

Towards Stylised Facts on International Migration Research

Immigrants' labour market integration, dynamics of remittance behaviour, and underlying mechanisms of migration rates

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To my family and friends

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ABSTRACT

This thesis touches upon three subjects within international migration, namely: immigrants' labour market incorporation, dynamics of remittances behaviour, and the role of migrant networks as an underlying mechanism of migration rates. Chapter 1 analyses employment and occupational attainment patterns of immigrants in Chile, using household surveys and applying on logistic regression models. Results indicate a coexistence between a convergence on employment patterns with a diversified occupational assimilation by migration origin and gender. Chapter 2 explores the dynamics of remittance behaviour of Senegalese immigrants in Spain from a longitudinal perspective, using data from MAFE and MEFE projects. Results indicate that the great majority of Senegalese migrants send remittances and that they rarely stop remitting once they start doing so. Moreover, results indicate a strong positive association between employment and remittance sending. Chapter 3 aims at explaining the global implications of migrant networks on Colombian migration rates, by informing an Agent-Based Model with data from the LAMP project. Results confirm that migrant networks played a key role in shaping the aggregated migration dynamics, although most of its aggregated effect was played by community networks instead of family ties. Results show that the sole presence of migrant networks is not a sufficient condition to shape aggregated migration dynamics, as the simultaneous role of macro factors is crucial. Finally, some concluding remarks are presented at the end of the thesis.

Resumen

La presente tesis presenta un análisis de tres temáticas de la investigación sobre migración internacional: la incorporación de los inmigrantes en el mercado laboral, las dinámicas del envío de remesas, y el rol de las redes migratorias como uno de los mecanismos subyacentes a las tasas migratorias. El capítulo 1 analiza los patrones de empleo y ocupacionales de la población migrante en Chile, utilizando datos de encuestas de hogares y aplicando modelos regresión logística. Los resultados indican una coexistencia entre una convergencia en los patrones de empleo con una asimilación ocupacional diversificada según origen migratorio y género. En el capítulo 2 se exploran las dinámicas en el envío de remesas de migrantes senegaleses en España desde una perspectiva longitudinal, utilizando datos de los proyectos MAFE y MESE. Los resultados indican que una gran mayoría de los senegaleses envían remesas y que una vez que se comienza a enviar recursos, terminar el flujo es poco común. Los resultados indican también una fuerte asociación positiva entre empleo y envío de remesas. El capítulo tiene como objetivo explicar las implicaciones globales de las redes migratorias en las tasas de migración internacional colombiana, a partir de informar un Modelo Basado en Agentes (ABM) con datos provenientes del proyecto LAMP. Los resultados confirman que las redes migratorias jugaron un rol clave en determinar las dinámicas migratorias a nivel global, aunque la mayor parte del efecto agregado está dado por redes dentro de la comunidad y no tanto por vínculos familiares. Los resultados señalan que, por sí solas, las redes migratorias no son una condición suficiente para determinar las dinámicas migratorias agregadas, ya que el efecto simultáneo de factores macro es clave a este respecto. Finalmente, se presentan algunas conclusiones al final de la tesis.

PREFACE

In 2015, four leading scholars expressed in a *Science* article, a relatively consolidated academic consensus within international migration researchers, stating that “our understanding of migration is handicapped by fragmentation of research and training along disciplinary lines and inadequate measurements. We need a comprehensive approach to migration and a central understanding that transcends disciplinary boundaries” (Willekens, Massey, Raymer, & Beauchemin, 2016, p. 897). Drawing from this awareness, Carling, Czaika, and Erdal (2020) elaborated ten empirically testable propositions to advance a comprehensive understanding of migration. Their approach to develop these propositions considered that rather than neglecting migration theories due to its limited explanatory scope, they are to be contextualized and “...combined to bridge the gap between theoretical assumptions, conceptual claims, and empirical observation” (p. 5). This PhD thesis was produced within this epistemological context, characterized by the coexistence of the awareness of a lack of a comprehensive framework with the motivation of contributing to the development of stylised facts in migration research, defined by being true in general, but not necessarily in every context (Carling et al., 2020).

The thesis consists of a research effort oriented to contribute upon three key interrelated subjects and academic debates within the field of international migration, namely: immigrants’ labour market incorporation, dynamics of remittances behaviour, and the underlying mechanisms of migration rates. Research design and contexts of study were selected by paying close attention to the global academic debates. This preface briefly describes the main motivations, aims, research designs and results within the chapters of the thesis.

Chapter 1 focuses on immigrants’ labour market incorporation is studied in Chile by means of analysing household surveys rounds 2013, 2015, and 2017. Immigration stock in the country become mostly intraregional (80% as of 2017), which is in line with an increase of internal movements within the Latin American region (Martinez & Orrego, 2016). Unlike previous decades, the profile of immigration in Latin America has changed from extraregional to intraregional flows. In this context, there is an opportunity to conduct research to enrich our understanding of intraregional migration that links its findings to the global international debate on international migration. In fact, when referring to research on intraregional migration in South America, Cerrutti & Parrado (2015) warned that “...[a] global discussion that incorporates intraregional migration into the worldwide, international academic discussion on both international migration and migratory policies—achieved by revisiting the dynamics, characteristics, and legal contexts of this type of migration—is still lacking” (p. 400).

To link my research of immigrants’ labour market incorporation in Chile to the global academic debate, I explored the external validity of assimilation and segmented assimilation theories (Chiswick et al., 2005; Heath and Cheung, 2007). These two theories provide interpretations of how migrant–native differentials in socio-economic positions evolve over time, as they can explain the disadvantages faced by immigrants in the labour market and draw from human capital theory. The *immigrant assimilation model* establishes that both the earning and occupational attainment gaps between those that are foreign-born and those that are native-born tend to disappear over time.

Segmented assimilation theories, on the other hand, question the idea that ethnic penalties should necessarily weaken over time. Even when controlling for time since arrival, educational attainment, and other socio-demographic factors, there are other mechanisms that result in specific barriers for migrants' assimilation, namely access to non-migrant social capital (Oesch and von Ow, 2017), discrimination levels in host societies (Bonoli and Hinrichs, 2012), and the labour market's structure and flexibility (Brodmann and Polavieja, 2011).

Drawing on the international academic debate on how immigrants are incorporated into the labour market, I identified a research gap in the Chilean academic research in relation to controlling for confounding socio-demographic factors and comprehending the role of the time spent in the host country on socio-economic integration. An important source of inspiration for the research design were the articles published in the special issue on "Employment Penalization of Immigrants in Western Europe" published by the journal *International Migration* in 2011 (Reyneri & Fullin, 2011). In practice, this meant that the analysis of migrant penalties in the labour market was studied by looking at traditional indicators such as labour market participation and employment, but also occupational status. Of special interest to be able to connect the finding to previous research, occupational status was measured by drawing on the European Socioeconomic Classification of Occupations. Economic informality by means of informal employment was considered a key indicator, given its importance as growing global concern that is associated with occupational and social exclusion, not only in Chile and Latin America but in more developed areas such as Eastern and Southern European countries (ILO, 2019). Moreover, to be able to contrast whether migrant penalties persisted, the role of time since arrival to Chile was something key to be considered. Finally, confounding sociodemographics were accounted to disentangle the effect of migrant origin on lower labour market integration.

The closest datasets to Labour Force Surveys in Europe in which detailed occupational status information and time since arrival was available consisted of the Chilean Household Surveys (HHS), provided respondents were restricted to ages between 15 and 64. The HHS is conducted every two years and has a cross-sectional nature with a sample size of approximately 200,000 individuals in each wave. The last three available rounds of the HHS (2013, 2015, and 2017) were merged, allowing to analyse the main immigrant groups separately in most cases. Because I was interested in the relation of the time since migration to socio-economic assimilation in the labour market, having different cross-sectional measures and the accumulated time since arrival allowed to decrease biases due to the period and cohorts effects, respectively.

Results were in line with previous research in that when controlling for time since arrival or time spent in the labour market, studies have found that migrant and ethnic penalties regarding the probability of being employed may be inexistent, especially in the context of high labour market flexibility and the demand for low-skilled labour such as in Southern European countries. Regarding occupational attainment, results indicated a diversified situation from both gender and migration origin, which might indicate the presence of ethnic rather than migrant penalties (Heath and Cheung, 2007). While several Latin American immigrant groups (particularly the men) have assimilated Chileans since arrival for all occupations, for those within salariat occupations, the occupational convergence among women was much slower or even unattainable for

some migrant groups. Concluding remarks stemming from this chapters are further discussed in chapter 1 and at the end of the thesis.

Chapter 2 deals with the dynamics of remittance-sending and aims at exploring under what conditions do Senegalese in Spain send remittances home. By drawing on the previous empirical evidence of Senegalese migrants in Europe, this chapter, written in collaboration with Dr. Ognjen Obucina, focuses on the Spanish context and aims to disentangle the way in which migrant remittance behaviour is affected by individual characteristics (e.g., gender and education), economic integration, (e.g., employment status), and their ties to origin (e.g., family reunification).

Migrant remittances is a research topic with multiple dimensions of relevance. Economically, migrant remittances have grown steadily over recent decades. Not only have they surpassed official development assistance in low-to-middle income countries, but they were also larger than foreign direct investment in 2019 (World Bank, 2020). Although remittances to Africa constitute only 10 per cent of total remittances compared to other regions such as Asia and Latin America, they constitute a significant share of the GDP for some African countries (OECD, 2005). In Senegal, official monetary remittances accounted for 10 per cent of their 2011 GDP (Cisse, 2011), and a similar figure (10.7 per cent of GDP) is observed for 2020 (UNDP, 2021). Research on the impact of remittances on development indicates that remittances have contributed to a 30 per cent reduction in Senegalese poverty (Diagne & Diane, 2008). For scholars and policy makers, however, the importance of remittances extends beyond their economic dimension, as remittances and their determinants are intertwined with migration histories and migrants' incorporation into host societies, and they are arguably one of the central manifestations of immigrants' transnational ties. Remittances help sustain pivotal contemporary migration practices such as transnational families and circular migration, and they can also encourage further migration flows (de Haas, 2010; IFAD, 2017).

Our research design for chapter 2 relies on a longitudinal approach, given that we intended to link a specific subject of study to a larger and comprehensive framework, in which remittances are intertwined with migration histories and migrants' incorporation into host societies. Remittances are understood as transnational economic activities that keep migrants connected to their countries of origin and emerge from a combination of the migrant's capacity and desire to engage in a wider range of transnational practices (Portes, Haller and Guarnizo, 2002; De Haas, 2010). Drawing from Carling (2008), we sought to understand the capacity and desire to remit by studying the characteristics of a particular migration context under study, the nature of families and households, and the demographic dynamics underlying the variance in remittance flows. While economic integration refers to local capacities, the desire to remit is influenced by ties to the country of origin. We accounted for the preconditions for sending remittances (e.g., presence of potential remittance receivers in the origin country), assuming that certain demographic and kinship variables reflect stages in family migration histories that constitute key micro-level determinants of remittance flows.

The implementation of our longitudinal approach in chapter 2 was possible thanks to the characteristics of the datasets used, namely the Migrations between Africa and Europe (MAFE); and Migrations Between Senegal and Spain (MESE). The MAFE biographical survey was carried out in five European countries (France, Italy, Spain, the UK and the

Netherlands) and three African countries (Senegal, DR Congo and Ghana). The survey includes around 600 Senegalese immigrants living in Spain, Italy, and France. We include around 200 respondents who lived in Spain at the time of the survey, which was in 2008. The MESE survey, carried out in 2011, enriched our sample with another 405 Senegalese immigrants in Spain and, unlike the MAFE survey, includes only one origin country (Senegal) and one destination country (Spain). The two surveys collect retrospective information on migrants lives, use the same sampling techniques and almost identical questionnaires, so that they can be easily combined into a single dataset (see the study by Kraus, 2019). The longitudinal nature of MAFE data let researchers analyse African migration as process that is in turn linked to other demographic processes. It therefore helps distinguishing timing of events, facilitating the analysis of causality between them. In fact, in their above cited paper, Willekens and others (2016) referred to this dataset, together with other ones such as the Mexican Migration Project datasets (MMP), as an exemplary data collection approach and as a reference for future migration surveys.

Methods used consisted of a combination of event history analysis and multivariate analysis. We performed Kaplan–Meier analysis to explore how long it takes immigrants to start remitting. We used the same method to analyse how likely immigrants are to stop remitting. The multivariate analysis is based on a two-level mixed-effects linear probability regression. The advantage of linear probability models, as compared to logistic regression, is an easier interpretability of coefficients, but also the comparability of its estimates across groups (see Mood, 2010 for more details).

Chapter's 2 results indicate that remittance sending becomes substantial already in the first year of arrival. In addition, three quarters of the great majority of Senegalese who end up sending remittances maintain this economic flow for at least ten years, suggesting the presence of sustained transnational ties over time. The high prevalence of remittance sending found in our analyses is in line with the remittance behaviour of Senegalese in France and Italy, as documented by Chort et al. (2012). It also matches the aggregate-level statistics on remittance sending among Senegalese living abroad. However, it should also be noted that our analysis indicates a non-linear inverse U-shaped association between time in the destination country and remittances, once observable characteristics are taken into account. More precisely, the probability of remitting peaks in the eighth year in Spain for men and in the eleventh year for women. This non-linear association is in accordance with most previous studies from other migration contexts. The multivariate analysis reveals a strong positive association between employment and remittance sending. Although most coefficients in the full model are similar for men and women, some important differences emerge as well.

Chapter 3 aims at explaining the global implications of migrant networks on Colombian international migration rates, while accounting for individual time-varying demographic characteristics and macro levels changes. This chapter, written in collaboration with Dr. Martin Hinsch and Dr. Joelle Mak, may be the most ambitious one as it touches upon several subjects, analytical levels, and methods. To approach this challenge, we relied on efforts of developing a comprehensive theoretical framework to understand migration (Castles, de Haas, & Miller, 2013; De Haas, 2021; D. S. Massey et al., 1993). While acknowledging the simultaneous role of micro and macro factors explaining migration, migration scholars have emphasized the importance to understand the levels of analysis, conditions, contexts, and groups under which each of the mechanisms

proposed by migration theories may operate. In a recent work, De Haas (2021) worked under the key epistemological premise that a great share of conflictive interpretations may be explained by these differences. Similarly, in their classic piece, Massey and others (1993) worked under this premise and depicted that migration determinants may change over time and that mechanisms that explained the initiation of a migration flow may differ from what maintains them. Particularly, our work in this chapter is greatly inspired by the cumulative causation theory (D. S. Massey, 1990) and the role of migrant networks (D. Massey & España, 1987) as a determinant factor in increasing motivations and capabilities to migrate (Haas, 2021; Massey et al., 1993; Munshi, 2003; Takenaka & Pren, 2010).

Chapter 3 draws from previous work relying comprehensive frameworks in which migration theories are linked to understand migration. The article by Baizán and González-Ferrer (2016) was a key reference, because it implements the idea that individual migration probabilities are influenced by the simultaneous role of micro and macro factors. The work combined MAFE data on life-histories with a series of macro data indicators such as employment growth to determine labour and family related migration probabilities of Senegalese individuals to Europe. The work by Klabunde, Zinn, Willekens, and Leuchter (2017) and by Williams, O'Brien, and Yao (2017) served as guidelines of how to link individual level estimations from longitudinal data to its aggregate expression of emigration rates. Although with different research purposes and modelling strategies, both research pieces approached the task of linking the micro level of individual probabilities to the macro level of aggregated migration rates by developing a simulation model, an Agent-Based Model, given the comparative advantage of its bottom-up approach. Klabunde, Zinn, Willekens, and Leuchter (2017) built an ABM in which the migration decision was theoretically informed and where the migration process was embedded within a larger framework of competing demographic processes (e.g. marriage), that were in turned governed by a series of empirically based decisions. The model was setup based on survey data from the MAFE dataset mentioned above. Williams and others (2021b), on the other hand, developed their ABM applied to the Nepalese context and aimed at explaining how armed conflict affects migration rates. Similarly to the ABM by Klabunde and others (2017), their ABM considered a series of multiple states where transitions between them was informed by equations fitted from surveyed data, and where the level of armed conflict was considered as one variable affecting individual behaviour. However, in their modelling strategy, the decision to migrate was also informed by coefficients estimated by fitting a model to the Nepalese communities of interest. To test the effect of conflict on migration rates, the authors simulated hypothetical scenarios where the estimated parameter was modified according to theoretically and policy relevant benchmarks.

In this sense, our research design also relied on the advantages of survey-based Agent-Based Models to accomplish our research purpose, which it was of explanatory nature. Although less ambitious than prediction of future trends, ABMs can be built with an explanatory purpose in mind, making the tool relevant to understand why something occurs (Edmonds et al., 2019). In Edmonds and others (2019) words, “[i]f one makes a simulation in which certain mechanisms or processes are built in, and the outcomes of the simulation match some (known) data, then this simulation can support an explanation of the data using the built-in mechanisms” (p. 7). By taking advantage of the ABM as a digital laboratory for social research, simulation makes possible to test under what conditions a global pattern of interest is reproduced. For the development of

our ABM, we used data on Colombian emigration to fit a statistical model that provides individual probabilities of international migration to Spain. The parameters (or coefficients, factors) estimated from the statistical model were then used in an ABM to compute individual agents' international migration probability, or transition probabilities from potential to actual migrants, in each time step. Through this, we could reproduce individual life histories over time, letting agents migrate according to the fitted parameters. In each time step a series of indicators at the macrolevel were computed, such as the number of new and cumulative migrants, annual and cumulative migration rates of the sampled individuals in the data.

We used the Colombian module of the Latin American Migration Project (LAMP) data as provided by Durand & Pren (2016). The Colombian dataset contains representative samples of 14 Colombian communities collected in 2008, 2009, 2011, 2013, and 2015. Communities are strategically chosen to reproduce a range of conditions with respect to size, geography, ethnicity, and economic organization (D. S. Massey & Zenteno, 2000). Information on environmental factors was drawn from several data sources, namely: the UCDP/PRIO Armed conflict dataset from the Uppsala Conflict Data Program (violence levels); the Determinants of Migration Policy (DEMIG) project, namely, the POLICY and VISA datasets developed at the International Migration Institute (Haas, Natter, and Vezzoli (2016)); The World Bank (economic growth in Colombia); OECD (employment growth in the US and Spain).

The analysis was oriented to contrast a set of hypotheses on the effect of migrant networks on the aggregated migration rates over time, namely: networks are determinants in shaping aggregated migration rates; network effects alone would be not sufficient to reproduce migration dynamics of international Colombian migration to Spain; aggregated dynamics in migration rates will be greatly driven by mechanisms operating on entire communities. As complementary explanations and in line with previous research on the simultaneous effect of micro and macro factors, we also considered hypotheses concerning macro factors and aggregated migration rates.

Chapter's 3 main results let us confirm that networks played a key role in shaping the aggregated migration dynamics of international Colombian migration to Spain in the period from 1962 to 2008. In the hypothetical scenario with an absence of network effects, migration dynamics would be greatly modified as migration rates decreased significantly. Network effects were therefore a necessary condition to explain and reproduce migration dynamics of Colombians to Spain. At the same time, the sole presence of migrant networks was not a sufficient condition to shape migration dynamics. In addition, our results indicated that most of the aggregated effect of networks was caused by community networks instead of family ties to previous migrants. In fact, family networks were not the ones responsible in explaining the upsurge in migration rates, although they might have been of importance at the individual level. Moreover, the scenarios created by means of our ABM show that macro factors were a necessary condition to shape migration dynamics, a result that is in line with previous research in other contexts (Baizán & González-Ferrer, 2016; Durand & Massey, 2010). Of particular importance were the economic factors of GDP and employment growth. While networks alone were necessary but not sufficient, it is the aggregation with macro level characteristics at origin and destination such as changes in economic security in Colombia, employment demand in Spain, as well as border stringency that shaped migration rates.

A great share of the effort has been to connect my research questions to the global academic debates on international migration, by applying theoretical frameworks and methods to some of the key issues on the comprehension of international migration. Hoping that by expanding research questions to new contexts, using longitudinal approaches to understand migration, and integrating different levels of analysis by using innovative research methods such as simulation modelling, I may contribute to consolidating a comprehensive understanding of international migration.

The following chapters of this thesis further depict what has been briefly advanced above. Chapters 1,2, and 3, are followed by a final chapter, in which some concluding remarks are discussed.

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1. LABOUR MARKET INTEGRATION OF INTRAREGIONAL IMMIGRANTS IN CHILE: THE ROLE OF INFORMALITY

Abstract

This article provides an analysis of the employment and occupational attainment of immigrants in Chile. We used data from the Chilean Household Survey for the years 2013, 2015, and 2017 and compared the probabilities of being active, employed, and informally employed among immigrants and native-born Chileans using logistic regression models. We then analysed the occupational attainment achieved alongside the role of informality in constraining upward mobility by means of multinomial logistic regression models. After controlling for socio-demographic confounding factors and the role of time since arrival, we found evidence that immigrants are not at a disadvantage when compared with natives regarding activity and unemployment. We found evidence of diversified occupational assimilation, which depends on both the migration origin and gender. Employment informality among Latin American immigrants appears to reduce their access to higher-skilled and high-quality jobs when compared to formal migrants.

1.1 Introduction

In the last two decades, the number of immigrants in Chile has grown exponentially. The immigration stock in the country increased from 1.2 per cent in 2002 to 7.8 per cent of the total population in 2019. Out of the 1.49 million foreigners accounted for in 2019, 80 per cent arrived in the past decade (Instituto Nacional de Estadísticas (INE) and Departamento de Estranjería y Migración (DEM), 2020). Compared to other historical periods in which immigration has also been significant, the recent upsurge is characterised by a numerical and proportional increase, as well as more diversity in countries of origin, geographical spread, and the well-defined waves of immigrants according to nationality (Martinez & Orrego, 2016; Solimano & Tokman, 2006). This sudden increase in the immigration stock has been highly driven by the shift towards intraregional migration of international movements in the Latin American region over the past decades, in which Chile has become a hub for Latin American immigration.

In the context of this migration upsurge, a growing amount of research has contributed to understanding immigration in the Chilean labour market. Studies addressing immigrants' integration into Chilean occupations have found a heterogeneous pattern in which extraregional migrants outperform locals, Andean migrants (i.e. Peruvians and Bolivians) perform worse, and Southern Cone migrants (Argentinians and Uruguayans) perform relatively similarly to Chileans (Doña, 2016; Economic Commission for Latin America and the Caribbean (ECLAC) and International Labour Organization (ILO), 2017). The focus on occupational attainment is crucial to understanding how foreign workers may perform, depending on different labour market structures with various demands for low- or high-skilled labour (Brodmann and Polavieja, 2011). Drawing on the international academic debate on how immigrants are incorporated into the labour market, we identified a research gap in relation to controlling for confounding socio-

demographic factors and comprehending the role of the time spent in the host country on socio-economic integration (Chiswick, Lee, and Miller, 2005; Reyneri and Fullin, 2011). We focus on recent Latin American immigration to Chile, accounting for the different migration origins and compare their rates of economic activity, employment, and occupational attainment. Our interest in this article is on recent immigrants' outcomes in the labour market rather than on the broader categories and debates on assimilation and integration, which are considered but are only tangentially part of our framework (Alba & Nee, 2013; Portes & Zhou, 1996).

Because of the Chilean economy's unique and highly market-oriented nature alongside the persistent levels of labour market segmentation posed by levels of informality ranging between 30 per cent to 40 per cent over the past three decades, Chile is a unique context from which to better understand immigrants' socio-economic assimilation and the persistence of ethnic penalties in the labour market. Drawing on empirical research from European countries and the US (Chiswick et al., 2005; Heath and Cheung, 2007; Reyneri and Fullin, 2011), we aim to provide an analysis on whether ethnic penalties decrease after controlling for socio-demographic factors and the time spent in the host country. Our focus is on the time since arrival, as a proxy for host country experience, and on economic informality, since the latter is a growing global concern that is associated with occupational and social exclusion, not only in Chile and Latin America but in more developed areas such as Eastern and Southern European countries (Esteves, Fonseca, & Malheiros, 2018; ILO 2019; Ponzio, 2018).

The remainder of this paper is organised as follows. The next section provides a description of the characteristics of the recent upsurge of immigration flows to the country, and its labour market. We then present the theories used to explain immigrants' disadvantages in the labour market. The methodology is then discussed, followed by the descriptive and analytical results. Finally, the paper concludes with a summary of the findings.

1.2 Immigration and the labour market in Chile

Migration stock in Chile increased from 1.2 per cent of the total population in 2002 to 7.8 per cent in 2019, corresponding to 1.49 million foreigners (INE and DEM, 2020). Moreover, 9 per cent of the migrants arrived during the 2000–2009 period, and 80 per cent arrived during the 2010–2019 period. Arranged by population numbers, the main migration groups are Venezuelans, Peruvians, Haitians, Colombians, Bolivians, Argentinians, and Ecuadorians, which account for 82.9 per cent of the total stock. While Argentinians, Bolivians, Ecuadorians, and Peruvians constitute an older trend of migration flows into the country, Colombians, Haitians, and Venezuelans constitute a more recent flow (Martinez and Orrego, 2016). Despite intraregional migration has been a constant phenomenon both in Chile and in the rest of the Latin American countries, since the 1970s has increased its relative importance. Europeans flows that had been the main flow and international migration stock in the Latin American region during second half of the XIX and first decades of the XX centuries, as well as immediately after the Second World War declined (ECLAC 2006). In Chile the intraregional migration stock increased from 58 per cent in 1990 to 78 per cent in 2015 (United Nations Department of Economic and Social Affairs (UN-DESA, 2017).

Previous research suggests that determinants of immigration to Chile are related to its rapid economic expansion during the last decades, more favourable labour market and social indicators compared to its country neighbors, political and social stability, the development of migrant networks, and the characteristics of the migrant policies in the country (ECLAC 2006; Doña & Mullan, 2014; Solimano & Tokman, 2006). The recent immigration upsurge to Chile can be dated since the late 1980s, mainly from its country neighbours and Ecuador, which occurred in parallel to the sustained and relatively stable economic growth, as well as poverty reduction (Solimano & Tokman, 2006). The positive gap between Chile and its main immigration flows in terms of per capita income, employment opportunities, and real salaries, acted as a key pull factor (OECD, 2018; Solimano & Tokman, 2006). Labour demand in the service sector is associated with the increase of female immigration to Chile, a pattern also observed in other Latin American countries, especially from Peruvians as domestic workers and Ecuadorians in the health sector (ECLAC & ILO 2017).

(Solimano & Tokman, 2006) looked at the size of the informal sector as a possible determinant of immigration to Chile, for which they provide a twofold interpretation. A “big” informal sector might facilitate entry into the labour market, but lower productivity firms pay lower salaries, which may be less attractive for immigrants. Chile has a lower share of the informal sector (30%) and informal employment (30%) compared to the Latin American average, which is estimated in 47% and 53%, respectively (CEPALSTAT 2019). Moreover, job growth rates have had a greater increase among high productivity sectors when compared to the low and medium sectors.

Nevertheless, the Chilean economy remains little diversified, with growth heavily relying on natural resources with little value added, and a lack of technological introduction in firms that have opted for labour intensive strategies (Romaguera, González, Mizala, and Montero, 1997). Chile’s economic growth is paired with a highly de-regulated labour market since its structural reforms of free market-oriented policies in the 1970s and a new national labour law in 1979 which aimed to promote foreign investment to transform the shape of the labour market by reducing labour costs and decentralising wage bargaining across all private sector occupations (Romaguera et al., 1997). Despite a series of changes being implemented during the 1990s to improve employment protection, wages are highly flexible under economic shocks (Romaguera et al., 1997), and when compared to other OECD countries temporary contracts Chile has the highest proportion (OECD, 2018). (Figueroa & Fuentes, 2015) showed that although relatively small for the Latin American context, precarious forms of employment are significant and widely present across the Chilean labour market. In 2018 there were an estimated 300,000 irregular migrants (Servicio Jesuita a Migrantes (SJM), 2020), corresponding to 24 per cent of the migrant stock until that date, which may be associated with an economic expansion intensive in labour demand and migration policies not yet able to process current immigration flows (Doña & Mullan, 2014; Solimano & Tokman, 2006).

