UNIVERSITY OF SOUTHAMPTON
FACULTY OF LAW, ARTS & SOCIAL SCIENCES
DIVISION OF ECONOMICS, SCHOOL OF SOCIAL SCIENCES

Essays on the Impact of Immigration

by
Marwah Alrasheed

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Abstract

This thesis addresses the impact of immigration on labour market outcome, trade creation and foreign direct investment through three main chapters. The first chapter examines the influence of foreign-born workers on female wages in the UK labour market. Unlike the majority of prior studies, this chapter focuses solely on the female context. It employs an empirical technique borrowed from Heckman (1974) in order to account for the sample selection problem while also examining the influence of foreign-born individuals utilising gender-specific qualification shares. This study concludes that there is no negative impact on the wages of native females. Additionally, it was discovered that foreign-born female shares had a negative influence on the earnings of foreign-born females who work in the UK, with the effect varying depending on the share. The second chapter investigates the impact of immigration networks on trade creation within the EU. Following the 2004 EU enlargement, citizens of new EU countries should have unrestricted access to the older EU member states. However, some countries established a transitional arrangement that they maintained for several years following the enlargement before allowing unrestricted migration. This chapter focuses on the period of time when free movement was permitted as a natural experiment so as to examine the effect of immigration on bilateral trading between EU countries. Based on previous research, this study employed the gravity model, with some modifications: the model was estimated using Difference in Difference estimation. A positive and statically significant impact was found on the import and the export of immigration networks. The third chapter examines the relationship between immigration and foreign direct investment flows from and to 15 former EU member countries during a 20-year period from 1998 to 2018. To address this relationship, this chapter utilises the standard Difference in Difference technique to estimate the gravity model, taking advantage of the time variation in the availability of free immigration movement to these 15 EU countries after the 2004 enlargement. It compares the impact of immigration across the old and new EU's immigrations, and the chapter also extends the analysis to include other countries from outside of the EU. The results demonstrate that immigration has a consistent and significant positive effect on FDI mobility.

Acknowledgement

With Everything that was going on with my life, especially my health issues, I received great and most needed support, encouragement and assistance from my family, and friends. That helps me and push me to fulfil my dream of finishing this thesis. My words of appreciation are not enough to express how thankful I am to have them in my life. Many thanks for every piece of encouragement and prayer you sent toward me during this hard time of my life. I would like to thank especially my mother and sister because they were my biggest support source in my life, and I think I would not be able to finish it without their support.

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I would like to express my greatest gratitude to Princess Nourah bint Abdulrahman University for giving me this generous opportunity to pursue my postgraduate studies in the UK.

I want to dedicate this work to my family members even the ones who left this world during the COVID-19 pandemic and thank them for their endless support. I would also like to dedicate this work to my grandmother's soul, who was my number one fan and I wish she could witness me achieving my goal. I would also like to dedicate this work to my father, who is my favourite man on the planet, and I hope to be able to share this achievement with him.

“With the oversight of my main supervisor, editorial advice has been sought. No changes of intellectual content were made as a result of this advice “

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Declaration of Authorship

I, Marwah Alrasheed declare that this thesis titled (*Essays on the immigration Impact)* and the work presented in it are my own and has been generated by me as the result of my own original research.

I confirm that:

1. This work was done wholly or mainly while in candidature for a research degree at this University;

2. Where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated;

3. Where I have consulted the published work of others, this is always clearly attributed;

4. Where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work;

5. I have acknowledged all main sources of help;

6. Where the thesis is based on work done by myself jointly with others, I have made clear exactly what was done by others and what I have contributed myself;

7. None of this work has been published before the submission

.

Signed: ……

Date: ……02/08/2022……

Research motivation

For both academics and policymakers, the topic of immigration is of crucial significance. The immigration number has been increasing rapidly in the last number of years. According to the recent world migration report in 2020, it estimates that there are around 272 million international immigrants around the world in 2019, accounting for approximately 3.5% of the world's population that year (McAuliffe et al., 2020). These figures are stark and it is clear that although immigrants represent a minority of the world's population, natives continue to express their concerns about immigration's impact on their country and them. A significant amount of research has been published, addressing how immigration impacts the economic outcomes for host and receiving countries. It is worth noting that in the last couple of decades, immigration and Migration Studies have developed into a robust research subject. Since the early 1880s, scholars raised questions about immigration, particularly internal immigration. The earliest known paper was Ravenstein's research on internal migration. However, it was not until the 1930s that migration Studies "exploded" as a widespread area of social scientific investigation.

Recently, immigration data have become more accessible and understandable for researchers to use in their studies. Despite this, the majority of studies reviewed in this paper are used old data that belongs to the last decade. That was one of the motivations behind this thesis, which aims to focus on a longer, more recent time period, which would enable an examination of the impact and change in immigration impact over time. Moreover, this thesis will focus on the influence of immigration on the EU, not only because the EU is very much under-examined in this respect in comparison to other contexts like the US, but also because the EU area has recently been considered a hotspot

for immigration (see Figure 1). Additionally, the chapters in this thesis cover a variety of research questions pertaining to immigration impact using different estimation techniques. The main question to be addressed in the following chapters is the following: To what extent does immigration have a detrimental influence on the economic output of host countries?

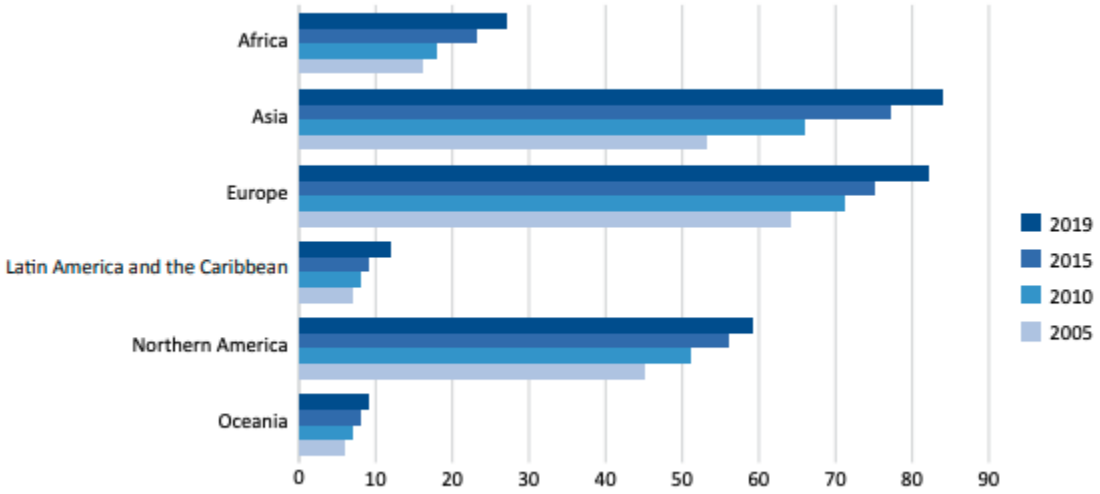


Figure 1: International immigration by major region of residence, 2005 to 2019 (source: World Migration Report 2020)

Introduction and thesis outline

Given the fact that EU nations have witnessed a significant increase in immigration in recent years, particularly following enlargement in 2004, this thesis focuses on this area to analyse the immigration impact on EU state members.

The first chapter of this thesis examines the effect of immigration on labour market outcomes. The chapter's primary focus is on the influence of immigration on female wages. To address this relationship, the research took a more focused approach in examining this influence and selected data from the UK for analysis, one of the EU's (former) members. The UK was selected to explore this link due to the fact that it immediately received a high number of immigrants during the EU's enlargement. Between 2003 and 2004, the number of immigrants nearly doubled from about 77,000 in 2003 to 175,000 in 2004. Consequently, the number continued to grow throughout the

time period covered by this research. With that being said, this chapter also addresses a gap in the literature by examining how immigration may affect the wages of females in the host country. In comparison to the amount of research that examines the relationship between immigration, men and labour market outcomes, this research addresses these very issues from the under-researched perspective of females. The approach utilised in this study was carefully developed to overcome the sample selection issue that might arise as a result of female labour market participation. Additionally, the study differentiates the effect of female and male immigration on the wage of working females. As a significant amount of the prior research distinguishes between immigration skills and their varying effects, this chapter will likewise distinguish between immigration skills in detail in order to examine the influence on wages for females. The research is not limited to the influence of native female earnings with their diverse ethnic origins; it will also look at the effect on foreign-born females earning wages who are already embedded in the UK labour market.

To that end, this chapter explores the impact of immigration on the labour market, and while there is still a gap in the literature to be filled, particularly regarding the impact of immigration on outcomes for female workers, the study continues to investigate the impact of immigration on different aspects of the host country's economy.

The second chapter of the thesis addresses all EU area members. Specifically, the chapter explores how immigration could potentially affect international trade. Through the economic and monetary union, the EU has developed a level of economic integration among its member states that simultaneously enables both free trade and the free movement of resources (labour and capital). In the case of a new member state that was previously more "distant" because of trade costs and had tight restrictions on labour mobility through borders, this "distance" will be narrowed. As a result, immigration (the "labour factor") become freer to move around within the Union. When this change in the labour factor is confirmed, it will have effects (among other things) on EU bilateral trade.

Exports and imports within the EU member states have risen dramatically since the expansion. According to Eurostat's statistics, average exports and imports increased by

roughly 12% in 2005, compared to around 7% in 2004. An increase in international trade was expected following the 2004 enlargement, due to the EU's trade agreement. Nevertheless, because former EU states did not legislate for instant unrestricted movement, enabling migration and immigration across new and old states, a time lag and a substantial number of immigrants to EU countries developed. This chapter will harness this time variance to contribute new perspectives to the existing literature by examining the impact of immigrant networks on export and import within the EU region. In doing so, the chapter will analyse this subject using bilateral data from inside the EU region. Consequently, the standard gravity model with the difference in differences econometric specification will be deployed, which highlights the different times of the free immigration movement from new EU members to old EU members, which will form a significant contribution from this chapter. Further, this research will differentiate between the impact on export and import for the former EU member. Addressing this issue for EU countries will be another part of the contribution of this chapter because the literature is currently very scant on these specific issues in relation to the EU.

The third chapter of this thesis will focus on bilateral foreign direct investment. In the past, there was a considerably large interest in examining how institutions and politics affected bilateral investments. However, only in the last 10–15 years has there been a lot of interest in the role of different types of promoting factors. The purpose of this chapter is to examine the influence of increased immigration inflow following the 2004 enlargement on the Foreign Direct Investment (FDI) movement. In doing so, the chapter aims to answer the following question: to what extent can immigration be considered a contributing factor towards investment? This chapter uses the policy change for EU labour mobility following enlargement, along with the variance in the time required to implement the policy across EU country members, as a natural experimental setting to find a causal impact of immigration on the FDI. Along with filling a gap in the literature on the influence of immigration on FDI in the EU, this chapter will also introduce a novel empirical technique for examining the relationship between immigration and FDI. It will distinguish between immigration from existing and new EU members, as well as immigration from outside the EU, in order to improve and expand the estimating methodologies. In accordance with the literature, this section will employ a version of the

gravity model throughout the study, as well as a variety of estimating techniques, in order to compare the results and ensure the consistency of the findings.

This thesis explores the influence of immigration on various economic outcomes in the United Kingdom and the European Union. The impact of immigration was determined to be positive across the majority of specifications considered in this thesis. It employs a number of econometric techniques to explore in depth the impact of immigration. The result was consistent and in line with the literature.

Chapter 1: The Impact of Immigration on the Wages of females Participating in the UK Labour Market.

Abstract: This chapter analyses the effect of foreign-born shares on the wages of females in the UK labour market. It adopts an empirical strategy that was derived from Heckman (1974) to encompass the sample selection problem while investigating the effect of foreign-born immigration using specific qualification shares for each gender of immigration. In the empirical analysis, this paper demonstrates that having children under the school age lowered the probability of participation in the UK labour market. As for the effect of immigration on the wages of females, this chapter found no adverse effect on white native female wages and some positive effect on some specifications for native females. On the other hand, immigration depresses the wage of foreign-born female workers in the UK, although they lead to slight wage increases in some specifications.

1.1 Introduction

As it is the case in many countries, the size of the foreign-born population in the UK increased from 5.3 million in 2004 to more than 9 million in 2017[1]. This growth has opened many questions that are still debatable today. For example, does the foreign-born population influence the wages of native workers? Are the foreigners taking native workers' jobs? Many economic publications have investigated this issue from different perspectives, studying the effects that foreign-born workers exert on the host country's labour market conditions, the conclusions of which were often conflicting. For example, some research found that the presence of foreign-born workers had a small effect on low-skilled worker wages, while others found no effect (Addison and Worswick, 2002; Card, 1990, 2005). Moreover, some research claims that foreign-born workers had a clear adverse impact on the labour market outcomes of the native population (Borjas, 2003,

[1] The sources are The International Passenger Survey and the Office of National Statistics.

2008; Orrenius and Zavodny, 2006). However, as some scholars argue, the observed negative impact was not limited to natives only, as new immigrants also suppress the wages of old immigrants (Kugler and Yuksel, 2008; Ottaviano and Peri, 2012). On the contrary, other studies found that native workers could benefit from foreign workers as their labour outcomes improve (Gavosto et al., 1999; Ottaviano and Peri, 2012). These studies, among many others, were focused on the effect of foreign-born workers on the total population (male and female) labour market outcomes or their effect on labour market outcomes for males. However, not many studies address the effect of foreign workers on female outcomes in detail.

In the case of females, it is more challenging to study the effect of the foreign-born because of the problem of females' willingness to participate in the labour market in the first place. Female participation in the labour force has been considered a contentious issue since the early 1960s when females were rapidly entering the workforce. Historically, female labour has been confined to the domestic space where it was deemed essential. The option for females between entering or staying out of the labour force has been addressed extensively in economics papers. A large body of literature about female participation was developed during the 1970s, 1980's and 1990's (Ettner, 1995; Heckman, 1974, 1979; Heckman and Macurdy, 1980). Mostly, the female choice to participate in the labour market is determined by leisure, work hours and household production (Jaumotte, 2003)[2]. Some authors focused on the sample of married females in particular to demonstrate the effect of household products on a female decision to enter the labour force. They analyse the probability of a married female entering the labour market based on the information about her children, husband's income and employment status, age and education level. The associated effect of these variables on the married female participation rate varied in these studies. Most authors found that the presence of young children in the household decreases the probability of female participation (Bingley and Walker, 2001; Heckman and Macurdy, 1980), whereas some argue that this is due to the high cost of children care (Connelly, 1992). The debate is still ongoing, and it is one of the

[2] See time allocation model by (Becker, 1965).

facts that should be taken into consideration when addressing the effect of the foreign-born on native female outcomes in the labour market.

This chapter will focus on the effect of immigration on the UK's native female wages while addressing the female probability to participate in the labour force using Heckman's sample selection model. Unlike previous research, immigration will be divided based on gender and qualification. Additionally, this chapter extended the timeline to 1994-2018, which expanded on the time range and historical period that has been researched previously pertaining to the UK labour market. The rest of this paper chapter is organized around the following: the second section reviews the related literature, the third section describes the empirical strategy, and the fourth section elaborates on the data and presents a data description. The fifth and sixth sections contain the estimation and the results, respectively, while the final section draws together some conclusions.

1.2 Previous studies

The literature on the impact of foreign-born immigration on the labour market is substantial. There have been different approaches to estimating the effects of immigration on labour market outcomes, among which include the spatial correlation approach and structural models using nested CES production functions. The spatial correlation approach uses regional data to measure the effect of immigration on the native local labour market. This approach was previously applied to study the labour market outcomes in the UK, the US and different European countries[3]. Researchers argued that using the local labour market and spatial correlation to measure the effect of immigration has some drawbacks. Firstly, it does not provide a clear viewpoint regarding the effects of immigration. This is attributed to the mobility of host country natives as a result of their expectation of wage reduction due to immigration inflow (Ottaviano and Peri, 2012). Secondly, the endogeneity problem can arise because of the unclear direction of the causality (Dustmann et al., 2003). This argument maintains that immigrants could

[3] See (Dustmann et al., 2005), (Borjas, 1999) and (Barone and Mocetti, 2011).

choose the local labour market because of the attractive conditions (higher wages and better job opportunities). Accordingly, the immigration inflow to a local market can affect labour market outcomes. To overcome the problems associated with the spatial correlation approach, researchers tend to use instrumental variables (Card, 2001). Dustmann, Schonberg and Stuhler (2016) explained and classified existing empirical specifications into three groups. The first specification exploits variations in the inflows of immigration across education–experience cells on a national level, which is also termed the national skill-cell approach. The second specification in this context involves the use of variations in the total flow of immigrants across regions, which is referred to as the pure spatial approach. The third specification involves the use of variations in immigrant inflows across both regions and skill groups, which is termed the mixture approach. The national skill-cell approach generates a higher negative wage effect on natives compared with the mixture approach. In contrast, the estimates gathered by the pure spatial approach tend to differ based on the skill group being studied.

Nevertheless, based on the literature, it can be argued that estimates obtained from various models cannot be compared or applied to answer different questions; moreover, their interpretations vary (Dustmann, Schonberg and Stuhler, 2016). Although the mixture approach and the national skill-cell approach help in identifying the relative wage effect of immigration of one experience group on another within-education group and of one specific skill group on another, the pure spatial approach helps recover the total wage effect of immigration on a specific native skill group because it considers complementarities across labour, capital and skill cells. In deploying variations across skill-experience cells at the national level, the adjustment of employment takes place only on the non-employment or unemployment margin. In contrast, in using variations across local labour markets, such as under the mixture approach or the pure spatial approach, the labour supply of natives might respond elastically because of the regional migration of workers. Dustmann, Schönberg and Stuhler (2016) further opined that these two approaches, the mixture approach and the national skill-cell approach, depend on the assumption that there is competition between a native and an immigrant who have similar education and experience.

Nevertheless, robust evidence indicates that when immigrants arrive in a country, they tend to downgrade, which can be observed in countries such as Germany, the US and the

UK. Similarly, allocating immigrants to relevant skill teams according to their abilities and skills might lead to inappropriate classification, thereby seriously disrupting the estimation of wages in the responses of local residents to the process of immigration. Although the identified bias might not be stated explicitly, evidence from the US indicates that, based on the mixture approach and the national skill-cell approach, downgrading might exacerbate unfavourable outcomes of immigration, particularly the latter. Therefore, downgrading might be identified as a key cause of the tendency of the national skill-cell approach to generate higher levels of negative wage effects compared with the mixture approach.

In addition to the elasticities of substitution between experienced and inexperienced workers and low-and high-skilled labourers, the parameter is dependent on the elasticity of the share of capital and supply of capital in the production process. The total effect not only measures the direct partial effects of an immigration-led labour supply on native workers in a specific education or education-experience group, but also the indirect effects through complementarities across capital and labour and across skill cells. If the capital supply is completely elastic, the total wage effect of immigration shall be zero on average, negative on specific skill groups, such as those that experience a large inflow of immigrants, and positive on other skill groups. Moreover, if there is complete inelasticity in the capital supply, the total wage effect might be negative on all kinds of skill groups (Dustmann, Schonberg and Stuhler, 2016). Dustmann, Schonberg and Stuhler (2017) conducted a case study of the inflow of workers from Czechoslovakia across the German–Czech border to determine the effects of labour supply shock caused by immigration on the wages and employment of native workers and explore the response dynamics in the policies developed to deal with the issue. The findings show that the labour supply shock caused a moderate decrease in local wages and a major reduction in local employment . The findings also suggest that unemployed workers or outsiders face a major burden caused by a labour supply shock. Therefore, workers employed in the identified areas must be protected from the harmful effects of labour supply shock caused by immigration.

Card (2009) studies the impact of immigration on the wage gap in the US market. He used census data from 1980 to 2000 along with American Community Survey data for 2005 and 2006 at a city-level labour market to estimate the effect. In contrast, many scholars such as Borjas (2003) emphasise that city-level data are not ideal for estimation because immigrants and natives can move across cities. Card (2009) argued that efficiency can be improved with the help of appropriately identified parameters. He utilised immigration settlement patterns as a source of identifying information for the instrumental variable specification and identified in his research the impact of immigration on the wage gap for each gender. He found that within 25 years, the gap (wage inequality) between native males and females had widened by 0.137% and 0.139%, respectively. Immigration explains 4–7% of the rise in wage inequality over that period. The impact is relatively small. Unlike the spatial correlation approach, the CES approach was used in much research at the national level data to estimate the effect of immigration (Borjas 2003, Manacorda *et al.* 2012, Ottaviano & Peri 2012). Researchers argued that using national data eliminates the problems that appear with regional data. In this approach, the aim is to estimate the elasticity of substitution between international immigrants and natives within the same skill group so as to find the effect on the native outcomes. Borjas (2003) used this methodology with the assumption of the perfect substitution between foreign and native workers, and he found a considerable effect on the natives' wages (a 10% increase in immigration inflow leads to a 4% decrease in the average wage and leads to 9% decrease for the low-skilled group). Ottaviano and Peri (2012) argued that the perfect substitution is a strong assumption. Even for a group with the same skills, particularly around education and experience, it is difficult to assume that the foreign-born could be a perfect substitute for native workers, given the varying differentiated characteristics between them, such as the language and background. Indeed, the perfect substitution assumption is expected to lead to a significant effect of the foreign-born on the natives' wages, as is the case in Borjas (2003) and Borjas & Katz's (2007) research, particularly with respect to the low-educated natives. As a result, other researchers who followed the same approach, such as Manacorda et al. (2012) and Ottaviano & Peri (2012), argued that it would be more realistic to assume that both the natives and the foreign-born are not perfect substitutes, as they found a small effect of the foreign-born on the native wages. Ottaviano & Peri (2012) argued that the small and insignificant effect of the foreign-born

on labour market outcomes found in previous studies is proof of the imperfect substitution between foreign-born and native workers.

