household level controls	No	Yes	Yes
Regional indicators	No	Yes	Yes
Mean of dep.var	0.148	0.070	0.078
N	2808	2808	2808

Source: EMOP 2016 Survey and authors' calculations.

Note: Regressions estimated using a bivariate probit model. In column 1, estimation is done for all type (internal and international). In columns 2 and 3, migration is defined for migration within and outside the country respectively. Mother is polygynous is a binary variable taking value 1 if mother is in a polygynous union and 0 otherwise. 1987 sub-district polygamy rate is the share of married men in a polygynous union re-weighted by the ethnic propensity to be a polygamous union. Individual's controls include age, age squared, years of education, number of siblings, sibling order dummies, mother's age, father's years of education, and father's migration history dummy. Other controls include household head gender, household size, urban area dummy, regional dummies, 1987 sub-district log population, 1998 sub-district ratio of returnees to population. Standard errors in parenthesis are clustered at sub-district level.\*Significant at 10%; \*\*significant at 5%; \*\*\*significant at 1%.

### 3.6.2 Mechanisms

In this section, we provide evidence on why polygamy affects migration by focusing on the role of siblings' migration. While having a household member with migration experience or even coming from areas with high migration history (migration networks) can fuel subsequent migration (see e.g., Beine et al. (2011)), having full or half migrant sibling might have different effect in addition to the pure migration

network effect. Table 3.7 presents descriptive statistics on the incidence of migration depending on the number of siblings with some migration experience. The first panel shows that the likelihood of being a migrant increase with the number of migrant siblings. The incidence of migration among those who have no migrant sibling is 7 percent while it is as high as 38 percent for those that have one sibling with some migration experience. It then decreases for individuals having more than one sibling with some migration experience, but the number of observations is very small. In the second panel, we consider full siblings only. The average incidence of migration is 11 percent. However, it increases to 31 percent for those individuals having one full sibling with some migration experience and goes down to 7 percent for those with no migrant full sibling. Finally, the last panel reports the incidence of migration depending on the number of migrant half-siblings. The incidence of migration jumps from 11 percent for those individuals with no migrant half-sibling to 18 percent for those who have one migrant half-sibling.

TABLE 3.7: Probability of being a Migrant, Depending on Number of Siblings with Migration Experience

<b>Total No of migrant siblings</b>	<i>Non-migrant</i>	<i>Migrant</i>	<i>Total</i>
0	92.44	7.56	100.00
1	62.24	37.76	100.00
2	98.84	1.16	100.00
3	94.87	5.13	100.00
Total	89.03	10.97	100.00
<b>No of migrant full-siblings</b>			
0	92.74	7.26	100.00
1	68.63	31.37	100.00
2	53.91	46.09	100.00
3	57.14	42.86	100.00
Total	89.01	10.99	100.00
<b>No of migrant half-siblings</b>			
0	89.20	10.80	100.00
1	82.14	17.86	100.00
2	93.33	6.67	100.00
3	100.00	0.00	100.00
Total	89.03	10.97	100.00
<i>N</i>	<b>3572</b>	<b>441</b>	<b>4013</b>

Source: EMOP 2016 Survey and authors' calculations.

Note: Migrant is a binary variable taking value 1 if individual is a migrant or migrated outside the country and 0 otherwise. Full-siblings is the number of siblings with the same mother and father. Half-siblings is the number of siblings with same father but different mother.

In Table 3.8, we estimate the correlation between having siblings or half-siblings

with some migration experience on individuals' migration decision. In column 1, we observe a positive and statistically significant relationship between having a migrant sibling and the likelihood of migrating. In column 2, we distinguish between half-siblings and full-siblings. The resulting estimates suggest a positive (negative) relation between full-sibling's (half-sibling's) migration status and individual migration status. However, in column 3, we interact migrant full-sibling status and half-sibling status. This results show that having a half-sibling with some migration experience conditional on having no migrant full-sibling increases the likelihood of migrating of about 8 percentage points. Similarly, having a full-sibling with some migration experience conditional on having no migrant half-sibling increases the likelihood of migrating of 28 percentage points.