The combination of more stringent borders in the Global North and lax national border policies in the country have also been considered a determinant of immigration to Chile (Doña & Mullan, 2014; Solimano & Tokman, 2006). Chile’s migration policy is fundamentally based on a set of migration administrative laws created in 1975 within a completely different historical period established during Pinochet’s dictatorship (Doña

& Levinson, 2004; Stang, 2016)). Under this migratory regime, however, most foreigners have entered the country as tourists and later change their status to temporary residents by obtaining a job offer. The Southern Common Market (Mercosur) agreement helps to explain the relatively open border regime towards some Latin American countries. Chile implemented a partial version of agreement, granting to the 'original' Mercosur members (Argentinians, Brazilians, Paraguayans, and Uruguayans) and to Bolivia (since 2014), a temporary residence permit of up to two years, which can later be extended to permanent residence (OECD, 2019). In addition, a series of arrangements at the ministerial level (e.g. health Ministry) and modifications to the Foreign Affairs Office (Departamento de Extranjeria) have been implemented on top of the 1975 framework since the 1990s, such as granting equal access to public health; public education for immigrants and their children, regardless of their immigration status; and regularisation programmes in 1998, 2013, and 2018 (OECD, 2019). In 2018, a set of policies oriented to limit inflows and promote high-skilled migrants were implemented. Some scholars have critically reviewed the implementation of these policies, as they increase barriers for migrants to access regular status, especially among Haitians and Venezuelans who are now required to obtain visas to enter the country (Finn, 2020; Stefoni, Lube, and González, 2018).

Intraregional immigration stock in Chile is characterized for having relatively high levels of educational attainment, compared with the Chilean native population and also in contrast to Latin American countries such as Argentina, Costa Rica, and the Dominican Republic (Carrasco & Suárez, 2018; ECLAC 2006). This may help understanding that the presence of immigrant labour is diversified across productive sectors (ECLAC & ILO 2017). However, there are certain immigrant groups where informal work is more prevalent such as Haitians men occupied in the construction sector (Stefoni, Leiva, & Bonhomme, 2017) and Peruvian women in the domestic services (Stefoni, 2002). Descriptive analysis of social exclusion measured of intraregional migrants, as compared to Chilean natives, have been found in terms of dwelling overcrowding, relative lower access to school and health services (Carrasco & Suárez, 2018; ECLAC 2006).

1.4 Literature review

The issue of the existence and extent of ethnic penalties in the labour has been studied in many countries around the globe, leading to empirical evidence showing that while employment patterns (i.e. levels of economic activity and employment) may converge (e.g. Spain), occupational trajectories between some migrants groups and natives tend to persist when sociodemographic confounding factors and time since arrival are accounted for (Heath & Cheung, 2007; Reyneri & Fullin, 2011). Segmented assimilation theories applied in the labour market provide a framework to better understand the underlying mechanisms that result in specific barriers for migrants' occupational assimilation, namely the labour market's structure (Brodmann and Polavieja, 2011), access to non-migrant social capital (Oesch and von Ow, 2017), and discrimination levels in host societies (Bonoli and Hinrichs, 2012).

Segmented labour markets are characterised by presenting an insider/outsider scenario in which the workforce is divided into a primary sector with better quality jobs, that is

(i.e. better wages, opportunities for upward mobility, and access to social protection), and a more precarious secondary labour market with reduced labour costs provided by fixed-term contracts and less access to social protection (Blossfeld, Mills, and Bernardi, 2006). Segmentation refers to the persistent differentiations in labour market opportunities for similarly productive workers, which result from the partial introduction of flexibilisation strategies that focus on new entrants (age or cohorts) and/or on the ‘non-standard’ employment relations for particular marginal groups (Barbieri, 2009). Previous studies have shown that highly segmented labour markets can concentrate large proportions of migrants, who are attracted by the lower entry barriers posed by the informal economy and income opportunities, such as in the cases of Italy and Spain (Barbiano di Belgiojoso, 2019; Bernardi, Garrido, & Miyar, 2011).

The conceptualisation of informality has evolved from a focus on firms and their productivity as the units of analysis (*informal sector*) to a broader approach that considers employment quality, and it can therefore tackle labour precariousness in firms that aim to increase competitiveness via labour cost reductions of outsourced and temporary workers (*informal employment*) (ILO, 2003). In this sense, both outsourced and temporary workers can be considered as informal because they might not have access to social protection, or the other types of benefits associated with labour laws. Informality plays a key role in terms that it may facilitate migrants’ access to the host country’s labour market, since there are few legal or administrative barriers to accessing jobs. However, it may also lead to a strong segregation into low-level and precarious occupations. This is problematic because poor working conditions (e.g. extended hours), less access to social protection (e.g. unemployment insurance), and income instability limit migrants’ abilities to make long-term investments (e.g. post-school training at their destination), which increases their chances of becoming trapped or segregated within lower-quality jobs and negatively affects their chances of upward mobility (Bernardi et al., 2011). The lack of access to social rights and public support upon arrival has also been considered a reinforcing factor in migrants’ occupational attainment segregation (Kogan, 2011).

Although immigrants’ social networks might be helpful for them to access employment, to achieve better quality jobs, social capital beyond the ethnically homogenous migrant networks (i.e. ties to locals) is needed (Munshi, 2003). Discriminatory practices such as employers choosing to differently reward groups that have equal productivity levels, or using hiring practices where certain migrant groups are associated with stigma of being worse employees, have been considered as the mechanisms underlying persisting ethnic penalties (Bonoli and Hinrichs, 2012). If present, disadvantages resulting from these discriminatory practices are more likely to affect migrants that are distinctly visible (e.g. by their different skin colour) from the local population (Heath and Cheung, 2007). In the Chilean case, its colonial history has led to the creation of heavily racialised institutions that discriminate as an underlying mechanism, which explains persisting disadvantages in the labour market towards non-European migrants, Indigenous peoples, and afro-descendants (Tijoux, 2016). Regarding discrimination towards migrants in Chile, several studies have explored the presence of discrimination towards Bolivians, Colombians, Haitians, and Peruvians, who may be perceived as phenotypically different by a Chilean population that self-represents as being modern and white (Mora and Undurraga, 2013; Stang and Stefoni, 2016).

When applying the segmented labour market theories into the Chilean context, we expect that employment patterns (i.e. economic activity and levels of employment) may converge between immigrants and Chileans. We posit that the relatively high labour flexibility of the Chilean labour market combined with the marked employment-oriented nature of Latin American migration allows us to expect similar or rapidly converging employment patterns from the migrants to that of the Chileans. However, we also expect some occupational assimilation to be constrained by underlying segmentation mechanisms. We posit that the mechanisms associated with segmentation will hinder socio-economic integration and therefore constrain occupational convergence for specific migrant groups, namely those perceived as visibly distinct by the Chilean population and migrant informal workers. Finally, the combination of a high level of labour market segmentation in the Chilean labour market with low public support for the unemployed let us argue that informal migrant workers will be trapped in lower-skilled jobs. Compared to informal Chilean workers, informal migrants should have a lower probability of accessing higher-skilled occupations. Moreover, informal migrant workers should tend to have a persistently low probability of accessing higher-skilled occupations when compared to formal migrant workers, who should present a convergent trend towards that of Chileans.

1.5 Data and methods

Our analysis used the Chilean Household Surveys (HHS), focusing on Chilean and Latin American migrants respondents aged between 15 and 64. According to (OIT, 2016), HHS have a comparative advantage over censuses to study labour migration in Latin America, because of periodicity, specificity of labour market related questions, and more detailed information of time since arrival. The HHS is conducted every two years and has a cross-sectional nature with a sample size of approximately 200,000 individuals in each wave. We merged the last three available rounds of the HHS (2013, 2015, and 2017), which allowed us to analyse the main immigrant groups separately in most cases. Because we were interested in the relation of the time since migration to socio-economic assimilation in the labour market, having different cross-sectional measures and the accumulated time since arrival allowed us to decrease biases due to the period and cohorts effects, respectively. Data limitations refer to immigrants' smaller sample size in the 2013 and 2015 waves, and that although both regular and irregular immigrants are included, there is no way of distinguishing them which may therefore lead to a negative bias. We use survey individual weights estimated for each survey year in our analyses.

Our analyses were divided into three parts. The first part consisted of logistic regression models to study the probability of being economically active versus inactive, the probability of being employed versus unemployed, and the probability of being informally employed versus formally employed. Second, to study occupational attainment, we then estimated a multinomial logistic regression based on the European Socio-economic Classification (ESeC). We use the same four categories considered in previous research on social stratification and immigrants' occupational outcomes, namely: (1) professionals and managers (higher- and lower-grade service occupations); (2) intermediate and self-employed occupations (higher-grade white-collar workers, small employers, and independent workers); (3) skilled manual workers; and (4) manual or non-skilled workers (Rose and Harrison, 2007). Third, to study the effect of the time

since arrival among the informal migrants and to also account for gender, our last analysis included a triple interaction between the female variable, time since arrival, and informality. The odds and predicted probabilities of informal Chilean and Latin American migrants accessing higher-skilled occupations were then compared. Men and women were analysed separately in all but the model that included the interactions.

We aim to jointly model foreign-and native-born respondents, together with the effect of time since arrival, for which we generated the following variables. One dummy variable named *chilean* indexing whether the person is foreign born (0) or native born (1). Moreover, we used country of origin, with Chileans as the reference category, to distinguish the main Latin American migrant groups in the country, as well as a broad category of “Other Latinamerica” which considers all other intraregional origins. We generated the variable time since arrival and coded it with dummies of two-year period (to ensure sufficient sample size), which ranged from 0–2 to 9+ years. Note that to facilitate the analysis of socio-economic assimilation, we included Chileans within the category 0-2 years. In practice, this means that in models with the dummy variable for Chilean and time since arrival, the reference category was migrants in the first time period (i.e. 0-2). In models with the variable country of origin and time since arrival, the reference category was Chileans. Alternative measurements explored of time since arrival are discussed in the final section of the article.

The measurement for informality considered the survey questions looking at the type of workers contract. Drawing from ILO’s measurement recommendation to consider a broad category of informal employment, we considered informal workers that were without a contract, temporary (fixed-term), and outsourced. As such, we were concerned not only with the informal sector focused on skills and productivity but also with informal employment across sectors and the access to better quality jobs across the social class spectrum (ILO, 2018). It is important to note that because the variable measuring informality concerned informal employment in relation to the presence and nature of working contracts, the third and last analysis was restricted to employees only and did not concern the self-employed or employers.

The control variables were female (yes/no), age groups, education, partner status, having children (yes/no), partner’s social class, informal employment, region of residence, and observation year. Education was coded according to four broad categories: primary level or lower; lower secondary level; upper secondary level; and tertiary level. The variable for partner status of respondents was coded into three groups of no partner, Chilean partner, or migrant partner, which allowed us to account for any social ties to the local population. The partner’s social class followed the same ESeC classification as above, with the exception that the categories for no partner and inactivity were added to keep respondents in those particular situations in the analysis. The variable for region grouped individuals from the metropolitan region, the north, and the rest of Chile. Finally, to control for possible period effects, the variable for observation of years accounted for the 2013, 2015, and 2017 survey years.

1.6 Descriptive findings

We conducted a series of descriptive socio-demographic analyses, presented in tables A1 to A3 in the Appendix. We confirmed the overall pattern for Latin American

migrants found in previous research and that is characterised by a younger structure and higher educational attainment compared to Chileans. Indeed, all groups of foreign born present lower age averages. Among men, Venezuelans and Haitians are the youngest, almost seven years younger than Chileans. Among women, it is Haitians and Bolivians who are the youngest. The Chileans' average years of education (11.6) was lower than that of all migrant groups except for the Bolivian and Haitian migrants, for both men and women.

Regarding employment patterns we found activity levels were higher than those of the Chileans for all immigrants, both among men and women. However, there are distinctive patterns concerning activity levels by national origin that are worth mention. Activity levels are considerably higher compared to Chileans among Venezuelans, Colombians, and Peruvians, both for men and women. Moreover, differences in the activity levels between men and women are the largest among Haitians (27.9 per cent points¹ higher for men), surpassing that of Chileans (23.4 pp). All other foreign-born groups present lower gender differences in activity levels, especially Venezuelans and Colombians. A similar pattern was observed for the levels of unemployment for mostly all immigrant groups when compared to the native-born Chileans. In fact, except for the Haitians and Other Latin Americans, the levels of unemployment were lower among the foreign-born. Among men, Venezuelans, Colombians, and Bolivians present between 2.5-4.1 less percentage points in unemployment compared to Chileans. Among women, the greatest difference to Chileans in terms of unemployment occurs among Colombians (4.1 pp), while is less pronounced for Bolivians (2.7 pp), Peruvians (2.1), Argentinians (1.8), and Venezuelans (1.7pp). In synthesis regarding activity and employment levels we found that despite employment pattern gaps between immigrants and Chileans follow a similar pattern by gender, the extent of these differences tends to be larger for women. For instance, among the women, the gap in terms of their activity level was large, with up to a 30 per cent difference between the Chileans and Venezuelans. However, the Argentinian women deviated from this pattern and resembled the inactivity proportion of the Chilean women. Regarding unemployment, the immigrant women presented a similar pattern to the men. However, an exception was seen for the Haitians, as the women accounted for 25 per cent of unemployment.

The proportion of economic informality displayed a somewhat similar pattern to economic activity and employment apart from the Bolivians, for whom the proportions were higher for both men and women. Haitians present informality levels only among men. In particular, the greatest differences in informality compared to Chileans are observed among Venezuelan men and Colombian women. Among men, Argentinians and Peruvians also present lower levels of informality, although the distance to Chileans is narrower. Among women, in addition to Colombians, Venezuelans and Argentinians present more than two percentage points differences in informality levels compared to Chileans. Haitian women present less than one point percentage difference in this indicator, compared to Chileans.

The patterns of occupational attainment were quite distinct between the men and women. For the men, the proportion of unskilled workers was around 30 per cent (except for the Haitians, at 42%), and the female migrants tended to be concentrated within these occupations, especially the Haitians, Peruvians, Bolivians, and

¹ From now onwards in the document “pp”.

Colombians. However, an average proportion of 15.5 per cent for men and 19.7 per cent for women occupied professional and managerial positions, which resembled that of the Chileans. Finally, the Argentinians and Venezuelans presented a higher proportion of men and women within this social class category.

A multivariate analysis was necessary to gain a better understanding, as it could control for the socio-demographic characteristics and other possible confounding factors. In the following sections, we present our results in relation to the aforementioned theoretical expectations.

1.6 Employment patterns: Results of the multivariate analysis

Tables 1 and 2 present the logistic regression results of the odds of being active, employed, and informal.

As regards the control variables, we observe that among Chileans and foreign born men, the likelihood of being active is higher among individuals ages 35-44, with secondary educational level, in a partnership, with children, and from the Metropolitan region. Among women, those with tertiary education and single are the ones with a higher likelihood of being economically active. In particular, the age effects show that economic activity seems to be more likely among men and women of ages 35-44, something that could be explained by delayed entry into labour market due to continuation of studies. The effect of education on the likelihood of being active is also notorious, where individuals with secondary educational level have greater levels, compared to those with tertiary education. As we did not control for currently attending educational programs, some of the variance could also be explained in that regards. The likelihood of being employed, among economically active men, is associated to older ages (i.e. 55-64), having a Chilean partner, having children, and residing in the Metropolitan region. Among women, although it tends to be a similar pattern to men in most control variables, tertiary education plays a role in increasing the likelihood of being employed. As regards economic informality, younger ages, lower educated, singles, and from regions different than the Metropolitan are more likely to be in these types of jobs, both among men and women.

When controlling for the socio-demographic characteristics (e.g. age, education, region, etc.) and time since arrival, we found a systematic result indicating that the immigrants have higher odds of being economically active and employed when compared to the Chileans, thus confirming the descriptive results stated above. This finding is consistent with the studies that point to the labour-oriented nature of Latin American migration to Chile (ILO, 2017), as well as the evidence in other contexts such as Southern Europe and the employment-oriented migration flows (e.g. Spanish) in Germany (Fullin and Reyneri, 2011; Kogan, 2011). Note, however, that migrants' economic activity tends to decrease over time, both for men and women. One explanation to this may be that migrants with longer time in the country would have lower urgent pressures to work due to having reunited family members and having accessed social protection systems, among others. The likelihood of being employed among the foreign born tends to be either equal or higher (among women) over time.

Finally, regarding informality, we found a significant effect for the first two years; however, it tends to disappear for later periods. This means that when holding everything else but time since arrival constant, immigrant workers presented similar probabilities of being informally employed. In this sense, the results confirm what we expected regarding similar or even greater levels of economic activity and employment.

Table 1
Logistic regression. Odds Ratios of being active versus inactive; employed versus unemployed; informal versus formal. Men (Controlled for age, education, partner status, children, partner's social class, region, observation year and time since arrival).

	Active	Employed	Informal
Age groups			
15-24	0.12***	0.50***	1.69***
25-34 (ref.cat.)			
35-44	1.68***	1.55***	0.77***
45-54	1.22***	1.64***	0.63***
55-64	0.50***	1.68***	0.53***
Education			
Primary	0.72***	0.99	3.11***
Lower secondary	0.61***	0.88***	2.32***
Upper secondary	1.97***	1.03	1.36***
Tertiary (ref. category)			
Partner status			
No partner	0.20***	0.35***	1.72***
Chilean partner (ref. cat.)			
Migrant partner	1.83***	0.64***	1.07**
Children	1.68***	1.27***	0.90***
Region			
Metropolitan region (ref.cat.)			
North region	0.78***	0.81***	1.40***
Other region	0.77***	0.90***	1.60***
Observation year			
2013 (ref.cat.)			
2015	0.89***	0.85***	1.16***
2017	0.89***	0.80***	1.20***
Partner's class			
No partner			
Inactive	0.71***	1.04	1.30***
Unskilled	0.71***	0.58***	1.51***
Skilled manual workers	0.91	0.67***	1.10*
Intermediate occupations and self-employed	0.77***	0.83*	1.18***
Professionals and managerial (ref. cat.)			
Chilean	0.33***	0.61***	0.76***
Time since arrival			
0-2 (ref. cat.)			
3-5	0.82	1.26	0.71**
6-8	0.63*	1.72	0.62***
9+	0.44***	1.07	0.81*
_cons	21.36***	27.72***	0.23***
N	217453	167383	119131

*=10 per cent significance, **=5 per cent significance, ***=1 per cent significance.

Source: Chilean Household Surveys 2013, 2015, 2017.

Table 2
Odds Ratios of being active versus inactive; employed versus unemployed;
informal versus formal. Women (Controlled for age, education, partner status,
children, partner’s social class, region, observation year and time since arrival).

	Active	Employed	Informal
Age groups			
15-24	0.16***	0.38***	1.87***
25-34 (ref.cat.)			
35-44	1.27***	1.49***	0.74***
45-54	1.13***	1.84***	0.62***
55-64	0.60***	2.41***	0.55***
Education			
Primary	0.30***	0.69***	4.60***
Lower secondary	0.33***	0.66***	2.88***
Upper secondary	0.67***	0.88***	1.34***
Tertiary (ref. category)			
Partner status			
No partner	2.03***	0.60***	1.43***
Chilean partner (ref. cat.)			
Migrant partner	1.40***	0.55***	0.84***
Children	1.27***	1.36***	1.02
Region			
Metropolitan region (ref.cat.)			
North region	0.70***	0.87***	1.32***
Other region	0.69***	0.77***	1.69***
Observation year			
2013 (ref.cat.)			
2015	0.91***	0.82***	1.08***
2017	0.95***	0.75***	1.13***
Partner’s class			
No partner (ref.cat.)			
Inactive	1.04	1.22*	1.40***
Unskilled	0.79***	0.66***	1.47***
Skilled manual workers	0.79***	0.66***	1.18***
Intermediate occupations and self-employed	1.00	1.10	1.10*
Professionals and managerial (ref. cat.)			
Chilean	0.42***	0.71**	0.80**
Time since arrival			
0-2 (ref.cat.)			
3-5	0.71***	1.55*	0.61***
6-8	0.71**	1.06	0.71*
9+	0.60***	1.10	0.86
_cons	2.44***	21.33***	0.25***
N	240110	123599	89534

*=10 per cent significance, **=5 per cent significance, ***=1 per cent significance.

Source: Chilean Household Surveys 2013, 2015, 2017.

1.7 Occupational attainment: Results of multivariate analysis

The odds ratios for men and women are presented in Tables 3 and 4, respectively, as well as the predicted probabilities (Figures 1 and 2) from the multinomial logistic regression of class attainment. Our results indicated a diversified pattern according to migration origin, gender, and social class. Overall, we observed that occupational assimilation might have already occurred since arrival as indicated by the time since arrival variables, although the time in the country played a role for some migration groups. This meant that, despite the persistence of the ethnic penalties that tended to

remain over time, we also observed that all migration groups achieved occupational assimilation in certain social classes and, in some cases, may have outperform Chileans (i.e. attain greater probabilities of accessing higher skilled occupations). For instance, from the model coefficients and figures, we observed that the Argentinians, Ecuadorians, and Venezuelans reached the highest levels of the social spectrum. The Peruvian men and Bolivian women, on the other hand, did not reach professional and managerial positions, but presented similar or higher odds of being self-employed. Our model also suggested that the Haitian men were overrepresented at the lowest occupational level and remained disadvantaged in their access to professional and managerial occupations, but could, however, reach skilled manual occupations.

Table 3:
Odds Ratios after multinomial logistic regression. Odds Ratio of entering high level classes (Professionals and managers, intermediate occupations or skilled manual) instead of unskilled manual class (Ref. Cat); Men (Controlled for age, education, partner status, children, partner's social class, region, observation year and time since arrival.

	Skilled	Interm. Occ.	Prof&Manag
Age groups			
15-24	0.98	0.60***	0.30***
25-34 (ref.cat.)			
35-44	0.95**	1.53***	1.25***
45-54	0.86***	1.91***	1.29***
55-64	0.74***	2.30***	1.67***
Education			
Primary	0.40***	0.38***	0.00***
Lower secondary	0.43***	0.37***	0.01***
Upper secondary	0.54***	0.36***	0.02***
Tertiary (ref. category)			
Partner status			
No partner	0.72***	0.61***	0.28***
Chilean partner (ref. cat.)			
Migrant partner	0.98	1.10**	0.87**
Children	1.06**	0.98	0.96
Region			
Metropolitan region (ref.cat.)			
North region	1.00	1.06*	0.67***
Other region	0.91***	0.88***	0.66***
Observation year			
2013 (ref.cat.)			
2015	0.90***	1.03	0.92**
2017	0.77***	1.01	0.78***
Partner's social class			
No partner			
Inactive	0.79***	0.50***	0.26***
Unskilled	0.62***	0.33***	0.09***
Skilled manual workers	1.00	0.54***	0.19***
Intermediate occupations and self-employed	0.88**	1.30***	0.37***
Professionals and managerial (ref. cat.)			
Migration origin			
Chile (ref. cat.)			
Venezuela	0.63**	0.38***	0.40***
Peru	1.08	0.95	0.21***
Haiti	1.32*	0.19***	0.14***
Colombia	1.11	0.73*	0.55**

Bolivia	1.00	1.33*	0.35***
Argentina	0.93	1.15	0.64
Ecuador	1.12	1.26	0.85
Other Latin America	1.55*	1.09	1.41
Time since arrival			
0-2 (ref. cat.)			
3-5	1.04	0.75	1.31
6-8	1.03	1.32	3.14***
9+	1.03	1.51**	2.30***
_cons	3.16***	2.28***	16.87***
N	155616		

*=10 per cent significance, **=5 per cent significance, ***=1 per cent significance.

Source: Chilean Household Surveys 2013, 2015, 2017.

To systematise these results, we identified three distinctive groups that can be represented by the following migration origins. The first group is characterised by the Venezuelans, who outperformed the Chileans in their access to higher-skilled occupations since arrival. As some studies have shown, Venezuelans are not only mostly more highly educated, but also accumulate job experience in professional occupations at origin (International Organization for Migration (OIM), 2018). They also have the highest level of social networks out of all the groups (together with Peruvians), and, up until 2019 (when the implementation of the new visa scheme was not yet in place), did not enter the country irregularly (SJM, 2020). Likewise, there is probably a selection effect for the Venezuelans, meaning that this immigrant group might be richer and therefore may be able to wait for better labour market opportunities. The Argentinians are also either similar to or outperform the Chileans since arrival, as they benefit from easier access to residence permits as granted by the Mercosur agreement. At this point is important to recall that Bolivians are only part of the Chilean Mercosur implementation since year 2014, and therefore its potential positive impact may not yet be observed. The second group of migrants is characterised by the Colombians, who may start with lower occupational attainments compared to the Chileans, but tend to converge later in time and even end up outperforming them. As we have depicted, the Colombians had higher educational attainments than the Chileans, although the gap was not as large for the Venezuelans and Argentinians. Ecuadorians could also be classified in this group, as they represented an older migration and were a relatively small group that were also characterised as having higher educational attainments.

Table 4:
Odds Ratios after multinomial logistic regression. Odds Ratio of entering high level classes (Professionals and managers, intermediate occupations or skilled manual) instead of unskilled manual class (Ref. Cat); Men (Controlled for age, education, partner status, children, partner's social class, region, observation year and time since arrival.

	Skilled	Interm. Occ. and self-employed	Salariat
Age groups			
15-24	1.12***	0.68***	0.27***
25-34 (ref.cat.)			
35-44	0.74***	1.02	0.74***
45-54	0.58***	0.95*	0.57***
55-64	0.59***	1.43***	1.02
Education			
Primary	0.14***	0.11***	0.00***
Lower secondary	0.21***	0.13***	0.00***

Upper secondary	0.50***	0.23***	0.01***
Tertiary (ref. category)			
Partner status			
No partner	0.47***	0.27***	0.12***
Chilean partner (ref. cat.)	1.00	1.00	1.00
Migrant partner	1.05	1.02	0.82**
Children	0.92***	1.11***	0.86***
Region			
Metropolitan region (ref.cat.)			
North region	1.07*	1.49***	1.31***
Other region	0.81***	0.80***	0.86***
Observation year			
2013 (ref.cat.)			
2015	0.96	0.92***	1.07*
2017	0.85***	0.92**	1.01
Partner's social class			
No partner			
Inactive	0.49***	0.33***	0.16***
Unskilled	0.35***	0.18***	0.07***
Skilled manual workers	0.61***	0.27***	0.11***
Intermediate occupations and self-employed	0.62***	0.77***	0.23***
Professionals and managerial (ref. cat.)			
Migration origin			
Chile (ref.cat.)			
Venezuela	0.63*	0.27***	0.15***
Peru	0.18***	0.14***	0.04***
Haiti	0.22***	0.13***	0.03***
Colombia	0.54***	0.29***	0.22***
Bolivia	0.35***	0.34***	0.06***
Argentina	0.66	0.50**	0.19***
Ecuador	0.47**	0.27***	0.23***
Other Latin America	0.36***	0.35***	0.20***
Time since arrival			
0-2 (ref. cat.)	1.01	1.10	1.06
3-5	1.39	1.52*	3.06***
6-8	1.78***	3.36***	5.67***
9+	1.01	1.10	1.06
_cons	7.52***	17.27***	76.14***
N	112789		

*=10 per cent significance, **=5 per cent significance, ***=1 per cent significance.