In the last two decades, economists started to analyse the effect of international immigration on the UK labour market. (Blanchflower et al., 2007; Ciaran and Olivian, 2014; Dustmann et al., 2003, 2012; Dustmann and Preston, 2011; Hatton and Tani, 2005; Manacorda et al., 2012). The research addressing this issue in the UK is relatively limited compared to the US, and it is still hard to state whether there is a clear impact of foreign-born on the UK labour market. The associated effects of the foreign-born on the natives' outcomes vary among the labour market outcomes. Some papers found a moderately negative impact on employment, especially among the intermediate education level worker (the low-skilled workers), while the effect on wage is positive yet it is poorly determined (Dustmann et al., 2005; Lemos, 2014; Wadsworth, 2010). Researchers argued that the positive effect of the foreign-born on higher-level natives' wages could be considered a surplus that benefits the natives. This is due to the fact that the marginal productivity of the foreign-born is higher than the wage they receive[4]. The lack of evidence of the foreigners' impact on natives was demonstrated in other research (Lemos and Portes, 2008; Lucchino et al., 2012). Furthermore, other studies found a significant impact on old immigrants from incoming new immigrants (Manacorda et al., 2012).
The studies vary depending on the definition of the variables and the labour market used. Some authors focus on the effect of the foreign-born who are involved in the UK labour market and define them as people who were not born in the UK but work in the UK (Dustmann et al., 2005; Manacorda et al., 2012). Anderson and Blinder (2012) distinguish between the migrant definitions based on the dataset used in their study relating to the National Insurance Number (NIN) dataset. It defines migrants as persons who hold a foreign nationality. However, the most common definition used in a large number of papers relates to the country of birth. Some research exploring the UK labour market focuses on the national labour market (Dustmann et al., 2012), while others divide the labour market into locale (regional) labour markets (Dustmann et al., 2003, 2005).

[4] As was discussed in a different paper about the UK case, immigrants to the UK are highly educated unlike the USA (Dustmann et al., 2003; Manacorda et al., 2012). This could support the assumption of the surplus to the UK economy.

Dustmann et al. (2012) studied the effect of immigration on the UK's wage distribution and adopted a nested CES production function framework. Unlike previous studies, they included capital in their framework. They used the Labour Force Survey (LFS) data from 1997 to 2005. In their chapter, they did not pre-allocate immigrantsto a particular skill group. Instead, they allowed immigration to have a differential impact on the native wage distribution. They found a sizable adverse impact on the lower wage percentile (0.5% on the 5^{th} wage percentile and 0.6% on the 10^{th} wage percentile). In this lower wage percentile, the immigration density is higher than natives. However, in the higher wage percentile, they found that immigration has a positive impact on native wages with around a 0.4% increase in the 95^{th} percentile. They concluded that the overall effect on the native average wage is positive. They argued that the downgrading or the initial mismatching could explain the positive impact on average (immigrants receive less than their marginal productivity).

Manacorda *et al*. (2012) followed Ottaviano and Peri's (2012) research and investigated the UK male case using the CES production function framework. They used the data from the General Household Survey (GHS) along with the data from the Labour Force Survey (LFS) for the period from the mid-1970s to the mid-2000s. The focus was on the effect of the foreign-born on men's wages. They found that the effect of new immigration is higher on old immigrants than on native men. This means that competition exists between new and old immigrants because of the perfect substitution. They claim that the weak effect on the natives is due to the imperfect substitutions between the foreign-born and natives.

Dustmann and Frattini (2014) focus on the fiscal effect of immigration to the UK. They used the LFS for the period from 1995 to 2011 as the main database along with other administrative data. They found a positive contribution to immigration from European countries, while non-European immigrants have made a negative contribution to the fiscal system. Anderson et al., (2006) studied how immigration from European countries affects the low occupational wages before and after the 2004 EU enlargement. They collect their data by conducting a postal survey and interviewing immigrants in low-paid

jobs. They found that even though immigrants could be classified as highly skilled workers, they work in low-wage sectors. The authors focus on four sectors, where they found that female workers dominated the hospitality and au pair sectors while males dominated the construction and agricultural sectors.

The impact of the foreign-born on occupational wages in the UK was addressed in several papers. Nickell and Saleheen (2015) used the LFS, the Annual of Hours and Earnings (ASHE) and the New Earnings Survey (NES) covering the period from 1992 to 2014 to investigate the effect of immigration on the average occupational wage. They estimated the effect by considering the variation of immigration and wages across occupations, time and region cells. They found that the immigration share has a different effect across the occupation levels but the effect on the average wage was small. The largest effect of immigration was on the semi/unskilled group where a 10% increase in the immigration share leads to a 1.8% decline in the wage for this group.

Some papers distinguish between native females and males and study the effect of the foreign-born of each gender separately. The first study for the UK which included females as a group was conducted by Dustmann et al., (2003). They found no evidence of a negative impact of foreign-born migrants on the wages of females or unemployment. Lemos and Portes (2008) include females as a separate group besides the low-skilled, young and two other groups to study the effect of the foreign-born on unemployment and wages. They reach the same conclusion as Dustmann *et al.* (2003). Although Manacorda et al., (2012) employed the skill cell approach to investigate the effect of the foreign-born on native UK males, they include females as a part of their analysis. At first, they perform their analysis for women only and find a negative but insignificant effect of foreign-born females on native female wages (about 0.06%). Then they estimate the model after they pool the cells for males and females and observe that the effect on males and females in total is close to the effect on males only. Not much research investigates the impact of foreign-born migrant on female outcomes in the UK. However, they do not mention the selection problem in the supply of female workers. Unlike these other pieces of research, this chapter addresses the selection problem using the Heckman

selection model while investigating the effect of the foreign-born on native female outcomes in more detail.

Other research has explored the effects of the foreign-born population on native females in other countries. Barone and Mocetti (2011) used the data from the Italy Labour Force Survey for 2006, 2007 and 2008 to analyse the effect of low-skilled immigration on highly educated Italian females. They focused on the share of female immigrants who specialise in domestic services. They adopted an Instrumental Variable approach depending on the previous wave of male immigration from the same country to overcome the estimation problem. The dependent variable they use is the participation rate and the hours worked by Italian females. The authors divided the sample into groups based on educational level and investigated the effect of specialised immigration on the education level groups and the total sample of Italian females. They found that an increase in the supply of female immigrants specialising in domestic services allows Italian females with high education to work more. This is beneficial for the economy due to the higher opportunity cost they face.

Similar research was carried out in the context of the US and Spain (Cortés and Tessada, 2011; Farré et al., 2011). A positive impact was found on native female wages and participation rates in these studies. Accetturo and Infante (2013) investigate the decision of foreign-born females to work in Italy. They used a dataset collected by Initiatives and Studies on Multi-ethnic Society (ISMU) in the period from 2001 to 2005. They found that for some ethnic groups (from central Asia and some parts of Africa), the level of activity and the employment rate was low, and this prompted the question: is this low rate a result of culture or skills? The results of this research indicate that the low employment rate of these ethnic groups does not associate with a higher reservation wage. Accetturo and Infante (2013) claim that the decision not to be involved in the labour market for foreign-born females from these ethnic groups is not voluntary. Rather, it is because of their low skill level that this does not meet the labour market demand. Fullin (2016) focuses on the labour market outcomes of immigrants in Italy and how race and religion play a role in the outcomes. He found that for females, only religion has an effect on the

unemployment rate. However, he did not find any significant impact of race and religion on occupational attainment.

Jaeger, Ruist and Stuhler (2018) asserted that the impact of immigration usually relies on spatial variations in the inflows of immigration for identification. In such circumstances, for the purpose of addressing the endogeneity of new immigrants' choice of location, high inflows are combined with their lagged geographical distribution in order to create an instrument. Several publications in leading journals have identified "past settlement" as an instrument to identify supposedly exogenous labour supply shocks. It also forms a key example of shift-share instruments with a similar underlying rationale, wherein the local economic compositions are combined with shifts on the larger level for the prediction of variations in the variable of interest. For the purpose of effective identification, shift-share instruments have gained popularity in a comprehensive range of literature, while introducing spatial or other aspects of cross-sectional variation that is conventionally based on time-series analysis (Jaeger, Ruist and Stuhler, 2018). In this regard, the findings of thir study indicate that periods with substantial changes in the country-of-origin composition might offer differences that can be studied with a variant of the shift-share strategy. Through the instrumentation of current and past inflows of immigrants with versions of past settlement instruments that differ only in their national aspects, the researchers isolated variations in inflows that were unrelated to current and local demand shocks, along with the process of adjustment to pass supply shocks. They argued that the initial impact of immigration on the wages of natives in the 1970s was significantly more negative than estimates in previous studies on spatial correlation and immigration, as suggested by the conventional shift-share instrument. The estimated influence of immigrant inflows during the 1960s on the growth of wages in the 1970s was positively related. However, in some specifications of a similar magnitude, a negative impact was observed in the 1970s inflow. The findings in this context also suggest that areas with a large flow of immigrants tend to experience a temporary but not persistent negative influence on local wages. The response observed in the short term demonstrated consistency with a standard factor proportions model wherein a rise in the supply of a specific factor leads to a reduction in its price (Jaeger, Ruist and Stuhler, 2018).

Long-term adjustment suggests a strong but gradual general equilibrium. Moreover, a slow and dynamic adjustment process indicates a specific problem in the past settlement instrument in the literature on immigration. However, in principle, the issue is relevant for other kinds of shift-share instruments that integrate local aggregate shifts and shares to generate spatial variations. Local shares are usually highly serially coordinated, regardless of whether they are created from the composition of demographic groups or industries. The validity of the shift-share instrument demands that one of two conditions be applicable. The first condition is that there is an absence of serial correlation in national shifts, and the second condition is that the variable of interest does not affect dynamic adjustments in outcomes. In situations where sudden shocks occur at the national level, the shift-share instruments might fulfil the first condition. In other cases, variants of the shift-share methodology must be deployed to isolate a variation that is not related to past shocks and to allow a causal interpretation of the outcomes (Jaeger, Ruist and Stuhler, 2018).

In the context of this previous research, this chapter will contribute to gaps in the literature by examining the effect of foreign-born immigration on the labour market outcome of British-born females. As demonstrated by a review of the relevant literature in this section, the research is sparse on this topic, especially for the UK. Despite the fact that females are more subject to professional biases such as the wage gap, and are entitled to be family/home caregivers, research and studies tend not to focus on this demographic group, despite the fact that they compose half of the global population. Nevertheless, the private and professional decisions of foreign-born females are typically subject to those of their spouses, and as a result, they appear to work mainly in substandard positions. Foreign-born women are frequently less educated, have more children, and reside in lower-income households. Moreover, among native-born and foreign-born females, the decision to participate and collect human resources may be affected to varying degrees by fundamental characteristics such as family development and childcare plans. This chapter focuses on females because unlike males, they might be a substitute for immigrants and immigrants might be a substitute for them [5]. In contrast, immigration might provide native

[5] For instance, if a woman is employed in a low-wage occupation or in a profession such as nursing, which is the same occupation (or profession) that an immigrant may perform, she is more likely to compete and has a high probability of being substituted by an immigrant.

females with the assistance they require at home (e.g., family care), allowing them to increase their participation in the labour market.

Therefore, this chapter will address the problem of female labour market participation prior to examining the effect of foreign-born individuals on the native labour market outcome.

Covering a longer period from (1994-2018), this chapter will look into how foreign-born females could affect native UK wages for women. The use of Heckman's sample selection model to address this effect is one of the contributions of this chapter to the literature. Moreover, this chapter provides a detailed classification of qualification levels that helps capture the different impacts of foreign-born individuals on the wages of female UK workers at different skill levels as measured by qualification achievement.

1.3 Theoretical background

Generally, the effect of immigration on the labour market is examined within the context of a competitive model of labour demand in which wages are completely flexible, which is a model of partial equilibrium for the supply and demand of labour that only takes into account one market at a time, neglecting any potential cross-market interactions[6]. In the short term, a competitive model predicts that increasing numbers of immigrants will reduce the outcomes of competing employees while increasing the outcomes of complementing employees. These models suggest that the wage of the host country is independent of migration over the long term. The adjustment of physical capital to immigration counteracts the decline in the capital-to-labour ratio. The economy restores to the equilibrium it had before immigration, where income and employment levels are identical to those prior to the inflow of immigrants.

However, a simplified model of the economy which presents the labour market is shown in Figure 2.

[6] The partial equilibrium model makes it possible to predict changes in important economic variables, such as a wage. Using the partial equilibrium model is advantageous because it is theoretically sound under certain assumptions. Moreover, it is remarkably easy to develop computationally and utilize with real data. Moreover, it is appropriate at a highly disaggregated level.

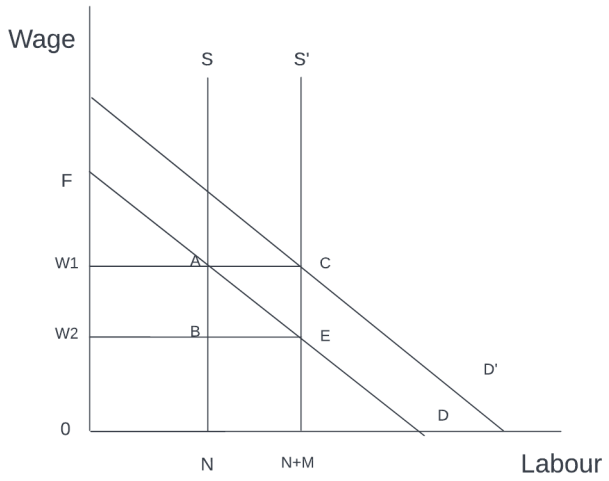


Figure 2: The labour market equilibrium.

Prior to immigration, the initial labour market equilibrium in this model is represented by D and S, where D represents the labour demand which is a decreasing function of wage, and S represents the initial labour supply for native labour (that is fixed at N). The initial wage is denoted as W1, and it is determined by the intersection of labour demand and supply at point A. In this economy, the total labour income is represented by the area of the rectangle (0, W1, A, N), which is the total number of workers' wages (N x W1). In the case of immigration flow, the number of workers in the labour market will increase. This increase will cause a shock to the labour market and expand the number of available workers. As a result, the labour supply will shift by M and be represented by S. Consequently, wages will drop to W2 to accommodate the additional labour supply at point E. Accordingly, the native worker's wage is reduced, and the total income for natives is now (N x W2). Their loss in income is attributed to falls in wages and this is represented by the area of the rectangle (W1, A, W2, B). The immigrant income (M x W2) will be shown as the area of the rectangle (N, B, E, N+M). However, while immigration initially drives down the wage from W1 to W2, it also increases the value of the total amount of production. Whereas prior to immigration, the total profit of the firm in this economy is presented by the area of the triangle (F, W1, A), increasing the number of workers because of immigration leads to an increase in the total profit for firms by the amount reflected by the area of the triangle (F, W, E). This increases in production

because of immigration and this is called immigration surpluses. Immigration surpluses are represented by the area of the triangle (A, B, E). In the long run, assuming that the capital will adjust to the increase of the workers in the labour market, the demand for labour will increase and shift to D', which leads the economy to a new equilibrium point E, with the initial wage W1 and the new supply that is N+M.

This simple theoretical model of the labour market shows how the influx of foreign-born workers could affect wages in the local labour market. However, capital and labour are the two input components in this model economy, and it is vital to understand how immigration affects the capital market. There are a large number of studies that contribute to explaining in theory how immigration could affect the labour market outcomes (for example see Ottaviano and Peri, 2006; Brücker and Jahn 2011; Dustmann et al. 2013).

The next section will employ a simple form of labour market theory for the wage as a function of labour, with different skills to estimate the impact of foreign-born females and males on native female wages.

1.4 Data and background

1.4.1 The UK female labour market: A background

Over the past decade, the female employment rate in the UK has been increasing. According to the Office for National Statistics (ONS), around 71% of the working-age female population (16 – 64) are in employment as of 2018. The gap between the female and male employment rate is now less than 10%, with around 80% employment reflecting the working-age male population. In the 1970s, several legislative Acts were introduced which have played a role in increasing the rate of female employment (the Equal Pay Act in 1970, the Sex Discrimination Act in 1975 and the Employment Protection Act in 1975).

According to the LFS data, between 1994 and 2018, around 68% of working-age females who have at least one child under the age of 16 are in full-time employment, and around 30% of them are economically inactive (the unemployed are around 4% and those not looking for a job come in at 27%). Recently, among the mother population, 72% choose to work.

There are several occupations dominated by female workers during this period compared to those dominated by males, especially in service-related sectors. About 78.9%, 78.2% and 68.6% of female workers working in "*Administrative and Secretarial Occupations*", "*Caring and Leisure and Other Service Occupations*" and "*Sales and Customer Service Occupations*", respectively. On the other hand, female workers have less frequency of employment in other jobs, with less than 35%, 17%, and 10% in "*Managers, Directors and Senior Official*", "*Process, Plant and Machine Operatives*", and "*Skilled Trades*" occupations, respectively. The case of dominating an occupation by either male or female workers dissolves in "*Professional*", "*Associate Professional and Technical*" and "*Elementary*" occupations, with around half of the workers in each of these occupations being equally represented by both genders. (source: Labour force survey LFS)

1.4.2 The background of female immigration to the UK

This section used the International Passenger Survey (IPS) to provide background information about foreign-born females in the UK. Although the IPS is the most accurate indicator of long-term migration to and from the UK, the LFS is the primary data source utilized in economic research because it gathers information on immigrant populations in the UK and their characteristics in the labour market. In general, the IPS and the LFS present the same scenarios of immigration to and from the UK over time. The IPS was created to measure international migration; for this reason, it was the preferred source of data in this section. However, LFS was used for the analysis in this chapter.
Before 1995 the number of females coming to the UK was less than 80,000 per year, but after 1995, the number has been increasing exponentially. In the last decade, the number varied between 200 and 250 thousand per year. Most female immigration comes from

the EU and Asian countries[7]. According to the 2011 UK Census, more than one million of the foreign female population in the UK were born in EU countries, and over 950 thousand were born in Asian countries, where more than half of them were Indian and Pakistani women. According to the data used in this chapter from the LFS (1994-2018), almost half of the foreign female population is white, suggesting that they came from EU countries. The second largest ethnic group[8] is Indian ethnicity, which makes up 12% of the foreign population. The Black ethnic group is the third largest with 10%, and according to the IPS, the majority of them come from Sub-Saharan Africa. Pakistani females represent around 7% of the foreign-born population. Finally, the rest are composed of Bangladeshis, Chinese and other ethnicities.

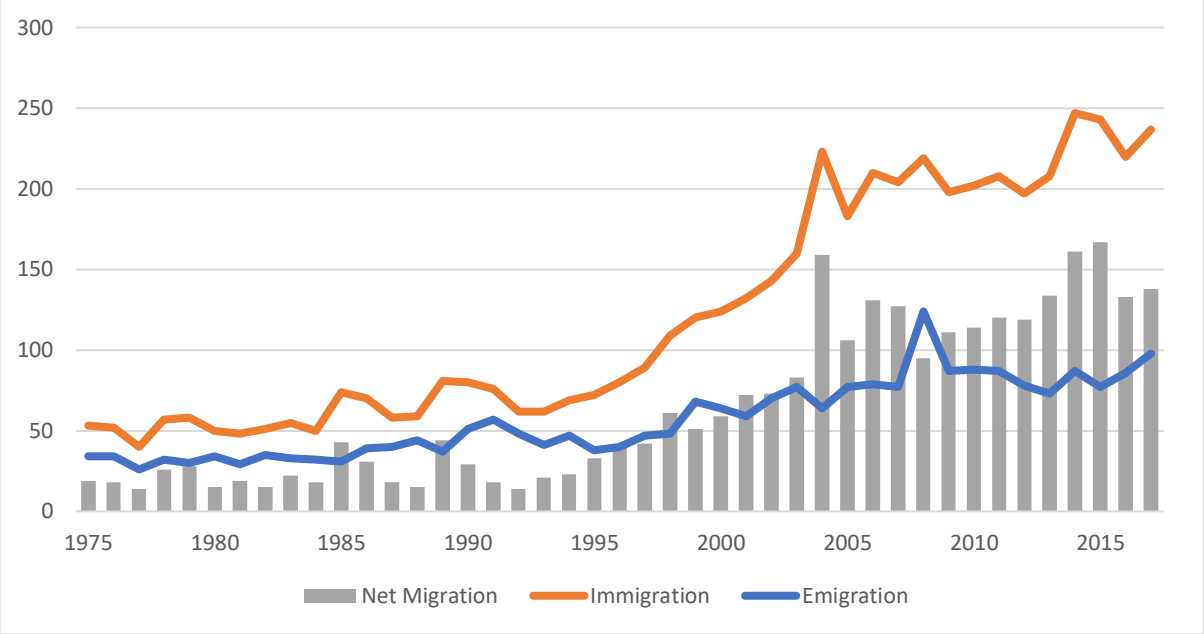
Based on the estimation from the International Passenger Survey (IPS), the number of female immigrants who arrived in the UK for work-related reasons has been increasing since 2000 and was fluctuating between a minimum of 60 and a maximum of 117 thousand per year, with roughly half of the inflow being female. In line with these facts, the LFS data used in this paper suggests that 61% of the total foreign female population was in employment during the period 1994-2018. Roughly, they form 13% or less of female workers in each occupation group; the rest are native female workers. In more than 5 occupation groups they constitute around 15% of the labour force. However, foreign female workers show very low appearances in the following occupations: "*Sales and Customer Service Occupations Process", "Plant and Machine Operatives*", "*Skilled Trades"* and *"Managers, Directors and Senior Officials*". In fact, the last three occupations, as discussed above, are occupations dominated by male workers, hence it is very likely for these occupations to be less preferable for foreign female workers. However, the small number of foreign females in the "*Sales and Customer Service Occupations Process"* could be due to their lack of English proficiency.