Moving on, Table 3.9 offers more evidence on the relationship between siblings' migration status and individuals' migration decision. Columns 1 and 2 report OLS estimates while columns 3 and 4 present 2SLS estimates. We instrument the variable "having a full-sibling with some migration experience" with the ratio of the number of male full-siblings to total number of full-siblings. Similarly, the variable "having a half-sibling with some migration experience" is instrumented with the ratio of the number of male half-siblings to total number of half-siblings. The logic behind using these instruments is that men have a higher probability of migrating in the Malian setting and that the sex composition of children is random in the Malian context where there is no sex selective abortion. Column 3 shows the effect of having a full-sibling with some migration experience on the likelihood of migrating. Estimates of the first-stage produce a F-statistic of 20 and show a positive relationship between having a full-sibling with some migration experience and the share of male full-siblings. The second-stage estimates show that having at least one full-sibling with some migration experience increases the likelihood of migrating by 35 percentage points. Similarly, in column 3, we observe a positive and marginally significant effect of having a half-sibling with some migration experience on the likelihood of migrating by 50 percentage points. Overall, there is thus suggestive evidence that the migration behavior of both full and half-siblings affects one individual's own

TABLE 3.8: Mother Polygynous and International Migration - OLS

	(1) Migrate	(2) Migrate	(3) Migrate
SibMigrate	0.1774*** (0.0238)		
FullSibMigrate		0.2414*** (0.0263)	
HalfSibMigrate		-0.0332 (0.0392)	
FullSibMigrate=0 × HalfSibMigrate=1			0.0853* (0.0455)
FullSibMigrate=1 × HalfSibMigrate=0			0.2714*** (0.0276)
FullSibMigrate=1 × HalfSibMigrate=1			-0.0190 (0.0523)
Observations	2815	2815	2815
$R^2$	0.134	0.162	0.175
Individual's controls	No	Yes	Yes
Household level controls	No	Yes	Yes
Regional indicators	No	Yes	Yes
Mean of dep.var	0.078	0.078	0.078
$N$	2808	2808	2808

Source: EMOP 2016 Survey and authors' calculations.

Note: Regressions estimated using ordinary least squares and two staged least squares. Migrate is a binary variable taking value 1 if the respondent is a migrant or migrated outside the country and 0 otherwise. SibMigrate is a binary variable taking value 1 if individual has a sibling who has migrated and 0 otherwise. FullSibMigrate is a binary variable taking value 1 if individual has a full-sibling who has migrated and 0 otherwise. HalfSibMigrate is a binary variable taking value 1 if individual has a half-sibling who has migrated and 0 otherwise. Individual's controls include age, age squared, years of education, number of siblings, sibling order dummies, mother's age, father's years of education, and father's migration history dummy. Other controls include household head gender, household size, urban area dummy, and regional dummies. Standard errors in parenthesis are clustered at sub-district level. \*Significant at 10%; \*\*significant at 5%; \*\*\*significant at 1%.

migration decision. In particular, we find that the effect of having at least one half-sibling with some migration experience has a larger effect on the likelihood of migrating than having at least one full-sibling with some migration experience. This piece of evidence is in line with the literature that shows that there exist co-wives' competition in fertility decision (see e.g., Rossi (2018)). This suggests that international migration decisions are also driven by social reasons.

TABLE 3.9: Mother Polygynous and International Migration - IV

	(OLS)		(IV)	
	(1) Migrate	(2) Migrate	(3) Migrate	(4) Migrate
FullSibMigrate	0.2400*** (0.0261)		0.3744** (0.1712)	
HalfSibMigrate		-0.0034 (0.0361)		0.5555* (0.3032)
<i>First stage-Sibling Migrate</i>				
Share of Full Male Siblings			0.0347*** (0.0077)	
Share of Full Male Siblings				0.1466*** (0.0332)
F-Statistic			20.15	19.52
Individual's controls	No	Yes	Yes	Yes
Household level controls	No	Yes	Yes	Yes
Regional indicators	No	Yes	Yes	Yes
Mean of dep.var	0.078	0.078	0.078	0.078
N	2808	2808	1981	931

Source: EMOP 2016 Survey and authors' calculations.