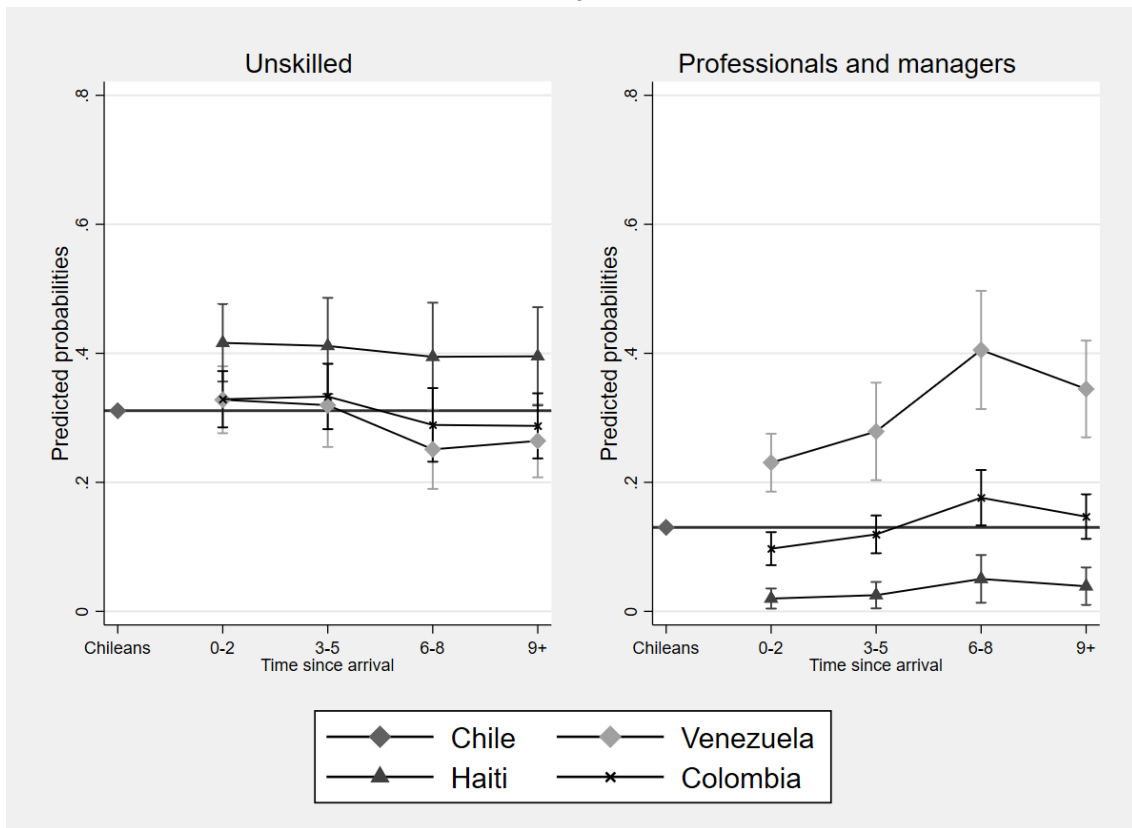
Source: Chilean Household Surveys 2013, 2015, 2017.

Finally, the third group is represented by the Bolivians, Peruvians, and Haitians, who have fewer chances to access higher-skilled occupations, but still manage to gain skilled job positions and self-employment opportunities. Our results suggest that the Haitian men had access to skilled manual occupations since arrival. Evidence from other studies has described that the Haitians in Chile are pioneer migrants and have greater opportunities in terms of income and educational attainment. At origin, many have professional jobs and are part of relatively middle-class families (Rojas, Amode, and Vásquez, 2017). Among the explanatory factors of these barriers in accessing higher-skilled occupations, studies point to a lack of fluency in Spanish and greater difficulty in gaining recognition of educational certificates. Scholars in Chile have strongly argued against the presence of discriminatory practices towards the Haitians both in the labour market and in their access to regular status (Rojas et al., 2017; Stefoni, Leiva, and Bonhomme, 2017). Bolivians and Peruvians could be classified in this group too, as they can also access skilled manual positions (i.e. the Peruvian men) and self-employed jobs (i.e. the Peruvian men and Bolivian women). Among the Peruvian women, ethnic

penalties tended to remain, and they tended to be highly segregated in the lowest-skilled jobs, which makes us think of a possible fourth group that can be characterised by higher levels of occupational segregation. (Stefoni, 2002) investigates why Peruvian women in Chile constituted such a labour market segmented group. The article describes how high levels of irregularity and social exclusion has coexisted since its origins in the 1990s with labour demand of domestic services by the middle-class Chilean households. This was confirmed by (Martínez, 2003) using census data, who found that Peruvian women had mostly incorporated into the labour market segment of “live-in” domestic workers, letting them more vulnerable for labour market exploitation and dependency of their employers.

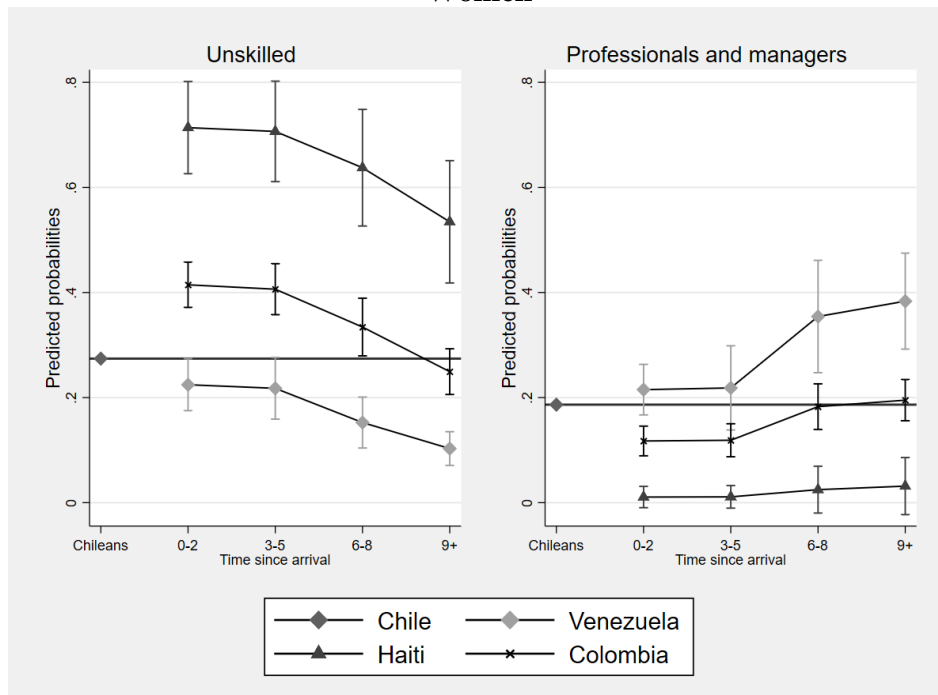
Overall, our results are consistent with the segmented assimilation hypothesis in that the Chilean labour market would allow for immigrants’ integration, although it would be constrained by persistent ethnic penalties for some groups because of high levels of segmentation. However, we did not account for the relevant nuances according to gender. Among the men in the unskilled social class, the gaps were less pronounced between both the migrants and when compared to that of the Chileans, whereas for the women the pattern depicted by the migration origin was much clearer. The latter indicates the coexistence of occupational convergence with persistent ethnic penalties for some groups. One explanation for these socio-economic assimilation differences by gender might be from fewer labour regulations in jobs performed by migrant men than by migrant women, which would therefore be more prone to discrimination. To rule out this possibility, we added *informality* to our multinomial logistic regression and analysed what happened among employees (the detailed results are available upon request from the authors). We found that informality was significant for all workers (both the Chileans and migrants), and that occupational convergence among the migrants was delayed to later periods. In the next section, we explore the role of informality in more detail. Another explanation for the gender differences in the convergence of occupational attainment might be in the type of tasks performed by the men and women, which we did not control for in our model.

Figure 1:
Predicted probabilities of occupying Unskilled and Professionals/managers positions by time since arrival. Chileans (Reference), Peruvians and Venezuelans. Men



Source: Chilean Household Surveys 2013, 2015, 2017

Figure 2:
Predicted probabilities of occupying Unskilled and Professionals/ managers positions by time since arrival. Chileans (Reference), Peruvians and Venezuelans.
Women



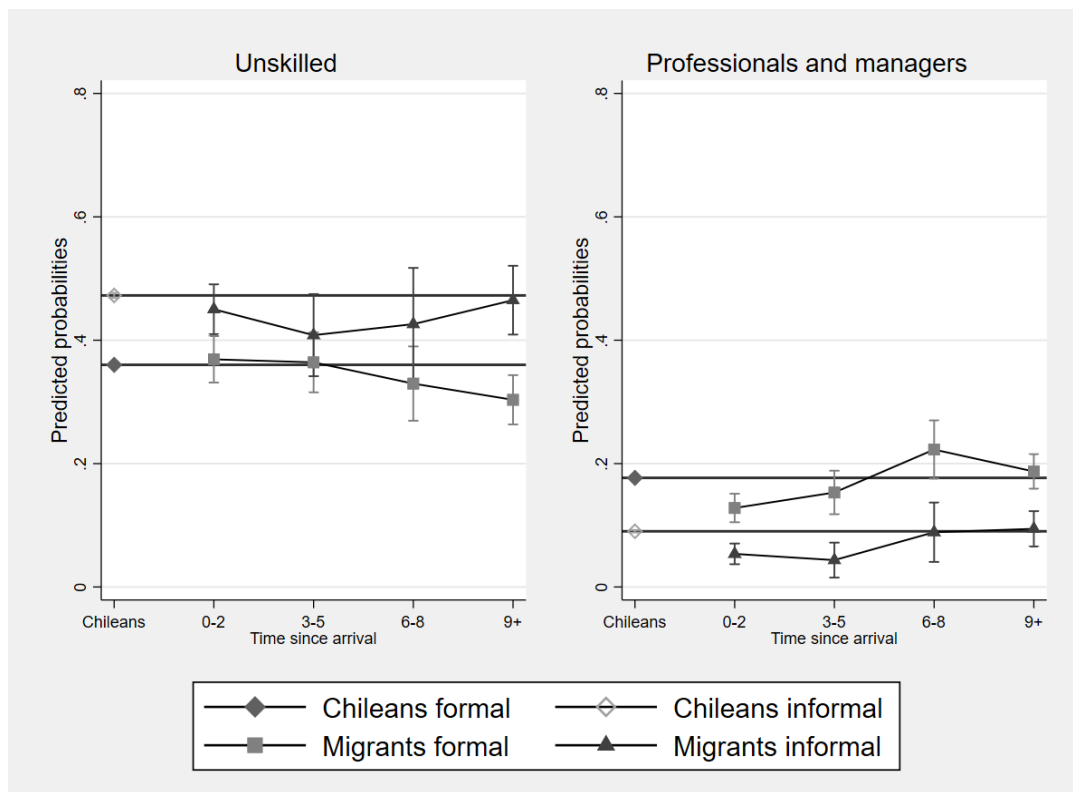
Source: Chilean Household Surveys 2013, 2015, 2017

1.8 The role of informality

Figures 3 and 4 show the predicted probabilities for the informal migrants over time, with the two straight lines representing the probabilities of the Chileans entering professional and managerial positions in formal and informal employment. When focusing on informal workers, we found that the predicted probabilities of entering higher-skilled occupations between the migrants and Chileans were either equal or presented an upward convergent trend for the former, although there were considerable differences according to gender.

Regarding men, Figure 3 show that the migrants in the unskilled social class present similar probabilities to the Chileans since arrival. Because of overlapping confidence intervals for all observed periods, a stable and invariant trajectory over time was inferred for occupations within this social class. The trajectories within professionals and managerial occupations presented an upward trend for the migrants that will converge with the Chileans from the sixth year onwards. For the women, the migrants in unskilled jobs presented greater disadvantages, and they tended to remain in these jobs for longer periods.

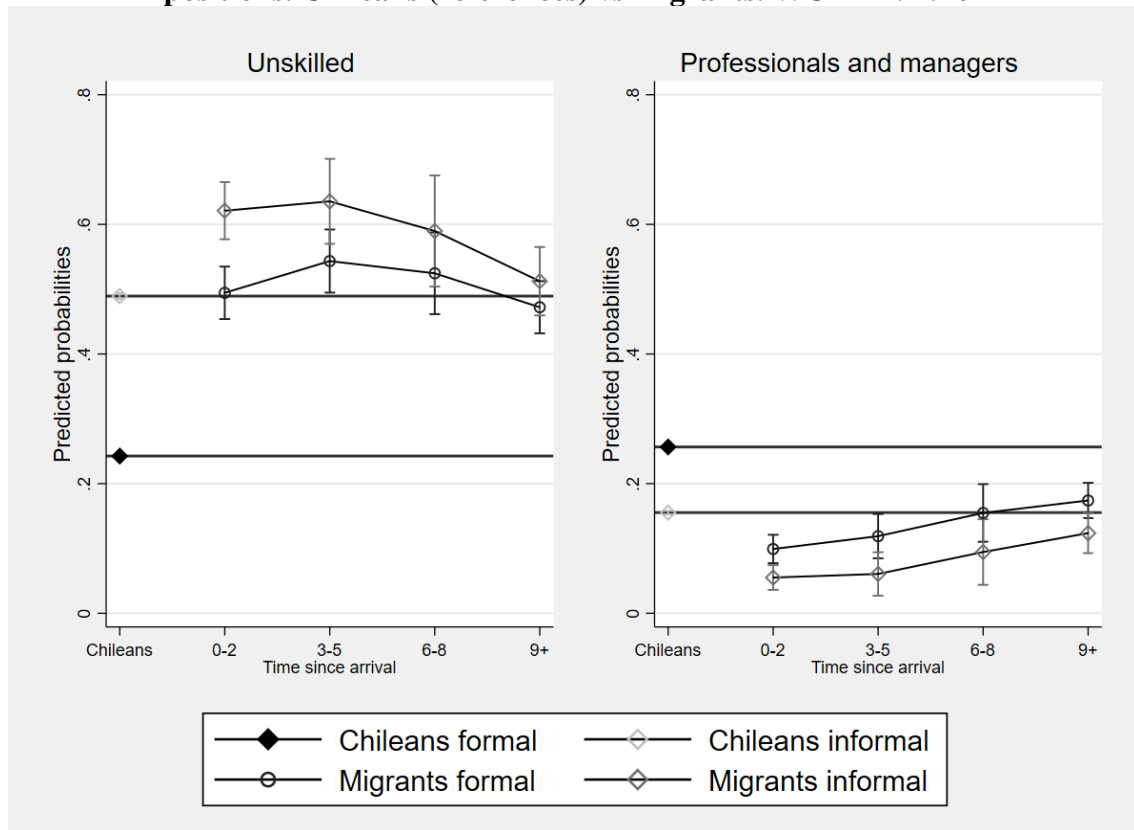
Figure 3:
Predicted probabilities of occupying Unskilled and Professionals/managerS positions. Chileans (references) vs migrants. MEN 15-64



Source: Chilean Household Surveys 2013, 2015, 2017

Figure 4 shows that the women have a much higher probability of occupying unskilled occupations, although the constraints eventually seem to be overcome for the migrants that have spent more than nine years in Chile. For the professionals and managerial positions among women, our model suggested both convergence and eventual assimilation over time, as was the case for men. When comparing the trajectories for the informal and formal migrants, we observed very similar patterns with the exception of men in unskilled occupations, who appeared to be leaving behind their occupations within the unskilled social class as time passed, although this pattern was not clear. Among the women in unskilled jobs, both the informal and formal migrants had a high probability of obtaining these occupations. In this sense, we found an occupational trap among the migrants, which was not necessarily associated with informal employment but rather with gender. This finding is in line with previous research that points to the reproduction of global care chains in which women labour is particularly demanded, leaving them with fewer chances to invest in the necessary skills or waiting times to access better job opportunities (Arriagada & Cadenas, 2012; Mora & Undurraga, 2013).

Figure 4:
Predicted probabilities of occupying Unskilled and Professionals/managers positions. Chileans (references) vs migrants. WOMEN 15-64



Source: Chilean Household Surveys 2013, 2015, 2017

1.9 Concluding remarks

When controlling for time since arrival or time spent in the labour market, studies have found that migrant and ethnic penalties regarding the probability of being employed are inexistent, especially in the context of high labour market flexibility and the demand for low-skilled labour such as in Southern European countries (Bernardi et al., 2011; Fullin and Reyneri, 2011). From our study on immigrants' labour market integration in Chile, the results did not indicate migrant penalties regarding rates of economic activity and access to employment, but rather the opposite. However, access to more secure jobs was less likely for the migrants during their first year since arrival. In this sense, regarding the general employment patterns of being economically active, employed, and having an informal occupation, Latin American migrants tended to present either higher or equal outcomes than Chileans, probably because of the clear employment-oriented nature of migration projects and the relative openness of the labour market.

Nevertheless, with regard to occupational attainment, we found a diversified situation from both gender and migration origin when controlling for sociodemographic confounding factors and time since arrival, which might indicate the presence of ethnic rather than migrant penalties (Auer & Fossati, 2019; Heath & Cheung, 2007). This means that labour market differences in occupational attainment are not necessarily due

to migration per se, but rather with the role of labour market segmentation mechanisms associated to ethnicity embedded in the social stratification system in Chile.

By holding sociodemographic characteristics equal and analysing the role of time we observed that while several Latin American immigrant groups (particularly the men) have reached similar occupational attainment than Chileans, for those within professional and managerial occupations, the occupational convergence among women was much slower or even unattainable for some migrant groups. Both male and female Bolivians, Haitians, and Peruvians had much lower chances of accessing higher-skilled occupations, although they did reach skilled manual occupations and were self-employed. On the other hand, the Venezuelans and Argentinians (and to some extent, the Ecuadorians) outperformed the Chileans in accessing higher-skilled jobs. Underlying segmentation mechanisms might contribute to this heterogeneity among the migrant groups, such as the presence of discriminatory practices towards some migrants due to a perception of being phenotypically different from the self-represented modern and white Chilean populations. The concentration of immigrant workers in certain occupations (e.g. domestic services) and the high proportion of social networks among some groups (i.e. the Bolivians and Peruvians) might also play a role in directing employment to certain niches. For the Haitians, the lack of language fluency should also be considered in their limited access to the top jobs, and is something that was not accounted for in our model.

We found that despite informality negatively affecting access to higher social classes, gender had a negative influence when explaining occupational segregation among migrants, which is probably linked to what scholars have investigated as a gendered global labour market and global care chains in Latin America and other contexts (Cerrutti & Maguid, 2010; Mora & Undurraga, 2013). The pressure of sending remittances combined with individual migration might be putting more constraints on carrying out the necessary long-term investments for upward mobility. Overall, employment informality among the Latin American immigrants seemed to reduce access to the higher-skilled and quality jobs when compared to the formal migrants, but it did not necessarily constrain upward mobility. Nevertheless, neglecting the hypothesis on the presence of an informality trap should not be read as an advantage over the Chileans, but rather as them reaching similar levels of segregation in their access to better quality jobs in a highly segmented labour market.

Our results are in line with the literature that indicates that in contexts characterised by flexible labour markets and segmentation, immigrants have a relatively high chance of being employed. However, our results confirmed that occupational assimilation is attainable for several migrant groups. These findings are closer to the polarised occupational trajectories experienced by some migrant groups in the United States and the United Kingdom (Felbo-Kolding, Leschke, & F. Spreckelsen, 2019; Heath & Cheung, 2007), and could be interpreted in light of the following characteristics for the Chilean context. First, as depicted, labour flexibility in the Chilean labour market is very high for OECD standards, and has rapid hiring (and firing) processes combined with an open border regime period, which provides relatively easy access for Latin American migrants through different regional mechanisms. Second, since the late 1990s, there has been employment growth at both the bottom and the top of the productive sectors, which is combined with a local population that is characterised by lower educational attainments when compared to that of the majority of immigrants.

Third, we cannot rule out the presence of discrimination mechanisms that constrain upward mobility for those immigrants that are perceived as being different by the local population, as multiple qualitative studies have pointed out.

It is important to highlight that the data used herein did not consider the HHS for the year 2020, conducted during the COVID-19 pandemic, due to its different characteristics and variables measurement, and because it was beyond the scope of this article. Given the exceptional times in which the 2020 HHS was conducted, some variables were not considered or included differently. This is the case for the variable time since arrival, that was measured as a dummy variable looking at recent (five or less years in Chile) and longer term migrants, as opposed to previous versions where the actual year of arrival was considered. Therefore, it is key to note that different socio-economic outcomes and trajectories for immigrants may be presented upon incorporating this data. In fact, descriptive analysis using the 2020 HHS have shown worse labour market incorporation among migrants, especially in terms of poverty and economic informality (Bravo, 2021). Since 2018, several reports have pointed out a shift in the characteristics of migration flows and their possibilities of labour market integration, which are mainly due to the changes in the visa and residence permit scheme put in place since that year, but are also due to the worsening of the situation and the subsequent stronger push factors at origin. For instance, Venezuelans, who have had relatively successful occupational trajectories, now have more difficulties in entering the country and accessing regular status (SJM, 2020). Finally, our results are drawn from a cross-sectional sample, and no causal claims should be inferred from them. Changes among individuals cannot be tackled; therefore, more precise and causal inferences regarding the role of time remain unknown. Other types of biases, such as selection bias due to unobserved characteristics of migrants (e.g. educational attainments at origin), or return bias, can only be acknowledged as limitations to be considered.

There are various limitations associated to the chosen research design that should be pointed out and briefly explained. Given we aimed to contrast and to provide an overview of employment and occupational patterns, a more detailed analyses for each of the labour market indicators were not conducted. Future work could conduct specific analyses on the dynamics of the activity, employment, informality and occupational, as well as to put concentrate on some of the patterns found, such as gender differences in each of these indicators. Moreover, the assimilation hypothesis could also be analysed by studying wages, information which is available in the Chilean household surveys.

As regards the modelling strategy, the sequential or conditional approach to study the likelihood of economic activity, employment, and informality could raise issues of selectivity. An alternative specification to explore in future work would model all the outcomes at one as mutually exclusive position using multinomial regression. Another alternative for future work is to study the probabilities of being active, employed, and informal using a Heckman probit model over the whole sample of individuals ages 15 and over. Adding simultaneous main and selection equation would let the researcher study differential effects of the covariates on the variables of interest.

Because our focus was on the role of time in explaining labour market penalties, our modelling strategy is limited concerning disentangling the overall effect of being foreign-born on the likelihood of achieving higher skilled occupations. Our model

specification does not measure the overall effect of being foreign born on employment patterns, but rather its combined effect with time since arrival. While this is not a problem *per-se*, given predicted probabilities over time since arrival are shown for all periods of time (including 9+), an alternative strategy would model natives and migrants separately. Moreover, this approach would let adding other foreign-born specific variables such as age at arrival, period of arrival, among others.

All in all, we expect our study contributes closing the gap on studying labour market integration in Chile, by considering the key role of time since arrival, as well as occupational attainment and informality indicators. To contribute to the international debate and empirical evidence, we aimed to use analytical categories and a research design in close dialogue with current international publications in the field of migration research. In this sense, there are certainly new lines of work to be explored such as deepen the analysis on the dynamics within each of the labour market indicators considered, update the work to the latest data sources published (e.g. National Migration Survey), as well as comparative analysis to other contexts.

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Appendix

**Table A1:
Age average and educational attainment by country of origin. Men & Women**

Men	Age average	Primary or less	Lower secondary	Upper secondary	Tertiary	Education years average	N
Chile	37.2	19.5	17.4	31.1	32.0	11.6	213417
Venezuela	30.5	1.7	3.4	17.1	77.8	15.4	393
Peru	34.0	6.7	12.7	53.4	27.2	12.3	1492
Haiti	30.7	23.0	25.8	34.5	16.7	10.9	372
Colombia	32.7	7.1	10.1	54.9	27.9	12.5	692
Bolivia	31.3	15.9	17.9	46.7	19.5	11.4	739
Argentina	34.7	9.2	15.7	31.8	43.4	12.9	742
Ecuador	33.9	9.4	9.7	42.6	38.3	13.1	189
Other Latin America	34.5	7.6	10.7	23.4	58.2	13.8	434
Total	37.1	19.2	17.2	31.4	32.2	11.7	218470
Women	Age average	Primary or less	Lower secondary	Upper secondary	Tertiary	Education years average	N
Chile	38.4	20.1	15.6	31.5	32.8	11.6	235117
Venezuela	32.8	1.3	1.2	12.7	84.7	15.7	428
Peru	35.9	8.9	15.3	52.2	23.6	11.9	1881
Haiti	29.9	24.7	24.0	37.2	14.1	10.7	221
Colombia	33.8	12.0	8.1	41.9	38.0	12.5	879
Bolivia	32.4	25.3	18.8	39.6	16.4	10.7	1194
Argentina	34.5	13.0	14.9	29.7	42.4	12.6	832
Ecuador	36.4	9.2	9.6	25.5	55.8	13.4	241
Other Latin America	36.0	7.5	11.3	33.4	47.8	13.5	544
Total	38.2	19.8	15.4	31.7	33.1	11.6	241337

Source: Chilean Household Surveys 2013, 2015, 2017.

**Table A2:
Employment patterns by country of origin. Men & Women**

	Men			Women		
	Active	Unemployed	Informal	Active	Unemployed	Informal
Chile	77.29	7.11	38.07	54.17	8.72	37.48
Venezuela	93.26	3.04	22.98	85.65	7.02	36.72
Peru	91.93	4.64	34.71	73.36	6.61	29.14
Haiti	92.71	11.60	50.70	64.86	25.13	47.76
Colombia	92.99	3.21	26.31	79.22	4.61	24.68
Bolivia	88.42	3.72	49.96	69.82	6.00	43.74
Argentina	82.37	6.57	31.47	59.97	6.86	32.27
Ecuador	90.75	1.60	21.81	68.19	6.20	22.85
Other Latin America	87.03	9.01	32.99	68.81	10.67	27.50
Total	77.75	7.03	37.83	54.86	8.66	37.19

Source: Chilean Household Surveys 2013, 2015, 2017.

**Table A3:
Occupational attainment by country of origin. Men & Women**

Men	Prof & Managerial	Intermediate and Self.Empl.	Skilled	Manual
	Chile	15.6	24.2	30.7
Venezuela	27.9	8.6	32.4	31.2
Peru	4.7	20.7	40.6	34.0
Haiti	1.8	6.2	49.9	42.2
Colombia	11.5	13.6	39.4	35.6
Bolivia	6.1	25.4	39.8	28.8
Argentina	22.9	27.1	27.7	22.3
Ecuador	17.9	12.1	38.3	31.7
Other Latin America	34.4	21.9	25.8	17.9
Total	15.5	23.9	30.9	29.7
Women	Prof & Managerial	Intermediate and Self.Empl.	Skilled	Manual
Chile	20.0	31.1	23.3	25.7
Venezuela	21.1	22.5	38.1	18.4
Peru	6.0	22.6	16.9	54.6
Haiti	1.1	6.9	16.5	75.5
Colombia	14.0	20.4	25.8	39.8
Bolivia	5.1	26.3	20.2	48.4
Argentina	20.9	31.4	27.5	20.2
Ecuador	25.9	39.5	16.8	17.8
Other Latin America	30.4	24.8	18.7	26.1
Total	19.7	30.7	23.3	26.3

Source: Chilean Household Surveys 2013, 2015, 2017.

2. THE DYNAMICS OF REMITTANCE BEHAVIOUR AMONG SENEGALESE MEN AND WOMEN IN SPAIN

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Abstract

This article explores the conditions under which Senegalese immigrants in Spain send remittances home, beginning with the premise that remittances are intertwined with migration histories and migrants' incorporation into host societies. Given the strong gender norms in Senegal we perform separate analyses for men and women. We use a longitudinal approach to analyse how remittance behaviour is affected by immigrants' characteristics, their economic integration, and their ties to origin and destination. Our data come from the *MAFE* and *MESE* surveys, which were implemented in 2008 and 2011, respectively. The results indicate that remitters constitute a clear majority among Senegalese immigrants in Spain. The Kaplan–Meier analysis shows that they rarely stop remitting once they start doing so, and the multivariate analysis reveals a strong positive association between employment and remittance sending. Although most coefficients in the full model are similar for men and women, some important differences emerge as well.