Foreign females are more likely to have some level of qualification. Less than 16% of working-age female immigrants do not have any kind of qualification. Indeed, previous

[7] These numbers are taken from Table 3.5a that was updated in 2018 by the Office for National Statics (ONS), using the International Passenger Survey.
[8] The ethnic group can be divided into: White including all white classifications, Black including all black classifications, Indian, Pakistani, Bangladeshi, Chinese and Other ethnicity.

research has argued that the case of UK immigrants is quite different compared to that of US immigrants in terms of their educational level. Unlike the US, a large number of UK immigrants are highly educated (Dustmann et al., 2012; Manacorda et al., 2012). The data in this chapter supports this argument since almost 36% of the working-age foreign female population is in the high-education group.

Figure 3: The number of female immigration flow to the UK.



Source: The International Passenger Survey and ONS

This figure represents that immigration in the United Kingdom is increasing at a fast rate as compared to net migration and emigration. This also means that the inflow of female workers to the UK has increased since the year 1992 onwards. On the other hand, the regional movement of females in the UK region is not considered because the research is focused on taking the UK as a whole region rather than focusing on female movements in particular cities such as London and Manchester.

1.4.3 Data and Descriptive

The data used in this study was obtained from the UK Labour Force Survey (LFS), which covers the LFS data from 1994 to 2018. The LFS is meant to be representative of the UK

population[9]. The current sample design included about 36,000 responding households per quarter. According to the Office for National Statistics, from 1973 until 1983, the LFS was carried out every two years in the spring quarter (March to May). Starting from 1984, the LFS was carried out every year until 1991. From 1992, the LFS occurred every quarter[10]. This survey was performed at the household level and the average sample size is around 18,000 in each wave (there are five waves in each quarter). The LFS started to collect data about earnings in 1993. The earning questions were asked only in the last interview (wave 5) to avoid an adverse impact on the overall response rate. Subsequently, starting in 1997 these questions were asked in both the first and fifth interviews (the first and fifth waves). This individual data in the LFS was pooled for the first wave of each quarter of each year. The data covers the period from 1994-2018 over 20 regions in the UK. The variable URESMC from the LFS was used to collect the information on the region[11]. Using this variable in the analysis offers the advantage of higher variability of the share of foreign-born workers. Table 1 reports the descriptive statistics of the LFS data used in this chapter. Column 1 displays the summary statistics for the total sample of female individuals in the UK labour market between the ages 16 and 70 from 1994-2018. The second and third column refers to the native female sample and the foreign sample, respectively. The first panel of the table shows the general, work and earning characteristics of the sample (age, marital status, the number of children below the age of 16, gross hourly income, employment and unemployment). The total number of observations is 1,097,402 with an average age of 43 years old. The foreign-born females seem to be slightly younger, being 41 years old on average compared to 43 for natives. Around 60% of the population are married and 17% of the females in the sample have at least one child under the age of 16. More than 68% of the total population is in full-time employment, however, among the foreign-born females, 61% are in full-time employment. The second and the third panels in Table 1 report the distribution of the

[9] The LFS data are accessible by approved researchers through different channels such as the Office for National Statistics, the UK Data Archive, Essex University and the Virtual Microdata Laboratory (VML).

[10] The quarterly LFS was introduced to Northern Ireland somewhat later than the rest of the UK. It was launched in Northern Ireland in 1994.

[11] (1) Tyne & Wear (2) Rest of Northern Region (3) South Yorkshire (4) West Yorkshire (5) Rest of Yorkshire& Humberside (6) East Midlands (7) East Anglia (8) Inner London (9) Outer London (10) Rest of South East (11) South West (12) West Midlands (Metropolitan) (13) Rest of West Midlands (14) Greater Manchester (15) Merseyside (16) Rest of North West (17) Wales (18) Strathclyde (19) Rest of Scotland (20) Northern Ireland.

total female population, the native and foreign-born females by qualification and ethnicity, respectively (Source: Office for National Statistics, 2021).

The skill composition of the foreign-born is different from natives (see the second panel in table 1). On average, the native female receives around 17 years of full-time education compared to foreign-born females who receive around 19 years of education. More details about the skill distribution dependent on the qualification level[12] are displayed in the second panel in Table 1. The reason behind choosing this classification in the analysis is discussed in more detail in Appendix 1. According to the LFS data, around 36% of foreign-born females have a high qualification level, while 29% of native females are at the same level. At the low qualification level, the data shows a significant difference between natives and foreign-born females, around 20% of foreign-born are reported at a lower level of educational attainment compared to 44% of the native females who are at the lower level. Some scholars in previous research include individuals who reported their education under other qualification classifications as low education. This chapter considers the two-qualification level as a separate group. Where the low qualification group includes individuals with a high school education or less, the other qualification group includes people who classified their qualification under another qualification type in the LFS. Foreign-born females who reported under other qualifications are around 27%, which is about 16% higher than natives. The reason for the higher percentage among foreign-born females compared to natives on the qualification level is that foreign females may hold a qualification from a foreign country that does not fit any UK qualification specification (Source: Office for National Statistics, 2021).

The third panel of Table 1 gives more insight into the ethnicity distribution among the female population. 90% of all the females in the UK are white in ethnicity. Among UK-born females, 96% are white, and 4% are presented by other ethnicities. However, among

[12] For estimation purpose, this chapter creates four education groups based on the following education levels: (1) high qualification level that includes ***Degree or equivalent*** and ***Higher education*** groups consider them as people who have completed more than high school education, (2) low qualification level which includes ***GCE, A-level or equivalent*** and ***GCSE grades A*-C or equivalent*** groups considering them as people who have completed the high school or less, (3) other education that includes people in ***Other qualifications*** group and (4) people how do not have any type of qualification are in ***No qualification*** group.

the foreign-born females, 50% are from a white ethnicity because EU immigrants constitute the highest number of immigrants to the UK. Black and Indian ethnic groups form a similar share of the foreign-born female population (about 10% each). Pakistani females represent 6% of the foreign-born female population, while Bangladeshi and Chinese females represent a share of 3% for each ethnicity. (Source: Office for National Statistics, 2021).

Table 1: The summary of statistics for the total female sample, including native females and foreign-born females.

Variable	*Total female sample*	*The native female sample*	*The foreign-born female*
#Obs	1,097,402	968,111	129,291
Age	42.85	43.10	41.015
	(13.120)	(13.242)	(12.0114)
Marital status	.602	0.593	. 673
	(.489)	(0.491)	(.4691)
# of dependent children under 5-year conditioning on having at least 1 child	1.25	1.25	1.78
	(0.478)	(0.476)	(0.9164)
Children dummy (if the female has at least one dependent child age 5 or under)	.166	. 157	.233
	(.372)	(.364)	(.423)
Hourly gross wage	10.013	9.888	11.137
	(7.601)	(7.465)	(8.674)
# of waged workers	530,258	478,922	51,650
Employment	.689	.699	.615
	(.462)	(.458)	(.496)
Unemployment	.033	.032	.046
	(.179)	(.175)	(.210)
Qualification			
Year of education	17.491	17.325	18.740
	(2.859)	(2.532)	(4.429)
%High qualification	.299	.291	.364
	(.442)	(.454)	(.469)
%Low qualification	. 412	.441	.198
	(.484)	(.497)	(.387)
%Other qualification	.124	.105	.267
	(.314)	(307)	(.427)
%No qualification	.163	.163	.169
	(.404)	(.369)	(.415)
Ethnicity			
White	.910	.964	.52
	(.287)	(.187)	(.5)
Black	.019	.007	.106
	(.136)	(.085)	(.306)
Indian	.018	.005	.113
	(.132)	(.072)	(.314)
Pakistani	.011	.004	.065
	(.106)	(.064)	(.245)
Bangladeshi	.004	.001	.027
	(.063)	(.031)	(.161)
Chinese	.004	.001	.027
	(.06)	(.024)	(.16)
Another ethnicity	.035	.018	.143
	(.185)	(.134)	(.369)

Data: LFS, 1994-2018 (fifth wave) the sample is restricted to the female population who are of working age (between 16-65). Standard deviations are reported between parentheses. A female individual is considered to be participating in the labour force if she is economically active (in employment including self-employment, and unemployment but is looking for a job). The hourly gross wage is not reported for each individual in the sample. Qualification groups are based on the LFS Highest Qualification (detailed grouping) classification. (1) high qualification level that includes* **Degree or equivalent** *and* **Higher education** *groups consider them as people who have completed more than high school education, (2) low qualification level which includes* **GCE, A-level or equivalent** *and* **GCSE grades A-C or equivalent** *groups considering them as people who have completed the high school or less, (3) other qualification that includes people in* **Other qualifications** *group and (4) no education that includes people in* **No qualification** *group.*

1.5 Empirical strategy

1.5.1 Heckman sample selection

This paper uses the Heckman sample selection two-step model to measure the effect of foreign workers on wages for females. The reason behind choosing this model is to correct the selection bias (Heckman, 1974). It is very common to study female labour supply and wages for females using the two-equation model. Because this chapter focuses on females, the Heckman selection model was used to control for female participation. Hence, the participation of females in the labour force is a main issue that the Heckman selection model solves, because those with high reservation wages may not participate in the first place. In this technique, two equations are estimated: a "selection" equation that determines the probability that a female with a specific set of characteristics will be employed and a "principal" or "wage" equation that incorporates an adjustment factor based on the selection equation to determine an estimated wage for every member of the sample, whether they are employed or not.

Following Heckman's approach[13], this paper starts by using the wage equation (1:1).

$W = \beta X + \epsilon$ (1:1)

where W is the wage per hour, X is a set of variables that determine the female wage and ϵ is the error term. The problem with the female sample population is that it is not representative of the labour female supply, i.e. the females are not selected randomly. This might lead to a biased estimate. The model, therefore, introduces the second equation to avoid such bias and selects the working females out of the total female population.

$W^* = \delta Z + \upsilon$ (1:2)

$p^* = \mathbb{I}\{\delta Z + \upsilon > 0\}$ (1:3)

Where p^* is an indicator function that represents female participation such that $p^* = 1$ if $\delta Z + \upsilon > 0$ is true and 0 otherwise. W^* is the reservation wage (it is not observed in the data). Z is a set of a household's characteristic variables which determine the probability

[13] Following Heckman and Robb (1985), this section uses repeated cross-sections because the selection correction necessary to analyse repeated cross-sections is much easier than the correction required by the panel method. Cross-section correction is a simple implementation of the Heckman two-step method.

of participation in the labour market. υ is the error term for this linear model. Firstly, the following assumptions should be made for the Heckman correction model: (1) (ϵ, υ) are independent of Z and their mean is equal to zero, (2) the error term is normally distributed $\nu \sim N(0,1)$, (3) both error terms are linearly related $\mathbb{E}(\epsilon|\upsilon) = \gamma\upsilon$ where $\gamma \in \mathbb{R}$. Secondly, the next move will be to calculate the expectation of the female wage condition on female participation (the subsample of the population for which $p^* = 1$).

$$\mathbb{E}(W|Z,\upsilon) = \beta X + \mathbb{E}(\epsilon|Z,\upsilon) = \beta X + \mathbb{E}(\epsilon|\upsilon) = \beta X + \gamma\upsilon \quad (1{:}4)$$

Applying the first assumption to this equation will lead to the second part since the error term is independent of Z. Then the third assumption leads to the last part of the equation (1:4). The $\gamma\upsilon$ is the bias expected given Z and the error term. However, equation (1:4) presents the expected bias from the error term, not from the observed probability of female individuals being in work. Therefore, we need to calculate the expected female wage conditioning on $p^* = 1$:

$$\mathbb{E}(W|Z,p) = \mathbb{E}[\mathbb{E}(W \mid Z, \upsilon)|Z,p] = \mathbb{E}[\beta X + \gamma\upsilon|Z,p] = \beta X + \gamma\mathbb{E}(\upsilon|Z,p) \quad (1{:}5)$$

From equation (1:5), the last variable. $\gamma\mathbb{E}(\upsilon|Z,p)$ is the bias introduced to this model by the non-random sample selection. Since the sample represents the individuals who participate in the labour market, in other words, if $p = 1$, the expiration $\gamma\mathbb{E}(\upsilon|Z,p)$ could be written as following $\mathbb{E}(\upsilon|Z,p=1)$. Recall equation (1:3), if $(p=1)$ then that means $(\upsilon > -\delta Z)$.

The inverse Mills ratio is calculated from the assumption of normal distribution of υ conditioned on $p = 1$ in the first step of the two-step approach, using the following equation as stated in Heckman (1976):

$$\mathbb{E}(\upsilon|Z,p=1) = {\emptyset(Z\delta)}\Big/{\Phi(Z\delta)} = \lambda(Z\delta) \quad (1{:}6)$$

Where $\emptyset(Z\delta)$ is the standard normal density function and $\Phi(Z\delta)$ is cumulative distribution function. $\lambda(Z\delta)$ is a proxy variable calculated as the probability of participation. The second step is to use the inverse Mills ratio λ to calculate the female wage equation:

$$W_{it} = \beta X_{it} + \lambda(Z_{it}\delta) + \epsilon_{it} \quad (1{:}7)$$

One problem with this model is the potential occurrence of multicollinearity if X and Z are included in the same variable. Nawata (1993) argues that since the Mills ratio is approximated by a linear function of Z, the estimator is expected to perform poorly due

to the multicollinearity. Other papers support this argument, such as (Yamagata and Orme, 2005). When the same characteristic variables explain the sample selection equation (1:2) and the wage equation (1:1), a high degree of multicollinearity may exist. In this study, the variable employed to measure the participation varies from the one used in the wage calculation. Thus, the multicollinearity problem is irrelevant.

When the focus is on women, one factor to consider is selection bias. Because of the non-random selection of native females from the population, the composition of the native workforce may vary after a supply shock, resulting in an erroneous shift in wages. The use of Heckman's approach can integrate a correction to selection bias and determine the effect of immigration on wages. In addition to sample selection bias, a variety of additional econometric problems may cause biased results. Endogeneity bias is a significant problem, as discussed earlier. Endogeneity bias occurs when the dependent variable (i.e., wages) has a causal effect on one or more explanatory variables (i.e., immigration). Endogeneity could be a concern in investigating the effect of immigration on wages based on regional data. It is common to anticipate that immigrant supply shocks will reduce the wages of equivalent workers.

Natives may respond to lower wages by moving to non-immigrant areas where, presumably, wages have not decreased. However, because this analysis focuses on females, such moves are less likely to occur. Unlike male workers, female workers are not able to move easily between local labour markets because of the care they need to provide for their homes and families. Moreover, even though it could be feasible to move, and it might be a concern, it is less so for females because moving is a joint household decision. In addition, there is little evidence that internal migration is a result of immigration (Peri and Sparber, 2010).

1.5.2 Estimation Strategy

As described in the previous section, the econometric framework which will be employed for this estimation is based on Heckman (1974). The first step of the analysis (the

participation equation) is presented in equation (1:8) and will be achieved under the Heckman estimation approach by the Probit model[14].

$$p^* = p_{it} = \propto_i + \delta \mathrm{Z}_{it} + \upsilon_{it} \qquad (1:8)$$

Where p^* is the probability of a female individual being involved in the labour force. The Z_{it} is a vector of explanatory variables that affect the female's decision to participate in the labour market. This variable usually includes individual characteristics. This analysis will consider the number of dependent children who are under 5 years old in the households as the main characteristic to determine the probability of the female participation in the labour market. Previous research indicates that preschool-aged children have the most impact on a woman's decision to work (Leclere and Mclaughlin, 1997). This might be due to several psychological and financial factors[15].

δ is the vector of unknown parameters and υ_{it} is the error term. The second section of tables (3,4,5,6) for each panel displays the results of the first step of the Heckman estimation which is equation (1:8). This part will solve the sample selection problem which is common when focusing on females. Then the next step will be to estimate how the foreign-born affects the native female wage by using equation (1:9):

$$W_{irt} = \beta_{it} + \beta_1 \, IMMI + \beta' x_{fit} + p_{it} + \tau_i + \varphi_i + (\tau_i * \varphi_i) + \epsilon_{fit} \qquad (1:9)$$

The dependent variable in equation (1:9) is for the logarithm of the gross hourly wages for females individual *i* at time *t* and region *r* between the age of 25 to 65, the self-employed individual will be excluded[16]. According to the literature (e.g., Longhi et al., 2010), the adoption of gross hourly wages is imperative in conducting an analysis because it focuses on the substitution effects of immigration on native females. Moreover, because the Heckman approach was applied in this analysis, the hourly wage was significant. It is long established in the literature that this wage is used in this approach.

[14] The first stage in the Heckman approach involved modelling female participation by estimating the reservation wage. The outcome of the first stage was a binary variable that required an appropriate model to be estimated, which in this case was the probit estimation. The second step involved modelling the observed value of the dependent variable, provided that it had been observed.

[15] For females, motherhood will be at its peak in terms of intensive care for children under this age. Mothers are most likely to be emotionally attached to their children between the periods when they are born and when they start their education. Moreover, for children under 5 years old, they are totally dependent on their mothers, and they are incapable preform any basic activity without an adult aid. Females could use help from childcare providers with their children, but the younger the children are, the higher the cost of childcare service. Which could prevent the female from participating in the labour market because it is financially suitable for her to take care of her children instead of using any help or service.

[16] Individual level data is used in the analysis section that was obtained from the LFS.

IMMI is the share of the foreign-born in the total population. β_1 is the parameter of interest that captures the effect of the share of foreign-born workers on various components of the female sample (the construction of this share will be discussed below). The $x_{it}$is the vector of explanatory variables, including the education level measured by the year left, full-time education, individual age and age squared. p_{it} is the inverse Mills ratio calculated from the first stage on the probability that the female individual is participating in the labour market. ? The $\tau_i, \varphi_i, (\tau_i * \varphi_i)$ are the time dummy, the region dummy, and the interaction between them, respectively. The ϵ_{it} is the error term.

The share of foreign-born (IMMI) individuals who are of working age (between 25 and 65) is categorised by gender and level of qualification. Borjas's (2003) definition of immigration share (for each level of education and gender) was used to construct the immigration share for this analysis $\frac{\Sigma\, foreign\ born_{qtr}}{\Sigma\,(foreign\ born_{qtr}+natives_{qtr})}$. Where $q, t\ and\ r$ refer to the education level, the year and the region, respectively. The regional heterogeneity for foreign-born distribution is the source of variability here. Table 2 provides a ten-year average comparison of the foreign-born share across select regions of the UK with the highest and lowest shares. As seen in the table (2), the foreign-born different shares vary by region and over time.

Table 2: A 10-year period comparison between the foreign-born shares over some of the highest and lowest regions.

	The share of Foreign-born females with high qualification	The share of Foreign-born females with low qualification	The share of Foreign-born females with other qualification	The share of Foreign-born females with no qualification	The share of Foreign-born males with high qualification	The share of Foreign-born males with low qualification	The share of Foreign-born males with other qualification	The share of Foreign-born males with no qualification
				1994				
East Anglia	.006	.01	.013	.004	.008	.007	.009	.005
Greater Manchester	.006	.008	.012	.015	.011	.009	.009	.012
Inner London	.035	.027	.071	.044	.033	.031	.055	.041
Outer London	.027	.022	.05	.018	.022	.026	.036	.015
Wales	.004	.003	.004	.002	.005	.004	.002	.002
West Midlands (Metropolitan)	.007	.007	.018	.027	.01	.013	.015	.026
West Yorkshire	.004	.003	.009	.016	.006	.01	.007	.01
				2004				
East Anglia	.011	.006	.008	.005	.008	.006	.006	.003
Greater Manchester	.007	.005	.005	.013	.009	.009	.005	.01
Inner London	.049	.028	.055	.049	.038	.021	.056	.033
Outer London	.029	.022	.051	.02	.031	.022	.036	.016
Wales	.005	.004	.004	.004	.005	.004	.002	.003
West Midlands (Metropolitan)	.007	.009	.013	.017	.007	.008	.012	.016
West Yorkshire	.005	.009	.009	.018	.008	.005	.011	.014
				2014				
East Anglia	.0351	.012	.0147	.0043	.0257	.0103	.0137	.0046
Greater Manchester	.0285	.0166	.0164	.0152	.0235	.0143	.0166	.0102
Inner London	.1386	.0473	.0402	.0304	.1094	.0312	.0358	.0254
Outer London	.1177	.0442	.0447	.0212	.0955	.038	.0372	.0144
Wales	.0158	.0088	.0057	.0028	.0138	.0053	.0048	.0033
West Midlands (Metropolitan)	.0306	.0181	.0264	.0275	.025	.0161	.0233	.0178
West Yorkshire	.0253	.0159	.014	.0159	.0186	.0132	.0167	.0113

The shares presented in this table are constructed from the LFS data from 1994-2018 following the definition similar to Borjas 2003 which is the share of foreign-born from a specific gender and qualification level over the total population in each year and regions that are under consideration in this chapter. The UK is divided into 20 regions in this chapter based on the usual residence for the individual. Seven regions were displayed in this table and presented some of the highest and lowest shares. The rest are in table A1 in the appendix.