Note: Regressions estimated using ordinary least squares and two staged least squares. Migrate is a binary variable taking value 1 if the respondent is a migrant or migrated outside the country and 0 otherwise. FullSibMigrate is a binary variable taking value 1 if individual has a full-sibling who has migrated and 0 otherwise. HalfSibMigrate is a binary variable taking value 1 if individual has a half-sibling who has migrated and 0 otherwise. Individual's controls include age, age squared, years of education, mother's age, father's years of education, and father's migration history dummy. Other controls include household head gender, household size, urban area dummy, and regional dummies. Standard errors in parenthesis are clustered at sub-district level. \*Significant at 10%; \*\*significant at 5%; \*\*\*significant at 1%.

### 3.7 Conclusion

This study is perhaps the first to examine the casual impact of polygamy family structure on international migration decisions. We contribute to the growing economic literature examining the determinants of international migration by introducing the role of the polygynous status of mothers; a marriage outcome faced by more than one quarter of women in Sub-Saharan Africa. We use data from a rich representative household survey and census from Mali; a country with long history of international migration and high polygamy rate to estimate the impact the polygynous status of mothers on children migration decisions. We address the identification challenges due to selection into polygyny status of mothers through instrumentation strategy by using the historical sub-district polygamy rates. Additionally, to shed light on the mechanisms, we instrument having a migrant sibling with the

share of male siblings.

We find that children of mothers in polygynous unions are more likely to migrate internationally. We explain the results by providing supportive evidence suggesting that it is due to sibling rivalry; having both full and half migrant sibling increases the likelihood of migrating. Our evidence suggests that co-wives' rivalry as documented in Rossi (2018) trickles down to children rivalry in migration. Our overall results suggest that, in addition to economic reasons, international migration is also driven by social reasons. Our findings raise interesting questions for further research such as how these households decide the optimal number of migrants to send and also whether and who (among the children of his wives) fathers decide to migrate, given that there might be preferences to having some remaining home in order to help manage the household and/or provide care for aging parents as highlighted in Stöhr (2015).



### 3.A Appendix

#### 3.A.1 Figures

FIGURE 3.1: Estimated Probability of Being in a Polygynous Union by Maternal Language in 1987