2.2 Introduction

Migrant remittances have grown steadily over recent decades. Not only have they surpassed official development assistance in low-to-middle income countries, but they were also larger than foreign direct investment in 2019 (World Bank, 2020). Although remittances to Africa constitute only 10 per cent of total remittances compared to other regions such as Asia and Latin America, they constitute a significant share of the GDP for some African countries (OECD, 2005). In Senegal, official monetary remittances accounted for 10 per cent of their 2011 GDP (Cisse, 2011), and a similar figure (10.7 per cent of GDP) is observed for 2020 (UNDP, 2021). Research on the impact of remittances on development indicates that remittances have contributed to a 30 per cent reduction in Senegalese poverty (Diagne and Diane, 2008). For scholars and policy makers, however, the importance of remittances extends beyond their economic dimension, as remittances and their determinants are intertwined with migration histories and migrants' incorporation into host societies, and they are arguably one of the central manifestations of immigrants' transnational ties. Remittances help sustain pivotal contemporary migration practices such as transnational families and circular migration, and they can also encourage further migration flows (de Haas, 2010; IFAD, 2017). By drawing on the previous empirical evidence of Senegalese migrants in

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Europe, this article focuses on the Spanish context and aims to disentangle the way in which migrant remittance behaviour is affected by individual characteristics (e.g., gender and education), economic integration, (e.g., employment status), and their ties to origin (e.g., family reunification). Our main research question is: Under what conditions do Senegalese in Spain send remittances home? We address this question by using a unique dataset that combines two retrospective surveys, namely *Migration between Africa and Europe* (MAFE, conducted in 2008) and *Migrations Between Senegal and Spain* (MESE, conducted in 2011).

Although remittance behaviour among Senegalese in Europe has already been addressed in some recent studies (among others, Chort, Gubert, and Senne, 2012; Vickstrom and Beauchemin, 2016), we complement the previous research in four ways. First, we introduce a dynamic component into the analysis of remittances by looking at when Senegalese immigrants start remitting and for how long they continue to do so. Second, we focus on a single destination country: Spain. This can be of importance when working with small samples, as our results cannot be biased by unobserved heterogeneity due to selection into different destinations. Third, we introduce into our model a wide range of variables reflecting family and economic ties to the home and destination countries. Fourth, we add a gender perspective to the overall analysis of remittance sending among Senegalese migrants by performing a separate analyses for men and women. Given the main features of the paper, it can be argued that its contribution to the literature on remittances is not confined strictly to the context of Senegalese migration. In particular, this concerns the longitudinal nature of the study, as a large majority of studies on remittances have been cross-sectional. Additionally, although the gender dimension of remittances is not entirely absent from the literature, it has been rarely addressed in previous studies.

2.3 Social context of the study

a) Senegalese Migration to Europe

With a population of around 17 million people, Senegal is a country characterized by low economic development and relative political stability. Although an important destination for some neighbouring West African countries, Senegal is also a country with a high level of emigration. According to UN-DESA (2019), around 45 per cent of Senegalese migrants live in another African country (with the most important destinations being Gambia and Mauritania), whereas 48 per cent of Senegalese migrants have opted for a European country. In the latter group, France, Italy, and Spain are by far the most important destinations, where the Senegalese populations are, respectively, 130,000, 104,000, and 52,000. Looking at the trends since 2010 (which roughly coincides with the time of the survey upon which this study is based), the UN DESA data suggest that the presence of Senegalese has moderately increased in France and Italy while it has very slightly decreased in Spain. In spite of this trend, the Senegalese in Spain still rank as the second largest group of African immigrants in the country (after Moroccans), followed by Algerians and Nigerians (INE, 2021).

While France has long been a typical destination country for Senegalese migrants due to its former colonial links and language ties, Spain and Italy have recently become attractive destinations. The tourism and industry sectors attracted migrants to Italy

during the 1990s, whereas Spain became important as a destination country due to a demand for labour in construction and the agricultural sector (Baizán and González-Ferrer, 2016). In his study on the occupational attainment of Senegalese migrants in France, Italy, and Spain, Obućina (2013) showed that labour pathways follow a U-shaped trajectory. This means that, on average, the occupational status of Senegalese migrants drops upon arrival in Europe and then increases over duration of stay, although with significant differences by destination. The pan-European approach in this study is complemented by Castagnone et al. (2015), who find that, in contrast to those residing in France and Italy, hardly any Senegalese in Spain are employed in skilled occupations even ten years following their immigration. It is likely that compositional factors underly these differences, as the same study finds that Senegalese migrants in Spain differ from those in France and Italy, namely in that they arrived in Europe more recently, are younger, and have lower levels of education. In this sense, questions naturally arise in regard to what extent Senegalese migrants are able to accumulate enough economic capital to start and maintain a remittance flow (Bruzzone et al., 2006).

b) Gendered Patterns of Senegalese Migration

Gender is one of the most basic elements structuring Senegalese migrants' experiences in Europe, as Senegalese men and women differ considerably in terms of the volume and type of migration. Although previous research suggests that migration aspirations in Senegal are nearly as widespread among women as among men (Carling et al., 2013), Senegalese migration is still highly influenced by a traditional patriarchal context that discourages female migration. Moreover, it is possible that remittances themselves are one of the mechanisms that shape the gendered nature of Senegalese migration. –For example, Beauchemin et al. (2015) argue that women are expected to stay in Senegal in order to ensure that the migrant husband will fulfil his obligations towards the home community. The process of feminisation of migration in Senegal is therefore slow, and international migration is still largely considered a masculine activity (Flahaux et al., 2014; Vause and Toma, 2015). It should, however, be noted that female family members remaining in Senegal often participate in the Senegalese culture of migration as “active stayers”, both by mobilizing financial resources to support the potential migrant before migration and by engaging in transnational activities after migration (Mondain and Diagne, 2013). When they do migrate abroad, Senegalese women most often do so for family reunification, that is, in order to join their partners already established abroad. However, the share of autonomous migrants among female migrants is not negligible either (Toma and Vause, 2013, 2014). Traditional views about gender roles also become manifest in the economic activity in the destination country. Castagnone et al. (2015) find that Senegalese labour market participation was higher among men than among women across all prominent European destinations, namely France, Italy, and Spain.

2.4 Theoretical background

In this paper, remittances are understood as transnational economic activities that keep migrants connected to their countries of origin and emerge from a combination of the migrant's capacity and desire to engage in a wider range of transnational practices, such as supporting future migrants, investments, and circular migration (Portes, Haller and

Guarnizo, 2002; De Haas, 2010). Our frame of reference draws from Carling (2008) in that we seek to understand the capacity and desire to remit by studying the characteristics of a particular migration context under study, the nature of families and households, and the demographic dynamics underlying the variance in remittance flows. While economic integration refers to local capacities, the desire to remit is influenced by ties to the country of origin. Also in line with the author, we account for the preconditions for sending remittances (e.g., presence of potential remittance receivers in the origin country), assuming that certain demographic and kinship variables reflect stages in family migration histories that constitute key micro-level determinants of remittance flows.

a) Family links hypothesis

Family ties are one of the key dimensions determining the level of migrants' attachment to their country of birth. The presence of family members in the origin country can trigger remittance sending through altruistic motivations. However, as migrants derive utility from their family's utility, the association between sending remittances and having family members such as parents or siblings in Senegal may not be exclusively motivated by pure altruism (Lucas and Stark, 1985). Previous literature has established that remittance sending may also be motivated by contractual arrangements between the migrant and the family members back home (Rapoport and Docquier, 2006). These mostly informal arrangements may concern a wide range of transactions between the migrant and the family. For instance, some migrants send money back home to compensate for the care of children left behind. Other motivations for remittance sending include a desire to maintain access to family property or financial support for the future migration of other family members. Bearing in mind the importance of both altruistic motivations and contractual arrangements — and assuming that they are not mutually exclusive — we expect that, all else being equal, family ties to Senegal will be positively associated with remittances (*the family links hypothesis*).

Just as our data allow us to identify family members living in Senegal each year after migration, we also have information on partners, children, and siblings living in Spain. Since family ties at the destination end of the migration process can affect remittance behaviour as well (Menjivar et al., 1998), we incorporate these variables into our multivariate model. A stronger presence of family members in the host country may cause migrants to shift their priorities, thereby weakening ties to the country of origin and having a negative effect on remittances. Furthermore, as some family members in the destination may need to be supported financially, this limits the resources available for sending remittances. Viewed from this perspective, a stronger presence of family members lowers the likelihood of remittance sending. On the other hand, if living together with a partner in Spain is the alternative to having a transnational family with a Senegal-based partner, this could result in a higher standard of living and more capacities to remit. Further, similar to the role of a strong presence of peer migrants and the migrant community (Chort et al., 2012), a stronger presence of family members and relatives may also imply stronger social control over immigrants' ties to their country of origin. This may result in a higher likelihood of remittance sending. As this paper does not specify hypotheses on the link between family ties in the destination country and remittances, this part of the analysis is strictly exploratory.

b) Material and physical links

Senegalese emigrants and returnees are more likely than non-migrants to invest in land, housing, and businesses in the home country (Mezger and Beauchemin, 2015). As owning property in Senegal creates practical and symbolic attachment (Obeng-Odoom, 2010), the investments can be an important way to maintain ties with the origin country. However, maintaining these investments requires resources that are often provided by remittances, and most previous studies (e.g., Lucas and Stark, 1985) indeed find a positive association between property in the origin country and remittance sending. In line with these considerations, we also expect to find that owning assets in Senegal increases the likelihood of remittance sending (*the material links hypothesis*). Visits to the home country are another important instrument for sustaining ties to the country of origin. Even short visits can help sustain emotional links to the origin (Cai, 2003), and most previous studies find that traveling to the home country or family members visiting the destination country are positively associated with the decision to remit (Cai, 2003; Vickstrom and Beauchemin, 2016). Because of this, we expect our study to also find a positive association between visits and remittance sending (*the physical links hypothesis*).

c) Migration decision making and remittances

Drawing on the new economics of labour migration (NELM) theory, Robert Lucas and Oded Stark (1985) suggested that remittances form part of a family adaptation strategy to reduce economic risk through some of its members migrating, thus premising that remittance decisions are linked with migration decisions. Migration itself should thus be understood as risk aversion behaviour, in which the household rationally decides to send some of its members to places where the labour market has different characteristics (“non-correlated labour markets”). Under this strategy, migrants receive assistance for their journey to new destinations and during unemployment periods while overseas. In exchange, households experiencing economic hardship would expect to receive remittances. Regarding household risk diversification, evidence shows a positive significant association between the presence of a family adaptation strategy and remittance sending (Cai, 2003). Therefore, from the perspective of the NELM theory, we expect to find a negative association between agency in migration decision-making and remittance sending. Put another way, it is expected that individuals who autonomously chose to migrate will have a lower likelihood to remit (*the autonomous migrant hypothesis*). We should, however, point out that this hypothesis mainly concerns male migrants, for reasons discussed below.

d) Economic integration and capacities to remit

Turning to the factors at work at the destination, socio-economic integration influences migrants’ capacity to remit, as resources can be sent to the origin country through the provision of reduced constraints and access to the labour market. In the words of Hammond (2014): “*The more settled people are in terms of their immigration status, their housing, educational achievement, employment, the more likely they are to be able to engage meaningfully in transnational activities*” (p. 1013). Employment status is generally positively associated with the likelihood to remit (Carling and Hoelscher,

2013; Castagnone et al., 2015). In their Norwegian study, Carling and Hoelscher (2013) find that immigrants with secure employment are more likely to remit than are those with insecure or no employment. Using a cross-sectional approach, Diagne and Rakotonarivo (2010) show that employment status is positively associated with remittance sending by Senegalese migrants in France, Italy, and Spain. Amuedo-Dorantes and Pozo (2006) show that the type of employment and occupational sector also matters, with their results indicating that self-employed migrants are less likely to remit than salaried migrants, whereas immigrants employed in the agricultural sector remit more than their counterparts in other labour market sectors. In sum, higher levels of economic integration should be associated with greater economic resources and higher capacity to send remittances (Carling and Hoelscher, 2013). Therefore, we expect that employed migrants are more likely to remit (*the capacity hypothesis*).

e) Gender-remittance nexus

Although interest in the so-called “gender-remittance nexus” is growing, the findings of studies are rarely consistent because the results vary substantially across social contexts (King et al., 2013). However, some patterns do emerge when looking at gender differences in motives to remit. A number of studies find that women’s remittance behaviour is more often motivated by family ties, whereas men are more often driven by economic motivations. Despite the possible differences between men and women in the magnitude of coefficients, we expect most principal associations of interest (which are formulated in our hypotheses) to be the same for men and women. A notable exception, however, concerns the links between remittances and agency in choosing to migrate. The migration decision hypothesis implicitly assumes that if migrants do not autonomously decide to leave Senegal, then they migrate out of compliance with a decision made by their (extended) family or local community. This assumption, which is heavily influenced by the NELM theory, may indeed hold for men. Like most countries in West Africa, Senegal is a heavily male-dominated society, which has two important consequences that need to be considered. First, as in most patriarchal settings, the dominant view is that women’s migration is riskier and that women are more exposed to dangers in the migration process. Second, when women do migrate, they most often do so as “tied movers”, meaning that they either migrate together with their husbands or join them once their husbands are established in the destination country (Toma and Vause, 2013). Therefore, the link between the nature of migration decision-making and remittances is less straightforward among women. Although we can safely assume that women who autonomously decide to migrate will have more agency in deciding whether or not to remit, it is difficult to predict — all else being equal — whether they will actually send money more often or less often when compared to migrating women who are “tied movers”.

f) Duration of stay and remittance flows

The association between remittances and duration of stay in the destination country is complex, due to the interplay of origin country conditions with the capacity and willingness to send remittances. The so-called remittance decay hypothesis predicts that remittances will decrease with duration of stay in the destination country. As more time passes following migration, ties to the origin country may weaken as emotional attachment wanes and the number of potential recipients at origin decreases due to chain migration and older family members dying. Furthermore, remittances intended for

paying back loans to finance migration may be restricted to shorter periods of time. Jones (2020) finds that Bolivian emigrants' remittances already begin to decline after two years abroad, which is faster than the decline in other manifestations of transnationalism (such as phone calls or return intentions). However, waning ties with the country of origin may be counterbalanced by an increasing capacity to remit (Carling and Hoelscher, 2013). The interplay of mechanisms working in opposite directions sometimes produces opposing patterns among different groups living in the same geographical context. Arun and Ulku (2011) find that the remittances of Indian and Pakistani immigrants in the Manchester area decrease with time spent in the destination country, while the opposite is the case with Bangladeshi immigrants. On a similar note, Brown (1998) shows that the remittances of Samoan immigrants in Australia decrease considerably with the length of stay, whereas they increase among Tongans during the first fifteen years. However, bearing in mind the simultaneous impact of the forces that encourage remittances, those that impede them, and the varying importance of these forces across time, we find these factors to be reflected in the most common results of previous studies: a non-linear inverse U-shaped relationship between remittances and duration of stay. In other words, remittances increase for some time after arrival, then start decreasing (among others, Lucas and Stark, 1985; Cai, 2003; Carling and Hoelscher, 2013).

2.5 Data and methods

a) MAFE and MESE surveys

The data used in this paper come from two closely related research projects: *Migrations between Africa and Europe* (MAFE); and *Migrations Between Senegal and Spain* (MESE). The MAFE biographical survey was carried out in five European countries (France, Italy, Spain, the UK and the Netherlands) and three African countries (Senegal, DR Congo and Ghana). The survey includes around 600 Senegalese immigrants living in Spain, Italy, and France. In this paper, we include only around 200 respondents who lived in Spain at the time of the survey, which was in 2008. The MESE survey, carried out in 2011, enriches our sample with another 405 Senegalese immigrants in Spain and, unlike the MAFE survey, includes only one origin country (Senegal) and one destination country (Spain). The two surveys are implemented using the same sampling techniques and almost identical questionnaires, so that they can be easily combined into a single dataset (see the study by Kraus, 2019). The surveys include Senegalese-born immigrants aged 25 to 75 years at the time of the survey and who emigrated from Africa at the age of 18 or older (Beauchemin, 2015). The Spanish municipal population register (*Padrón*) served as a sampling frame, which allowed researchers to include a random sample of both documented and undocumented migrants. In the questionnaire, the respondents are asked if there have been periods in their life when they regularly sent money to someone in a country other than the country where the respondent lived. If the answer is positive, the respondents are additionally asked to specify the years during which they sent remittances as well as the country to which they sent money.

b) Methodology

Before implementing the principal descriptive and multivariate analyses, we transformed the data into person-years. Remittance behaviour is measured through a

dichotomous variable that indicates whether the immigrant sends money back to Senegal in the year of observation. The variable takes value 1 in the years in which he or she sends remittances, otherwise it takes value 0. Note that a variable registering the amount of remittances sent was not available in the datasets. Apart from basic trends on remittance behaviour, our descriptive analysis is also based on event history analysis. In the first step, we perform Kaplan–Meier analysis to explore how long it takes immigrants to start remitting. In the second step, we use the same method to analyse how likely immigrants are to stop remitting. The descriptive analysis takes into account post-stratification weights in order to reduce the sampling error. Given that our sample is relatively small and that most immigrants in our sample were recent immigrants at the time of the two surveys, the descriptive analysis of remittance behaviour largely focuses on the first ten years in Spain. Since substantial gender differences can exist in migration behaviour, immigrant integration, and maintenance of ties to origin, all the analyses are performed separately for men and women.

The multivariate analysis is based on a two-level mixed-effects linear probability regression. The advantage of linear probability models, as compared to logistic regression, is an easier interpretability of coefficients, but also the comparability of its estimates across groups (see Mood, 2010 for more details). This may be of a particular importance in this study, given that we perform separate estimates for men and women. The use of the linear probability model implies that the coefficients obtained in this analysis show how much the probability to be remitting in the year of observation changes, in terms of percentage points, when the corresponding independent variable changes by one unit. Our data have a two-level hierarchical structure: the measurement occasions i form level 1, and they are nested within individuals j , who form level 2. Using of mixed effects allows us to estimate both between-individual variance and within-individual variance. Additionally, to obtain a more fine-grained picture of the association between remittance behaviour and time spent in the destination country, the regression also estimates between-individual slope variances for duration of stay in Spain and its squared term. Our model can thus be written as follows:

$$y_{ij} = \beta_{0j} + \beta_{1j}t_{ij} + \beta_{2j}t_{ij}^2 + \gamma_n X_{nij} + e_{ij},$$

where:

$$\beta_{0j} = \beta_0 + u_{0j}$$

$$\beta_{1j} = \beta_1 + u_{1j}$$

$$\beta_{2j} = \beta_2 + u_{2j}$$

The overall intercept, averaged across all individuals, is denoted by β_0 , whereas u_{0j} stands for the individual-specific random intercept. β_1 and β_2 are the average slopes of the regression of y on duration of stay in Spain t and its squared term t^2 , respectively. The random slopes, specific to individual j , are denoted by u_{1j} and u_{2j} . X is a vector of n independent variables, whereas e_{ij} is an occasion-specific residual that captures of unmeasured time-varying characteristics. The unstructured covariance matrix allows all variances and covariances of the random effects to be distinct. We obtain robust standard errors by using the cluster option in the regressions.

In line with the model presented above, the analysis includes duration of stay in Spain as well as its squared term (henceforth also referred to as YIS – years in Spain). Whereas the descriptive statistics focus on the first ten years in Spain, the multivariate analysis takes into account the remittance behaviour irrespective of the duration of stay in Spain. In the absence of information on month of arrival, duration of stay is expressed as the number of calendar years the respondent has lived in Spain³. To test the family-links hypothesis, we include a number of time-varying indicators of strength of ties to Senegal and Spain during each year in the destination country. More precisely, when it comes to ties to origin, we control for: 1) number of children in Senegal; 2) number of siblings in Senegal; 3) a dummy variable for respondents having a partner in Senegal; 4) a dummy variable that takes value 1 if the respondent's mother is alive and living in Senegal; and 5) a dummy variable that takes value 1 if the respondent's father is alive and living in Senegal. We also add three indicators of the strength of ties to Spain: 1) number of children in Spain, 2) number of siblings in Spain; and 3) having a partner in Spain. To test the autonomous migrant hypothesis, we include a dummy time-invariant variable that takes the value 1 if the respondent autonomously decides to migrate. As a means to test the pure material links hypothesis, we include dummy variables for 1) owning a house in Senegal, 2) owning a plot in Senegal; and 3) owning a business in Senegal. Including of a categorical variable for the labour market attachment allows us to test the capacity hypothesis. We distinguish between three categories: 1) non-employed (reference group), 2) employed; and 3) self-employed respondents. The physical links hypothesis is tested by including a dummy variable that takes the value 1 if the immigrant has visited Senegal at least once since arriving in Spain. Finally, age and its squared term, as well as education level, are also included in the model as control variables. Education is a time-invariant variable and refers to educational attainment at the time of the survey. The multivariate analysis is performed in two steps. Model 1 includes demographic variables, migration-specific variables (duration of stay in Spain and the nature of the migration decision-making process), and variables reflecting the strength of ties to origin. Model 2 complements Model 1 by also including variables for the immigrants' situation in the country in the destination country, namely labour market attachment and family ties to the destination country. As is the case in the descriptive analysis, the multivariate models are estimated separately for men and women.

c) Sample characteristics

Table 1 shows the characteristics of the sample at the time of the survey. Beginning with basic demographic characteristics, the average age of Senegalese migrants at arrival in Spain is about 28, for both men and women. Also for both sexes, more than half of the survey respondents have primary school or less. Turning to migration-specific variables, Senegalese men and women in Spain were fairly recent immigrants at the time of the survey, with an average duration of stay in the country at around 8.5 years. More than three quarters of men autonomously decided to migrate, whereas this is the case for only slightly more than one quarter of women. As for family ties to Senegal, gender differences are modestly pronounced along most dimensions. Men have on average 1.12 children left behind in Senegal, as compared to 0.75 among women.

³ The lowest value of this variable is 1. For instance, if a respondent arrived in Spain in 2004, the variable duration of stay takes value 1 in 2004, value 2 in 2005, etc.

Regardless of gender, the Senegalese in our sample have an average of almost seven siblings living in Senegal. More than a half of the survey respondents have fathers living in Senegal. At the same time, around three out of four men and four out of five women have a mother living in Senegal. However, differences between men and women are clearly pronounced when it comes to partners. In particular, more than half of the men have a partner living in Senegal, whereas this is only the case for one out of eight 8 women. The share of survey respondents who have a property in Senegal ranges between 18 and 29 percent, depending on the type of property (plot or house) and gender (the share being somewhat higher among men). At the same time, a small percentage of respondents have a business running in Senegal at the time of the survey. More than two thirds of men and around half of women were employed at the time of the survey. Among both sexes, the share of employees was more than twice as high as that of the self-employed.

Table 1: Sample characteristics at the time of the survey (weighted)

	Men	Women
Age at arrival	28.19	27.58
Primary education or less	59.84	52.64
Secondary education	18.62	20.52
Higher education	21.54	26.84
Years in Spain	8.43	8.65
Migration own decision	77.67	26.18
No. of children in Senegal	1.12	0.75
Has partner in Senegal	56.48	12.37
No. of siblings in Senegal	6.62	6.87
Father alive	53.81	57.04
Mother alive	74.94	82.91
House in Senegal	28.79	20.23
Plot in Senegal	25.48	17.92
Business in Senegal	5.47	4.44
Has visited Senegal	50.57	46.83
No. of children in Spain	0.33	1.58
Has partner in Spain	14.42	66.84
No. of siblings in Spain	0.45	0.57
Not employed	30.58	50.92
Employee	47.19	34.34
Self-employed	22.22	14.74
N	302	305

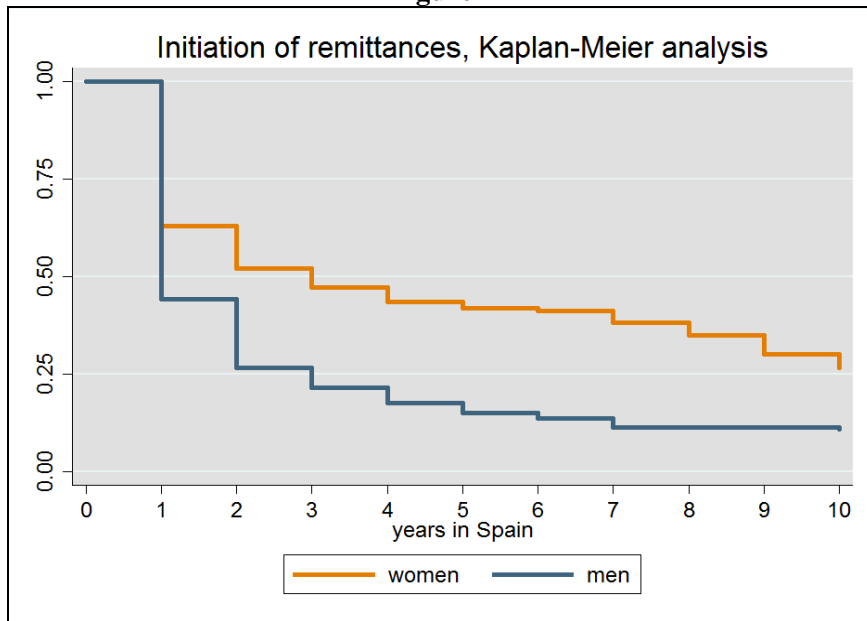
Source: MAFE and MESE surveys

2.6 How much and when do the Senegalese in Spain remit?

Our initial analysis shows that most Senegalese migrants in Spain send money home at some point. More precisely, 73 per cent of men and 56 per cent of women remit at the time of the survey. In order to incorporate the time dimension into the analysis, we run Kaplan–Meier models of the initiation and termination of remittances. The first part of our analysis of the dynamics of remittance sending is presented in Figure 1, which shows how long after arrival it takes migrants to start remitting. Three main conclusions emerge from this analysis. First, a large majority of Senegalese in Spain send money home at some point. By the tenth year in Spain, around 90 per cent of men and around 70 per cent of women will have remitted at least once. Second, they start remitting fairly soon after arrival. Just above half of men and just above a third of women already start remitting in the first year after arrival. Finally, for each duration since arrival in Spain, the share of Senegalese migrants who have started remitting is somewhat higher among

men. Moreover, a Cox regression-based test for equality of survivor functions suggests that differences between men and women are statistically significant. A separate analysis of hazard rates (detailed results not reported) shows that the likelihood to start remitting, conditional on not having started yet, decreases with the time spent in Spain. For instance, the likelihood for men to remit in the first year is 53 per cent, conditional on not having remitted yet. This likelihood falls to 14 per cent after five years and is only 3 per cent after ten years.