The analysis in this section will be structured in the following way: firstly, the effect of the different foreign-born shares on the wages of the whole native female sample will be examined. This step will provide a clear picture of their impact and could indicate overall whether they are considered substitutes for native females or not. Then, the analysis will continue by examining the effect of the different foreign-born shares on the wages of the

UK female subsamples. The native female is initially divided into two subsamples based on ethnicity: white native and non-white native females. This categorization of the ethnicity will help distinguish between the impact of the foreign-born on the white native females and the non-white native females, as they are the second generation of immigrants who were born in the UK and now are considered native. In addition, the sample of native females was further subdivided based on their level of qualification in order to capture any differences in foreign-born individuals' effects on the wages of natives with different skill levels. Furthermore, married females were included as a part of the analysis for robustness checks. Foreign-born shares, as mentioned earlier, were divided into four groups based on their level of qualification for each gender. Therefore, the analysis will address the effect of foreign-born females and males separately.

1.6 Analysis and results

1.6.1 The effect of foreign-born female shares

This section presents the baseline estimation results of equations (1:8) and (1:9) for a series of alternative specifications of the effect of foreign-born female shares only on wages. The analysis starts with considering all levels of qualification in the sample of native females. Table (3) displays the resulting coefficient estimation for equations (1:8) and (1:9) using the OLS and the Heckman estimation approach for the overall sample. Columns 1, 3, 5 and 7 contain the estimates for a standard OLS. The results of the OLS estimation are not significant across all the estimations in Table (3).

The results of the Heckman two-step estimation are in Columns 2, 4, 6 and 8 of Table 3. The first section of the table shows the results of the Heckman approach's second step, while the second section shows the results of the first step, which reports the likelihood of a female being involved in the labour market. As previously discussed, the number of children aged 5 and under is the key variable in determining the female's participation decision in this analysis. The results show that an increase in the number of children who are 5 years old or less is associated with a decrease in the probability of female participation in the labour market for all sample specifications. With an additional child

aged five or under, the probability of participation decreases by 17% for all native females. However, distinguishing between white and non-white native females, the results show that native females from different ethnic backgrounds have a slightly higher probability of not participating in the labour market if they have children who are 5 years old or less. According to the results, the probability of participation in the labour market decreases for non-white native females by 18% compared to white females, with a 16% decrease in the case of having a child under 5 years old. Children have more of an effect on foreign-born female participation in the labour market, whereas having an additional child brings down the probability of foreign-born female participation by 32%. Furthermore, the selection model results for the non-white native sample (represented by other ethnicity groups) and the foreign-born female shown in the second section of Table 3 of columns (6 and 8) indicate that children have a greater impact on participation on them. The reason behind that is that households of the foreign-born and the second generation of other ethnic groups (non-with) tend to have more children than white natives.

After determining the probability of participation across all groups presented in Table 3, the second step is to measure the impact of the foreign-born female shares on wages. For all native female samples presented in column 2, the coefficient estimated shows a different level of significance and impact. The shares of foreign-born females reported positive and significant results on natives' wages. An increase in the share of foreign-born females with high and low qualifications by 1% leads to an overall increase in the native female wage by 0.28% and 0.02%, respectively. While an increase in the share with other qualifications by 1% leads to an increase of 0.09%., an increase in the proportion of foreign-born females with no qualifications results in a 0.02% increase in native female wages. Column 4 in table 3 presents the estimation of the impact on the white female wage. The results are similar to the ones reported in column 2 for all native female samples, except for the impact of the share with no qualifications, which reports similar results, yet it is not significant for this estimation. The estimation results for column 6, which focused on the non-white natives and foreign-born females, reported insignificant coefficients. Column 8 reports the estimation results of the foreign-born female sample only. A positive and significant impact was found from the shares of high and no

qualification. However, the only negative impact reported is for the share of low qualification, where a 1% increase in the number of foreign-born females with low qualification leads to a 0.03% decrease in the wage.

The table results demonstrate two main outcomes overall, which are, firstly, that foreign-born females with all levels of qualifications are not substitutes for native females. The second is that there is a probability of a small and negative impact of foreign-born females with low qualifications on the wage of foreign-born females, which makes them a substitute in this case. In order to investigate this finding further, the analysis will continue by dividing the native females into groups according to their level of qualification.

Table 3: The effect of foreign-born female shares on native and foreign-born female wages.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	All native female		***The white native female***		***The non-white native female***		***The foreign-born female***	
	OLS	Heck	OLS	Heck	OLS	Heck	OLS	Heck
Share of foreign-born females with high qualification	-0.131	0.276***	-0.130	0.277***	-2.919	-2.713	0.146	0.249*
	(0.153)	(0.00182)	(0.153)	(0.00184)	(5.020)	(4.943)	(0.509)	(0.00698)
Share of foreign- born female with low qualification	).104	0.0183***	-0.106	0.0180***	0.628	0.116	0.104	-0.0343**
	(0.0952)	(0.00310)	(0.0953)	(0.00313)	(2.356)	(2.458)	(0.324)	(0.0138)
Share of foreign- born female with other qualification	0.00724	0.0945***	0.00964	0.0944***	-0.633	-0.545	0.201	0.0442**
	(0.0629)	(0.00244)	(0.0629)	(0.00249)	(1.100)	(1.087)	(0.205)	(0.00983)
Share of foreign- born female with no qualification	-0.0646	0.0215***	-0.0643	0.0200	-1.098	-1.313	-0.211	0.00737
	(0.0430)	(0.00268)	(0.0431)	(0.00273)	(2.888)	(2.847)	(0.145)	(0.0115)
N	429,557	759,360	418,053	731,734	11,504	27,626	47,650	103,990
R-squared	0.357		0.357		0.384		0.223	
Chi-square		287110.97		25413.1		7153.17		26220.9
Selection model								
# of children under 5		-0.170***		-0.163***		-0.183***		-0.322***
		(0.00293)		(0.00302)		(0.0131)		(0.00695)
λ		0.290***		0.316***		0.0368		0.0852***
		(0.0170)		(0.0183)		(0.0677)		(0.0235)
Selected Observations		429,557		418,053		11,504		47,650
Non-selected Observations		329,803		466,491		16,122		56,340

Standard errors in parentheses ***P<0.01, **P<0.05,*p<0.1. The first section reports the wage equation with OLS and the second step of Heckman estimation. The dependent variable is the log of a gross hourly wage. The variable of interest is the share of foreign-born females; it was constructed based on qualification level, year and region. The controls for time, region, education and age were included in both estimations. The second section reports the participation equation, the first step of Heckman estimation (sample selection). λ present the mills' ratio of the first step of hackmen estimation the data used in this table are individual data covering the period between (1994-2018).

Table 4 displays the OLS and the Heckman two-step estimation results for the subsamples female. Each panel of this table contains the result for each level of qualification separately (panel A: displays the estimations for the female who are in a high qualification level, panel B: displays the estimations for the female who are in a low qualification level, panel C: displays the estimations for the female who are in other qualification levels, panel D: displays the estimations for the female who are in no qualification level). Using this subsample in the estimation is giving more insight into the effect of the shares used in the estimation and the selection problem.

The sample selection results for these subsample groups behave differently at each qualification level. When compared to the other subsample groups, having more children who are not in the school puts a slight pressure on the probability of participation for white native females in the high-qualification sample. For the white native female with

low, other, or no qualifications, the effect of having children under 5 is quite large. However, for foreign-born females, the effect of children on the probability of participation in the labour force is large, yet not all selection estimation coefficients (λ) have significant results. In panels, B and D of Table 4, which represent samples with low qualifications and no qualifications, respectively, the selection model results for non-white and foreign-born females are not significant. That means there is no selection problem among these groups. On the other hand, for high qualification and other qualification samples, children seem to put more pressure on the probability of non-white females and foreign-born females being involved in the UK labour market. The ethnic groups who present the non-white native subsample female are Black, Indian, Pakistani, Bangladeshi, Chinese and other ethnicities that are not white. The individuals in this subsample could be considered as the second generation for immigration since they are born in the UK but from different ethnicities (non-white). The selection problem was not captured in this subsample, this could be because the children have not had much of an effect on this group. The selection could be captured in this group if some other characteristics were presented at the first step of the estimation in this group, such as the culture and religious effect. In particular, for females from these ethnicities and backgrounds, the effect of such characteristics on participation could be significant and need further investigation.

Moreover, across the qualification subsample groups presented on panels A, B, C, and D, only native white females report significant results for the first step, indicating that children under the age of 5 always have an impact on the participation of native white females, and the lower the qualification level of the native white female, the greater the likelihood that she will not be involved in the labour market.

Turning to the important variable, which is the foreign-born share, the results are consistent with Table 3's findings. The only significant results reported in Table 4 regarding the impact of the foreign-born share on native females were for panels A and B, which presented the sample of high and low-qualification groups of females. In panel A, an increase of 1% in the foreign-female share with high, low and no qualification causes a 0.09%, 0.51% and 0.53% raise in the wages of highly qualified native women, respectively. Moreover, the results in panel B show that an increase in the foreign-born share with high

qualification by 1% leads to a 0.02% increase in the wages of less-qualified white natives. The other foreign-born female shares have no significant impact on the less qualified native female. However, a negative impact was found on the foreign-born female workers with high and low qualifications (panel A, and B column 6), yet the result on panel B for the first step of this group is not significant, therefore it will not be taken under consideration.

According to the findings of this table, a complementarity relation was found between white native and foreign-born females with high, low, and no qualifications for the highly qualified female, while a supplementary relation was found for foreign-born females with the share of other qualifications. This part of the supplementary is interesting because it indicates that a foreign-born female with a high qualification who is already involved in the UK labour market could be substituted with a foreign-born female who falls under the other qualification category. The reason could be that a foreign-born female could hold a high education qualification in her home country, but when answering the survey, she chooses the other qualification category because of the different education classification system.

By disaggregating the outcomes by level of education, it was possible to conduct an accurate analysis of the effects of immigration and to identify underlying trends and patterns. Overall, the findings indicated a positive effect on native female earnings, a decreasing effect from high to low skills driven by white females in contrast to non-white females, and a negative effect on incumbent foreign-born low-skilled migrants. Despite their varying levels of education, foreign-born females had a favourable influence on highly skilled native female incomes (i.e., the complementarity effect). Female immigration with low or no qualifications had a greater effect than female immigration with high qualifications, which could be interpreted that immigrants with high qualifications increasing the productivity of highly skilled white native females when they work at a job that requires high qualifications by exchanging knowledge and experience and filling job vacancies in a market for highly skilled workers. Low-skilled foreign-born females enhance the productivity of high-skilled native females by providing low-cost home services to them, increasing the latter's participation in the labour force and allowing them to be more productive in their employment. In contrast, the negative effects of female immigrants with

other qualifications on highly skilled foreign-born female workers were found to be a supplementary relationship, as discussed previously. This may be because the other qualification group had high levels of education, which made them substitutes for high-skilled foreign female workers because they were willing to work for lower wages.

Table 4: The effect of foreign-born female shares on each qualification level, wages of native and foreign-born females.

	(1)	(2)	(3)	(4)	(5)	(6)
	The white native female		***The non-white native female***		***The foreign-born female***	
	OLS	Heck	OLS	Heck	OLS	Heck
Panel A: High Qualification						
Share of foreign- born female with high qualification	-0.402	0.0932*	2.774	0.0871	-0.0120	-0.0804
	(0.237)	(0.0818)	(5.337)	(0.0817)	(0.745)	(0.242)
Share of foreign- born female with low qualification	-0.286	0.505**	-1.965	-1.363	0.123	0.0791
	(0.147)	(0.207)	(3.322)	(2.140)	(0.472)	(0.205)
Share of foreign- born female with other qualification	-0.0757	0.0517	0.725	0.358	0.195	-0.341*
	(0.0951)	(0.0820)	(1.255)	(0.515)	(0.287)	(0.255)
Share of foreign- born female with no qualification	-0.0999	0.527***	1.280	0.253	-0.339	-0.180
	(0.00518)	(0.189)	(2.156)	(0.605)	(0.206)	(0.204)
N	144,775	213,463	5,266	9,861	22,035	37,719
R-squared	0.193		0.265		0.140	
Chi-square		41635.4		2723.41		13391.28
Selection model						
# of children under 5		-0.107***		-0.148***		-0.285***
		(0.00527)		(0.0213)		(0.0112)
λ		0.639***		0.0766		0.0833**
		(0.0552)		(0.127)		(0.0405)
Selected Observations		144,775		5,266		22,035
Non-selected Observations		68,688		4,595		15,684
Panel B: Low Qualification						
Share of foreign- born female with high qualification	0.186	0.0227**	3.574	3.574	-1.722	-1.708
	(0.237)	(0.0844)	(4.466)	(4.280)	(1.203)	(1.173)
Share of foreign- born female with low qualification	0.0848	-0.171	-3.089	-3.089	-1.206*	-1.205*
	(0.147)	(0.210)	(7.039)	(6.745)	(0.729)	(0.712)
Share of foreign- born female with other qualification	0.0351	-0.00770	0.512	0.512	0.0552	0.0528
	(0.0996)	(0.0862)	(1.075)	(1.030)	(0.534)	(0.521)
Share of foreign- born female with no qualification	-0.0454	0.0905	0.0702	0.0702	-0.337	-0.335
	(0.0678)	(0.192)	(0.729)	(0.698)	(0.367)	(0.358)
N	181,615	304,950	4,472	10,946	10,225	19,662
R-squared	0.216		0.301		0.179	
Chi-square		103671.65		1918.03		2216.43
Selection model						
# of children under 5		-0.257***		-0.243***		-0.368***
		(0.00447)		(0.0202)		(0.0170)
λ		0.0299*		0.000338		-0.0344
		(0.0157)		(0.0747)		(0.0443)
Selected Observations		181,615		4,472		10,946
Non-selected Observations		123,335		6,474		9,437

Table 4 (continued)

Panel C: Other Qualification						
Share of foreign- born female with high qualification	-0.630	-0.00106	0.455	0.437	0.216	-0.356
	(0.718)	(0.267)	(3.031)	(2.672)	(1.044)	(0.344)
Share of foreign- born female with low qualification	-0.635	-0.231	-2.140	-2.170	0.309	-0.0492
	(0.421)	(0.202)	(11.91)	(10.50)	(0.662)	(0.259)
Share of foreign- born female with other qualification	-0.173	-0.104	-0.0230	0.00516	0.00344	-0.0268
	(0.305)	(0.273)	(5.799)	(5.112)	(0.454)	(0.409)
Share of foreign- born female with no qualification	0.269	0.271	-0.234	-0.256	0.205	0.219
	(0.204)	(0.203)	(5.726)	(5.047)	(0.311)	(0.304)
N	40,794	76,305	922	2,737	11,052	26,871
R-squared	0.269		0.446		0.193	
Chi-square		28462.30		741.48		6775.27
Selection model						
# of children under 5		-0.386***		-0.284***		-0.404***
		(0.0114)		(0.0500)		(0.0138)
λ		0.0861***		-0.0306		0.0673*
		(0.0257)		(0.149)		(0.0355)
Selected Observations		40,794		922		11,052
Non-selected Observations		35,511		1,815		15,819
Panel D: No Qualification						
Share of foreign- born female with high qualification	0.113	-0.142	0.484	0.524	0.373	0.363
	(0.537)	(0.177)	(0.569)	(0.503)	(2.547)	(2.380)
Share of foreign- born female with low qualification	0.205	-0.204	0.0284	0.0111	0.343	0.330
	(0.326)	(0.461)	(1.078)	(0.943)	(1.509)	(1.410)
Share of foreign- born female with other qualification	-0.0533	-0.119	-0.452	-0.504	0.147	0.154
	(0.204)	(0.177)	(1.354)	(1.187)	(0.625)	(0.584)
Share of foreign- born female with no qualification	0.125	0.347	0.157	0.168	0.0781	0.0759
	(0.137)	(0.418)	(0.555)	(0.486)	(0.486)	(0.454)
N	41,907	118,924	709	3,678	3,649	17,853
R-squared	0.295		0.452		0.326	
Chi-square		23050.38		578.27		1765.80
Selection model						
# of children under 5		-0.407***		-0.378***		-0.366***
		(0.0116)		(0.0560)		(0.0216)
λ		0.0721***		-0.0835		0.0281
		(0.0262)		(0.173)		(0.0590)
Selected Observations		41,907		709		3,649
Non-selected Observations		77,017		2,969		14,204

Standard errors in parentheses ***P<0.01, **P<0.05,*p<0.1. The first section of each panel reports the wage equation with OLS and the second step of Heckman estimation. The dependent variable is the log of a gross hourly wage. The variable of interest is the share of foreign-born female based on their level of qualification; it was constructed based on time and region. The controls for time, region, education and age were included in both estimations. The second section reports the participation equation, the first step of Heckman estimation (sample selection). Each panel represents the estimation for the subsample of the white native, non-white native and foreign-born female in each level of qualification. λ present the mills' ratio of the first step of hackmen estimation the data used in this table are individual data covering the period between (1994-2018).

1.6.2 The effect of foreign-born male

This section focuses on the impact of foreign-born males on native and foreign-born female wages. Table 5 presents the estimation of equations (1:8) and (1:9) using the shares of foreign-born males (divided by qualification level) to address their effect of them. The sample selection results (the first step of Heckman estimation) for this section are the same as the previous section since the sample of the females (natives and foreign-born) used in each model is the same. The only significant effect of foreign-born males observed in this table is associated with the share of men with high qualifications. Increasing the share of highly qualified males leads to an increase in the overall native female wage by 0.6%.

Even though these results are statistically significant, the reported level of significance for the P- value is weak. No other impact was found of the male shares on female wages. However, the analysis in this section continued by investigating the impact of male shares on subsamples of females based on their qualification level. The resulting coefficient of this part of the analysis shows no significant outcome. Thus, this section does not report nor discuss this part of the analysis (the results are reported in the appendixes Table A1:2).

Although the results are small and mostly insignificant, the overall foreign-born male and females have a positive impact on the native female wages. Consistent with previous findings, foreign-born seemed to have a complimentary relationship with native UK females and a supplementing relationship with foreign-born females.

Table 5: The effect of foreign-born male share on native and foreign-born female wages.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	All native female		***The white native female***		***The non-white native female***		***The foreign-born female***	
	OLS	Heck	OLS	Heck	OLS	Heck	OLS	Heck
Share of foreign- born male with high qualification	-0.208	0.643*	0.467	0.463	2.312	0.359	-1.516	-1.525
	(0.317)	(0.344)	(773.3)	(0.886)	(2.551)	(0.900)	(1.118)	(1.112)
Share of foreign- born male with low qualification	-0.201	-0.790	0.228	1.233	0.984	0.696	-1.198	-1.216
	(0.234)	(0.646)	(493.3)	(1.553)	(1.416)	(1.267)	(0.806)	(0.801)
Share of foreign- born male with other qualification	-0.206	-0.408	0.239	-0.703	0.693	0.0507	-0.990	-1.001
	(0.234)	(0.368)	(508.8)	(1.050)	(1.034)	(0.521)	(0.806)	(0.802)
Share of foreign- born male with no qualification	0.100	0.629	-0.295	-0.533	-1.314	-0.992	0.590	0.608
	(0.00264)	(0.604)	(449.2)	(0.966)	(1.118)	(0.918)	(0.898)	(0.893)
N	428,584	758,387	417,410	731,091	11,174	27,296	47,635	103,975
R-squared	0.356		0.357		0.363		0.222	
Chi-square		235144.85		253233.5		7558.87		13592.11
Selection model								
# of children under 5		-0.170***		-0.163***		-0.181***		-0.322***
		(0.00293)		(0.00302)		(0.0132)		(0.00695)
λ		0.287***		0.314***		0.0220		0.0848***
		(0.0170)		(0.0183)		(0.0688)		(0.0234)
Selected Observations		429,557		418,053		11,504		47,650
Non-selected Observations		329,803		466,491		16,122		56,340

Standard errors in parentheses ***P<0.01, **P<0.05,*p<0.1. The first section reports the wage equation with OLS and the second step of Heckman estimation. The dependent variable is the log of a gross hourly wage. The variable of interest is the share of a foreign-born male based on their level of qualification; it was constructed based on time and region. The controls for time, region, education, and age were included in both estimations. The second section reports the participation equation, the first step of Heckman estimation (sample selection). λ present the mills' ratio of the first step of hackmen estimation the data used in this table are individual data covering the period between (1994-2018).