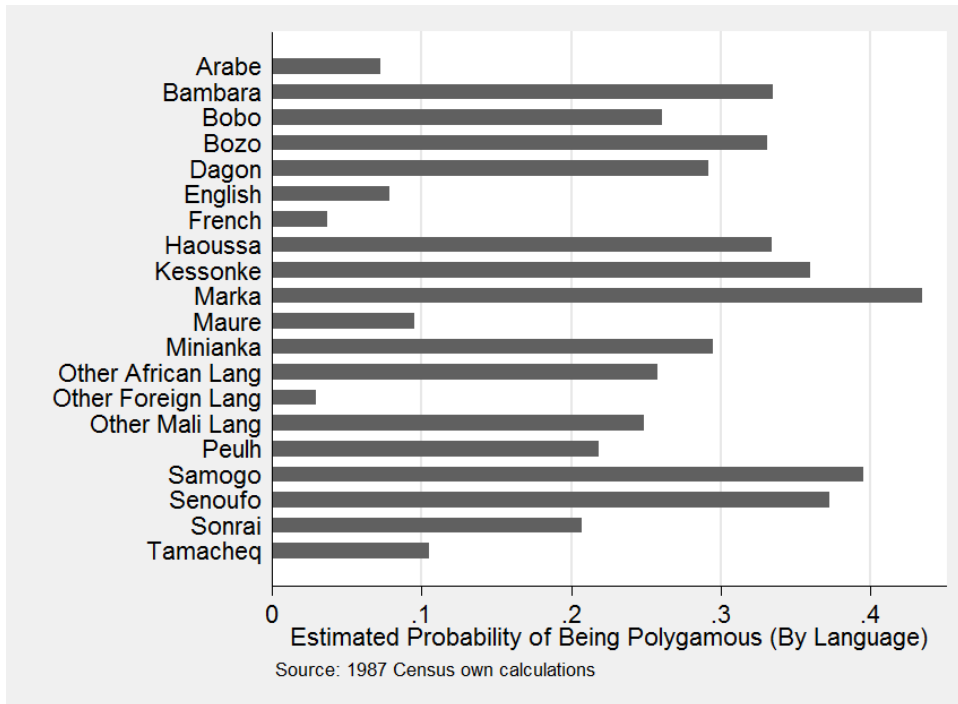
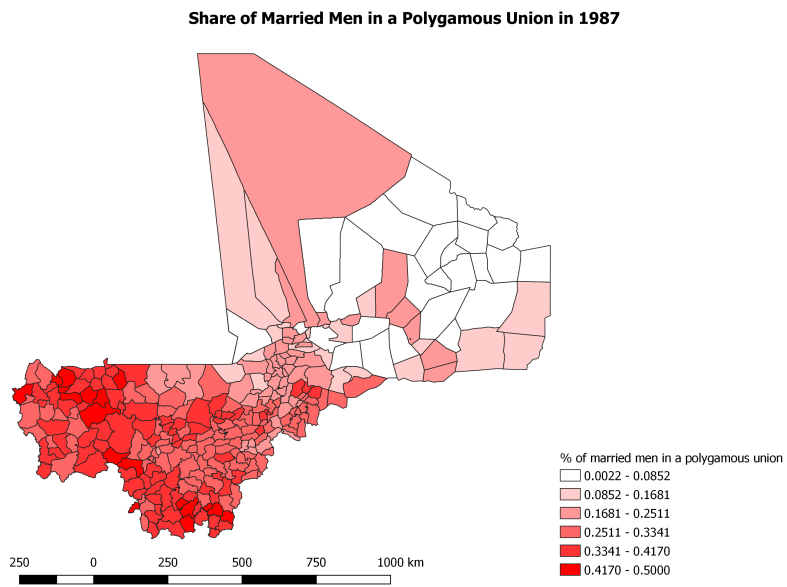


FIGURE 3.2: Share of Married Men in a Polygynous Union in 1987



# Conclusion

The purpose of this thesis was to contribute to our understanding of the drivers of international migration by asking the following novel research questions. How does occupation-skill mismatch affect the selection of immigrants? How does uncertainty about the risks of dying en route and chances of obtaining legal status affect the willingness to migrate illegally? How does polygamous family structure affect international migration decisions? We answer these questions by utilizing data from three countries; Portugal, The Gambia, and Mali.

In the first chapter we document that immigrants from 40 origin countries in Portugal face high incidences of occupational-skill mismatch. We show that these incidences of mismatch affect the selection or type of migrants coming into the country. The results show that the incidence of overeducation leads to negative selection while correct occupational-skill matches leads to positive selection of immigrants. Given the potential benefits of international migration as documented in the literature, these results have policy implications. Receiving countries' selective policies aimed at attracting high skilled immigrants should also focus on reducing occupation-skill mismatch, probably through degree recognition and standardization in collaboration with sending countries; and this will subsequently benefit home countries not only through the increases in income and remittances but also incentives for investment in human capital.

In the second chapter we implemented a lab-in-the-field experiment to understand willingness to migrate illegally by focusing on a sample of male youths aged 15 to 25 in The Gambia, the country with the highest proportion of illegal migration flows to Europe. We showed that potential migrants overestimate both the risk of dying en route to Europe, and the probability of obtaining legal residency status. The experimental results suggest that the willingness to migrate illegally is affected by information on the chances of dying en route and of obtaining a legal residence

permit. Our estimates show that providing potential migrants with official numbers on the probability of obtaining a legal residence permit and the risk of dying en route affect the likelihood of migrating. This has the potential to help migrants make informed decisions and perhaps save lives.