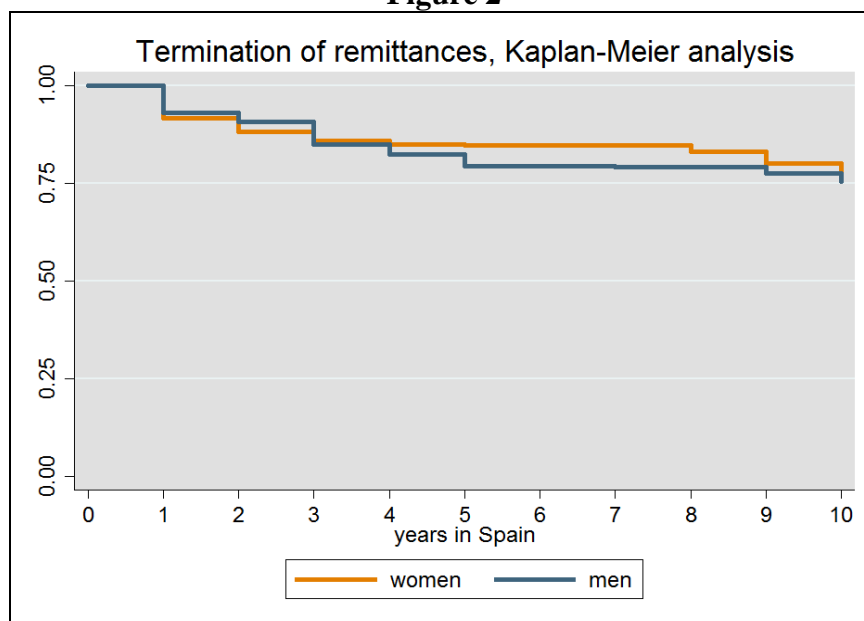
Figure 1



Source: MAFE and MESE surveys, own calculations

Figure 2 shows how much time it takes immigrants to stop remitting once they start. The results suggest, first, that the process of terminating remittances takes longer than it does to initiate a remittance flow and, second, that migrants are more likely to start remitting than to cease doing it. Only 7 per cent of men and 8 per cent of women stop remitting a year after the initiation of remittances. Even after ten years, three quarters of Senegalese immigrants will still be sending money back to Senegal. Also, gender differences are much less pronounced than they are for initiating remittances, and the test for equality of survivor functions finds no statistically significant difference between men and women when it comes to terminating remittances. Similar to what was found for the initiation of remittances, the likelihood to stop remitting decreases over time.

Figure 2



Source: MAFE and MESE surveys, own calculations

The two figures presented above and the results of the hazard rate analysis suggest that, for the same duration of stay, the likelihood to start remitting for the first time is generally higher than the likelihood to stop remitting. It thus comes as no surprise that, without controlling for observables, the association between remittance sending and duration of stay is positive during the first ten years in Spain, as can be seen in Figure A1 in the Appendix. Around 83 per cent of men and 68 per cent of women send money to Senegal during the tenth year of stay in Spain. In other words, although remittance sending is already substantial in the first year of stay in Spain, by the tenth year it becomes clearly dominant among women and nearly universal among men. Note also that from figures 1 and 2, two groups may be identified. A group that starts remitting as soon as they arrive, given figure 1 shows very little decline in the Kaplan -Meier curve after the second year and keeps remittances over time (Figure 2) and a group that never starts remitting. We discuss this finding in the conclusion.

2.7 Multivariate analysis – who remits?

The results of the multi-level mixed effects models are shown in Table 2, separately for men and women. Beginning with the demographic predictors of remittance sending, the more parsimonious Model 1 shows that age at arrival is not a significant predictor of remittance behaviour for men. For women, the likelihood of remitting increases with age, although the relationship is non-linear. Some gender patterns also emerge when looking at education level, as the likelihood of remitting is 9 percentage points higher among men with tertiary education compared with men who have primary education. In contrast, no significant differences by education are found among women. Both duration of stay and its squared term are significant predictors of remittance behaviour. The signs and magnitudes of the coefficients suggest that, after controlling for observables, the association between duration of stay and remittances is non-linear. More precisely, the likelihood of remitting initially increases with time spent in Spain, and it reaches its maximum after 8 years for men and 11 years for women. The family

links hypothesis receives some support from our model. Having children increases the chances of remitting, and more so among women. Among men, having a partner living in Senegal increases the chances of remitting, whereas having siblings in Senegal makes remitting more likely among women. The analysis shows little support for the autonomous migrant hypothesis, as the association between the type of migration decision-making and remittances is not statistically significant among men. However, this is not the case for women, among whom the likelihood of remitting is almost 13 percentage points higher if they autonomously decided to migrate as compared to those whose migration was the result of a collective decision. Finally, Model 1 supports neither the material links hypothesis nor the physical links hypothesis, as property in and visits to Senegal have no significant associations with remittances.

Table 2: Remittance sending among Senegalese migrants in Spain, mixed-effects linear probability regression

	Men		Women	
	Model (1)	Model (2)	Model (1)	Model (2)
<i>Migration characteristics</i>				
Age at arrival	0.017	0.018	0.031**	0.020
Age at arrival sq.	-0.000	-0.000	-0.001**	-0.000
YIS	0.046***	0.038***	0.051***	0.044***
YIS ² /100	-0.290***	-0.196***	-0.241***	-0.198***
Migration own decision	0.005	0.007	0.126***	0.104**
<i>Socioeconomic background</i>				
No education or primary (ref.)				
Secondary	-0.140	0.002	0.054	0.046
Higher education	0.089*	0.067	0.024	0.003
Not employed (ref.)				
Employed		0.294***		0.204***
Self-employed		0.249***		0.191***
<i>Family dynamics</i>				
No. of children in Senegal	0.021***	0.021*	0.030***	0.035***
Has partner in Senegal	0.047***	0.037*	0.014	0.005
No. of siblings in Senegal	-0.000	0.002	0.011**	0.008
Father alive	0.046	0.025	0.004	-0.012
Mother alive	0.006	-0.011	0.014	0.001
No. of children in Spain		0.002		0.001
Has partner in Spain		-0.013		0.018
No. of siblings in Spain		0.034**		-0.040***
<i>Material and physical links</i>				
Has visited Senegal	-0.001	-0.003	0.024	0.019
House in Senegal	0.046	0.034	0.053	0.061*
Plot in Senegal	0.029	0.034	0.044	0.055
Business in Senegal	-0.070	-0.051	0.012	-0.016
Constant	0.187	-0.049	-0.274	-0.133
Between-individual variances/covariances				
Intercept variance	0.243	0.205	0.224	0.190
	s.e. 0.017	s.e. 0.016	s.e. 0.014	s.e. 0.013
YIS variance	0.014	0.010	0.010	0.009
	s.e. 0.003	s.e. 0.002	s.e. 0.002	s.e. 0.002
YIS ² /100 variance	0.480	0.306	0.357	0.272
	s.e. 0.209	s.e. 0.145	s.e. 0.140	s.e. 0.085
Intercept-YIS covariance	-0.039	-0.030	-0.020	-0.018
	s.e. 0.006	s.e. 0.005	s.e. 0.004	s.e. 0.004
Intercept-YIS ² /100 covariance	0.179	0.126	0.057	0.059
	s.e. 0.050	s.e. 0.038	s.e. 0.031	s.e. 0.025
Covariance (YIS, YIS ² /100)	-0.076	-0.053	-0.055	-0.046

	s.e. 0.025	s.e. 0.019	s.e. 0.017	s.e. 0.011
Within-individual variance	0.034	0.033	0.034	0.033
	s.e. 0.003	s.e. 0.003	s.e. 0.003	s.e. 0.003
N	302		305	
Person-years	3,091		3,041	

Source: MAFE and MESE surveys; * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$

Model 2 introduces variables indicating the capacity to remit and family ties to Spain. As expected by the capacity hypothesis, attachment to the labour market increases the likelihood of sending remittances. Moreover, the effect of employment is sizeable and surpasses that of other significant variables. Compared to the non-employed and all else being equal among Senegalese men, the likelihood of sending remittances is 25 percentage points higher among the self-employed and 29 percentage points higher among employees. The corresponding figures for women who are self-employed and employees are, respectively, 19 and 20 percentage points. In contrast to the role of economic ties to Spain, the importance of family ties to the country of destination is fairly weak. Having children or a partner in Spain is not associated with remittance sending, neither for men nor for women. For men, each sibling residing in Spain adds 3.4 percentage points to the likelihood of remitting. Interestingly, we find the opposite for women, as each sibling living in Spain lowers the likelihood of sending remittances by 4 percentage points.

Including new variables in Model 2 brings about small to moderate changes in the magnitudes of most variables from Model 1. The most substantial change among men is the disappearance of significant associations between being highly educated and sending money to Senegal. Among women, age and the number of siblings in Senegal are no longer significant predictors of remittances. However, homeownership becomes significant at the 10 per cent level, with the coefficient suggesting that owning a house in Senegal adds 6 percentage points to the likelihood of remitting. We obtain a similar coefficient for having a plot in Senegal; however, this result only comes close to but does not reach the 0.1 significance level ($p < 13$ per cent). The lower part of the table shows random effects. Once we adjust for all the covariates (Model 2), between-individual variance is estimated at 0.205 for men and 0.190 for women, whereas within-individual variance for both sexes is 0.033. This implies that, among men, 86 per cent of the total residual variance in remitting behaviour is due to differences between individuals, while the remaining 14 per cent are ascribed to within-individual variance over time. The corresponding shares among women are 85 per cent and 15 per cent.

In order to further address the question of differences in remittance behaviour between men and women, we implemented an additional regression by including both sexes and a dummy variable for men (details not reported). The results show that, once observables are taken into account, the likelihood of remitting is 8 percentage points higher among men.

2.8 Conclusion

We use data from two retrospective surveys on Senegalese migrants in Spain to explore the patterns of remittance sending from destination to origin. Motivated by strong gendered patterns in migrations between Senegal and Europe, we perform a separate analysis for men and women. Using a longitudinal approach, we find that around 90 per

cent of men and 70 per cent of women will have remitted at least once by the end of their tenth year in Spain. Remittance sending becomes substantial already in the first year of arrival. In addition, three quarters of the great majority of Senegalese who end up sending remittances maintain this economic flow for at least ten years, suggesting the presence of sustained transnational ties over time. The high prevalence of remittance sending in this paper is in line with the remittance behaviour of Senegalese in France and Italy, as documented by Chort et al. (2012). It also matches the aggregate-level statistics on remittance sending among Senegalese living abroad. However, it should also be noted that our analysis indicates a non-linear inverse U-shaped association between time in the destination country and remittances, once observable characteristics are taken into account. More precisely, the probability of remitting peaks in the eighth year in Spain for men and in the eleventh year for women. This non-linear association is in accordance with most previous studies from other migration contexts.

Drawing on a strong link between labour market participation and remittances for both sexes in our multivariate analysis, we argue that strong support exists for the capacity hypothesis. The analysis lends some support to the family-links hypothesis as well, mainly through a positive association between having children in Senegal and remittance sending. This association is found among both men and women. Having a partner in Senegal also increases the likelihood of remitting, but only among men. This finding may reflect Senegal's patriarchal norms that are dominant in both sexes, according to which economic responsibility falls primarily on men (Pilon and Vignikin, 1996; Adjamagbo et al., 2006). Concerning the material-links hypothesis, we find no evidence for it among men, whereas among women it is supported through a positive significant association between owning a house in Senegal and remittance sending. In the Senegalese context, international migration helps overcome gender inequalities in access to asset ownership (Mezger and Beauchemin, 2015). It is thus possible that asset ownership has a stronger symbolic meaning for Senegalese women than for men, which may explain the gender difference related to the material links hypothesis. We find no support for the physical-links hypothesis, as the analysis shows no link between visits to Senegal and remittances. The autonomous migrant hypothesis is also the only gendered hypothesis, as it concerns only men. However, as we find no link between migration being the migrant's own decision and subsequent remittances, this hypothesis is not supported either. Remittance sending among Senegalese men in Spain is almost universal, and it may be the case that remittance-related norms and expectations in Senegal are such that the commitment to remit is not weaker among autonomous movers. On the other hand, our analysis shows that, all else being equal, women who migrated on their own initiative remit more. Considering that remittance dyads (sender-to-receiver pairings) are not gender neutral in immigrant families from male-dominated societies (given that the man and his family take priority, King et al., 2013), this finding may suggest that female agency in the migration decision-making process is positively associated with women's bargaining power when deciding who in the family remits to whom in Senegal.

Family ties to destination are weak predictors of remittance behaviour in our analysis, with only the number of siblings in Spain having been found to be significantly correlated with our dependent variable. We found important gender differences in these correlates, namely, that the number of siblings in Spain increases remittances among men, which may suggest that a stronger family presence exerts some pressure on men to send remittances. In contrast, a negative association between the two variables among

women may suggest that a strong sibling presence increases the likelihood that remittances are expected from other family members, namely brothers, thus freeing female immigrants from this obligation. This is in line with traditional patriarchal roles of Senegalese society, that may be reproduced at destination once siblings arrive and therefore explaining part of these gender differences. This explanation would be in line with Liu et al. (2018), who find that sibling networks influence Senegalese intra-African migration while it is specifically brother networks that motivate emigration to Europe. Interestingly, we find no link between remittances and having children in Spain. This result may be indicative of Senegalese immigrants' strong ties to their extended families in the home country.

The separate analyses for men and women in our paper were motivated by strong gender norms in Senegal, particularly by pronounced gender patterns in migration behaviour. Based on our results, it can be argued that very different migration mechanisms for men and women produce moderate differences in remittance behaviour. Men are somewhat more likely to remit overall. The event history analysis reveals that they are more likely than women to start remitting. On the other hand, once they start remitting, women are as likely as men to maintain their remittances. Men's propensity to remit remains somewhat higher even after controlling for observables. This difference may be due to the expectations of the patriarchal home community, but it is also possible that economically active Senegalese men in Spain have a higher income and thus more resources than economically active women. Multivariate analyses by gender reveal that most coefficients for men and women in the full model are similar in terms of significance level, sign, and magnitude. The random effects obtained in separate estimates by gender are very similar as well. Once we control for observables, as much as 86 per cent of the residual variance for men and 85 per cent for women is due to differences between individuals, with the remaining share being due to within-individual variance over time. However, although few gender differences were found, those that we have identified and discussed above are important for understanding remittance behaviour and transnational ties, and they certainly deserve to be scrutinized in future research.

This study is not without limitations. As is often the case in the literature on remittances (see Carling, 2008), we know only whether or not a person remits while the actual amounts of money sent remain unknown. Using the MAFE household survey, Diagne and Rakotonarivo (2010) studied the amounts and frequency of remittances obtained by the households from the Dakar region. Their results show that 57 per cent and 10 per cent of migrants remitted, respectively, 100,000 and 200,000 West African CFA francs (FCFA) or less per transfer (roughly equivalent to 150 and 300 euros at the time of their study). For the sake of comparison, the average monthly salary in the Senegalese formal private sector was 220,000 FCFA in 2009, and the average monthly public sector salary was 133,000 FCFA (ILO, 2013). They also found that, among those who remit, four out of ten do so at least once a month. Another limitation of our study is that we cannot observe either the recipients or purposes of the money being sent. Although our analysis suggests that financial capacity plays a very important role in remittance sending, we are only able to control for level of attachment to the labour market and have no reliable information on earnings or other sources of income.

A natural progression of this work in years to come would be to run a similar survey of Senegalese immigrants in Spain and analyse potential changes in patterns of remittance

sending. At the time of the two surveys used in our analyses, Spain was still emerging as a destination country and, consequently, most of the Senegalese in our sample were recent immigrants to Spain. They have since become a more established community while the destination country has itself undergone substantial socio-economic changes. Based on the results from figures 1 and 2 concerning two clear groups (one remitting soon after arrival and that never stops remitting, and a group that do not start remitting), it would be interesting to explore whether there is a group that is not at risk of remitting, together with its characteristics. One way to incorporate this into the analysis would be by running split-population models that incorporate this dynamic into the estimation. Finally, despite most migrants that started remitting tend to do so during first two years since arrival, it would be worth exploring the factors pushing individuals not remitting after 2 years in Spain to start remitting.

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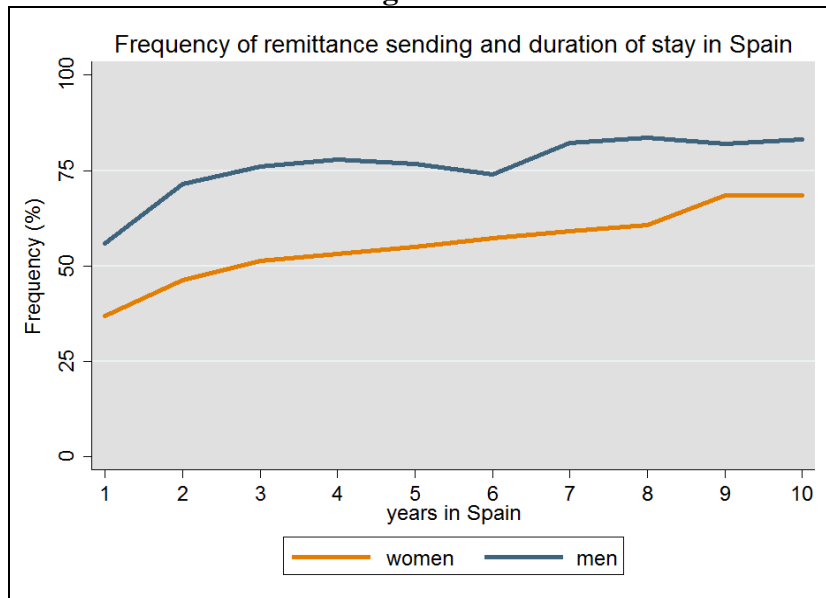
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Appendix

Figure A1



Source: MAFE and MESE surveys, own calculations

3. USING SURVEY-BASED AGENT-BASED MODELS TO BETTER UNDERSTAND MIGRATION RATES: HOW DID MIGRANT NETWORKS AND MACRO FACTORS AFFECT COLOMBIAN INTERNATIONAL MIGRATION SPAIN BETWEEN 1962-2008?

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Abstract

While empirical evidence is relatively consolidated concerning the role of migrant networks in influencing the individual probability of migration, less attention has been paid to how networks formed at the microlevel are linked to changes in the aggregated number of migrants and migration rates from origin countries. By relying on event history analysis methods and data from the Latin American Migration Project, we inform an Agent-Based Model of individual migration trajectories of Colombian migrants to Spain to understand under what conditions of migrant network and macro effects, certain aggregated migration dynamics are reproduced. We contrast a series of *what if* hypothetical cases where networks effects are modified to understand the mechanisms underlying the aggregated migration rates over time. Results confirm that networks played a key role in shaping the aggregated migration dynamics of international Colombian migration to Spain in the period from 1962 to 2008, although most of the aggregated effect of networks was played by community networks instead of family ties to previous migrants. Moreover, our results indicate that the sole presence of migrant networks is not a sufficient condition to shape migration dynamics.

3.1 Introduction

Research on determinants of international migration has shown, in different contexts, the key role of migrant networks in increasing migration propensities (Lamela, Pérez-Caramés, & Fernández-Suárez, 2012; D. S. Massey & Aysa-Lastra, 2011). Networks act both as a mechanism for increased motivation and capability (De Haas, 2021; Sen, 1999) to migrate, by providing a broad range of assistance, destination-specific information, as well as access to job opportunities (Baizán & González-Ferrer, 2016; D. S. Massey & Aysa-Lastra, 2011). While empirical evidence is relatively consolidated concerning the role of migrant networks in influencing the individual probability of migration, less attention has been paid to how networks formed at the microlevel are linked to changes at the macrolevel, that is, the variation in the aggregated number of migrants and migration rates from origin countries. While the understanding of whether individuals are more likely to leave their country is of key relevance in terms of knowing the migration determinants, from a policy-making perspective aggregates become crucial (Klabunde & Willekens, 2016; N. E. Williams, O'Brien, & Yao, 2021b). Drawing on the cumulative causation theory, Lindstrom and López (2010) argued that the development of migrant networks was one the main determinants in the emergence of a take-off in migration rates, which led to an S-shaped evolution of rates

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over time in communities of origin. Migration rates in these cases follow a curve similar to the diffusion or innovation models, in which out-migration grows slowly until it reaches a critical juncture point, after which it stabilizes. While acknowledging a multiplicity of intertwined factors, both micro and macro, research on determinants of migration has found that networks are key drivers to consider, both independently, but also in interaction with macro or institutional changes such as socioeconomic conditions at origin (Silva and Massey 2015) and employment growth (Baizán and González-Ferrer 2016) at destination.

In this paper, we aim to explain the global implications of migrant networks on migration rates, while accounting for individual time-varying demographic characteristics and macro levels changes. We approach this by developing a simulation model, an Agent-Based Model that reproduces individual migration trajectories to understand under what conditions of migrant network and macro effects, certain aggregated migration dynamics are observed. By relying on the comparative advantage of its bottom-up approach, migration scholars have used ABM for the study of international migration with a multiplicity of purposes (Hinsch & Bijak, 2022), such as prediction of future migration trends (Klabunde, Zinn, Willekens, & Leuchter, 2017; Willekens, 2017) and better understanding of migration determinants (Bell, Hernandez, & Oppenheimer, 2019; Williams et al., 2021b). Although ties to previous and current migrants have certainly been features of previous ABMs of international migration, to our knowledge, this tool has not yet been used with an explanatory purpose of understanding the link of migrant networks and aggregated migration dynamics from an empirical perspective, and in dialog with previous research analysing on individual migration determinants (Massey & Aysa-Lastra, 2011). We focus our attention on the case of Colombian international migration to Spain from 1962 to 2008, and analyse hypothetical scenarios to look at how changes in the influence of migrant networks at the micro level affect the aggregated migration patterns over time. While previous research of Colombian international migration (Iglesias & Rua, 2016; A. Silva & Massey, 2015) shows that networks are crucial in influencing migration at the individual level, we explore to what extent they determine the overall shape and dynamics of migration rates over time. In this sense, our research question is, how are annual and cumulative international migration rates of Colombians moving to Spain affected by changes in migrant networks and macro factors? Moreover, would migration rates be constant in the absence of network effects? Do we still observe quantitative shifts in the migration dynamics if network effects are disabled? What are the macro effects such as labour demand at destination on migration dynamics, when controlling for migrant networks?

We use data from the Latin American Migration Project (rounds 2009, 2011, 2013, and 2015) (Durand & Pren, 2016; D. Massey & Durand, 2022) to examine the role of micro-level cohort characteristics (e.g. socio-demographics) and migrant networks. Information on environmental factors is drawn from several data sources, namely: the UCDP/PRIO Armed conflict dataset from the Uppsala Conflict Data Program (violence levels); The World Bank (economic growth in Colombia); OECD (employment growth in the US and Spain).

3.2 Social context of the study

a) Colombian International migration

Between the years 1960 to 2008, Colombian international migration has had three main destinations, namely: Latin American neighboring countries, the United States, and Spain. While in the broad period of 1960 to 1990, international migration of Colombians was mainly destined to Venezuela and the United States, it is from 1990 onwards when migration to Spain becomes more significant. According to data from United Nations Population Division (UNDESA, 2019), as of 2010, 37% of Colombian emigration was established in Venezuela, followed by the United States and Spain, with 26% and 15%, respectively. Venezuela had historically been the main destination for Colombian migration, with 178 thousand in 1970. Immigration to Venezuela increased in the following decades, reaching 919 thousands in 2010 (UNDESA, 2019). Other Latin American countries have also been important intraregional destinations, as in 2010 the total Colombian migration, including Venezuela, consisted of 1.26 million persons. As regards Colombian migration to the United States, census figures indicated a stock of 64 thousands migrants in year 1970 (Cárdenas & Mejía, 2006), that rose to 658 thousands in 2010 (UNDESA, 2019), although most of the growth was produced before the 2000s. Although Colombian migration to Spain was marginal prior to 1990, with only 13 thousands, it started to increase from then onwards, experiencing an upsurge in the first decade of the 2000s (Cebolla, González-Ferrer, & Arango, 2007). UNDESA (2019) figures indicate that the Colombian migration stock in Spain increased almost ten times between the years 2000 and 2010, growing from 40 thousand to 376 thousand in this period, indicating a much more rapid growth in a shorter time span, compared to the other two main destinations.

b) Origin and destination socioeconomic conditions

Deterioration of safety and economic conditions in Colombia have been two intertwined contextual factors considered in the literature looking at Colombian international migration. Minor intensity level of conflict (i.e. between 25 and 999 battle-related deaths in a given year) resulting from the armed conflict in Colombia started in year 1964 and remained at these levels until 1984, according to the Uppsala Conflict Data Program (UCDP). From 1985 the armed conflict intensified, escalating to war levels (i.e. at least 1000 battle-related deaths in a given year) in several years⁶ (Pettersson & Öberg, 2020). As for economic security in Colombia since the 1960s, GDP growth presented its first negative values in the beginning of the 1980s (i.e. 1982-1983), although the lowest values were observed at the end of the 1990s with -1.1% and -5.8% in 1998 and 1999, respectively. Moreover, the unemployment rate in Colombia rose to almost 20 per cent between years 1999-2001 (Cebolla et al., 2007).

Concerning contextual characteristics at the main destination countries, the literature indicates the role of proximity, labour demand and border management as important factors to understand out migration flows of Colombians (Cárdenas & Mejía, 2006; Cebolla et al., 2007; Cerrutti & Parrado, 2015). Migration to Venezuela has been mainly explained by its proximity, economic growth and labour demand associated to oil production. Other intraregional destinations were also relevant and received

⁶ 1985, 1992, 1994, 1996, 1999-2002, and 2004-2005.

considerable shares of refugees during the most intense period of the armed conflict, especially Ecuador and Panama due to its proximity (A. C. Silva & Massey, 2014).

The United States as a destination of Colombian migration has been mostly explained in relation to job opportunities available and changes in the US immigration policy that opened country visas, allowing entry possibilities to Latin American and Asian migration (Guarnizo, 2006). Visas were, however, capped to 20,000 per country each year, thus limiting massive entry into the United States. Other relevant entry channels consisted of family reunification, that later contributed to a more diversified migration in terms of sociodemographic and occupational composition (Cárdenas & Mejía, 2006; Guarnizo, 2006).

Colombian international migration to Spain coincided with the structural labour market changes in this country. As explained by Cebolla, González-Ferrer and Arango (2007), due to its links to Latin American countries, Spain has had a selective and preferential policy towards migration from these countries compared to other origins (e.g. African countries). These changes opened significant job opportunities in the lower skilled occupational sector (García-Polavieja, 2003), allowing employment access to the increasing migration flows to the country (Baizán & González-Ferrer, 2016). The authors claim that the implementation of visas in 2002 towards Latin-Americans decreased flows of Colombians to Spain, although its effectiveness was limited because of a delayed implementation and other entry channels available such as family migration and asylum. Although the system to concede refuge in Spain was characterized as rigid and slow, compared to other European countries, the number of Colombians asylum seekers rose in Spain during the most intense period of the armed conflict (Cebolla et al., 2007).

3.3 Theoretical framework

Our work is greatly inspired by the cumulative causation theory (D. S. Massey, 1990) and the role of migrant networks (D. Massey & España, 1987) as a determinant factor in increasing motivations and capabilities to migrate (Haas, 2021; Massey et al., 1993; Munshi, 2003; Takenaka & Pren, 2010). As an overarching framework, we rely on a comprehensive approach to understand aspirations and capabilities to migrate, as depicted by Haas (2021). Therefore, we start from the premise that individual characteristics, as well as a simultaneous presence of key factors at origin and destination are jointly responsible for determining migration (Baizán & González-Ferrer, 2016; Castles, de Haas, & Miller, 2013; N. E. Williams, O'Brien, & Yao, 2021a).

a) Role of migrant networks and cumulative causation theory

Migrant networks, a specific form of social capital (Massey et al. 1987), may facilitate migration by providing information and resources that reduce the costs or risks of mobility and life at destination, as well as increasing migrants' potential gains by allowing access to job opportunities (Munshi, 2003). When analysing labour migration, Piore (1979) argued that once migration flows are established, networks may even replace job recruitment. Migrant networks are therefore a determining factor when explaining sustained migration flows over time.