1.6.3 The effect on the married sample

This section considers only the married female sample, dividing them as earlier into subsamples by their qualification attainment, then running this through the Heckman estimation only. As mentioned earlier, the female sample could not be treated as a random sample because of the selection problem; to some extent, the married female sample highlights the selection problem from a different perspective. Excluding a single female will eliminate the confounding effect generated by the female force to be involved in the labour market (being the only income source possible for the family, especially if having a child). Moreover, the decision to be involved in the labour market or involved in house production will be dependent on the number of children under school age while assuming the husband is a source of household income. Overall, the results of the

selected models for married females are similar to the results when using the all-female sample. The probability of being involved in the labour market is decreasing with the increasing number of children who are under school age (5 years old or less).

In the estimations in Table 4 and 6, the results for the first step (selection mode) of the non-white native appear insignificant in all subsamples used in the estimations. However, focusing on the married sample enhances the result of this group to be significant in the overall sample and the low qualification subsample.

Additionally, for the foreign-born female with low qualifications, unlike the previous estimations, the selection model result becomes significant. Moreover, among the married female sample, the group reporting the lowest effect of children is the white native female, and within this group, the effect is reduced for subgroups with higher levels of qualification. While the foreign-born female group's participation is the most affected by having children who are 5 years old or younger.

However, the estimation of the wage equation using only the married sample enhanced the findings across all specifications in Table 6. The estimation indicates that foreign-born females had a positive effect on the wages of native white females in all of the groups shown in panel A of table 6.

The significant effect of the foreign-born female's share on the non-white married native female was modest overall. A foreign-born female with high and no qualifications reports a positive impact on the overall non-white married sample. With the subsamples analysis in panel B, this impact seems to be concentrated only on non-white females with no qualification, yet the sample selection step has failed to capture any selection problem as discussed earlier for this group.

The final panel in this table illustrates the impact of foreign-born females' shares on the foreign-born married female who is involved in the UK labour market. Different impacts of the shares were found on overall, high, low and other qualification subgroups, but none on the group with no qualifications. Foreign-born females with high and other qualification levels have a positive impact on the wages of foreign-born female workers which vary between 0.05% and 0.3%. Furthermore, a negative impact of the share of foreign-born females with low qualifications on the overall foreign-born female worker

sample was discovered, with a 1% increase in this share resulting in a 0.04% decrease in the overall wage of marred foreign-born female wage. While investigating this impact across the foreign-born female subgroup, it appears to be limited to the group of foreign-born females with other qualifications (panel c column 4).

Table 6: The effect of foreign-born female shares on each qualification level wages of married native and foreign-born female.

(1)	(2)		(3)	(4)	(5)
Panel A: White Native Female sample					
	Overall sample	High Qualification	Low Qualification	Other Qualification	No Qualification
Share of foreign- born female with high qualification	0.299***	0.234***	0.281***	0.283	0.317*
	(0.00253)	(0.00653)	(0.00332)	(0.00641)	(0.00605)
Share of foreign- born female with low qualification	0.0199***	0.00520	0.0334	0.0353*	0.0319
	(0.00425)	(0.0114)	(0.00557)	(0.00995)	(0.00892)
Share of foreign- born female with other qualification	0.0942**	0.0659***	0.0965*	0.101**	0.103
	(0.00338)	(0.00887)	(0.00448)	(0.00844)	(0.00757)
Share of foreign- born female with no qualification	0.0155**	0.0214**	0.0180*	0.0199*	0.0221***
	(0.00365)	(0.00993)	(0.00481)	(0.00807)	(0.00758)
N	519,346	152,815	217,113	55,097	81,478
Chi-square	120999.49	7420.58	27772.84	7890.52	9213.84
Selection model					
# of children under 5	-0.087***	-0.0609***	-0.183***	**-0.234*** **	-0.269***
	(0.00343)	(0.00552)	(0.00518)	(0.0132)	(0.0139)
λ	0.857***	1.209***	0.300***	**0.230*** **	0.242***
	(0.0544)	(0.181)	(0.0290)	(0.0527)	(0.0492)
Selected Observations	271,931	91,022	117,425	28,058	29,425
Non-selected Observations	247,415	61,793	99,688	27,039	52,053
Panel B: Non-White Native Female sample					
	Overall sample	High Qualification	Low Qualification	Other Qualification	No Qualification
Share of foreign- born female with high qualification	0.252***	0.179	0.240	0.301	0.214***
	(0.0186)	(0.0267)	(0.0282)	(0.0613)	(0.0771)
Share of foreign- born female with low qualification	0.0125	-0.00350	0.0702	-0.105	0.0414
	(0.0357)	(0.0518)	(0.0546)	(0.113)	(0.144)
Share of foreign- born female with other qualification	0.0256	0.0185	0.0564	0.107	0.256**
	(0.0266)	(0.0392)	(0.0396)	(0.0877)	(0.106)
Share of foreign- born female with no qualification	0.0702***	0.0231	0.0476	0.0336	-0.0440
	(0.0262)	(0.0404)	(0.0383)	(0.0771)	(0.0912)
N	18,289	6,227	7,313	1,962	2,540
Chi-square	3623.33	636.78	678.81	237.25	205.53
Selection model					
# of children under 5	-0.111***	-0.120***	-0.172***	-0.223***	-0.328***
	(0.0147)	(0.0233)	(0.0233)	(0.0567)	(0.0641)
λ	0.281*	0.157	0.241*	0.180	-0.361
	(0.144)	(0.192)	(0.137)	(0.234)	(0.230)
Selected Observations	6,628	2,883	2,574	621	477
Non-selected Observations	11,661	3,344	4,739	1,341	2,063
Panel C: Foreign-Born Female sample					
	Overall sample	High Qualification	Low Qualification	Other Qualification	No Qualification
Share of foreign- born female with high qualification	0.271***	0.170***	0.205***	0.231***	0.312***
	(0.00879)	(0.0139)	(0.0161)	(0.0170)	(0.0226)
Share of foreign- born female with low qualification	-0.0412**	0.00549	0.00386	-0.0665**	0.0671
	(0.0172)	(0.0270)	(0.0327)	(0.0327)	(0.0431)
Share of foreign- born female with other qualification	0.0475***	0.0472*	0.138**	0.172***	0.0857
	(0.0122)	(0.0191)	(0.0223)	(0.0259)	(0.0296)
Share of foreign- born female with no qualification	-0.00391	0.0275	0.0124	-0.0342	-0.0108
	(0.0144)	(0.0229)	(0.0249)	(0.0277)	(0.0381)
N	82,422	29,354	14,947	22,224	14,398
Chi-square	7875.14	1507.97	878.08	1255.66	708.65

Table 6 (continue)

Selection model					
# of children under 5	-0.242***	-0.189***	-0.315***	-0.324***	-0.361***
	(0.00747)	(0.0117)	(0.0188)	(0.0148)	(0.0242)
λ	0.333***	0.370***	0.104*	0.223***	-0.0219
	(0.0374)	(0.0721)	(0.0628)	(0.0515)	(0.0719)
Selected Observations	31,215	14,076	6,717	7,429	2,535
Non-selected Observations	51,207	15,278	8,230	14,795	11,863

Standard errors in parentheses ***P<0.01, **P<0.05, *p<0.1. The first section on each panel reports the wage equation of the second step of Heckman estimation. The dependent variable is the log of a gross hourly wage. The variable of interest is the share of foreign-born females; it was constructed based on qualification level, time and region. The controls for time, region, education and age were included in both estimations. The second section reports the participation equation, the first step of Heckman estimation (sample selection). Each panel represents the estimation for overall and the subsample qualification level for the white native, non-white native and foreign-born female. This table includes only the married female sample. λ present the mills ratio of the first step of hackmen estimation the data used in this table are individual data covering the period between(1994-2018).

To sum up the analysis part of this chapter, the findings across all specifications were consistent for the sample selection problem and the foreign-born share impact on the female wage. The estimations found no evidence of a negative impact of foreign-born females and males on UK native female workers. However, it was found that the foreign-born female workers experienced a negative impact in different specifications across the analysis.

1.6.4 The impact of immigration using alternative specification: Robustness check

This section provides additional robustness tests to evaluate the sensitivity of the baseline results reported in Table 4. This section will analyse the effect of foreign-born females on the wages of native females by employing different education classifications used in the literature to measure skill depending on the age at which an individual left full-time education (Dustmann, Frattini, et al., 2012). The skill component will be categorised into two education levels. The individual lift in full-time education after the age of 20 is categorised as a high education level, and the individual lift in full-time education at the age of 20 or before is categorised as a low education level. On the basis of the new categorization in this section, the immigrant share in this case will be divided into two shares with high and low levels of education. Table 7 is divided into 3 panels: A, B, and C present the three different samples: white, non-white, and foreign-born respectively. Each panel will include the estimation results of the Heckman model for the overall sample, the high education and the low education level sample.

The result for this sample selection based on this two-education level classification is in line with the main finding. The group that experiences less negative effects of having children under 5 years old is the white native group, while the non-white native in this specification reported an insignificant Mills ratio, the same problem occurs earlier during the main analysis step. Foreign-born females have the higher adverse impact of having young children among these groups. However, when comparing the high and the low education level across all groups, the results show that the probability of a female in the low education group participating in the labour market is less than that of females in the high education group.

Looking into the results on the shares of foreign-born females with high and low education levels on the wages of females involved in the UK labour market, the finding is in line with the results reported earlier. Foreign-born females have a positive and significant impact on the white native female. However, compared to the results in Table 4 column 2, the coefficient for foreign-born females with a high qualification share has a smaller value than the one presented in Table 7 column 2 with the high education level share, while it reports a higher value of the coefficient for low qualification share compared to low education level share. However, unlike the previous results for the non-white native group, the impact of the share of high education level reporting demonstrates some significant values across all subsamples of this group in panel B, yet the first step is not significant. The last group in panel C, which is the foreign-born female workers, are the only category having a negative impact on the subsample with a high education level.

Regardless of the new specification used to classify the skill level, the results overall are consistent with the baseline estimates and conclusion.

Table 7: The impact of foreign-born female using alternative education classification.

	(1)	(2)	(3)
Panel A: White Native Female sample			
	Overall sample	High Qualification	Low Qualification
Share of foreign- born female with high qualification	0.454***	0.390***	0.499*
	(0.00198)	(0.00301)	(0.00261)
Share of foreign- born female with low qualification	0.0253***	0.0131*	0.0326**
	(0.00446)	(0.00697)	(0.00563)
N	733,030	322,545	410,485
Chi-square	213052.28	65217.70	61890.74
Selection model			
# of children under 5	-0.146***	-0.140***	-0.229***
	(0.00289)	(0.00386)	(0.00451)
λ	0.354***	0.349***	0.164***
	(0.0201)	(0.0284)	(0.0190)
Selected Observations	419,349	208,044	410,485
Non-selected Observations	313,681	114,501	199,180
Panel B: Non-White Native Female sample			
	Overall sample	High Qualification	Low Qualification
Share of foreign- born female with high qualification	0.428**	0.420*	0.436**
	(0.0154)	(0.0190)	(0.0262)
Share of foreign- born female with low qualification	-0.0376	-0.0868	0.00337
	(0.0264)	(0.0357)	(0.0392)
N	27,710	15,363	12,347
Chi-square	6075.04	2625.79	1320.49
Selection model			
# of children under 5	-0.184***	-0.212***	-0.246***
	(0.0131)	(0.0164)	(0.0230)
λ	0.0379	0.00867	-0.0443
	(0.0676)	(0.0734)	(0.0903)
Selected Observations	11,588	7,587	4,001
Non-selected Observations	16,122	7,776	8,346
Panel C: Foreign-Born Female sample			
	Overall sample	High Qualification	Low Qualification
Share of foreign- born female with high qualification	0.380***	0.326***	0.497***
	(0.00757)	(0.00895)	(0.0135)
Share of foreign- born female with low qualification	-0.0178	-0.0201*	0.0222
	(0.0193)	(0.0223)	(0.0362)
N	82,422	29,354	14,947
Chi-square	7875.14	1507.97	1999.89
Selection model			
# of children under 5	-0.322***	-0.336***	-0.455***
	(0.00695)	(0.00795)	(0.0163)
λ	0.0886***	0.0817***	0.0190
	(0.0237)	(0.0257)	(0.0399)
Selected Observations	31,215	14,076	9,763
Non-selected Observations	51,207	15,278	21,051

Standard errors in parentheses ***P<0.01, **P<0.05, *p<0.1. *The first section on each panel reports the wage equation of the second step of Heckman estimation. The dependent variable is the log of a gross hourly wage. The variable of interest is the share of foreign-born females; it was constructed based on education level, time and region. The controls for time, region, education and age were included in both estimations. The second section reports the participation equation, the first step of Heckman estimation (sample selection). Each panel represents the estimation for overall and the subsample qualification level for the white native, non-white native and foreign-born female. λ present the mills ratio of the first step of hackmen estimation the data used in this table are individual data covering the period between (1994-2018). The results outlined that the immigration of skilled or highly qualified females in the UK is higher as compared to the females who are less skilled and less qualified.*

1.7 Conclusion

This chapter discusses the effect of immigration on UK female wages. Although the focus was on native UK females, it also addresses the effect on foreign-born female wages (foreign-born females who work in the UK). The analysis adopts a framework similar to Heckman (1974) to encompass the sample selection problem while investigating the effect of the foreign-born population using specific qualification shares in each gender. The number of children that are under school age is the main determinant considered in the analyses for the selection problem. If the individual female reservation wage is higher than the wage in the labour market, then she will be excluded from the sample. In other words, having more children younger than 6 years old affects the decision of a female to be involved in the labour market. The main findings of this part of the analysis are in line with the results of the previous papers using Heckman's methodology to study the female supply (Heckman, 1974; Kornstad and Rønsen, 2014).

Young children have a negative impact on their mother's participation in the labour market. When the sample of females was sectioned into subsamples based on their level of qualification, the effect of children was found large on the low qualification level compared to the effect on the females with a high qualification as expected. The reason behind this different effect on children is that the female with a high qualification has a higher opportunity cost if she decides not to work than the female with a low qualification. After the selection problem is studied in the first step, the second step aims to investigate the effect of foreign-born shares on female wages. One new aspect of this paper for the foreign-born share is to isolate the effect of the foreign-born with other qualifications from the high and low qualification groups. This classification improves the results in two ways. First, it allows researchers to capture the actual effect of both high and low qualifications on foreign-born shares with more clarity. Secondly, it gives a new understanding of the effect of foreign-born individuals in this group.

The main finding of this chapter is that foreign-born have no adverse effect on native UK female wages in almost all the cases considered in this paper. The result is consistent with the previous studies for the UK that include females in their analysis or consider them in a pooled sample with males (Dustmann et al., 2003; Manacorda et al., 2012). Another

finding of this paper is that the adverse effect exists on foreign-born female wages from different male and foreign-born female shares, and some positive impact was found on the wages in some cases. Mainly, the negative impact was found from the shares of foreign-born males and females with other qualifications on the overall wage of foreign-born females in the sample. There is a significant effect of this share on the wage of the foreign-born with a high qualification, which means that there is a substitution effect between them. The descriptive analysis shows that the foreign-born with other qualification shares include individuals who have both high and low education according to the age when education was completed, and the substitution effect could be from the individuals who left education when they were over 20 years old.

Additionally, another finding of this paper is that the results related to the non-white female sample. The sample selection shows no significant result when considering the entire non-white female sample. However, when the estimation focuses only on married females, the estimates become significant for some specifications. The non-white female sample presents a minority ethnic group that lives in the UK as the second generation of immigrants. Having children is not the only determinant that should be taken under consideration when analysing the first step in the framework that was adopted in this paper. Further investigation with detailed data about this group can be considered in future research.

In conclusion, the considerable contribution of this paper has been to consider the impertinence of analysing the effect of the foreign-born on UK female wages in detail using long periods and recent LFS data. Moreover, it investigates the foreign-born shares from a new perspective that highlights each skill level on its own in a framework that addresses the selection problem in the female sample.

Appendix 1

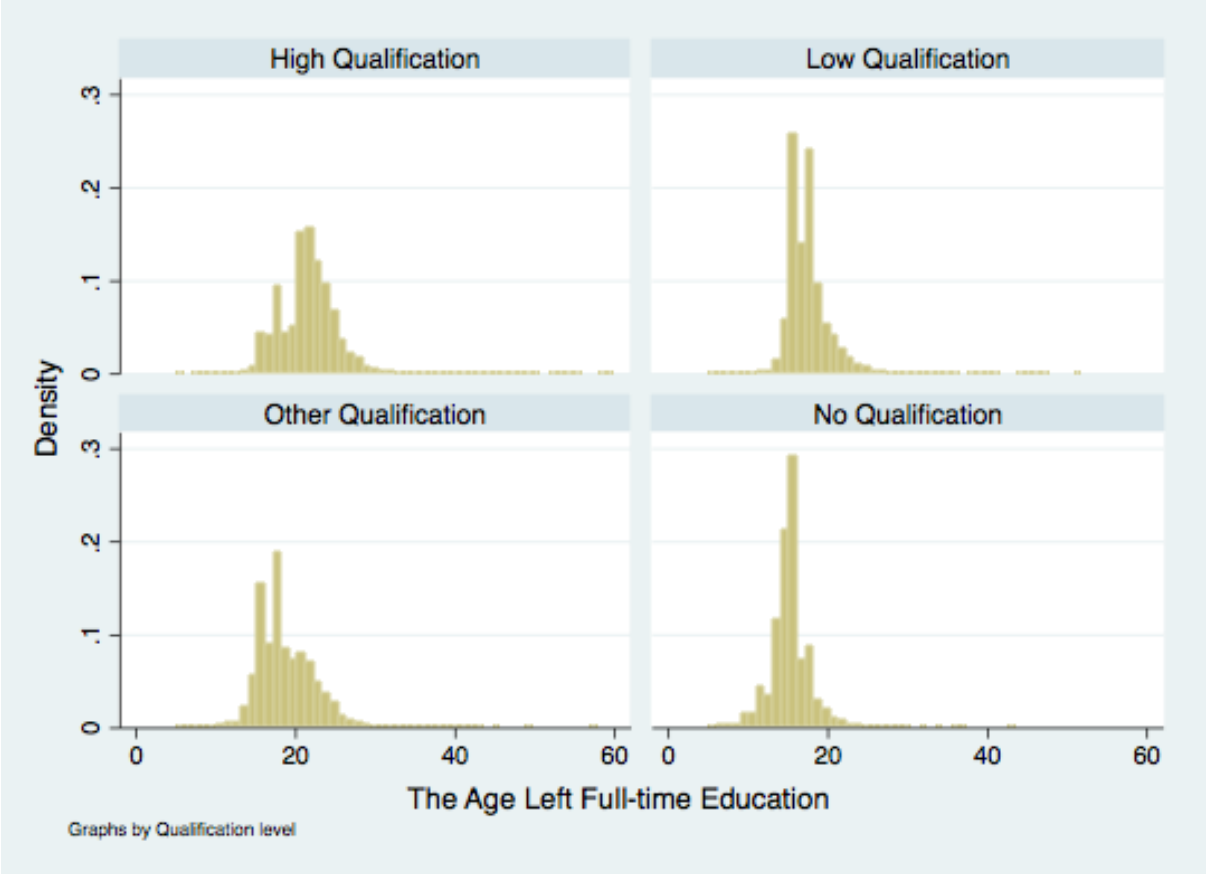
Appendix A1:1

This section clarifies the skill composition chosen for the analysis in this paper. It is important to emphasise that the foreign-born who come to the UK are relatively highly educated. Using the age left the full-time education as a bit problematic, especially for foreign-born because of the different starting and finishing age of full-time schooling in each country. Moreover, the LFS has a detailed section about education and qualification, which could be used for detailed classification of the natives and foreign-born skilled composition. The EDAGE indicator from the LFS was used to construct the age of education variable used in this paper, excluding the value of 96 (people who are still in education). Additionally, this paper uses the variable HIQUL11D which referring to the highest qualification held by the person when the interview took place (this variable is a detailed grouping that was constructed by the LFS using the HIQUAL11 variable). The qualification level groups in this paper used the following classification.

(1) The high qualification level: that includes individuals who hold a qualification, which is a *Degree or equivalent* and *Higher education* considering them as individuals who have completed more than high school education. (2) Low qualification level: which includes *GCE, A-level or equivalent* and *GCSE grades A*-C or equivalent* groups considering them as individuals who have completed the high school or less. (3) Other qualification: that includes individuals who report their qualification as *other qualifications* on the LFS. This group of individuals who chose other qualification they probably could not find their type of qualification on LFS qualification system. Even though the variable HIQUAL11 was updated over the years, yet it could not cover all type of qualification. (4) No qualification: individuals how do not have any type of qualification. Individuals in this group could spend some time in education, but they do not have any type of qualification on their position. This classification of qualification levels allows the analyses to capture the effect of each group by its one.