In the final chapter we showed that polygamous family structure affects international migration decisions. We showed that children of mothers in polygynous unions are more likely to migrate internationally. We explain the results by providing supportive evidence suggesting that it is due to sibling rivalry; having migrant full and half siblings increases the likelihood of migrating. Our evidence suggests that co-wives' rivalry as documented elsewhere trickles down to children's rivalry in migration, suggesting that while neglected in the literature, family structure is crucial to understanding migration. Our findings in this chapter raise interesting questions for further research, such as how these households decide on the optimal number of migrants to send and also whether and who (among the children of his wives) fathers choose for migration, given that there might be preferences to having some remaining home in order to help manage the household and/or provide care for aging parents.

In sum, this thesis contributes to our understanding of what drives international migration. It focuses on three different drivers of international migration: occupation-skill mismatch, uncertainty about the risks of dying en route and chances of obtaining legality status, and the polygamous family structure.

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# Trois Essais sur la Migration Internationale

**Mots clés:** Migration internationale; Sur(sous)-qualification; Sélection; Aspirations  
Intentions de migrer; Migration illégale; Polygamie; Rivalité fraternelle.

## Résumé

Cette thèse vise à contribuer à une meilleure compréhension des facteurs qui agissent sur la décision de migrer des individus. Dans le chapitre 1, nous montrons qu'au Portugal, les immigrants occupent souvent des postes pour lesquels ils sont surqualifiés, et que cette non-adéquation entre profils et emplois occupés influence la sélection dans la migration. Les phénomènes de surqualification, plus marqués chez les individus les plus qualifiés, entraînent une sélection négative des migrants, tandis qu'une bonne adéquation entre profils et emplois conduit à une sélection positive. Dans le chapitre 2, nous tirons profit d'une expérimentation sur le terrain pour comprendre comment les décisions de migrer illégalement vers l'Europe des jeunes gambiens sont influencées par l'information qu'ils ont sur les risques associés à cette mobilité. Nous montrons d'abord que les participants au jeu surestiment à la fois le risque de périr en route et la probabilité d'obtenir un statut légal en Europe. Nos résultats suggèrent par ailleurs que la décision de migrer illégalement est influencée par l'une et l'autre probabilité. Informer les candidats au départ sur les risques réels encourus pourrait ainsi les aider à prendre des décisions en connaissance de cause et contribuerait peut-être à sauver des vies. Dans le chapitre 3, nous examinons les liens entre structure familiale et migration, en étudiant l'influence du type d'union des mères sur le comportement migratoire de leurs enfants. Nous trouvons que les

enfants nés de mères en union polygame sont plus enclins à migrer vers l'étranger.  
Nous expliquons ce résultat par la rivalité fraternelle qui en découle.

# Essays on International Migration

**Keywords:** International Migration; Willingness to Migrate; Occupational-Skill Mismatch; Illegal Migration Selection; Polygamy; Expectation; Sibling Rivalry.

## Abstract

The purpose of this thesis is to contribute to a better understanding of the drivers of international migration. In Chapter 1, we document that immigrants in Portugal face a high incidence of occupational-skill mismatch, and show how it affects the selection into migration. We find that the incidence of over-education leads to negative selection while correct occupational-skill matches lead to positive selection. In Chapter 2, we rely on a lab-in-the-field experiment to understand the willingness to migrate illegally of young males aged 15 to 25 in The Gambia. We first show that potential migrants overestimate both the risk of dying en route to Europe, and the probability of obtaining legal residency status. The experimental results suggest that the willingness to migrate illegally is affected by information on the chances of dying en route and of obtaining a legal residence permit. Providing potential migrants with official numbers on both probabilities thus affect their likelihood of migrating. This has the potential to help migrants make informed decisions and perhaps save lives. In Chapter 3, we investigate the impact of family structure on international migration decisions. We find that children of mothers in polygamous unions are more likely to migrate internationally. We provide further evidence suggesting that this result is due to sibling rivalry: having full- or half-siblings in migration increases the likelihood of migrating. Our evidence suggests that co-wives' rivalry as documented elsewhere trickles down to children's rivalry in migration, suggesting that while neglected in the literature, family structure is crucial to understanding migration.