Migrant networks can be classified according to the strength of the tie (strong vs. weak) and whether they are personal vs. nonpersonal. Strong personal ties refer to the closest family relatives (parents and siblings), while weak (personal) ties concern other relatives (e.g. aunts, cousins) and friends (Granovetter, 1973; Massey & España, 1987). Personal ties refer to all direct links formed at the micro level between individuals, whereas non-personal relate to aggregate measures of connections in a specific territory or community (Fussell, 2010; Lindstrom & López, 2010). Family ties sharing a household are defined in the literature as migrant household networks, in order to account for household risk diversification strategies motivating migration (Katz & Stark, 1986). By applying the social capital framework to migration research, scholars have suggested that resources emanating from strong and weak ties had a differential influence on migration (Garip, 2008; Liu, 2013). Due to its intrinsic trustworthy nature, strong ties would help potential migrant with direct assistance during the trip and at arrival, therefore reducing migration costs. Weak ties would lead to more innovative and useful information concerning labour market opportunities, influencing expectations and potential benefits of migration.

Empirical evidence in the Latin American region has systematically found that, in conjunction with other factors, there is an effect of family networks on individual probabilities of international migration (Durand & Massey, 2010; Liu, Riosmena, & Creighton, 2018; A. Silva & Massey, 2015), although mostly to the extraregional type of moves (Lundquist & Massey, 2005). The effect of family networks has also been found to be destination-specific, meaning that individuals at origin are not only influenced in terms of migration timing but also with respect to which location they choose. In fact, in the case of international Colombian migration, Silva and Massey (2015) found that those individuals with ties to the United States and Canada go to North America, whereas those with ties to European countries move to Europe. Most research analysing the effects of personal migrant networks on individual migration propensities has focused on strong family ties (Liu, 2013). One exception to this was Liu's (2013) study of Senegalese migration to Europe, where she found that weak personal ties increased odds of migrating, supporting the role of personal migrant networks outside the close family on influencing international migration.

Non-personal migrant networks consider all indirect connections with migratory experience, including those of acquaintances and strangers. The analysis of non-personal connections has been traditionally operationalized as a measurement of cumulative migration experience, or *migration prevalence rate*, within communities (Fussell, 2010; Lindstrom & López, 2010; D. S. Massey & Aysa-Lastra, 2011). To distinguish them from personal strong and weak ties, we will refer to them as community network from now. Scholars have pointed to various underlying mechanisms through which community networks may influence migration propensities.

The first and most commonly referred mechanism consists of the presence of weak ties within communities (Garip, 2008; D. S. Massey & Aysa-Lastra, 2011). Extended family and friends may provide access to information on international labour markets, influencing motivations and aspirations to migrate among members in a community. A second mechanism concerns to the effect increased migration within communities have on the relative deprivation of individuals (Garip, 2008; Stark & Taylor, 1989). In their relative deprivation hypothesis of international migration, Stark and Taylor (1989) suggested that migration propensities are highly influenced by expected income gains relative to the other members within communities because they were their main

reference group. In turn, by seeing an impact on local development and material conditions generated by migration of other members, individuals become not only more motivated and capable to migrate, but consider migration as means to maintain social position within their communities (Garip, 2008).

Drawing on the key role of social capital infrastructure generated by the development both of family ties and community migrant networks, the cumulative causation theory explains how migration determinants may change over time (Fussell, 2010; D. S. Massey et al., 1993). While economic differential and household risk diversification strategies may be determinants of initial motivations and capacities for migration, the development of migrant networks transforms international migration into a social phenomenon, acting as a structural factor that explains why migration systems establish and persist. Factors that explain initiation of a migration flow might be different from those that let it continue over time. In his study of five Latin American countries⁷, Fussell (2010) found a significant effect of both family and community networks on individual international migration probability.

Based on the cumulative causation theory (D. S. Massey, 1990), Lindstrom and López (2010) further explored the mechanisms underlying aggregated migration rates, as well as the selectivity of migrants between the different stages of migration. In the pioneer stage, a slow increase of migration rate is present, driven by individual migration. Therefore, individuals with higher economic resources will migrate. In the second stage, take-off, migration rates accelerate due to the influence of migrant networks. Here, migration becomes a social phenomenon where individual decision-making is assisted by migrant networks produced by previous pioneer migrants. Both intention and capability to migrate are affected. Finally, in the stabilization or mature stage, migration rates stabilize when agents with the intention and ability to move have already done so. Drawing on the above, we present three hypotheses that relate the effect of migrant networks on the aggregated migration rates over time.

H1. Migrant network necessity hypothesis: given the key role of migrant networks on increasing motivations and capabilities to migrate, contributing to transform migration from an individual phenomenon to a social one, we expect network effects to be determinants in shaping aggregated migration rates. Removing network effects on individual migration probabilities will greatly influence migration dynamics, yielding much lower migration rates.

H2. Migrant network sufficiency hypothesis: drawing on the idea that migrant networks act simultaneously with other macro factors at origin and destination, we expect network effects alone would be not sufficient to reproduce migration dynamics of international Colombian migration to Spain. In the absence of macro factors effects, we expect a substantial decreased of migration rates.

H3. Community migrant networks hypothesis: consistent to previous findings in other Latin American contexts concerning the role of family ties on influencing individual migration, we expect both family and community networks will play a key role on individual migration probabilities in the Colombian case too. However, given the observed migration rates to Spain in the Colombian case depicted in the social context, characterized by an accelerated upsurge in relatively short time, we expect the

⁷ Costa Rica, Dominican Republic, Mexico, Nicaragua, and Puerto Rico.

aggregated dynamics in migration rates will be greatly driven by mechanisms operating on entire communities, namely: increased motivations and aspirations to migrate produced by information diffusion through weak ties and greater relative deprivation.

b) The simultaneous role of micro and macro factors on migration determinants

At the micro level, theoretical work and empirical evidence show that migration patterns differ by sociodemographic characteristics (Donato, Hiskey, Durand, & Massey, 2010; D. S. Massey & Zenteno, 1999). Younger and single individuals for instance, tend to be more motivated and have less constraints to migrate. Educational and occupational attainment constitute sources of human capital associated to increased capacities to migrate. Wealth and property ownership are financial resources that households can resort to cover migration costs, although assets can act at the same time as deterrents to migration as they anchor people to their countries of origin. Ties to individuals with previous migrant experience formed at the micro level constitutes a source of social capital that can yield qualitative changes in migration dynamics, as depicted in the previous paragraphs.

Macro level factors can be classified into origin and destination ones. As regards origin, researchers have considered the effect of violence in sending regions. Although theoretically a decrease in safety operates as a so called “push factor”, both due to the direct threat to communities affected, but also indirectly by worsening economic circumstances, researchers have obtained mixed results. In their study of four Latin American countries⁸, Alvarado and Massey (2010) only found a positive effect of violence migration in Nicaragua, but a negative effect in Mexico, Costa Rica, and Guatemala. Economic security at origin has traditionally been taken into account by looking at Gross Domestic Product (GDP) per capita. This indicator has been generally found to have a positive relationship with migration (Alvarado & Massey, 2010; Takenaka & Pren, 2010), although its effects can also be non-linear (De Haas, 2010). Turning to macro factors at destination, changes in labour markets at destination may provide employment opportunities. In their study of Senegalese migration to Europe, Baizán & González-Ferrer (2016) found that the changes in labour market resulting from economic restructuring in Spain, generated temporary and low paid jobs to which lower skilled migrant workers could have relatively easy access. Finally, policy changes regarding border management and stringency of entry access may influence timing and choice of destination, although their effectiveness tends to be limited by structural factors such as labour market demand at destination and the development of migrant networks (Czaika and De Haas 2013).

Based on the above, we present the following hypotheses concerning macro factors and aggregated migration rates.

H4 - Macro factors effects hypotheses: by including macro variables on individual migration choices, we aimed at accounting for the simultaneous effect of macro factors on individual migration probabilities. We would expect a consistency regarding effects of macro factors on individual probabilities and aggregated rates. Drawing on the previous theoretical and empirical work, we expect the following effects: First, the

⁸ Costa Rica, Guatemala, Mexico, and Nicaragua.

presence of national level conflict and violence should be important as a contextual factor for Colombian migration. However, considering previous research indicating that the influence of violence on migration is mostly indirect (through the deterioration of economic conditions), in the presence of the other macro factors its effect would be relatively low (**H4a**). Second, we expect economic factors at origin and destination would be a key driver underlying development of migration rates (**H4b & H4c**). Of particular importance, labour demand in Spain would greatly influence overall rates. Finally, strong (weak) border stringency would have a negative (positive) although moderate effect on aggregated migration rates, as it would be circumvented by other structural factors such as networks and economic factors at origin and destination (**H4d**).

c) Purposes of Agent-Based models in migration research

The use of Agent Based Models in social sciences dates back to the 1980s, in what has been defined as the third wave in social simulation (Gilbert & Troitzsch, 2005; Macy & Willer, 2002). In contrast to the first and second waves, where social computation modelling relied on macro and micro simulation models, respectively, the ABM in the social sciences let researchers explore the microfoundations of global patterns and interdependence between agents (Macy & Willer, 2002). According to Zagheni (2015), ABMs are a type of individual-based simulations characterized for its bottom-up approach. Specifically, “[a]gent-based models simulate agents with built-in behavioural rules of action and interaction with other individuals and their environments. The main goal of agent-based models is to study the emergence of global patterns from simple behavioural rules of autonomous agents” (Zagheni, 2015, p. 5). In this line, Billari et al. (2006) emphasized that ABMs pre-suppose rules of behaviour and verify whether these micro-based rules can explain macroscopic regularities.

The comparative advantage of ABM’s bottom-up approach has been of great use in population studies (Billari, Fent, Prskawetz, & Scheffran, 2006; Grow & Van Bavel, 2017) and migration research (Hinsch & Bijak, 2022; Klabunde & Willekens, 2016). Population studies have used ABM to analyse demographic processes from a bottom-up approach, by incorporating transitions to conceptually relevant states (e.g. marriage, childbearing, migration) (Zagheni, 2015). State transitions are defined by rules of behaviour that may be informed from purely theoretical assumptions to empirical evidence, or a combination of both, depending on the research purpose.

Given that ABM let link micro behaviours to global patterns, a number of applications in migration research have been oriented to improve projections and forecasting of international migration rates, a field that has so far lacked bottom-up approaches according to migration scholars (Klabunde et al., 2017; Willekens, 2017). In this line, Willekens (2017) developed a simulation model to generate international emigration rates based on the operationalization of the Theory of Planned Behaviour (TPB). The model consisted of the separation of the individual decision to migrate into a series of stages and its respective transition rates from intention, planning, and actual migration. By running the model on a virtual population of 100,000 individuals 15-years old, he obtained similar emigration rates, that were comparable to world estimates. Klabunde and others (2017) maintained a theoretically based migration decision but expanded Willekens’ (2017) model in the following substantive ways. First, while the migration decision was theoretically informed by the TPB, the migration process itself was

embedded within a larger framework of competing demographic processes (e.g. marriage), multistates, that were in turn governed by a series of empirically based decisions. In this sense, single agents entering a marriage state, for instance, would change their probabilities of being potential migrants. Second, the model was setup based on actual surveyed population, namely, Senegalese individuals sampled by the Migration between Africa and Europe project (Beauchemin, 2018). Third, the model free parameters of the decision to migrate were calibrated against observed Senegalese emigration rates to Europe. Given results obtained from this ABM yielded similar emigration rates present in the sampled MAFE data, the model is used by the authors to project a series of future policy-relevant scenarios based on shifts in the individual behaviour (e.g. fertility) and economic conditions (e.g. GDP).

Although less ambitious than prediction of future trends, ABMs can be built with an explanatory purpose in mind, making the tool relevant to understand why something occurs (Edmonds et al., 2019). In Edmonds and others (2019) words, “[i]f one makes a simulation in which certain mechanisms or processes are built in, and the outcomes of the simulation match some (known) data, then this simulation can support an explanation of the data using the built-in mechanisms” (p. 7). By taking advantage of the ABM as a digital laboratory for social research, simulation makes possible to test under what conditions a global pattern of interest is reproduced. With this approach in mind, Williams and others (2021b) developed an ABM applied to the Nepalese context aiming at explaining how armed conflict affects migration rates. Similarly to the ABM by Klabunde and others (2017), their ABM considered a series of multiple states where transitions between them was informed by equations fitted from surveyed data, and where the level of armed conflict was considered as one variable affecting individual behaviour. In their model, the decision to migrate was also informed by coefficients estimated by fitting a model to the Nepalese communities of interest. To test the effect of conflict on migration rates, the authors simulated hypothetical scenarios where the estimated parameter for conflict was modified, by setting it to 0, duplicating it, or change the timing of its effect. Interestingly, their results indicate a negative effect of conflict on emigration rates, that was explained due to a decrease in return migration rates.

As for other research areas and fields, there are certainly a multiplicity of modelling purposes for which ABM have been used in migration research, such as description, theoretical exploration, among others (Edmonds et al., 2019; Hinsch & Bijak, 2022). In this context, Hinsch and Bijak (2022) highlight the idea of designing “models to” instead of “models of”, to emphasize that model features and its assumptions should be in close relationship to the problem at stake. Drawing on this, and by guiding our modelling strategy on a KISS principle as a good practice of scientific computing (Wilson et al., 2014), we aim at developing a relatively simple ABM that would let us replicate individual migration trajectories and explain the role of migrant networks and other macro factors of interest on the aggregated migration dynamics of the context of interest.

3.4 Data and Methods

a) Datasets description.

We use the Colombian module of the Latin American Migration Project (LAMP) data as provided by Durand & Pren (2016). The Colombian dataset contains representative samples of 14 Colombian communities collected in 2008, 2009, 2011, 2013, and 2015. Communities are strategically chosen to reproduce a range of conditions with respect to size, geography, ethnicity, and economic organization (D. S. Massey & Zenteno, 2000). It is key to note that in comparison with the rest of the country, international migration in some of the selected communities is higher and therefore not representative of national level, as they were part of the geographic area that was mostly hit during the coffee crisis in 1990s (A. Silva & Massey, 2015). Communities are defined by the site where the survey is implemented. In cities, communities are neighborhoods or a geographically distinct part of it, while in towns (or *ranchos* according to MMP/LAMP nomenclature), communities tend to be the whole place (Mexican Migration Project, 2012).

Within each community, researchers randomly select approximately 200 households and interview household heads and spouses. The survey gathers detailed retrospective information on the life trajectories of household heads and spouses, including information on the first and last international trip when existing. In addition, socio-demographic data and migratory experiences for each household member is also collected.

For each community, LAMP attempts to sample immigrants who settle in the United States and Spain. To locate migrants overseas, the project relies on field notes and referrals. In the absence of a sample frame to ensure a representative size of the migrants in each community, the project performs an estimation based on children of household heads (Mexican Migration Project, 2012). This methodology has also been implemented in other migration contexts to estimate the total size of migration and emigration rate (Schoumaker & Beauchemin, 2015; Willekens, Zinn, & Leuchter, 2017). By having a sample of migrants both at origin and at destination, the LAMP project aims at reducing bias in the understanding of migration by solely focusing in one of the two places, such as the selection bias of returned migrants or in the cases where all household members have migrated.

Our main module of interest corresponds to the LIFE module, that includes complete life-course data for household heads in relation to a series of time-variant and time-constant sociodemographic characteristics. Second, we use the PERS module to extract information on the rest of household head family ties, allowing us to identify the presence of a family migrant network. Finally, we use the information about sampling weights of communities in the United States and Spain present in the COMMUN module to deal with missing values in the variable community, as it is explained below.

We supplemented the LAMP data with five sources of macroscopic data. First, we used two datasets from the Determinants of Migration Policy (DEMIG) project, namely, the POLICY and VISA datasets developed at the International Migration Institute (Haas, Natter, and Vezzoli (2016)). The POLICY dataset compiles information on more than 6,000 migration policy changes in 45 countries from 1945 to 2014. The data used in this paper corresponds to migration policies in the United States and Spain. We use the information on policy changes concerning border management and entry requirements, as well the targeted migrant group of each policy measure. The VISA dataset contains information on the start of visa requirements by origin country. We use entries

concerning Colombians. Violence levels in Colombia are obtained from the UCDP/PRIO Armed conflict dataset from the Uppsala Conflict Data Program (Pettersson and Öberg (2020)). The UCDP dataset is a key reference concerning the study of organised violence and armed conflict. It contains high-quality data with annual updates. Economic information concerning GDP growth in Colombia, employment growth in the United States and Spain, are drawn from official figures gathered by The World Bank and OECD.

b) Weights

All our analyses use the weights included in the LAMP dataset. The use of weights in LAMP is intended to represent the different size in the number of eligible households between the different geographic areas that LAMP focuses on, that is, large metropolitan areas, medium-size cities, and rural villages. Weights in LAMP are associated to communities of origin and therefore used to adjust the sample size of each community to the actual number of households in each community. In this sense, weights in LAMP consists of the inverse probability of household heads of being interviewed. Therefore, communities with higher number of households have larger weights, as they represent more households.

Because LAMP interviews individuals in the US and Spain, weights are not only community-specific, but also sample-specific. In other words, the number of household heads each person represents varies depending on whether individuals were interviewed in Colombia or at one of the two destinations. In this sense, an individual from community *X* can have three different weights, but the one that is assigned to depends on where was interviewed. Community weights for individuals interviewed in Colombia and overseas follow the same principle, which consists of representing the inverse of the sampling fraction by dividing interviewed and eligible households. However, the computation of the latter requires to approximate as best as possible to the total of eligible household of migrant household, as it needs to consider different migration rates in each community. To do this, the LAMP project uses data on the children of the household head of the Colombian sample, following the same procedure specified for the MMP project (Mexican Migration Project, 2012).

c) Data management key considerations

In this section we explain treatment of missing values in LAMP data and the decisions regarding data preparation to enable it to work in the Agent-Based Model simulation.

From the 20 variables used in the analysis, four contained missing values, namely: educational attainment, occupational status, community, and weights. Educational attainment and occupational status had missing values in 23 and 26 individuals, respectively. This amounts to 763 and 867 person-years, respectively, represents the 0.8 and 0.91 percent of the total person-years included in our analysis. In the occupational status variable, missing values consisted both in gaps within individual's life histories and cases where all observations for an individual were missing values. 76 individuals had missing information in the variable community, corresponding to 964 person-years and 1.04 percent of the data. It is key to note that all individuals with missing data corresponded to persons interviewed overseas, 12 in the US and 64 in Spain.

For the ABM to work there must be no missing data. We therefore proceeded to impute values to the missing information. The following imputation procedure was conducted in the variables educational and occupational attainment. Cases with gaps in specific years were filled with the last value observed, from past to present. Otherwise, the filling of missing values was conducted from present to past. This criterion followed a conservative approach in which individuals at origin follow an upward educational or occupational trajectory. For cases with missing values in all their observed years, data imputation relied on a random person of the same age.

Imputing a community of origin to the 76 individuals with missing information in this variable required a different procedure than the one described above. Note that the fact that LAMP does not report community belonging and weights for these individuals interviewed overseas means that they did not belong to any of the 14 communities of origin. Luckily, because LAMP provides community weights for individuals interviewed overseas, we were able to resort to them to assign the most likely community to which a migrant might have belonged. As depicted above, weights in LAMP are intended to represent the community size, for which weights for individuals interviewed in Colombia and overseas are included. Therefore, an individual from community 1 interviewed in Spain, for instance, is weighted differently as if it was interviewed in Colombia. This allows LAMP, drawing on the methodology of the MMP project, to estimate representative samples of the binational communities of origin and most importantly reliable estimates of migration rates (D. S. Massey & Zenteno, 2000). In concrete, the procedure consisted of assigning a community by using the weights at the two destinations as the probability distribution to select a community of origin. The underlying justification of this procedure consists of assigning higher probabilities to those destinations with higher migration rates.

d) Measurement/Operationalization

Our dependent variable is defined by four distinctive categories, namely: no migration, migration out of Colombia to a Latin American country, to the United States, or to Spain. In the analysis, we include only first direct migrations to these destinations, resulting in 369 migrations. By first direct migrations we mean stays of 12 months or longer at destination, which excludes transit migration. We focus on migration determinants in relation to first migrations because subsequent migration occurs in different circumstances, such as the establishment of new migrant networks and resources earned in previous migrations (Baizán & González-Ferrer, 2016).

Table 1 presents sample descriptives of the variables used in the models, both of all person-years and at migration or time of the survey. Mean values (for continuous variables such as number of children) or the frequency distribution (for categorical variables such as occupational status). First, in the column named “Person-years”, we show the means and the frequency distribution, computed out of the total number of person-years in the sample used in our analyses. Second, we present the values of the variables either measured at migration for individuals that have migration to a Latin American country, the United States, or Spain, or measured at censoring time (i.e., at survey time or at migration to other destination) for other individuals.

Table 2
Sample descriptive statistics: proportion or mean values of the variables included
in the models for international migration from Colombia. Person-years in the
sample and values at migration or at censoring

Variable	Person-years	Values at migration or at survey year
Age	34.60	42.95
Female	0.42	0.41
Education years	8.77	9.93
Partner	0.61	0.57
Number of children	1.83	1.88
<i>Occupational status</i>		
Unskilled Manual	0.16	0.17
Skilled Manual	0.16	0.16
Lower Service	0.19	0.27
Routine Non_manual	0.08	0.06
Salaried	0.13	0.11
Unemployed	0.27	0.23
Work experience	14.27	20.00
Assets	0.30	0.44
<i>Migrant networks</i>		
Intrarregional	0.01	0.03
Usa	0.02	0.05
Spain	0.02	0.07
Community migrant network	0.07	0.16
<i>Community</i>		
Commun 1	0.07	0.05
Commun 2	0.04	0.03
Commun 3	0.06	0.05
Commun 4	0.10	0.09
Commun 5	0.06	0.04
Commun 6	0.27	0.39
Commun 7	0.06	0.06
Commun 8	0.02	0.02
Commun 9	0.04	0.03
Commun 10	0.03	0.02
Commun 11	0.04	0.03
Commun 12	0.12	0.11
Commun 13	0.06	0.04
Commun 14	0.05	0.04
<i>Border stringency</i>		
Border USA	-0.11	-0.05
Border Spain	-0.21	-0.48
Violence	0.29	0.24
GDP growth	1.84	1.79
Employment growth USA	1.41	-0.54
Employment growth Spain	1.31	-1.39

Oil prices	25.52	59.83
Person-years		90201
Individuals		3002
Migrations		369
Migrations Intraregional		74
Migrations USA		91
Migrations Spain		204

Source: LAMP for individual life-histories; DEMIG, *UCDP/PRIO*, The World Bank, OECD, and OPEC for sources of macroscopic data.

Our measurement of migrant networks distinguishes between family and community migrant networks, by drawing on the approaches present in the literature using MMP and LAMP data (e.g. Munshi 2003; Takenaka and Pren 2010; Silva and Massey 2015). Migrant family networks are destination specific and consist of time-variant noncumulative indicators of the presence of family migrant networks to each of the destinations of interest. This is measured by means of a dummy variable that accounts for first migrations from any of the family ties of ego within the household roster at the time of the survey. Migrant community networks are measured by computing the proportion of migrant family networks in each community. This results in a time-variant measure of community-specific emigration rates, which is equivalent to the so called prevalence migration rate used in studies working with MMP and LAMP data (examples cited above).

Independent variables consist of age, gender, education years, partnership status (married or in a consensual union), number of children, occupational status, years of work experience, and ownership of assets. Information on professional occupations in LAMP is coded using the Mexican Occupations Classification from year 1996 to provide comparability across countries within the LAMP project. Occupations were subsequently collapsed into a simplified version of the European Socio-Economic Classification (Rose, Harrison, & Pevalin, 2014). The work experience indicator was constructed using the cumulative sum of the year that an individual has been employed. The indicator of individual's resources reflects whether she/he owns property in Colombia, including land, dwelling, and business.

Institutional or macro factors are divided into origin and destination ones. At origin, we consider a variable for the presence or absence of periods of armed conflict in Colombia. This consists of a simplified dummy version of the original *UCDP/PRIO Armed conflict* measure that considers discrete annual violence intensity discrete levels from 0 to 2 (Pettersson & Öberg, 2020). Economic growth in Colombia was measured as the annual change, in percentage terms, of Gross Domestic Product per capita in the country reported by the World Bank data portal (World Bank, 2022), which indicates the economic conditions in Colombia. This indicator was available since year 1961.

Destination institutional variables refer to the level of stringency in the US and Spain border regulations towards Colombians, based on the data provided by the DEMIG project in its POLICY and VISA datasets. Within the POLICY dataset each data entry represents one policy change enacted in a specific country and year (de Haas, Natter, & Vezzoli, 2016). In turn, each policy change contains information on the following six aspects: area covered (e.g. border and land control); policy tool (e.g. recruitment agreement), migrant category (e.g. skilled workers) targeted; migrant origin (e.g.

Colombians) targeted; change in restrictiveness of the policy (more or less restrictive); and magnitude of the policy change (minor or major policy change). Based on the latter, we computed an index to reflect the annual border stringency relative to 1961 in the United States and Spain. We focused in the policy areas of “Border and land control” and “Legal entry and stay” that affected directly or indirectly (e.g. when all migrant origins were targeted) Colombian immigrants. Drawing on previous literature using data from the DEMIG project, we took the mean of the annual policy changes across entry categories (e.g. low skilled, high skilled, students) and weighted annual policy changes by the information on the magnitude provided in the dataset (Flahaux, 2014). Finally, the imposition of an entry visa was included in the index as a major policy change.

A proxy of labour demand was measured by the annual employment growth rate in the US and Spain, respectively, based on the Labour Force Surveys (OECD, 2022). This indicator includes individuals of all nationalities living in the US and Spain. Information on employment and on oil prices was available from year 1956 and 1960, respectively.

Data availability of the macro information starts in year 1961 (i.e. GDP in Colombia), which makes us restrict our analyses from that year onwards. Moreover, because we are interested in analysing migration rates with respect to population under risk, we stop the analysis in year 2008, which is the year individuals interviewed in that year are right censored. All in all, our analytical sample consists of 3002 individuals and 369 first migrations made directly from Colombia to a Latin American country, the United States, or Spain.

e) Analysis

We use Agent Based Modelling (ABM) informed by survey data, along the lines of *Survey Data Based ABMs* (Williams, O’Brien, and Yao 2017). This means that we use our available data to fit a statistical model that provides individual probabilities of international migration. The parameters (or coefficients, factors) estimated from the statistical model are then used in an ABM to compute individual agents' international migration probability, or transition probabilities from potential to actual migrants, in each time step. Through this, we can reproduce individual life histories over time, letting agents migrate according to the fitted parameters. In each time step a series of indicators at the macrolevel can be computed, such as the number of new and cumulative migrants, annual and cumulative migration rates of the sampled individuals in the LAMP data. In order to test the effect of networks at the macrolevel, we contrast the observed scenario to different *what if* hypothetical cases where networks effects are modified, as explained in more detail below. All in all, our analytical strategy can be divided in three steps, namely: model fit; reproduction of life history by means of an ABM informed by the fitted parameters; and comparing hypothetical macrolevel scenarios of migrant network effects. Below we depict steps one and two. Step three consists of our results.

f) Event History Analysis of individual migration probabilities

Given the longitudinal nature of our data and our interest in working with yearly changes in individual migration probabilities, our statistical model consists of a discrete-

time Event History Analysis of competing risks. Drawing from Steele (2005), we define a categorical response y_{ti} :

$$y_{ti} = \begin{cases} 0, & t < y_i \\ 1, & t = y_i \end{cases}$$

where the discrete-time multinomial logit model is given by

$$\log\left(\frac{h_{ti}^{(r)}}{h_{ti}^{(0)}}\right) = \alpha^{(r)}(t) + \beta^{(r)}X(t)_{ti}^{(r)} \quad r = 1, 2, 3. \quad (1)$$

$h_{ti}^{(r)}$ represents the event-specific hazard of migration to destination r during interval t for individual i . The conditional probability represents the probability of migration to any Latin American country, the United States, or Spain over the probability of staying in Colombia in a given person-year. Because our data is of discrete-time form (yearly information was collected), a discrete-time (as opposed to continuous-time) model is preferred (Allison 1982; Yamaguchi 1987). In Eq. (1), X represent a vector of observed time-varying (and non-time-varying) individual characteristics, and β represent their coefficients. Besides our duration variable (i.e. age), all time-varying variables are lagged by one year. Individuals enter the analysis when they turn 18 years old and exit when they turn 65, at the time of the survey or when the event of international migration occurs. Right censoring is applied for individuals migrating to any other destination (e.g. Africa). Given data availability restrictions concerning the macro factors, starting from year 1961, and also because we lag these variables too, the analysis starts in 1962.

g) Agent Based Model characteristics

The design of our ABM has been guided by our research purpose, namely, explaining the role of migrant networks at the macro-level. Drawing from Edmonds et al. (2019) description of the many possible purposes for an ABM model, ours is mostly empirical and of explanatory nature. We use ABM to gain a better understanding of the potential causal effect of networks on the aggregated migration counts and rates, in the case of Colombian international migration between 1962 and 2008. In the following section we describe our ABM model, by explaining the characteristics of the data to inform it, agents' properties, the behavioural rules that govern status change, how the simulation is setup, the model parameters that need to be defined to run the simulation, and the main outputs of interest produced by the simulation.

h) Importing the data to inform the ABM

First, there are the following characteristics of the data informing the ABM model. Micro data, that is, data associated to individual characteristics, are required to be in a discrete-time format, where rows are the unit of analysis and columns the variables of interest. In the ABM model presented in this paper, the micro data that informs the model corresponds to the LAMP data of Colombian migration (as depicted above).