According to the LFS data, for the foreign-born sample during the period covered in this paper, over 26% of them are in the other qualification group. That is the second highest percentage after the high qualification group with 36% of total foreign-born (including male and female who was considered in this paper). Treat this group as a separate group has its advantages on capturing the actual effect of the high and the low qualified foreign-born. However, this group cannot be treated as a low skilled group because when comparing the age left full-time education in this

group between the native and the foreign-born sample, the data shows different results. For foreign-born, the distribution of this group over the age lift full-time education shows an interesting pattern see figure (A1:1).



Figure(A1:1): the distribution of foreign-born individual by the level of qualification over the age left full time education .

Table A1:1 a comparison between the shares of foreign-born distribution in 1994,2004 and 2014.

	The share of Foreign-born female with high qualification	The share of Foreign-born female with low qualification	The share of Foreign-born female with other qualification	The share of Foreign-born female with no qualification	The share of Foreign-born male with high qualification	The share of Foreign-born male with low qualification	The share of Foreign-born male with other qualification	The share of Foreign-born male with no qualification
				1994				
East Anglia	.006	.01	.013	.004	.008	.007	.009	.005
East Midlands	.005	.005	.006	.01	.007	.006	.005	.007
Greater Manchester	.006	.008	.012	.015	.011	.009	.009	.012
Inner London	.035	.027	.071	.044	.033	.031	.055	.041
Merseyside	.006	.002	.003	.003	.003	.006	.001	.002
Northern Ireland	.005	.004	.001	.005	.002	.005	0	.003
Outer London	.027	.022	.05	.018	.022	.026	.036	.015
Rest of North West	.003	.005	.008	.006	.005	.005	.003	.005
Rest of Northern Region	.003	.004	.003	.002	.003	.004	0	.002
Rest of Scotland	.005	.003	.006	.004	.005	.005	.003	.003
Rest of South East	.01	.01	.014	.008	.01	.011	.008	.005
Rest of West Midlands	.006	.007	.007	.006	.007	.007	.006	.003
Rest of Yorkshire & Humberside	.004	.004	.004	.002	.005	.005	.004	0
South West	.007	.007	.004	.005	.006	.01	.004	.003
South Yorkshire	.003	.001	.003	.005	.003	.006	.007	.003
Strathclyde	.005	.004	.005	.004	.002	.003	.002	.002
Tyne & Wear	.005	.002	.003	.002	.005	.003	.002	.002
Wales	.004	.003	.004	.002	.005	.004	.002	.002
West Midlands (Metropolitan)	.007	.007	.018	.027	.01	.013	.015	.026
West Yorkshire	.004	.003	.009	.016	.006	.01	.007	.01
				2004				
East Anglia	.011	.006	.008	.005	.008	.006	.006	.003
East Midlands	.006	.006	.007	.006	.006	.005	.005	.007
Greater Manchester	.007	.005	.005	.013	.009	.009	.005	.01
Inner London	.049	.028	.055	.049	.038	.021	.056	.033
Merseyside	.006	.002	.006	.002	.005	.001	.002	.005
Northern Ireland	.01	.005	.001	.004	.004	.005	.002	.004
Outer London	.029	.022	.051	.02	.031	.022	.036	.016
Rest of North West	.004	.006	.005	.006	.006	.003	.005	.007
Rest of Northern Region	.003	.002	.002	.002	.003	.003	.001	.001
Rest of Scotland	.007	.003	.006	.003	.006	.004	.003	.001
Rest of South East	.012	.008	.011	.005	.01	.007	.009	.004
Rest of West Midlands	.004	.003	.005	.004	.005	.003	.004	.003
Rest of Yorkshire & Humberside	.005	.004	.002	.002	.004	.004	.005	.003
South West	.007	.006	.007	.003	.007	.006	.006	.002
South Yorkshire	.004	.004	.007	.006	.004	.003	.005	.005
Strathclyde	.005	.004	.003	.002	.006	.002	.002	.003
Tyne & Wear	.005	.003	.005	.004	.004	.005	.006	.003
Wales	.005	.004	.004	.004	.005	.004	.002	.003
West Midlands (Metropolitan)	.007	.009	.013	.017	.007	.008	.012	.016
West Yorkshire	.005	.009	.009	.018	.008	.005	.011	.014

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					2014			
East Anglia	.0351	.012	.0147	.0043	.0257	.0103	.0137	.0046
East Midlands	.0234	.0158	.0146	.0096	.0181	.0144	.0133	.0072
Greater Manchester	.0285	.0166	.0164	.0152	.0235	.0143	.0166	.0102
Inner London	.1386	.0473	.0402	.0304	.1094	.0312	.0358	.0254
Merseyside	.018	.0048	.0053	.0058	.0132	.0085	.0079	.0074
Northern Ireland	.0184	.0075	.0101	.0067	.0106	.0091	.0086	.0075
Outer London	.1177	.0442	.0447	.0212	.0955	.038	.0372	.0144
Rest of North West	.0144	.0103	.0098	.0076	.0139	.0081	.0101	.0045
Rest of Northern Region	.0152	.0052	.004	.0021	.0094	.007	.0052	.0024
Rest of Scotland	.0263	.009	.0088	.0012	.0198	.0061	.0094	.0026
Rest of South East	.04	.0163	.0159	.0057	.033	.0133	.0118	.0046
Rest of West Midlands	.016	.0102	.0087	.006	.0171	.0076	.0104	.0047
Rest of Yorkshire & Humberside	.0214	.0109	.0091	.0056	.0147	.006	.0105	.0021
South West	.0279	.0134	.0079	.0032	.0184	.0109	.0087	.0021
South Yorkshire	.0158	.0107	.0112	.0065	.0116	.0075	.0116	.0056
Strathclyde	.0189	.0041	.0059	.0041	.013	.0029	.0059	.0032
Tyne & Wear	.0204	.008	.007	.005	.0139	.007	.0085	.005
Wales	.0158	.0088	.0057	.0028	.0138	.0053	.0048	.0033
West Midlands (Metropolitan)	.0306	.0181	.0264	.0275	.025	.0161	.0233	.0178
West Yorkshire	.0253	.0159	.014	.0159	.0186	.0132	.0167	.0113

The shares presented in this table are constructed from the LFS data from 1994-2018 flowing the definition similar to Borjas 2003 which is the share of foreign-born from a specific gender and qualification level over the total population in each year and region that are under consideration on this paper. The UK is divided into 20 regions in this paper based on the usual resident for the individual.

Table A1:2 the effect of foreign-born male shares on each qualification level wages of native and foreign-born female.

	(1)	(2)	(3)	(4)	(5)	(6)
	The UK white female		***The UK non-white female***		***The foreign born sample***	
Panel A: High Qualification						
	OLS	Heck	OLS	Heck	OLS	Heck
Share of foreign- born male with high qualification	-0.146	0.647	1.740	0.663	-2.378	1.742
	(0.467)	(0.502)	(2.340)	(0.501)	(1.573)	(2.248)
Share of foreign- born male with low qualification	-0.294	-0.898	4.401	-0.940	-1.767	4.375
	(0.343)	(0.945)	(6.494)	(0.944)	(1.141)	(6.239)
Share of foreign- born male with other qualification	-0.285	-0.516	0.532	-0.539	-1.590	0.530
	(0.343)	(0.538)	(0.951)	(0.537)	(1.136)	(0.913)
Share of foreign- born male with no qualification	0.184	0.735	-1.265	0.773	1.052	-1.270
	(0.393)	(0.884)	(1.875)	(0.882)	(1.279)	(0.0179)
N	144,775	213,463	5,266	9,861	22,035	37,719
R-squared	0.192		0.255		0.139	
Chi-square		14788.16		1909.43		3851.50
Selection model						
# of children under 5		-0.107***		-0.148***		-0.285***
		(0.00527)		(0.0213)		(0.0112)
λ		0.639***		0.0766		0.0833**
		(0.0552)		(0.127)		(0.0405)
Selected Observations		144,775		5,266		22,035
Non-selected Observations		68,688		4,595		15,684
Panel B: Low Qualification						
Share of foreign- born male with high qualification	-0.221	1.322	2.026	2.028	0.587	-0.342
	(2,851)	(2.192)	(4.857)	(4.648)	(16,675)	(2.434)
Share of foreign- born male with low qualification	-0.0295	2.203	0.687	0.685	-0.820	-1.397
	(1,819)	(5.915)	(2.416)	(2.312)	(10,637)	(1.805)
Share of foreign- born male with other qualification	-0.0624	0.549	0.157	0.157	-0.230	-0.834
	(1,876)	(0.945)	(1.759)	(1.684)	(10,970)	(1.829)
Share of foreign- born male with no qualification	-0.0954	-1.055	-0.300	-0.301	-0.181	0.344
	(1,656)	(1.824)	(1.436)	(1.375)	(9,685)	(2.120)
N	181,615	304,950	4,472	10,946	10,225	19,662
R-squared	0.260		0.280		0.180	
Chi-square		73665.13		2070.17		2455.01
Selection model						
# of children under 5		-0.257***		-0.243***		-0.368***
		(0.00447)		(0.0202)		(0.0170)
λ		0.0299*		0.000338		-0.0344
		(0.0157)		(0.0747)		(0.0443)
Selected Observations		181,615		4,472		10,946
Non-selected Observations		123,335		6,474		9,437

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			Panel C : Other Qualification			
Share of foreign- born male with high qualification	2.824**	0.951	0.449	0.449	0.0304	-0.562
	(1.347)	(0.571)	(0.886)	(0.777)	(2.218)	(0.664)
Share of foreign- born male with low qualification	1.635	-3.113	0.537	0.497	0.0943	-0.329
	(1.040)	(1.380)	(3.197)	(2.803)	(1.611)	(0.763)
Share of foreign- born male with other qualification	1.686	-2.385	-0.0338	-0.0360	0.0873	-0.299
	(1.033)	(1.068)	(0.422)	(0.369)	(1.617)	(0.760)
Share of foreign- born male with no qualification	-1.301	5.647	-0.207	-0.206	0.392	0.751
	(1.255)	(2.556)	(0.687)	(0.602)	(1.816)	(1.378)
N	40,794	76,305	922	2,737	11,052	26,871
R-squared	0.279		0.306		0.190	
Chi-square		16826.16		417.21		2846.92
Selection model						
# of children under 5		-0.386***		-0.284***		-0.404***
		(0.0114)		(0.0500)		(0.0138)
λ		0.0861***		-0.0306		0.0673*
		(0.0257)		(0.149)		(0.0355)
Selected Observations		40,794		922		11,052
Non-selected Observations		35,511		1,815		15,819
Panel D: No Qualification						
Share of foreign- born male with high qualification	-0.105	-0.587	1.007	1.018	-0.346	-0.322
	(0.948)	(1.021)	(3.505)	(2.989)	(4.176)	(3.904)
Share of foreign- born male with low qualification	0.000423	0.313	2.724	2.871	-0.137	-0.131
	(0.720)	(1.927)	(7.782)	(6.645)	(3.304)	(3.089)
Share of foreign- born male with other qualification	-0.0703	0.0326	-1.918	-1.988	-0.0433	-0.0259
	(0.711)	(1.098)	(5.997)	(5.117)	(3.094)	(2.893)
Share of foreign- born male with no qualification	0.426	0.143	1.357	1.496	0.144	0.115
	(0.850)	(1.818)	(2.443)	(2.109)	(3.933)	(3.678)
N	41,907	118,924	709	3,678	3,649	17,853
R-squared	0.290		0.285		0.240	
Chi-square		18235.64		257.98		1275.24
Selection model						
# of children under 5		-0.407***		-0.378***		-0.366***
		(0.0116)		(0.0560)		(0.0216)
λ		0.0721***		-0.0835		0.0281
		(0.0262)		(0.173)		(0.0590)
Selected Observations		41,907		709		3,649
Non-selected Observations		77,017		2,969		14,204

Standard errors in parentheses ***P<0.01, **P<0.05,*p<0.1. The first section reports the wage equation with OLS and the second step of Heckman estimation. The dependent variable is the log of a gross hourly wage. The variable of interest is the share of foreign-born male; it was constructed based, qualification level, time and region. The controls for time, region, education and age were included in both estimations. The second section reports the participation equation, the first step of Heckman estimation (sample selection). Each panel represent the estimation for the subsample of the white native, non-white native and foreign-born female in each level of qualification.

Chapter 2: Immigration and Trade Creation in the EU

Abstract: After the enlargement of the European Union in 2004, citizens of new EU member states received free access to countries that had been members of the EU for many years. However, in light of this some EU states established a transitional agreement to mitigate immediate immigration into their states, and an agreement was followed for a few years after enlargement, prior to eventually allowing free movement. This chapter considers the difference in time from 2004's enlargement to when free movement was allowed as a natural experiment to examine the effect of immigration on bilateral trade within EU member states. Following previous research, this study employs the gravity model while adding the Difference in Difference estimation to the model and utilising the variation from different points in time to authorise the free movement of immigration from the new EU member to the other EU member states. In accordance with the findings in previous research, the results indicate that immigration has a positive impact on exports and imports, with the effect on import being, to some extent, greater across the majority of the analysis's specifications.

2.1 Introduction

The immigrant population in the European Union (EU) has grown significantly, especially after 2004. Some EU countries were recently listed among the top 10 countries with the largest proportion of immigrant populations. In light of this surge of immigration into the EU states, alongside the impending introduction of new restrictions and policy changes as a result of Brexit, it is essential to analyse the economic consequences of immigration on the EU. Investigating this issue is significant as it enables researchers to evaluate the scale of the impact of immigration on economic outcomes.

The immigration impact has been and continues to be a popular subject of investigation in economics, with a large number of studies analysing their impact on various economic outcomes. However, the research literature on immigration does not sufficiently investigate the relationship between immigration and trade, particularly in the context of the EU, which is very much under-researched in comparison to other contexts. Moreover, according to Eurostat statistics between 2004 and 2018, the volume of exports and imports grew by around 45% within EU member states. To that extent, this chapter notes that the increase in immigration has an effect on the value of trade within the EU. Given that this issue has been under-researched in the EU context, this chapter seeks to address this gap by examining the impact of immigration on bilateral trade in the EU.

The links between immigration and trade have been established in varying ways in the literature[17]. In general, immigration has a positive impact on trade, particularly in relation to exports and imports between the country of origin and the destination country. On the one hand, immigrants' preferences for goods from their home countries will encourage the importation of products from their country of origin, while on the other hand, transaction costs are reduced, which helps in the promotion of trade between the country of origin and the host country. The movement of immigrants alongside international trade between countries has different restriction and criteria[18], which is not the case for the countries within the EU. There is an agreement that allows free immigration between all EU member states, as well as a trade agreement inside the EU region[19].

[17] The Neoclassical theory, under specific conditions, established an indirect link between international immigration and the bilateral trade through the ratio of the endowment needed to produce the goods – capital and labour – in an open economy (Parsons & Winters, 2014). Gould (1994) presents another link between immigration and trade through the direct effect of the benefit of information and networking on the transaction cost of the trade between countries. In another words, immigration flow to the host countries gives easy access to the information needed in an international transaction. Other papers investigate the network effect on international trade (Rauch, 1999, Peri & Requena-Silvente, 2010 and Parsons & Vézina, 2018).

[18] The requirements for granting immigration admission to a country varies. For example, some focus on family reunion and others are based on a points system, among other factors. Similarly, international trade is a subject to different restrictions depending on which trade area or organisation a country is related to such, as the World Trade Organization (WTO) and the North American Free Trade Agreement (NAFTA).

[19] The EU members benefit from trade agreements within the EU as well as trade agreements with other regions, such as the EU trade agreement with the Caribbean (CARIFORUM), which has been provisionally in effect since 2008, and the EU trade relationship with southern African developed countries (SADC), which has been provisionally in effect since 2016, among others. (see appendix A2:1 for more information).

After the 2004 expansion, immigrants from new member states were in principle allowed to freely enter any other EU state. However, new EU members and their citizens did not immediately obtain free access to all states once they obtained membership status; rather, this action took place at different times across different states. This point is very similar to the concept of the Vietnamese Boat people's natural experiment by Parsons and Vézina in 2018 when movements of immigration are motivated by a natural event rather than any economic-related reasons. The natural event in the EU case is the free movement of migrants from the new EU members to the old member states after the restriction has been lifted. This chapter will examine the link between immigration and bilateral trade in the context of the gravity model, using the natural experiment as its form of identification. Moreover, it will adopt the Difference in Difference approach with the Pseudo-Poisson Maximum Likelihood estimation technique. This estimator is simple to implement in the gravity model, but it is rarely applied in the literature or previous research. It will introduce a treatment group based on the time of the policy change in the older EU states. To the best of the author's knowledge, this chapter is the first to use the natural experiment with the difference in difference estimation to examine the impact of immigration on bilateral trade in the EU area. However, to test for the validity of the difference in difference approach, the analysis will utilize the Instrumental variable technique as a robustness test.

The results demonstrate evidence of the positive long-term effects of immigration, exports and import creation, therefore emphasising a powerful channel through which immigration may promote trade. In terms of their connections to their home countries, immigrants are clearly distinguishable from native populations and these connections are sustained by regular information exchanges.

This chapter's remaining sections are organised as follows: the second section briefly reviews the relevant literature, the third section introduces the empirical strategy and data, the fourth section shows the estimation and findings, and the final section, section five, provides a conclusion.

2.2 Previous Studies

The classical theory about immigration and international trade originated from a simple concept, which comes from a country's comparative advantages. Under specific conditions, the trade will be determined according to a country's endowments of production factors, which are usually capital and labour. Under the assumption of free trade between two countries with a similar level of technology, bilateral trade would eventually lead to equal goods prices and factor prices in both countries (Samuelson, 1949). However, if trade restrictions exist between countries, that would lead to unequal goods prices, and the factor prices will also not be equal. Under the assumption of free immigration movement, the factors would move between countries leading to equal factor prices and subsequently, equal goods prices (Robert A . Mundell, 1957). Here, the effect of international immigration on international trade is through the labour supply. In a two-country economic setting, if labour moves to the country with the higher wage, the supply of labour will increase, putting downward pressure on wages in the host country. This will result in a decrease in costs and an increase in production, which in turn will have an impact on exports and imports. This theory was criticised by scholars who argue that the strict assumptions of the neoclassical theory do not correspond to reality.

Another link between international immigration and trade was introduced by Gould (1994). He argues that immigrant labour contribution to international trade does not stop at contributing to the labour supply in the host county. The host country could also benefit from immigrants' links to their home country. Gould adapts two hypotheses to illustrate how immigration could impact international trade. The first is the immigration preference hypothesis. In this case, immigration will increase demand for the goods produced in the home country, which leads to an increase in the imports from the home country to the host country. Gould also highlights the importance of the immigration link in reducing transaction costs as his second hypothesis. He argues that immigration could reduce the communication cost because of the lower language barrier and the cost of obtaining information about their home country's market. The immigration link hypothesis can affect both imports and exports between the host and the home country. Using the gravity model, he estimates separate regressions for exports and imports for

the USA's trade with 47 countries. He found that immigration affects imports and exports in a positive way. His analysis also focuses on different immigrant characteristics such as education and the length of stay in the host country (Gould, 1994b). However, his paper was criticised for its failure to capture the macro trends that could affect trade and immigration. Moreover, the causality effect from immigration to trade was not well established. However, the findings were significant in highlighting the crucial role played by immigrant information in determining bilateral trade flows to the US. The effects of immigrant information can be more significant with respect to the imports and exports of products that are manufactured for consumers rather than producer goods. Compared with imports, exports tend to be more affected by links to immigrants (Gould, 1994b). Nevertheless, a small immigrant community can overcome most of these effects. However, a large community must be in place before the import sector can overcome most of these effects. The findings of this study are highly significant with respect to the preference for home-country products by immigrants within the import sector. In addition, the findings provide some useful insights into the association with immigrants, such as the increase in technology transfer across the globe (Gould, 1994b).

Following Gould's hypothesis about the immigration link, Friedberg and Hunt (1995) investigate the effect of immigration on the bilateral trade of Canada. Employing the gravity model, the authors found a positive relationship between immigration and trade. Their results show that a 10% increase in immigration leads to an increase in exports by 1% and imports by 3%. They avoid one of Gould's shortcomings by adding a time dummy to capture the macro trend.

Rauch's (1999) contributions to this literature were significant. Firstly, he distinguished between the types of goods produced. He classified all goods into homogenous goods, reference goods and differentiated goods. The latter is the one that is mostly affected by immigration in bilateral trade because the information about the price of these goods is not usually available for international commerce, unlike the first two. While Gould's study using bilateral data does not provide a good result but rather than suggestive, Rauch used a gravity model to test his theory. He extended Gould's model by adding a variable for linguistic and colonial links. He found that the coefficient of this variable is small for homogenous goods compared to differentiated goods, which supports the theory that

immigration links do primarily affect the trade for differentiated goods (Rauch, 1999). A study by Rauch and Trindade (2002) explored the immigration link to trade by investigating the effect of ethnic Chinese networks on international trade, using Rauch's (1999) classification for goods. Their results show that ethnic Chinese networking increased bilateral trade more for differentiated products rather than for homogenous products. The authors explained the impact on international trade through the existence of ethnic Chinese networks, which help to match buyers and sellers in the characteristics space. Rauch (1999) also argued that immigrants can minimise transaction costs by creating social networks with their country people in their respective home countries, which is beneficial in supporting trade between the host country and the home country. Social networks assist in matching international sellers and buyers and thus help minimise the transaction costs of a trade. According to the literature, this effect is higher for differentiated goods than for homogenous products that are usually traded through organised exchanges. This is also an important hypothesis that has been tested by previous empirical studies. In this context, White and Tadesse (2007) evaluated the effects of immigration on the reduction of cultural distance, which enhanced trade. Jiang (2007) explored an innovative approach that focused on measuring the role of information via immigrants in the extensive and intensive margins of trade. These studies were significant in revealing empirical evidence that confirmed the positive effects of immigration on bilateral trade between the host and home countries of immigrants.