Although the statistical model used to estimate individual migration probabilities in each simulation year is based on empirical data only, running the LAMP data into the ABM requires completion of person-years (procedure explained below) for simulated individuals once a migration event is observed in the data. Because the ABM evaluates the probability of migration based on the estimated parameters (i.e. statistical model), those individuals that migrated in reality must be evaluated even if they were originally right-censored for the statistical analysis. We solve this absence of data due to censoring by completing person-years beyond year of migration. Specifically, time-variant variables age and work experience increase yearly by 1. The rest of time-variant and time-constant variables remain as the last empirical value observed before the migration event is observed. Person-years are completed until time up until individuals turn 65 years old.

i) Agents' properties, determination of status change, and setup.

Second, as for agents' properties, agents represent unique individuals with three properties, namely: birth year, values, and status. Birth year and values are defined by the data. While birth year is self-explanatory, values and status require some explanation. The property *values* consists of a vector of values in the variables of interest, which are the same ones considered in the statistical analysis presented above. Note that because there are time-variant variables in the statistical model, the property *values* will be a combination of time-constant and time-variant variables.

Agents have two possible states, potential and migrant. In each time-step, potential agents are updated based on a set of rules (explained below). Agents can also be activated or deactivated for different modelling purposes, such as conditioning agents' entering the simulation based on agents' characteristics, a specific time period, etc. For instance, in our model, we use this feature to deactivate potential agents once all their person-years have been evaluated. Note that the presence or absence of family migrant networks are part of agents' values. Because we only model household heads, agents are not connected between them as no global ties are considered.

Third, what characterize a survey-based ABM is that the rules of behaviour that govern the status change is drawn from an empirical base (Williams et al., 2021a; Williams, O'Brien, & Xiaozheng, 2017). In our model, agents are evaluated by the set of estimated parameters obtained from the Event History Analysis. In each simulation step, the evaluation of agents computes a probability based on the fitted parameters and the agent's sociodemographic values, as well as the institutional conditions at that time. If that probability is greater than a random number between 0 and 1, then agents shift their status from *potential* to *migrant*. Because we use the estimation obtained from the Event History Analysis, the mathematical rule that underlies the shift of status consists of the parameters estimated from the logistic regression function applied to each of the agent's person-years across their life-trajectories. The estimated parameters are presented in the results section.

Forth, in the simulation setup, all potential migrants are loaded into the simulation into their respective birth cohort. Our simulation sets up a population of agents defined as cohorts of potential migrants distributed according to their birthdates. Each cohort contains a number of individuals, equivalent to the number in the sampled data, that are loaded at the time-step 0 of the simulation. The time-step in which they enter the

simulation and their yearly probability of migration is evaluated by the simulation run. To keep coherence between the estimated parameters from the data, where risk of migration is defined for age 18-64, we only include individuals of these ages into the setup. Note that the number of individuals included in each cohort depends on the empirical distribution of individuals present in the data.

j) Simulation run

Fifth, the simulation run starts by loading the micro and macro data and the empirically estimated parameters or statistical model. There are five model parameters that need to be specified, namely: number of years or time-steps to run the simulation, one of the three destinations of interest to be modelled (e.g. Spain), scenarios for micro and macro variables, and a random seed.

In this paper, we run the simulation for 78 years, which corresponds to the range between our first agent entering the simulation (i.e. 1930) and the survey year where all agents are right censored. However, due to the model automatically restricting the evaluation of agents to the start of availability of macro data information, year 1962 in our case (due to lagged variables), we focus our attention from simulation year 32 (1962 – 1930). The simulation stops after 78 years because it corresponds to the exit of individuals that were retrospectively interviewed in the LAMP data. Although there are individuals interviewed in later years (i.e. 2011, 2013, 2015), valid computation of migration rates requires to do so. Otherwise, an inflated rate would appear as a result of having right censored individuals that are no longer in the risk set. Note that we chose this time frame because our research purpose consists of understanding migration rates by replicating migration probabilities based on the empirical data at hand. However, our model allows to run the simulation further in time. In principle, the ABM can also compute trajectories with simulated or imputed data beyond the empirical data. The most straightforward simulation with the data at hand consists of evaluating the complete population cohort, that is, all individuals ages 18-47 years beyond year 2008. However, a more plausible generation of new population of agents that reproduces demographic dynamics would be needed for a paper focusing on prediction.

There are three destination of interest that can be chosen from our empirical data, migrating to a Latin American country (intra-regional migration), the USA, and Spain. The selection of destination varies dependent on which set of parameters is chosen to run the simulation. In this sense, migration rates for each of the destination of interest can be analysed. In the analyses presented in this paper we focus on Spain, mostly because the increase in the migration rates over time is clearer, as it was a more recent in comparison to the migration streams to intra-regional countries and the USA.

The scenarios that can be modeled relate to the different specifications of the parameters space from the statistical model that is used to determine status change. Therefore, the parameter space is defined by the combinations of parameter values estimated in the Event History Analysis. In this sense, the ABM allows to vary both micro and macro parameters to build *what if* scenarios. For instance, the micro factor occupational status at origin can be set to have a null, half, or double effect. By default, the ABM uses the original parameters estimated from the data. The migration rates obtained from the default scenario can be used as a reference category, to which alternative scenarios can be compared. Because we are interested in the effect of migrant networks, we focused in

modifying the parameters related to family and community networks. To provide a comparative perspective in relation to other parameters, we also looked at scenarios with different effects of the macro factors, namely: violence levels, GDP, employment growth, and border stringency.

Once all the simulation parameters are set, the simulation runs over the time frame specified. In each time step, the number of agents that correspond to each birth cohort are added. Because we are interested in replicating observed trajectories, the simulation steps of the model coincide with the actual calendar years in the LAMP data. Therefore, time-step number 1 is equivalent to the calendar year 1930. In concrete, in time-step 1 there is one 18 years old individual in the LAMP data, that enters as an agent into the simulation. Although all agents are added during the simulation run, agents status update can be restricted to the availability of macro data, as depicted earlier. This decision is justified on the basis that the rules that define status change from potential to migrant consider both parameters of micro and macro variables. In our modelling, macro data availability starts in year 1962, therefore, the status update of agents only starts in time step 32, as mentioned above. Once availability of macro data starts, agents proceed to be updated in each time step. This meaning that all agents present in a cohort (both new and old entrants), that have not migrated before, are evaluated in their individual probability of migration. Note that agents that have change their status from potential to migrant are right censored and no longer updated.

The simulation stops in the year when no more data is available and that individuals are evaluated in their actual reported person-years.

k) Output

Model output consists of a series of indicators generated for each time-step related to migrant counts and rates, namely: new migrants and cumulative migrant counts; annual and cumulative migration rate. Annual and cumulative rates are defined as follows.

Annual rate:

$$\frac{d_{mig_t}}{d_{mig_t} + n_{nomig_t}}$$

Secondly, cumulative rate:

$$\sum_t^{t+k} \frac{n_{mig_t}}{n_{mig_t} + n_{nomig_t}}$$

Where d_{mig_t} is new migrants in time-step t , n_{nomig_t} is the count of all potential migrants in year t , and n_{mig_t} is the count of all migrants in year t .

3.5 Results

We present two sets of results. First, we briefly describe results from the analysis of LAMP and macro data on the individual propensities to migrate obtained by means of the Event History Analysis. Second, we present results of the annual and cumulative migration rates to Spain simulated by our Agent-Based Model, informed by the coefficients from the statistical estimation. To contrast our hypotheses, we distinguish between the default replicated trajectories based on the estimated coefficients from the LAMP and macro data, and a series of eight hypothetical scenarios.

a) Determinants of individual migration

Table 2 presents the event history analysis results for first migration to intraregional countries, the US, and Spain. Given this article is focused on international migration to Spain, we restrict the presentation of results mostly to this context, with some exceptions when interpretation is enhanced by complementing from results regarding migration to intraregional countries and the US. Moreover, given to our research design of obtaining migration propensities to each of the three destinations of interest and therefore dividing the total sample size of migrants into three, results for the estimation of the migration to intraregional countries and the US shows less statistical significance. The estimated model presented in table 2 was chosen due to its lowest AIC and BIC values compared to other specifications, such as including oil prices as a macro variable to account for employment growth in Venezuela. Note, however, that we kept a somewhat simple model consistent with the state of art academic research on migration determinants although leaving out interaction effects. Alternative specifications both in terms of number of variables and interactions are discussed in the last section of the article.

Table 2:
Multinomial logistical estimated of discrete-time event history models of first international migration from Colombia, by destination type.

Variable	Intraregional		USA		Spain	
	Log-odds	Sig.	Log-odds	Sig.	Log-odds	Sig.
Age	0.073		0.095		0.309	***
Age squared	-0.002		-0.001		-0.005	***
Female	0.033		-0.201		0.415	*
Education years	0.040		0.097	**	0.127	***
Partner	0.130		-0.735	**	-0.453	**
Number of children	0.014		-0.297	*	-0.226	**
Occupational status						
Skilled Manual	0.112		0.762		-0.457	
Lower Service	-0.213		1.249	*	-0.340	
Routine Non_manual	-0.257		1.728	**	-0.555	
Salariat	-0.473		0.989		-0.985	**
Unemployed	-0.420		0.765		-0.129	
Unskilled Manual	0.000		0.000		0.000	
Work experience	0.039		0.218		0.184	
Assets	0.081		-0.581		-0.422	*
Migrant networks						
Intrarregional	0.818		0.734		-15.583	
Usa	-17.122		1.729	***	-16.502	

Spain	0.420	-16.944	1.897 ***
Community migrant network	0.084 ***	0.023	0.094 ***
Community			
Commun 1	0.084 ***	1.699 *	-1.225
Commun 2	-0.769	1.521 *	-0.392
Commun 3	0.013	2.240 ***	-2.669 *
Commun 4	-0.931	1.553 **	0.577
Commun 5	0.150	-0.358	-0.215
Commun 6	-1.332	0.035	1.663 ***
Commun 7	-0.716	-0.499	0.095
Commun 8	-1.543	-0.167	-1.848
Commun 9	-0.222	-0.788	-0.020
Commun 10	-0.827	-16.587	-16.939
Commun 11	0.417	0.650	-0.118
Commun 12	1.037 *	1.319 *	-0.316
Commun 13	-0.042	0.713	-0.335
Commun 14	-0.084	0.000	0.000
Border stringency	0.000		
Border USA	-1.768	0.504	-0.287
Border Spain	0.970	1.168	-1.945 **
Violence period	-0.597	0.230	-0.025
GDP growth	-0.120	-0.067	-0.228 ***
Employment growth USA	0.195	0.032	0.135
Employment growth Spain	-0.005	0.022	0.194 ***
_cons	-8.239 ***	-10.568 ***	-12.779 ***

Significance: * $p < 0.10$, ** $p < 0.05$, *** < 0.01 .

The model confirms the key role of family migrant and community networks in determining individual migration propensities as found in several other studies (Silva and Massey 2015; Baizán and González-Ferrer 2016; Takenaka and Pren 2010). In line with what Silva and Massey (2015) found for the case of Colombia with 11 communities, the effect of migrant family networks is strong and destination-specific, with log odds of 1.73 and 1.9 for the US and Spain, respectively. This confirms the idea that the international experience of close ties tends to influence the decision of which destination to choose at the time of migrating. Probably due to lower migration costs, first movements to Latin American countries are not associated to family networks in these countries. However, community networks present a positive and strong effect for migration to Intraregional countries and Spain, while they are less important and not significant for US migration, respectively. Note that due to lack of observations, some coefficients have very large (and not significant values) values, such as Intraregional migrant networks on the likelihood of migration to Spain.

As regards sociodemographics, in all three destinations, migration propensities tend to increase with age, although the coefficient is only significant for Spain. Migration to Spain shows a clear non-linear pattern in terms of age, peaking at age 30. This age pattern in migration is consistent with life course explanations that suggest differentiated motivations and constraints over time. As regards sex, the model shows that for the case of Spain there is a differentiated gender migration pattern, where women have higher chances of migrating. While for intraregional and migration to

Spain migration log odds are higher among females, the opposite situation occurs for the US. That effect of gender persists being significant while adding all the other covariates in the case of Spain, may be related to the key role of labour demand in the care sector experienced by the country (Hellgren, 2015).

As for the rest of the control variables from the LAMP data, the model depicts the following. Having a partner and the number of children tend to decrease the probability of migration, both regarding migration to the US and to Spain. Migration propensities tend to increase with educational attainment both for first migrations to the US and Spain. However, when looking at occupational status, the model suggests an inverted U-shaped pattern for the US, where middle skilled workers have higher migration propensities compared to the low and high skilled ones. A different situation is observed for Spain, where lower skilled workers tend to have higher migration propensities. The coefficient for the work experience resulted to be non-significant for all the three destinations. Assets ownership is negatively associated to migration to Spain. Finally, the dummy variables for the communities of origin of individuals confirm the presence of unobserved time-constant characteristics that influence migration.

The coefficients estimated from the macro data play an important role in influencing individual migration propensities mostly for the case of Spain. Focusing on the destination-specific variables, results indicate that border stringency in Spain is negatively associated with migration to this country. Indeed, higher policy efforts towards migrants' selection expressed by the index of border stringency, are associated with lower individual migration probabilities. The variable measuring violence did not show an effect on individual migration probabilities, which is consistent with what Silva and Massey (2015) found for their study of 11 Colombian communities. Economic indicators, that is, GDP changes in Colombia and employment growth in Spain show negative and positive effects, respectively.

b) Scenarios.

Figures 1 and 2 present the annual and cumulative migration average rates of the default model, defined as the simulated rates based on the coefficients obtained from the statistical estimation (i.e. coefficients from table 2). Figure 1 shows the observed and simulated annual rates. In addition, and as means for validating our simulated values, we include the yearly predicted probabilities estimated from the event history analysis. Note, however, that these predicted probabilities are not rates and are only added for illustrating the resemblance between ABM simulated rates and its probability counterpart. As depicted in the methods section, the simulated annual rates are the result of the ABM simulation where migration is a result of agents' values and the estimated coefficients. We simulated ten random replicates for each scenario to ensure consolidated rates and present the average values in the figures below. Moreover, we resorted to the RMSE (root mean squared error) as a measure to confirm differences between curves. RMSE values are presented in table A1 in the appendix and consists of the computation of the root mean squared error between the simulated annual rates in the default and hypothetical scenarios.

Figure 1
Simulated (average across replicates) and observed annual migration rates of Colombian migration to Spain, years 1962-2008. Predicted probabilities added for illustrative purposes

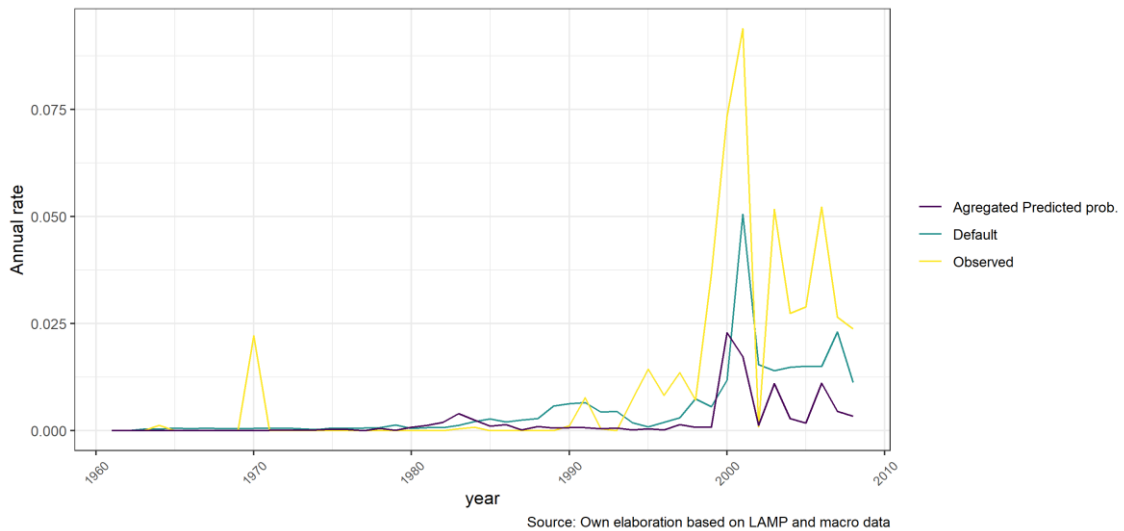
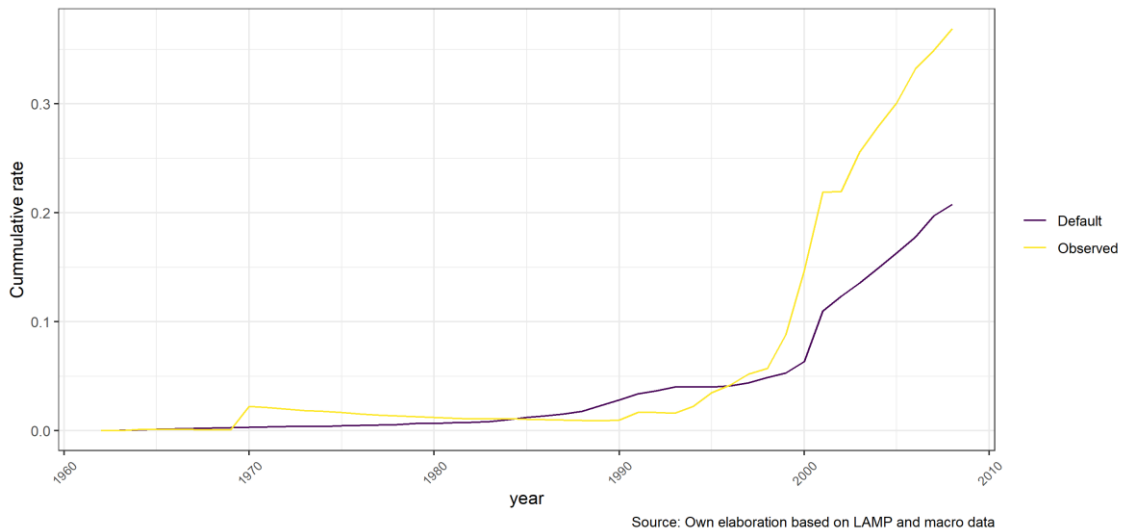


Figure 2 presents the observed and simulated cumulative rates, the latter for ten random seeds too. Cumulative migration rate, also known as prevalence migration rate, has been the canonical indicator used by migration scholars working with MMP and LAMP data to refer to the cumulative migration experience within a community (e.g. territory, country). This figure shows the simulated cumulative rates follow a similar trend compared to the observed rates. As in the case of the annual rates, curves are similar in their upward trend, although different in their numerical values. Despite these differences, for our research purpose this is not necessarily problematic, because scenario comparisons are carried out in relation to the default model. In the following presentation of scenarios, we present comparisons between simulated cumulative rates which are easier to visualize, leaving for the appendix all the figures with the annual rates (figure A1).

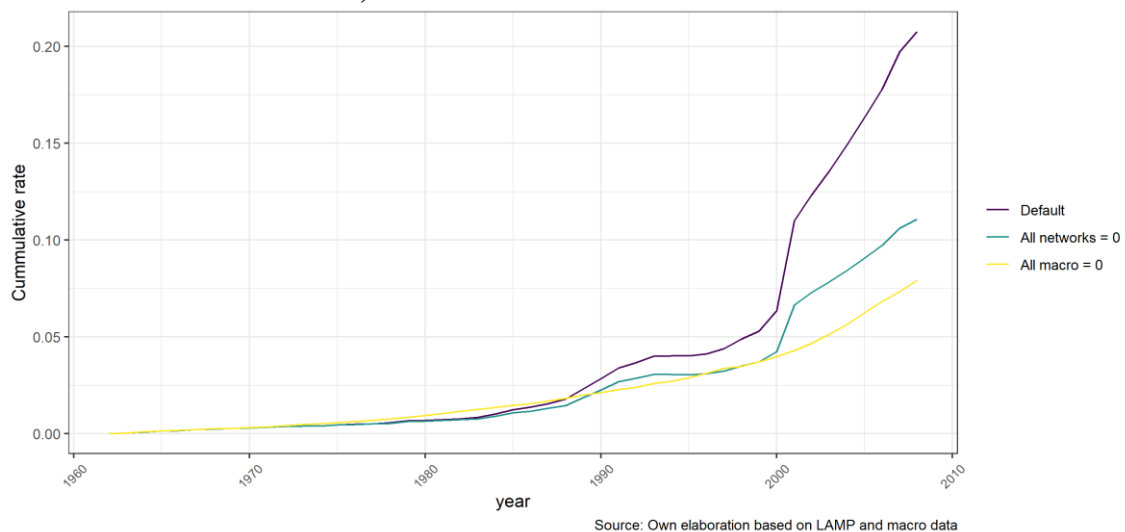
Figure 1
Simulated and observed cumulative migration rates of Colombian migration to Spain, years 1962-2008



To contrast hypotheses 1 and 2, figure 3 shows cumulative migration rates with family and community networks disabled, respectively. The green line in figure 3 indicates that cumulative rates diminished to an average of 0.11 across replicates at the end of year 2008. Disabling network effects has a considerable impact on overall rates, confirming **hypothesis 1**. In the absence of network effects, the overall shape of rates does not remain, especially from year 2000 were rates take-off in the default model. This indicates that migrant networks were indeed a key underlying mechanism explaining the observed migration upsurge.

To contrast **hypothesis 2**, we simulated a scenario where all macro effects were disabled and migrant networks and control variables are kept as in the original estimated model, as presented by the yellow line in figure 3. This scenario let us contrast whether the sole effect of migrant networks is a sufficient condition to reproduce migration dynamics presented in the default model. Results indicate that, indeed, networks alone are not sufficient, but it is the aggregation (additive effect) with macro level characteristics at origin and destination such as changes in economic security in Colombia, employment demand in Spain, as well as border stringency that shaped migration rates. In fact, in this scenario, the simulated cumulative rates only slowly increase from 1962 to less an average of 0.08 in 2008. These results are also confirmed when looking at the RMSE of the scenario, which consists in the largest difference compared to the default model, as depicted in table A1 in the appendix. All in all, these results provide evidence to confirm hypothesis 2.

Figure 2
Cumulative migration rates of Colombian migration to Spain, years 1962-2008.
Default scenario, all networks and all macro variables disabled.



Hypothesis 3 is contrasted by means of comparing the differentiated aggregated effect of family and community networks. As depicted in figure 4, we observe that the simulated rates with family network effect disabled are only marginally different than the default model. In fact, table A1 in the appendix shows that the RMSE value between the default and scenario with disabled family networks is 0.0006. Interestingly, while the effect of family networks is important in influencing individual migration probabilities, they did not play such a key role in terms of explaining aggregated levels of migration rates for Colombians into Spain. This is probably due to the relatively low

numbers of family networks in place, where the percentage were 2 and 7 of all person-years and values at censoring time, respectively, as described in the sample descriptives above. In other words, the number of individuals affected by disabling family network effects is not large and therefore aggregated rates are not heavily impacted.

On the contrary, disabling the effect of community networks produces a significant change in the aggregated rates, as depicted by the yellow line. In fact, we now see that the main driver behind the change of rates in the previous figure was due mainly due to disabling community network effects, as it can be confirmed by the very similar RMSE values between the two scenarios in table A1 in the appendix. All in all, these results suggest that for our case and period of study, community networks, measured as the cumulative international migration experience within a community had a stronger effect than family in the aggregated rates.

Figure 3
Cumulative migration rates of Colombian migration to Spain, years 1962-2008.
Default scenario, family networks and community networks disabled.

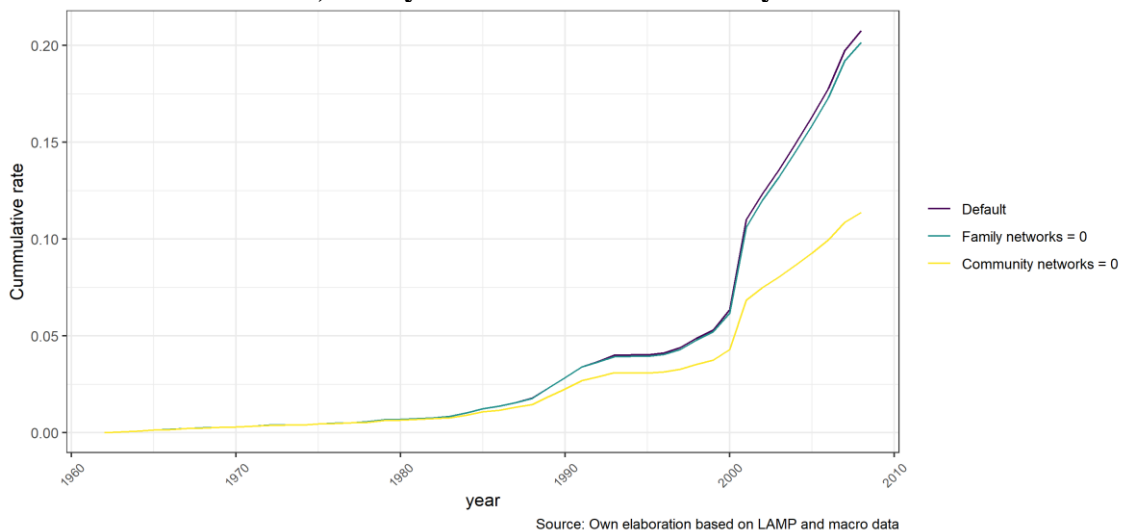


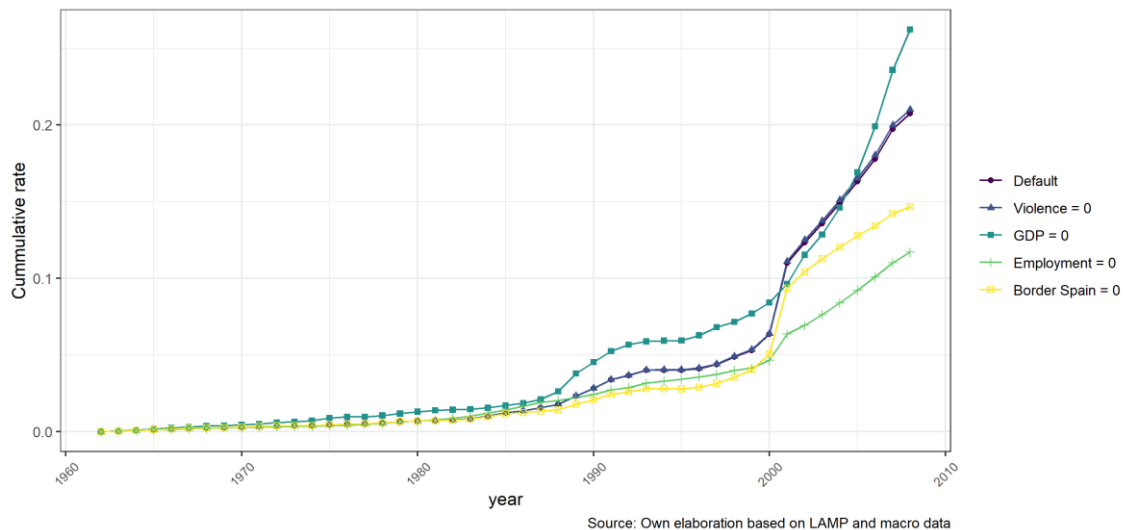
Figure 5 compares four scenarios to contrast hypotheses 4A, 4B, 4C, and 4D. We proceed by disabling a different coefficient of the following origin and destination-specific macro variables of interest: violence levels, GDP changes, employment growth, and border stringency in Spain. Results indicate that besides violence levels, disabling the macro effects estimated concerning individual migration propensities have an impact on the aggregate level. With the exception of border stringency in Spain, there is a correspondence between what was estimated at the micro level in terms of individual migration propensities and migration rates.