In this regard, Dunlevy and Hutchinson (1999) highlighted the role of immigrants as a key link to trade between their home and host countries in three ways. First, immigrants might have an interest in the goods produced in their home countries. The presence of an immigrant community, my lead to development of minimum critical mass that develops a specific market for the import of such products. In this context, this interest might also be applicable to finished food and manufactured products. A second link can develop as immigrants explore the opportunities for trade between their home and the host country. In such circumstances, knowledge of product and cost differentials and taste factors related to immigrants can play important roles in promoting the linkage between the two countries, which can be identified as an information bridge. The third linkage concerns the information bridge, which can be identified as the pro-trade effects of ethnic

networks. Immigrants tend to have an advantage because of their mutual understanding of the culture of trust in dealing with pepole who are at home. This can further be understood as a direct implication of ethnic network theory with respect to the international trade of goods. These linkages, such as information, taste and transaction costs, are parallel to the linkages between earlier and later migration with respect to chain migration and the effects of family and friends. In a parallel trend, it is also assumed that the difference between the benchmark group and the actual group is constant over a period and that it can be set based on visual observations. There is also an important reason to anticipate that immigrants who have settled earlier tend to create simultaneously with the purpose of promoting a greater flow of traded goods and a higher inflow of new immigrants. A trade-diverting effect can be identified as a fourth factor in this context. According to the literature, immigrants might influence the host country to manufacture goods that have been imported. This could develop to the degree that immigrants held specialised knowledge regarding the methods or technology used in production or even the extent to which the domestic producers accommodated the taste of the immigrants in home production. This entrepreneurial process could be improved to the extent that capital flows are influenced by immigrants. In light of this understanding, it can be suggested that trade–substitution effects include taste, ethnic networks and information on trade substitution but not trade creation. The posited effects of immigrants on trade are ambiguous.

In this context, Cristóbal (2010) asserted that two channels enable the immigrant population to benefit from bilateral trade between their home and host countries. This includes a set of mechanisms through which these channels operate. First, immigrants have an inclination towards their home country's products, which can be understood as the preferred channel. Second, immigration can minimise the costs of a transaction, which is referred to as the transaction cost reduction channel. This second channel can be identified as twofold because, on one hand, the mechanism of immigration tends to create ethnic networks through business contacts and knowledge and understanding of home-country markets. Immigrants can have an advantageous position regarding dealing with their country people in the home country because of higher trust and a mutual understanding of the culture, which is understood as the ethnic network mechanism. On

the other hand, cultural ties, such as historical colonial associations, common languages, similar preferences, and adequate knowledge of social and political institutions, can play an important role in minimising trading transaction costs. In addition, an immigrant population might cause a reduction in transaction costs by incorporating its knowledge of products in the two countries and their attributes, thereby signifying the information mechanism (Cristóbal, 2010). According to the literature, the significance of the two channels for bilateral trade varies, regardless of the trade flows in exports and imports. The effects of the second channel also vary according to the kind of products being traded and the individual attributes of the immigrants, such as the level of education, business activity or job in the host country, and the home country of the immigrants. These differences can be helpful in determining the mechanism through which the link between trade and immigration is operationalised. Therefore, while the reduction in transaction costs influences exports and imports in the same manner, the preference or taste of the immigrants for products from the home country tends to influence only the exports from the home countries to the host countries of the immigrants. Similarly, a positive effect of immigration can be observed on the exports of the home countries of immigrants, but not on imports. These findings also suggest that immigration influences trade through immigrants' preferences for products from their home countries. If both imports and exports are influenced in a positive manner, but there is a different effect on exports, this preference mechanism would indicate the difference. Additionally, the effect of preference would also be higher on differentiated products than on homogenous products. This is because the reason for the preference of goods sourced from a specific country is negligible with respect to homogenous products compared with differentiated goods, the ideal variety of which might not be available in the local market, so import is required (Cristóbal, 2010). However, in the context of transaction cost reduction, as highlighted by Gould (1994), the additional knowledge brought by immigrants can be more significant for consumer goods than for producer goods because the former tends to be subjected to higher differentiation across different countries. In addition, Dunlevy and Hutchinson (1999) asserted that the purchase of consumer goods and processed food by immigrants tends to have greater effects compared with semi-manufactured or crude products, to the extent that they are imported for the purpose of fulfilling specific preferences. Therefore, if the positive effects of immigrant stock are observed to be

higher for consumer goods than for producer goods, it could be identified that the increase in information about foreign products gained through immigrants caused the underlying mechanism. In this context, the literature also highlights that the place from which immigrants come can also be significant. Some home countries tend to have social and political institutions similar to those in the host country, which is particularly relevant in countries that have a cultural or colonial association, such as those belonging to the European Union, wherein countries have similar economic integration agendas and tend to share similar common institutions. In such cases, immigrants from such countries tend to bring less new information with them compared with those from other countries, thereby making a lesser contribution to the reduction of transaction costs.

Parsons and Vézina (2018) demonstrate the link between immigration networks and trade using the natural experiment of the exodus of Vietnamese boat people to the US. The authors used the exogenous allocation of the 1975 Vietnamese refugees across US states for immigration stocks in 1995 as an Instrumental Variable (IV) to overcome the causality problem and then estimate the effect on exports from 1995 to 2010. They employed a cross-sectional and an IV version of the Pseudo-Poisson Maximum Likelihood estimator (PPML) to determine the effect of Vietnamese migrants on the exports of each US state. They found that Vietnamese immigration had a strong effect on US exports to Vietnam. In addition, the authors addressed some empirical issues such as the direction of the causality, by using a natural experiment in their paper.

Other studies have addressed these issues at the state level in the US. For example, Gove (2017) used a variety of datasets to collect the data at the state level for the US and Mexico. He was able to map the Mexican migrants in the US states to their Mexican states of origin. Gove also focused on the importance of the geographic destination. Using a gravity model to estimate the state-to-state fixed effect, he found that each average additional migrant contributes to the US state exports by $1,984, and to the Mexican state exports by $538 (which is considered as US imports from Mexico).

While the previous research has tried to explore the link between immigration and trade indirectly through the labour supply and directly through the immigration network, other research such as Chaney's (2014) established a strong link between the firm exports and the network. Chaney adopts a dynamic model of formation of an international social

network of import and export. He investigated its effect on French firm exports and found that firms can export only to the market with which they have contact. Although his focus is entirely on social networks and firm contacts, it explains to some degree how immigrants could lower the cost of establishing contacts with the foreign market through their knowledge as was discussed in much previous research.

Lee et al (2014) investigated the effect of cultural inflows on the import of consumer products to Japan. Their study did not include migrants when estimating the cultural effect. Instead, they used foreign media products such as movies and TV productions from the US, Korea and China to determine the cultural effect on Japanese imports from these countries. They found that cultural products from a specific country have a positive impact on the import of some other products such as household and leisure products and a negative effect on the same products from other countries. Although this study takes a different approach to explaining the effect of culture on imports, it does explain the effect on the demand for foreign goods (imports) through the media effect. Immigrant communities who live in a host country could have a stronger cultural effect on the import of similar types of goods. Tadesse B. & White (2010) introduced cultural distance as a determinant of bilateral trade between the US with its 75 trading partners. Moreover, they added the immigration stock from these trading partners' countries in each state and employed the gravity model to estimate the impact of cultural differences on state-level exports. They found that as the cultural difference gap widens between the US and its trading partner, the state-level exports to this country become smaller. However, they found that immigrants have a positive effect on exports, which partially offsets the negative impact caused by cultural differences.

Bandyopadhyay & et al (2008) established a link between ethnic networks and US exports. They used state-level panel data from 1990 to 2000 to implement the fixed effect and a pooled cross-section version of the gravity model. Unlike others, they allowed the network elasticity to differ across countries to identify the differences in network effects across ethnic groups. They found that network elasticity is important for a subset of countries, but not for all of them. They argued that for the countries with statistically insignificant results, the proxy is not ideal for measuring the network effect in those countries, as the number of migrants from those countries is small.

In the literature, the relationship between immigration and EU exports and imports has not been conclusively established. However, several research has investigated the link between immigration and some of the EU members. For instance, Peri and Requena (2010) used individual micro-level transaction data to explore the link between immigrants to Spain and trade, covering the period between 1995 and 2008. Using the gravity model and a variety of empirical methods such as OLS, panel Instrument Variable and Pseudo-Poisson Maximum Likelihood (PPML), they estimated the effect of migrants on Spain's exports. Moreover, they categorised export transactions using two metrics (A) the extensive export margin which is the number of transactions and (B) the intensive export margin which is the average value per transaction. The results from this research demonstrate the evidence of a positive impact of immigrants on exports by increasing the extensive margin. Furthermore, the results support the idea that immigrants reduce transaction costs for differentiated goods through their knowledge, especially of countries that are culturally distant from Spain.

Girma and Yu's (2002) research was one of the first to focus on immigration impact in relation to bilateral trade in the UK. It distinguished between immigration from the Commonwealth and Non-Commonwealth countries and how each affects the bilateral trade of the UK with those countries. Similar to other research from the literature, the authors employ the gravity model using a simple OLS model to estimate the different effects of both groups of immigrants. The authors found that the migrants from non-Commonwealth countries positively affect the bilateral trade between their country and the UK. On the other hand, they found no significant impact of immigration from the Commonwealth countries and the UK's exports and imports. Research by Ghatak & et al (2009) focused on the effect of immigration on the bilateral trade flows between the UK and Central and Eastern European countries. Using panel data from 1996 to 2003, they investigated the effect of immigration from Romania, Bulgaria, Czech Republic, Hungary, Poland and Slovakia on trade with the UK, finding a positive impact on bilateral trade. Subsequently, Ottaviano & et al (2018) have made a contribution to increasing the research taking place in the UK in this area. They address the effect of immigration on the exports, imports and productivity of UK firms in the service industry. They used a simple partial equilibrium model of immigration and international trade in services to estimate

the effect. Their model introduces three types of immigrants' effects on international service trade. First, immigrants increase the productivity of the service sector and reduce costs. Secondly, they reduce the import of intermediate goods because such goods are considered a substitute for the goods imported by UK firms. Finally, by benefiting from immigrants' knowledge, UK firms increase their export to the immigrants' country of origin. Empirical analysis conducted in the study supports the model hypotheses about the various impacts of immigration. Other papers studied this issue in different countries such as Italy, Portugal and Spain (Artal-Tur et al., 2012; Co et al., 2004; Herander and Saavedra, 2005).

Accordingly, then, the research would suggest that immigration mostly has a positive impact on trade. Genç & et al (2011) conducted a meta-analysis to address the impact of immigration on trade using the results of 48 papers. They found that an increase in immigration by 10% leads to an increase in trade volumes by 1.5%.

In the context of this review of the literature, this chapter focuses on the immigration impact on trade creation in the EU area. The 2004 enlargement is used as a natural experiment to measure the impact on trade. This study employs the Difference in Differences (DID) approach with the gravity model to determine the impact of immigration. Although the gravity model has been widely used in the literature, it is often estimated using the Pseudo-Poisson Maximum Likelihood (PPML) or Generalized Least Squares (GLS) estimators. This chapter introduces a different technique to estimate the gravity model through DID. Being an EU member minimises some factors that could affect trade like tariffs and gives this study the possibility to use the enlargement, which led to a sharp increase in the immigrant population from the new to old members, as the key aspect of the DID estimation. It also helps to overcome endogeneity by establishing a clear causal effect of the immigration network on the bilateral trade flow within the area. This chapter is the first to produce evidence from a natural experiment of the causal link between immigration from the EU and bilateral trade within the EU. Additionally, by using the DID, this chapter contributes to the existing literature by introducing this technique to estimate the gravity model. The results of this chapter provide more support for the idea that immigrants are substantially different from local populations with regard to their

connections to their home countries. These links are maintained via a shared language and regular information exchanges.

2.3 Trade and gravity model

The gravity model theory is derived from the 1687 notion of Newton's law of universal gravitation. Anderson (1979) was one of the first economists to establish a theoretical economic basis for the gravity equation. Since then, the idea of the gravity model was extensively used in economic contexts, especially when addressing international economic issues. McCallum (1995) has previously used the gravity model in trade, where he utilised the gravity equation to evaluate the effect of national borders on the regional trade pattern between Canada and the United States. His work was questioned by scholars in the way of how borders may affect domestic purchasing patterns. Therefore, the 'border effect' has been one of the most investigated subjects[20]. Anderson and Wincoop (2003) presented a potential answer to the McCallum border puzzle issue. According to their research, McCallum's estimation of the gravity equation is invalid due to the problem of the omitting variable. They developed their arguments using the same dataset as McCallum. By including multiple resistance components, they created a more consistent and effective model, which they then used to solve the McCallum border puzzle. The gravity model is the principal instrument for linking trade and costs. As mentioned earlier in the previous studies section of this chapter, a number of studies used the gravity model to explain the relationship between immigration and trade by including the immigration network as one of the factors that could influence the information cost leading to an impact on trade. This was the case with Rauch's (1999) study. A basic trade gravity model is presented as follows:

$$Trade_{ij} = \frac{GDP_i GDP_j}{Dis_{ij}}$$

[20] The 'McCullum Border Puzzle' is the name given to a significant number of analyses and publications focusing on the subject of border effects. A study by Cheong et al. (2015) addressed the border impacts on the extensive and intensive margins of trade and concluded that the distance puzzle remains unresolved.

Where $Trade_{ij}$ is the value of bilateral trade between the home country i (country of origin) and the host country j (destination country). $GDP_i \; and \; GDP_j$ are the gross domestic income for the home country and host country, respectively, which represent the national income for each country. Dis_{ij} is the distance between both countries. This trade gravity model establishes a relationship between the GDP of two countries, a measure of their income and degree of development, and the impact of distance as a proxy for trade costs on the volume of trade. The gravity model's theoretical interpretation is strong. According to Yotov et al (2016), at least five noteworthy points may explain the trade gravity model's enormous success and attraction: (1) it is an intuitive model; (2) it has a solid theoretical foundation; (3) it reflects a feasible general equilibrium system; (4) it has a flexible structure which means that these frameworks are incorporated into a large class of general equilibrium frameworks that examine the relationship between trade and labour markets etc; (5) the predictive ability is one of the gravity model's most appealing properties. This chapter follows the literature and implements a version of the trade gravity model to explain the relationship between EU immigration and bilateral trade.

2.4 Empirical strategy and data

For the empirical evaluation of the effect of immigration on trade creation in the EU, this chapter uses the Difference in Difference (DID) approach with the simple gravity model framework. Using the DID to examine trade creation is not common in the literature since it requires a specific application setting. The study by Wolf and Ritschl (2011) is one of the very few studies that used the DID with the gravity model for international trade data to evaluate the effect of change in current policy on trade creation. The authors introduce a group-specific fixed effect to DID in order to identify and estimate the policy treatment impact. Similarly, this section starts with the basic empirical form of the trade gravity model that is presented in the following equation:

$$lnX_{ijt} = \beta_0 + \beta_1 lnIMMI_{ijt} + \beta_2 lnZ'_{ijt} + \varepsilon_{ij} \qquad (2:2)$$

Where X_{ijt} is the export and import from country *i* to country *j* at time t. $IMMI_{ijt}$ is the immigration population from country j to country i at time t[21]. Z'_{ijt} is a set of control variables for both countries at time t.

The DID methodology in general is a way to examine the difference in the outcomes between two groups for the same time period to test a new policy effect. These two groups are the treatment and control groups. In the first period, both groups' outcomes were not affected by the new policy because it was not implemented yet. In the second period, the policy will take place. Then the treatment group will include only the individuals who were exposed to the new policy, while the control group will include the individuals who were not exposed to the new policy. A key assumption is that the two groups share a common trend; hence, in the absence of any treatment, the dependent variable should evolve similarly in both groups. This is known as the parallel trend hypothesis. However, because a treatment affects the treated group, the evolvement varies. The issue is that the effects of post-treatment cannot be observed. However, the point may be determined using the parallel trend assumption, and the effect of the treatment can then be estimated.

This section applies DID methodology with multiple time periods and groups. Bertrand et al (2004) introduce the multiple groups and time periods in DID estimation. The authors argue that by using the standard DID, all uncertainty in inference will be in the error term for estimating the mean of treatment and control group in each period, and the policy effect will have the same mean responses since it is identified by two time periods for both groups. Following their general framework, first, a full set of time and country dummies for both groups were added. The dummy that measures the effect of the policy in this approach will be a binary dummy that equals to one for the treatment group countries after the policy takes place. Additionally, a continuous variable is included, which allows for precise immigration effect measurement. The equation for this specification is:

$$Y_{ijt} = \beta_0 + \tau_t + \alpha_j + \beta_1 2Time * Treat_{ijt} + \beta\, Z_{ijt} + \varepsilon_{ijt} \ldots\ldots (2:3)$$

[21] In the literature, when examining the influence of immigration on labour market outcomes, the immigration variable is used as lagged accompanied by the instrumental variable method to prevent endogeneity and bias estimate results. Nonetheless, analysis in the present study addresses these issues by utilising the DID method and the natural experiment event. In addition, the strategy of delayed immigration is less prevalent in the literature on immigration network impact.

Where i is the individual index, j is the treatment group index and t is the time index. τ_t& α_j are the full set of time and treatment group effects, respectively. $2Time * Treat$ is the time and treatment group covariant. $Z_{ijt}$is a set of control variable covariants[22].

2.4.1 The natural experiment

This chapter focuses on measuring the immigration impact on trade creation in the EU area. Accordingly, this section describes the chronology of events involving the immigration movements at various points in time following EU enlargement. The countries included are members of the EU union. The EU enlargement in 2004 caused a major increase in the number of immigrations from new EU members states[23](EU-13) to the other EU members (EU-15)[24]. This study is using the enlargement as a natural experiment of increasing the immigration population. According to the EU's official website, not all countries allowed free movement after the enlargement. Only three countries of the EU-15 allowed free access for immigration from the EU-10 immediately in 2004, which are the UK, Sweden and Ireland. The rest of the EU-15 had a transitional agreement that restricted the access of immigration from the EU-13 to these countries. This transitional agreement was lifted at some point after the enlargement. Greece, Spain, Italy, Portugal and Finland started allowing free access by 2006, followed by Luxembourg and the Netherlands in 2007, France in 2008, Belgium and Denmark in 2009, and the last countries to allow free access were Germany and Austria in 2011. This difference in time when EU-15 members applied the free access policy gives this study an opportunity to explore the difference in the bilateral trade volume with the EU-13 of the EU-15 countries that applied the policy vs. the countries that did not. Examining this dichotomy provides a useful context to measure immigration impact on trade.

[22] See Bertrand et al. (2004) for more details of this model.
[23] In 2004 the Czech Republic, Cyprus, Estonia, Latvia, Lithuania, Hungary, Malta, Poland, Slovenia and Slovakia joined the EU as new members (EU-10), and in 2007 Bulgaria and Romania also became new members of the EU (EU-2).
[24] The (EU-15) refers to the EU countries who were members of the EU union before 2004, these are: (Austria, Belgium, Germany, Denmark, Greece, Spain, Finland, France, Ireland, Italy, Luxembourg, Netherland, Portugal, Sweden, United Kingdom).

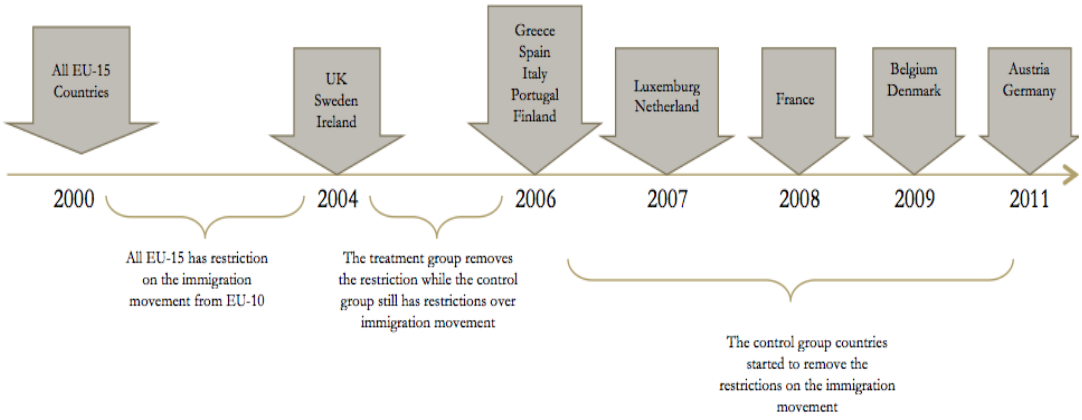


Figure 4: The timeline showing the years in which each country of the EU-15 lifted the movement restrictions on immigration.