Turning to each of the scenarios, results indicate the following. First, as regards disabling the effect of violence levels, the scenario shows a minor change to the default simulated rates, with a RMSE of 0.004 between the annual rates curves. In fact, disabling the network effects has the lowest impact in terms of the annual migration rates. This result is not necessarily surprising, because as depicted in the coefficients from the event history analysis, the effect of violence on individual propensities was already small, and therefore the relatively small effect at the aggregated level was expected. Moreover, we found similar results when analysing the effect of violence on individual migration probabilities.

Second, both the changes in GDP in Colombia and employment growth in Spain show an important shift at the aggregate, confirming the role of economic security and labour demand at destination (i.e. Spain) as key drivers of migration rates over time. Disabling the effect of GDP in Colombia, increases cumulative migration rates from an average of 0.21 to 0.26. In other words, simulating a hypothetical scenario where the economic insecurity effects are disabled tends to increase migration rates for our case of study. Had Colombian GDP not grown in the levels it did during the period of interest, Colombian migration to Spain would have been 0.05 larger (5 percentage points). Disabling the effect of employment growth has also a sizeable effect on migration rates, as it reduces them to 0.12 in year 2008. It is key to note that disabling GDP and employment growth had the second and third largest impact, respectively, among all scenarios, indicating important evidence to confirm the key role played by economic security at origin and the increases in labour demand produced in Spain on influencing Colombian migration during the period of interest.

Finally, as regard the macro effects of border stringency, results are somewhat surprising. While the estimated coefficient was negative in terms of decreasing individual migration propensities, disabling its effect generates a decrease on migration rates, as shown in figure 5. In fact, contrary to what expected, aggregate levels of migration rates are lower when the border stringency effect is set to 0. As it will be further commented in the discussion, we suspect our results at the aggregated level should be due to a potential better specification that we did not explore, such as including interaction effects. Nevertheless, given the scope of this article where a relatively simple statistical model was planned from the beginning, we decided to keep the presented event history analysis, as it let us contrast all the scenarios of interest.

Figure 4
Cumulative migration rates of Colombian migration to Spain, years 1962-2008.
Default, violence, GDP, employment growth, and border scenarios.



3.6 Discussion

The aim of this article was to explain the global implications of migrant networks on migration rates, while accounting for time-varying demographic individual characteristics and macro levels changes in the context of international Colombian migration to Spain in the period from 1962 to 2008. We approached this objective by using Agent-Based Modelling (ABM), a tool that lets researchers connect individual characteristics and behaviours to macrolevel dynamics (Billari et al., 2006; Edmonds et al., 2019; Macy & Willer, 2002). Drawing from previous survey based ABM applications (Warnke, Reinhardt, Klabunde, Willekens, & Uhrmacher, 2017; N. Williams et al., 2017), we created our own ABM and informed it with longitudinal retrospective survey data to be able to reproduce individual migration trajectories and to explore a series of hypothetical scenarios.

Our ABM was useful to confirm that networks played a key role in shaping the aggregated migration dynamics of international Colombian migration to Spain in the period from 1962 to 2008. In the hypothetical scenario with an absence of network effects, migration dynamics would be greatly modified as migration rates decreased significantly. Network effects are therefore a necessary condition to explain and reproduce migration dynamics of Colombians to Spain. At the same time, the sole presence of migrant networks is not a sufficient condition to shape migration dynamics. In addition, our results indicate that most of the aggregated effect of networks was caused by community networks instead of family ties to previous migrants. In fact, family networks were not the ones responsible in explaining the upsurge in migration rates, although they might have been of importance at the individual level. Moreover, the scenarios created by means of our ABM show that macro factors were a necessary condition to shape migration dynamics, a result that is in line with previous research in other contexts (Baizán & González-Ferrer, 2016; Durand & Massey, 2010). Of particular importance were the economic factors of GDP and employment growth. While networks alone are necessary but not sufficient, it is the aggregation with macro level characteristics at origin and destination such as changes in economic security in

Colombia, employment demand in Spain, as well as border stringency that shaped migration rates.

However, it is key to be cautious about what type of statements can be drawn from our findings in relation to the role of community migrant networks on aggregated rates. Because we followed a similar approach to the measurement of migrant community ties from previous studies (Fussell, 2010; Garip, 2008), but also due to the characteristics of LAMP data, migrant networks within communities are measured indirectly and at the non-personal level, yielding in practice the cumulative migration rate in each territory. This implies a difficulty to distinguish between mechanisms such as increased motivation to migrate to maintain a relative social status within communities (i.e. relative deprivation) from the presence of actual weak ties (e.g. aunts, friends). With these important constraints in mind, our findings are nevertheless in line with previous international migration research, in that migrant networks constitute a necessary factor in shaping aggregated migration dynamics, although the cumulative causation would mostly operate at the community level, in the case of Colombian migration to Spain (Fussell, 2010; D. S. Massey et al., 1993).

We hope our work contributes to the increasing use of ABM models to study migration. While there is a multiplicity of research purposes for which ABM may be used (e.g. prediction, explanation), we find explanation and theory testing a particularly useful one. By informing ABMs with micro data, they become a relatively straightforward social laboratory to discuss both academic debates and policy relevant questions concerning aggregate numbers and rates (Edmonds et al., 2019; N. Williams et al., 2017). Because our primary focus was to use this model to inform an ABM to be able to conduct experiments to better understand the link between micro level individual probabilities and macro level aggregated rates, we followed a KISS principle recommended as a good practice for scientific computing (Wilson et al., 2014). In this sense, the bulk of the work for this article consisted of developing an ABM that could be informed by survey data and its respective parameters to reproduce individual migration decisions over time. Nevertheless, there are several limitations that are important to be discussed. Addressing these limitations would help enhancing the ABM and might serve to tackle new research purposes.

One key limitation refers to the statistical model specification that informs agents' migration decision. Certainly, in order to predict migration rates, model fit and not only similar trends between observed and estimated rates would be important. Although we run our simulations with the country with the largest migration counts (i.e. Spain) compared to the other two destinations, a more sizeable sample of migrants should yield more precise coefficients and likely other effects would appear statistically significant for the other two destinations. A previous version of the statistical model informing the ABM presented at the UPF Doctoral Workshop in March 2022 considered the whole aggregated sample of international migrants without distinguishing by destination. Several of the estimated coefficients from this model that were also significant in the final one, had indeed smaller confidence intervals, however, the effects of the occupational status variables, as well as the destination-specific macro factors were difficult to interpret and probably mostly influenced by those individuals moving to Spain. And most importantly, we wanted to account for the destination-specific role of family migrant networks. We compensated this smaller sample size produced by the decision of separating destinations, by including individuals interviewed overseas, as

explained above in the methods section. This decision, in turn, brought up potential new biases, but given our purpose of developing an ABM to explain a specific relationship between the micro and the macro in the data at hand, we don't expect to state our findings at the population level of Colombian international migration to Spain.

Concerning the statistical model specification, the measurement variables and their selection for the event history analysis was mostly based on similar studies on international migration. The article by Silva and Massey (2015) in which individual migration propensities of Colombians to the US and Canada, Latin American countries, and European countries were analysed was one of our primary references. We kept a dummy approach to the measurement of family migrant networks and included a variable for community networks measured in the similar fashion from the literature using MMP and LAMP (Fussell, 2010). We added other micro and macro variables, included by recent studies in other contexts to account for the simultaneous effect of employment growth at destination, as well as the role of border stringency changes. Certainly, this model specification left room for further statistical specifications to inform the ABM. Of particular interest would be to explore different measurements of family migrant networks, distinguishing between household versus non-household family ties (Liu, 2013), as well as separating the effect of spouses with previous migratory experience (Toma & Vause, 2014). In addition, analysing the interaction of family ties and macro factors could be explored, given the interactive effect of networks observed in other contexts such as in the case of employment at destination and networks on Senegalese migration to Europe (Baizán & González-Ferrer, 2016). In the case of international Colombian migration, Silva and Massey (2015) looked at the interaction between violence and family ties, without finding significant effects. Moreover, non-linear versions of GDP, employment growth in Spain and the US, as well as border stringency could also be included. In particular, the measurement of border stringency could also be changed, not only by including a non-linear version, but also by analysing entry categories separately and therefore accounting for the distinction between more selective border policies rather than more or less stringent (de Haas et al., 2016).

Several features could certainly be added to the ABM currently at hand: for instance, from a research purpose oriented to develop new theory on the role of migrant networks on aggregated migration rates, an explicit modelling of networks would be something to work on. One alternative would be to add explicit interactions between agents within household or communities. Actual surveyed individuals from the household heads could be included into the analysis to form household networks, or heads could be connected to form personal community ties. Moreover, the effect of these explicitly modelled networks could be added separately to influence the migration decision. Another research could deal with the debate on the selectivity of pioneers versus followers across time (Lindstrom & López, 2010; Takenaka & Pren, 2010), by randomizing the individuals entering the simulation, thus letting the researcher look at whether a random sample from calendar year 2000, for instance, would have had similar migration rates as individuals from year 1980. Finally, drawing on the Theory of Planned Behaviour (TPB) (Ajzen, 1985), ABMs in migration research have generally divided the migration decision into intention, planning, and actual migration (Bell et al., 2019; Klabunde et al., 2017). The distinction between these stages could be added, to explore differences between actual and potential migration rates.

Adapted only with minor adjustments, our ABM may be utilized to explore the link between micro behaviours and aggregate levels of migration rates in other contexts. If the input data is defined in person-years form, where rows refer to individuals and columns to variables, we expect our ABM to work with different datasets. Datasets could contain actual surveyed, web-scraped, or simulated and projected populations. In addition to the data itself, plausible statistical models to inform the migration decision would be necessary to make the ABM to work.

A final reflection relates to the substantive meaning of simulating alternative scenarios at the macro level. The exercise of modifying effects estimated from micro-level data to explore macro level implications in the context of migration research is something previous migration scholars working with ABM have encouraged (Williams, O'Brien, & Yao, 2021; Williams et al., 2017). Once the decision function of an ABM is informed by a statistical model, simulating alternative scenarios is straightforward, as the coefficients of the model may be modified at discretion. According to Williams and other (2021), one key advantage of data informed ABMs is the ability to simulate rates. Predicted probabilities estimated from regression models are not equivalent, although related, to rates, therefore limiting our understanding of macro level dynamics. In addition, micro data informed regression models yield results for individual probabilities, which are more difficult to interpret from a policy-oriented approach where counts and rates are generally more relevant.

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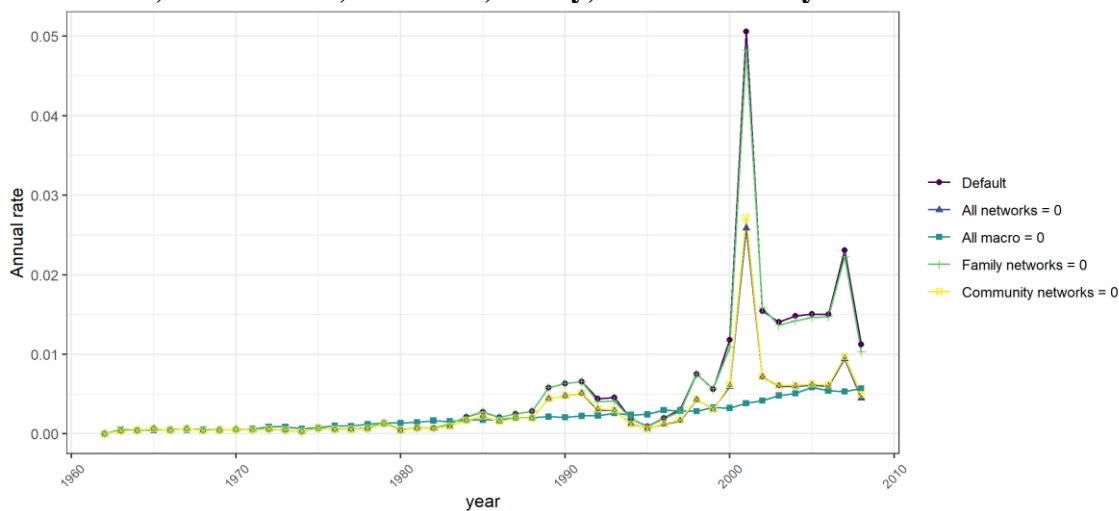
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Appendix

Figure A1

Annual migration rates of Colombian migration to Spain, years 1962-2008. Default, all networks, all macro, family, and community networks disabled.



Source: Own elaboration based on LAMP and macro data

Table A1

RMSE cuotient between scenarios

	RMS E	HH net	Community net	All net	All macro	Bord er	Violen ce	GD P	Employment
Family network	0.000								
Community network	6		1						
All networks	0.005	0	9.13	1					
All macro	0.008	2	9.48	1.04	1				
Border	0.003	2	14.90	1.63	1.57	1			
Violence	0.000	4	6.14	0.67	0.65	0.41	1		
GDP	0.007	4	0.65	0.07	0.07	0.04	0.11	1	
Employment	0.005	8	14.13	1.55	1.49	0.95	2.30	21.68	1
	0.005	8	10.48	1.15	1.11	0.70	1.71	16.07	4
									0.7
									4
									1

Source: own elaboration based on LAMP and macro data

4. CONCLUDING REMARKS

In the context of a lack of comprehensive framework to understand migration suggested by various scholars (Willekens, Massey, Raymer, & Beauchemin, 2016), this thesis is a modest attempt of contributing to the consolidation of stylised facts in migration research in relation to three global academic debates, namely: immigrants' labour market incorporation, dynamics of remittances behaviour, and the underlying mechanisms of migration rates. Drawing on Carling, Czaika, and Erdal (2020) I approached the tasks by contextualising and combining migration theories to the proposed research problems. In these concluding remarks, I briefly depict the main substantive findings, as well as the limitations and precautions that the reader should bear in mind. I also summarise some the ideas for future research that stemmed from the three main dissertation chapters. Although I intended to be as less redundant as possible from the previous chapters, I ask the reader apologies in advance for some inevitable repetition.

Chapter 1 dealt with immigrants' labour market incorporation in Chile, by considering previous research within the country and Latin America. I aimed at linking this evidence to the global academic debates on immigrants' labour market incorporation by analysing the assimilation and segmented assimilation theories (Chiswick et al., 2005; Heath and Cheung, 2007) in the Chilean context. When applying the segmented labour market theories into the Chilean context, I argued that because of the relatively high labour flexibility of the Chilean labour market combined with the marked employment-oriented nature of Latin American migration, similar or rapidly converging employment patterns from the migrants to that of the Chileans would be observed. I also expected some occupational assimilation to be constrained by underlying segmentation mechanisms. The combination of a high level of labour market segmentation in the Chilean labour market with low public support for the unemployed let me argue that informal migrant workers would be trapped in lower-skilled jobs.

General employment patterns of being economically active, employed, and having an informal occupation, Latin American migrants tended to present either higher or equal outcomes than Chileans, probably because of the clear employment-oriented nature of migration projects and the relative openness of the labour market. Nevertheless, with regard to occupational attainment, I found a diversified situation from both gender and migration origin when controlling for sociodemographic confounding factors and time since arrival, which might indicate the presence of ethnic rather than migrant penalties (Auer & Fossati, 2019; Heath & Cheung, 2007). This means that labour market differences in occupational attainment are not necessarily due to migration per se, but rather with the role of labour market segmentation mechanisms associated to ethnicity embedded in the social stratification system in Chile.

Results from chapter 1 were in line with the literature that indicates that in contexts characterised by flexible labour markets and segmentation, immigrants have a relatively high chance of being employed. However, results confirmed that occupational assimilation is attainable for several migrant groups. These findings are closer to the polarised occupational trajectories experienced by some migrant groups in the United States and the United Kingdom (Felbo-Kolding, Leschke, & F. Spreckelsen, 2019; Heath & Cheung, 2007), and could be interpreted in light of the following characteristics for the Chilean context. First, labour flexibility in the Chilean labour

market is very high for OECD standards, and has rapid hiring (and firing) processes combined with an open border regime period, which provides relatively easy access for Latin American migrants through different regional mechanisms. Second, since the late 1990s, there has been employment growth at both the bottom and the top of the productive sectors, which is combined with a local population that is characterised by lower educational attainments when compared to that of the majority of immigrants. Third, the presence of discrimination mechanisms that constrain upward mobility for those immigrants that are perceived as being different by the local population, as multiple qualitative studies have pointed out, is also something to be considered.

As depicted in chapter, several limitations and precautions need to be considered. It is important to highlight that the data used herein did not consider the yet-to-be released HHS for the year 2019, which might show worse socio-economic outcomes for immigrants. Since 2018, several reports have pointed out a shift in the characteristics of migration flows and their possibilities of labour market integration, which are mainly due to the changes in the visa and residence permit scheme put in place since that year, but are also due to the worsening of the situation and the subsequent stronger push factors at origin. For instance, Venezuelans, who have had relatively successful occupational trajectories, now have more difficulties in entering the country and accessing regular status (SJM, 2020). Finally, results are drawn from a cross-sectional sample, and no causal claims should be inferred from them. Changes among individuals cannot be tackled; therefore, more precise and causal inferences regarding the role of time remain unknown. Other types of biases, such as selection bias due to unobserved characteristics of migrants (e.g. educational attainments at origin), or return bias, can only be acknowledged as limitations to be considered.

Chapter 2 dealt with the dynamics of remittance-sending among Senegalese migrants in Spain. We explored under what conditions do Senegalese in Spain send remittances home, by relying on a longitudinal approach and data. Bearing in mind the importance of both altruistic motivations and contractual arrangements, we expected that, all else being equal, family ties to Senegal would be positively associated with remittances. In line previous research, we also expected to find that owning assets in Senegal as well as visits to the country would increase the likelihood of remittance sending. From the perspective of the new economics of labour migration (NELM) theory, we argued that agency in migration decision-making would be negatively associated to and remittance sending. We also proposed a capacity hypothesis, stating that higher levels of economic integration should be associated with greater economic resources and higher capacity to send remittances (Carling & Hoelscher, 2013). Although we did not propose any hypothesis related to the so-called “gender-remittance nexus”, we conducted our analyses being aware that the link between the nature of migration decision-making and remittances is less straightforward among women. As regard the relationship between duration of stay of and remittance sending, we drew from previous studies and expected a non-linear inverse U-shaped relationship between remittances and duration of stay. In other words, we argued that remittances would increase for some time after arrival and then start decreasing.

Drawing on a strong link between labour market participation and remittances for both sexes in our multivariate analysis, results provided strong support for the capacity hypothesis. The analysis lent some support to the family-links hypothesis as well, both for men and women, mainly through a positive association between having children in

Senegal and remittance sending. Concerning the material-links hypothesis, we found no evidence for it among men, whereas among women it is supported through a positive significant association between owning a house in Senegal and remittance sending. We found no support for the physical-links hypothesis, as the analysis shows no link between visits to Senegal and remittances. As we found no link between migration being the migrant's own decision and subsequent remittances, the autonomous migrant hypothesis could be not supported either. Remittance sending among Senegalese men in Spain was found to be almost universal, and it may be the case that remittance-related norms and expectations in Senegal are such that the commitment to remit is not weaker among autonomous movers. On the other hand, our analysis showed that, all else being equal, women who migrated on their own initiative remit more.

There are important limitations to be considered concerning the analysis of remittance sending among Senegalese in Spain presented in chapter 2. As depicted by Carling (2008), we know only whether a person remits while the actual amounts of money sent remain unknown. Another limitation of the study is that we could not observe either the recipients or purposes of the money being sent. Lastly, although our analysis suggested that financial capacity plays a very important role in remittance sending, we were only able to control for level of attachment to the labour market and have no reliable information on earnings or other sources of income. A natural progression of this work would be to run a similar survey of Senegalese immigrants in Spain and analyse potential changes in patterns of remittance sending. As discussed in the chapter, at the time of the two surveys used in our analyses, Spain was still emerging as a destination country and, consequently, most of the Senegalese in our sample were recent immigrants to Spain. They have since become a more established community while the destination country has itself undergone substantial socio-economic changes.

Chapter 3 aimed at explaining the global implications of migrant networks on Colombian international migration rates, by means of developing an Agent-Based Model informed by survey data. As depicted in the introduction to this dissertation, this task was oriented by a set of hypotheses concerning the effect of migrant networks on the aggregated migration rates over time.

Results provided support in that networks played a key role in shaping the aggregated migration dynamics of international Colombian migration to Spain in the period from 1962 to 2008. We found that the presence of networks was therefore a necessary condition to explain and reproduce migration dynamics of Colombians to Spain and that the sole presence of them was not a sufficient condition to shape migration dynamics. Results indicated that most of the aggregated effect of networks was caused by community networks instead of family ties to previous migrants. Our results also indicated that, indeed, macro factors were a necessary condition to shape migration dynamics, a result that is in line with previous research in other contexts (Baizán & González-Ferrer, 2016; Durand & Massey, 2010). Economic factors of GDP and employment growth were of key relevance. All in all, we concluded that while networks alone were necessary but not sufficient, it is the aggregation with macro level characteristics at origin and destination such as changes in economic security in Colombia, employment demand in Spain, as well as border stringency that shaped migration rates to Spain.

However, we also emphasized in chapter 3, that is key to be cautious about what type of statements can be drawn from our findings. Because we followed a similar approach to variable measurement of migrant community ties from previous literature (Fussell, 2010; Garip, 2008), but also due to the characteristics of LAMP data, migrant networks within communities are measured indirectly and at the non-personal level, yielding in practice the cumulative migration rate in each territory. This implies a difficulty to distinguish between mechanisms such as increased motivation to migrate to maintain a relative social status within communities (i.e. relative deprivation) from the presence of actual weak ties (e.g. aunts, friends). With these important constraints in mind, our findings are nevertheless in line with previous international migration research, in that migrant networks constitute a necessary factor in shaping aggregated migration dynamics, although the cumulative causation would mostly operate at the community level, in the case of Colombian migration to Spain (Fussell, 2010; D. S. Massey et al., 1993).

We hope our work contributes to the increasing use of ABM models to study migration. While there is a multiplicity of research purposes for which ABM may be used (e.g. prediction, explanation), we find explanation and theory testing a particularly useful one. By informing ABMs with micro data, they become a relatively straightforward social laboratory to discuss both academic debates and policy relevant questions concerning aggregate numbers and rates (Edmonds et al., 2019; Williams, O'Brien, & Yao, 2017). Although we think our primary focus of better understanding the link between micro level individual probabilities and macro level aggregated rates was fulfilled, there were several limitations that are important to be discussed. Addressing these limitations would help enhancing the ABM and might serve to tackle new research purposes.

One key limitation refers to the statistical model specification that informs agents migration decision. The chapter discussed how a research purpose oriented to predict migration rates would require a better model fit and population estimation, and not only similar trends between observed and estimated rates would be important. We specified that we run our simulations with the country (i.e. Spain) with the largest migration counts compared to the other two destinations, but that certainly a more sizeable sample of migrants should yield more precise coefficients and likely other effects would appear statistically significant for the other two destinations.

Concerning the statistical model specification, the measurement variables and their selection for the event history analysis was mostly based on similar studies on international migration. Certainly, this model specification left room for further statistical specifications to inform the ABM. Of particular interest would be to explore different measurement of family migrant networks, distinguishing between household versus non-household family ties (Liu, 2013), as well as separating the effect of spouses with previous migratory experience (Toma & Vause, 2014). In addition, analysing the interaction of family ties and macro factors could be explored, given the interactive effect of networks observed in other contexts such as in the case of employment at destination and networks on Senegalese migration to Europe (Baizán & González-Ferrer, 2016). Moreover, non-linear versions of GDP, employment growth in Spain and the US, as well as border stringency could also be included. In particular, the measurement of border stringency could also be changed, not only by including a non-linear version, but also by analysing entry categories separately and therefore

accounting for the distinction between more selective border policies rather than more or less stringent (de Haas, Natter, & Vezzoli, 2016).

Several features could certainly be added to the ABM currently at hand, namely: include an explicit modelling of networks; randomizing the individuals entering the simulation to contribute to the debate on the selectivity of pioneers versus followers across time; and incorporating the distinction between intention, planning and migration stages, to explore differences between actual and potential migration rates. Although not necessarily a new feature, we expect our ABM to handle similar data in person-years format quite well, therefore, making it a starting point to look at other migration contexts. Datasets could contain actual surveyed, web-scraped, or simulated and projected populations. In addition to the data itself, plausible statistical models to inform the migration decision would be necessary to make the ABM to work.

To sum up, this dissertation is a modest although significant advance in our understanding of some of the key global debates on the study of international migration. Concerning the first chapter, and from a substantive point of view, I hope that this research would contribute to the generation of stylised facts and comprehension of immigrants' labour market integration in Chile. As depicted earlier in the introduction, I was motivated to contribute in bridging the Chilean context to the global debate on labour market integration and time since arrival. The whole research design considered state of the art theoretical frameworks and methods used to study such research questions by leading scholars analysing immigrants' labour market incorporation. In addition to my interest in the global debate on international migration, I sincerely expect results and the research approach may contribute to the local academic and policy debate in Chile in times of crucial public investment on the institutional framework to integrate migration flows to the country.

As regards chapter 2 of this dissertation, I expect readers would value and understand my motivation of linking remittances into the larger picture that constitutes migration and the associated sociodemographic processes. Working on that chapter was a great opportunity to studying migration as a process and from a life course perspective. Working with the modules from the MAFE project was a challenging although fulfilling learning process, that I recommend to any researcher interested in analysing migration using retrospective longitudinal data and methods. Although the subject of remittances has been profusely analysed, looking at it from a longitudinal perspective opens new research questions that may shed light into our understanding of international migration.

While chapter 2 was my first serious incursion into dealing with migration from a longitudinal perspective, chapter 3 represented a somewhat natural next methodological step considering the purpose at hand. When I first started reading similar research using Agent-Based Models to study international migration, I was surprised by the quite fluid dialog with demographic methods where a longitudinal approach was one of its intrinsic comparative advantages, such as event history analysis methods. Moreover, after having experienced the process of developing a simulation model, I have better understood how useful this tool can be as a laboratory for social science and demographic research, especially considering its potential for analysing hypothetical scenarios. This is of particular interest for the field of international migration, characterized not only by fragmented research, but also data limitations. I very much hope that by using these

tools, our understanding of international migration and policymaking can be enhanced in future years.

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