As countries opened their borders at different points in time, this section argues that the immigration movement to the host EU country is exogenous and uncorrelated with immigrants' choices and economic opportunities related to trade with their home country. Moreover, using the fixed effect in the model specification means that the distribution of immigration is exogenous, conditional on the fixed effect, which implies looking for variations that "with in" from one period to the other period conditional on time FE; hence, the variation in immigration is conditionally exogenous. This siting will be implemented in the trade gravity model by the DID approach, as discussed earlier, to get the causal effect of immigration to trade. Using the above DID specification of the gravity model yields the following equation:

$$lnX_{ijt} = \beta_0 + \beta_1 2time * Treat_{ijt} * lnIMMI_{ijt} + \beta_2 lnZ'_{ijt} + \propto_i + \tau_t + \delta_j + \varepsilon_{ijt} \quad (2:4)$$

Where X_{ijt} is the export and import from country *i* to country *j* at time *t*. i in this equation refers to the countries of origin of immigration which are the EU-13. *j* corresponds to the EU-15 countries, which are the destination (host) countries. $2time * Treat * lnIMMI_{ijt}$ is the variable of interest that measure the effect of immigration on trade after the country allowed free immigration movement. Z'_{ijt} is a set of control variables for both the countries of origin and destination countries, including the GDP and population for both countries and the distance between them. $\propto_i, \delta_j, \tau_t$, are a set of dummy variables

representing the country-specific controls for the country of origin and country of destination and time-fixed effect, respectively. ε_{ijt} is the error term. The identification strategy of the policy effect in panel data siting of the gravity model is straightforward, even though it is commonly unspecified throughout the literature. Specifying group-specific fixed effects and employing DID estimation is a useful method for identifying within-variation. In this case, this is represented by $2time * Treat_{ijt}$ that can take the value of 1 of the country in the treatment group and 0 in the control group. This part is explained in detail in the estimation section of this chapter.

2.4.2 Data

This section provides details and context pertaining to the immigrants, trade data and sources. The EU enlargement in 2004 and 2007 caused a major increase in the number of immigrants from the new EU members to the older, member states. In 2004, the Czech Republic, Cyprus, Estonia, Latvia, Lithuania, Hungary, Malta, Poland, Slovenia and Slovakia joined the EU as new members (EU-10), and in 2007 Bulgaria and Romania also became new members of the EU (EU-2).

The data in this chapter was obtained from three different public sources. The bilateral trade data (consistent with exports and imports) was retrieved from the **i**nternational trade in goods and statistics database, which is a part of the official Eurostat databases (OEUD). The data contains annual trade volumes for each EU country with their trade partners since 1988. Additionally, the GDP and population figures for all the countries that were also obtained from OEUD are included in this study. Table 8 reports the summary statistics for these variables for all the countries before and after the first enlargement (more details are available in appendix (A2:3). Because this chapter examines all EU member states, a significant amount of data was missing when the researcher examined the differentiated and intermediate product flows. As a result, the research focused on aggregate trade flows, as these were the only data available from the three sources utilized for the data collection.

Table 8: Summary statistics for all EU-28 countries.

	N	Mean	Sd
Before 2004			
Export in million	5,341	2578.863	7356.314
Import in in million	5,341	2436.69	6972.311
Population	5,341	17395967	21922757
GDP	5,341	347194.82	568589.27
Destination	5,341	867.376	458.599
After 2004			
Export in million	11981	3646.246	10416.982
Import in in million	11981	3554.04	10124.663
Population	11981	17973912	22770680
GDP	11981	479751.43	729526.59
Destination	11981	867.376	458.569

This table include the mean and standard deviation (Sd) for the main variables included in the gravity model in this chapter for all EU-28 country members before and after 2004 enlargement. Covering the period from (1998-2018). The Immigration stock is missing data due to the lack of availability in the sores used in this chapter.

It has always been difficult to obtain data on immigration since there is a lack of availability for both the countries of origin and the countries that are receiving immigrants. To fill in the gaps in the data, three different databases were combined. This allowed the researchers to compensate for the missing values in the individual databases. Thus, the data on immigration was obtained from the international migration databases provided by the Organization for Economic Cooperation and Development (OECD), the official Eurostat database (OEUD) and the Office for National Statistics (ONS). These databases provide the number of immigrants in the receiving country (host country) every year by the country of birth, while also providing details on the immigrants' country of origin. The UK immigration population figures are often missing in both OECD and OEUD databases, therefore this data was replaced with the figures from the ONS. Table (9) presents descriptive statistics of the average number of immigrant stock for EU-15 before and after the enlargement. According to the data in Table (9), the UK is the country that has experienced the biggest immigration stock from the EU-13, with an average of approximately 800,000 immigration stock after 2004. Almost every country in the EU-15 reported an increase in the average immigration stock, with the exception of Greece, which reported an average decline of nearly 8,000 in immigration stock.

Table 9: Average immigration stock from EU-13 to EU-15 before and after the enlargement.

	Before the enlargement		***After the enlargement***			
Over	***Mean***	***Std.DIV***	***Mean***	***Std.DIV***	***Different***	***Significant***
Immigration Population						
AUSTRIA	151715.3	4767.662	201738.5	8106.156	50023.2	*
BELGIUM	23689.75	2743.497	65509.13	6188.204	41819.3	*
GERMANY	384766	71797.43	1437719	97917.47	105295	**
DENMARK	15229.25	370.4694	41733.33	4777.833	26504.1	***
GREECE	22001	12702.28	13978.27	3541.131	-8022.7	-
SPAIN	27383.25	6638.247	105691.1	6141.005	78307.8	***
FINLAND	11104	551.3857	34410	4240.888	23306	*
FRANCE	121850.5	784.7905	134566.1	1247.557	12715.6	*
IRELAND	3184.25	1095.25	112452.5	22278.64	109268.2	-
ITALY	67081.5	3623.65	155207	7262.919	88125.5	*
LUXEMBOURG	1763.25	116.6815	7585.867	791.5174	5822.62	***
NETHERLANDS	26346.5	798.993	91372.2	11437.45	65025.7	**
PORTUGAL	1125.286	885.7153	9062.059	6516.933	7936.7	**
SWEDEN	69785.5	381.6695	108720	6449.004	38934.5	*
UNITED KINGDOM	217000	6137.318	999066.7	105715.1	782066.7	***

This table includes the mean and standard deviation for immigration population from the EU-10 which are (Czech Republic, Cyprus, Estonia, Latvia, Lithuania, Hungary, Malta, Poland, Slovenia and Slovakia) and EU-2 which are (Bulgaria and Romania). Due to the lack of availability at both sites, there is some missing data and the countries with incomplete data were excluded from the analysis.*** p<0.01, ** p<0.05, * p<0.1

2.5 Estimation and the results

2.5.1 The estimation of the gravity model using OLS and PPML

First, this part of the analysis starts with a simple gravity model without the DID specification. It applies a similar estimation of the immigration impact on trade following the precedent set in previous research. Table (10) shows the estimation results for equation (2:5) using a Pseudo-Poisson Maximum Likelihood estimator (PPML) and (OLS). Compared with OLS, PPML has two major advantages in solving some econometric issues. First, estimates are not affected by heteroscedasticity. Second, it is possible to include zero-trade observations, and the PPML estimator is reliable, with or without the inclusion of zero-trade observations.

$$lnX_{ijt} = \beta_0 + \beta_1 lnIMMI_{ijt} + \beta_2 pop_{it} + \beta_3 pop_{jt} + \beta_4 GDP_{it} + \beta_5 GDP_{jt} + \beta_6 Dis_{ij} + \propto_i + \tau_t + \delta_j + \varepsilon_{ijt} \dots (2:5)$$

Where *pop* is the population of country *i* and country *j* at time *t*. GDP is the Gross Domestic Product in a country to control the country's size. Dis_{ij} is the distance between the capital of country *i* and the capital of country *j*. $\beta_0, \beta_1, \beta_2, \beta_3, \beta_4, \beta_5 \wedge \beta_6$ are the parameters to be estimated. The regressions result in columns 1, 2, 5 and 6 in Table (10) are in line with the previous studies, which find a positive impact on both exports and imports. The countries included in these regressions were the EU-15 as the host countries and the EU-13 as the countries of origin. In these regressions, the immigration stock is the variable of interest, which measured the number of the immigration population from the EU-13 countries to the EU-15 countries each year. Additionally, the regressions in columns 7 and 8 in Table (10) used different measures for immigration, which is the immigration ratio $\frac{immi_{stock_{ijt}}}{pop_{it}}$, where $immi_{stock_{ij}}$ is the immigration stock from the country of origin in the host country each year, and pop_{it} is the number of the population in the host country each year. Using this immigration variable yields similar results in that immigration has a positive impact on exports and imports, even though the results are not significant for exports. The results of the standard gravity model using the PPML, with all controls taken into account, are presented in the first two columns of this table, which cover the period from 2000 to 2017. The outcomes of the controls are, to some extent, in line with expectations. However, if some coefficients are not as predicted, it may be because the country's FE is absorbing their influence. Nonetheless, the distance coefficient is associated with a negative sign across all analysis specifications. The third and fourth columns of Table (10) display the PPML-based estimation results for the period between 2000 and 2006. The outcome of the immigration stock coefficient is marginally greater than the coefficient covering a lengthier time period in the first two columns. The justification is that the sudden increase in immigration following the enlargement is greater than in other periods.

The estimation findings in columns 5 and 6 are the OLS estimation results, which are comparable in terms of the positive impact but have larger coefficient values. The final two columns indicate the estimated findings of PPML for the other immigration measurement, the immigration ratio, as described previously. This result is significantly greater than the immigration stock coefficient estimate. One point worth noting is that the impact of immigration on imports is always recording a slightly higher coefficient

value across all specifications in this table. This means in this case, the immigrants' preference for their goods is strong.

Table 10: Regression results for the trade gravity model using PPML and OLS for exports and imports (2000-2017).

	PPML				OLS		PPML	
VARIABLES	(1) Ln(Export)	(2) Ln(Import)	(3) Ln(Export)	(4) Ln(Import)	(5) Ln(Export)	(6) Ln(Import)	(7) Ln(Export)	(8) Ln(Import)
Ln(IMMI stock)	0.00651***	0.0110***	0.00742***	0.0132***	0.135***	0.221***		
	(0.00057)	(0.00085)	(0.00096)	(0.00140)	(0.00984)	(0.0142)		
Immigration ratio							1.185***	1.855***
							(0.257)	(0.338)
Ln (GDP_org)	0.0446***	0.0299***	0.0283**	-0.0156	0.859***	0.573***	0.0589***	0.0363***
	(0.00520)	(0.00682)	(0.0111)	(0.0163)	(0.0887)	(0.128)	(0.00490)	(0.00700)
Ln (GDP_dis)	-0.000946	-0.000464	-0.000781	-0.000694	-0.00944	-0.00512	0.00273	0.00556**
	(0.00157)	(0.00194)	(0.00262)	(0.00360)	(0.0325)	(0.0467)	(0.00179)	(0.00279)
Ln (pop-org)	0.0208*	0.0391**	0.0205	-0.0233	0.589***	1.104***	0.00275	0.0305
	(0.0113)	(0.0168)	(0.0593)	(0.122)	(0.214)	(0.308)	(0.0130)	(0.0199)
Ln (pop-des)	-0.0421*	0.0537	0.142	0.115	-1.310***	0.152	0.0724***	0.244***
	(0.0229)	(0.0387)	(0.103)	(0.169)	(0.312)	(0.448)	(0.0246)	(0.0424)
Ln(distance)	-0.0478***	-0.0509***	-0.0459***	-0.0496***	-0.967***	-1.011***	-0.0628***	-0.0702***
	(0.00153)	(0.00197)	(0.00258)	(0.00330)	(0.0226)	(0.0325)	(0.00143)	(0.00178)
Constant	3.246***	1.312*	0.122	1.632	31.07***	-2.029	-0.875	1.650***
	(0.488)	(0.781)	(2.074)	(3.403)	(7.056)	(10.15)	(0.674)	(0.406)
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Origin FE	YES	YES	YES	YES	YES	YES	YES	YES
Destination FE	YES	YES	YES	YES	YES	YES	YES	YES
Observations	1,849	1,849	660	660	1,849	1,849	1,849	1,849
R-squared	0.858	0.833	0.856	0.816	0.861	0.839	0.905	0.936

*Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1, this table includes the results of the bilateral estimation for the EU-15 with EU-10 during the period of (2000-2017) for all estimations (except column 3and 4 the estimations are for the period between 2000-2006, since the EU-15 country started to lift the transitional agreement around 2007) (Malta and Cyprus were excluded) from the data because free access was available to the EU-15 since 2004).*

2.5.2 The difference in difference estimation using OLS and PPML

The main regression specification in this study applies the DID estimation in the gravity model that was introduced in equation (2:4). The DID is generally the difference in the outcome before and after the enlargement and between the treatment and control groups. In order to effectively examine the influence of immigration and provide a warmup for the remaining analysis, the analysis started with using a short period of time between the (2000-2006). Using this short period will limit the treatment group to the 3 countries that opened their border for immigration from the EU-13 in 2004. The

treatment group here (from the EU-15) are the UK and Sweden[25]. The control group includes the rest of the EU-15 countries. From 2000 to 2004 (the enlargement), both groups had a restriction on immigration movement, and from 2004 to 2006 the treatment group removed the restrictions while the control group still applied it (see Figure 4). The reason for beginning the DID analyses with such a short period of time is to adhere to the traditional application for DID, which consists of two periods of time, before and after 2004. After 2006, other EU-15 countries will begin to open their borders, so the before and after periods will be at different points in time. However, applying this to the bilateral trade data means every treated country has a set of links with the other countries, so it involves all treated countries with the other countries. In this case, the identification of a country within the treatment group is based on its relationship with all other countries; hence, the fact that the number of immigrants from the EU-13 varies as the identification for the treatment group.

Starting with the basic regression (2:6) without the control variables, columns 1 and 4 reports the outcome of the DID estimation after adding the host country, country of origin and time-fixed effect. The result is different for imports and exports. The DID variable shows the effect of removing the immigration restrictions policy on exports and imports[26], which is negative for exports and not significant for imports. This implies that applying the policy of free movement decreases exports by 3% at the 1% significance level, while showing no effect on imports. This is the effect of the policy. However, reporting a negative sign in this coefficient or the inconsistency of policy DID outcome sign is expected because it is a binary variable, which has a high chance of getting absorbed in the destination country FE that added in all of the regression.

The main interest of this chapter is the effect of immigration on trade creation, hence the variable of interest in Table (11) is DID*log (IMMI-stock) which captures the difference in difference by adding to the previous DID variable, that is, the difference between the

[25] Ireland was one of the countries that allowed free movement after 2004 but the data was not available for immigration movement by country of origin, hence it was excluded from the analyses.

[26] The DID variable displays the shift that occurred in the EU-15's export and import numbers after the EU-13 became a member state in 2004 in comparison to the numbers that existed prior to enlargement. When comparing before and after results, the average percentage change in export and import to and from the EU-13 for the treatment group was subtracted from the average percentage change in export and import from the EU-13 for the treatment group.

immigration stock effect for the treatment and control groups. This coefficient highlights the average impact of immigration from the EU-13 on exports and imports after becoming an EU member, which is then subtracted from the average impact of immigration from the EU-13 on export and import after the enlargement. In Table (11), the measurement of immigration is the immigration stock in the host country (EU-15). Regardless of the specification and trade direction, the estimated coefficients for the immigration impact are consistently positive. Columns 2 and 5 in Table (11) report the estimated coefficients for DID, without adding any controls except for the fixed effect for both host and origin countries and time. At the 1% significance level, the increase of immigration stock by 10% leads to the increase of the imports and exports of host countries by 0.09%. Moreover, when applying the gravity model with the DID specification (columns 3 and 6), the estimated coefficient is significant.

$$lnX_{ijt} = \beta_0 + \beta_1 2time * lnIMMI_{ijt} + \beta_2 lnIMMI_{ijt} + \beta_3 pop_{it} + \beta_4 pop_{jt} + \beta_5 GDP_{it} + \beta_6 GDP_{jt} + \beta_7 Dis_{ij} + \propto_i + \tau_t + \delta_j + \varepsilon_{ij} \ldots (2:6)$$

On the other hand, using the share of immigration to local population is another way of measuring the impact of immigration on trade creation that is used in this section. Table (12) reports the result after following the same estimation process as in Table (11) but using the share of immigration instead of immigration stock. The estimations presented in columns 1 and 3 are mostly about the impact of implementing the free immigration movement policy on the trade outcome. The resulting coefficient is insignificant for the export, yet it is reporting a negative impact.

Table 11: Regression results for the gravity model immigration stock (2000-2006).

VARIABLES	(1) Log(Export)	(2) Log(Export)	(3) Log(Export)	(4) Log(Import)	(5) Log(Import)	(6) Log(Import)
Diff-in-Diff Dummy (DID)	-0.0359***	-0.0418*	-0.0279*	-0.00414	0.0726***	0.0344*
	(0.00563)	(0.0254)	(0.0166)	(0.00631)	(0.0264)	(0.0178)
DID*log(IMMI-stock)		0.00877***	0.00455***			0.00312*
					0.00866***	
		(0.00278)	(0.00174)		(0.00288)	(0.00182)
Ln (IMMI-stock)	0.0272***	0.0275***	0.000427	0.0333***	0.0336***	0.0134***
	(0.00108)	(0.00109)	(0.000923)	(0.00139)	(0.00142)	(0.00140)
Ln (GDP_org)			0.0276*			-0.0169
			(0.0166)			(0.0163)
Ln (GDP_dis)			0.00320			-0.000734
			(0.00387)			(0.00360)
Ln (pop-org)			0.0114			-0.0240
			(0.0826)			(0.121)
Ln (pop-dis)			0.0391***			0.137
			(0.00320)			(0.168)
Ln(distance)			-0.0646***			-0.0495***
			(0.00311)			(0.00329)
Year FE	YES	YES	YES	YES	YES	YES
Origin Country FE	YES	YES	YES	YES	YES	YES
Receiving Country FE	YES	YES	YES	YES	YES	YES
Constant	2.782***	2.781***	2.243*	2.702***	2.701***	1.252
	(0.0122)	(0.0122)	(1.258)	(0.0154)	(0.0155)	(3.376)
Observations	660	660	660	660	660	660
R-squared	0.701	0.703	0.801	0.701	0.702	0.816

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1, this table includes the results of the bilateral estimation for the EU-15 with EU-8 during the period of (2000-2006) since the EU-15 country started to lift the transitional agreement around 2007 (Malta and Cyprus were excluded from the data because free access was available to the EU-15 since 2004).
* The treatment group includes (UK, Sweden), these countries allowed free movement since 2004.
* The control group includes the rest of EU-15 (excluding Portugal and Greece due to the lack of the data for the immigration population).
* All regressions were estimated using PPML.

However, the impact of implementing the free movement policy on import is highly significant and positive. In columns 2 and 4, interestingly, using the immigration ratio instead of stock captures a higher impact of immigration from the EU-13 on the average export and import of the EU-15, to and from the EU-13. Increasing the ratio of immigration to the population by 1% leads to an average positive change in the export of the treatment group by 3% compared to the pre and post-enlargement period. The average change in imports is higher by almost 1%, as the increase in the ratio of immigration to the population in the host country (EU-15) leads to an average positive change in imports by 4%. The results of the analyses so far are in line with the literature,

and it is worth noting that the effect of the EU-13 immigration on the EU-15 imports is slightly higher than their impact on the exports. In addition, the control variables of the trade gravity model, ones associated with a significant coefficient, are as anticipated, reporting a negative impact for the distance variable and a positive impact for the other GDP and POP variables.

The preliminary analysis results of this section provide an indication of how immigration could affect bilateral trade using the standard 2 periods, 2 group DID specification. Moving forward, the analyses will keep going by putting the DID through multiple time periods to use the natural experiment method in the upcoming section.

Table 12: Regression results for the gravity model using the immigration ratio (2000-2006)

VARIABLES	(1) Log(Export)	(2) Log(Export)	(3) Log(Import)	(4) Log(Import)
Diff-in-Diff Dummy (DID)	-0.00565	-0.0150***	0.0346***	0.0111*
	(0.00635)	(0.00469)	(0.00831)	(0.00624)
DID*Immigration ratio		3.203*		4.533**
		(1.768)		(1.827)
Immigration ratio	10.48***	2.222***	12.55***	5.569***
	(2.095)	(0.722)	(1.580)	(1.486)
Log (GDP_org)		0.0283*		-0.00226
		(0.0165)		(0.0175)
Log (GDP_dis)		0.00271		-0.000115
		(0.00376)		(0.00362)
Log (population-org)		0.0158		-0.0660
		(0.0824)		(0.127)
Log (population-dis)		0.0389***		0.278
		(0.00308)		(0.178)
Log (distance)		-0.0658***		-0.0683***
		(0.00285)		(0.00248)
Year FE	YES	YES	YES	YES
Origin Country FE	YES	YES	YES	YES
Receiving Country FE	YES	YES	YES	YES
Constant	2.924***	2.187*	2.912***	-0.625
	(0.00736)	(1.255)	(0.0127)	(3.521)
Observations	660	660	660	660
R-squared	0.850	0.801	0.318	0.805

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1, This table contains the results of the bilateral estimation for the EU-15 with the EU-8 during the period of (2000-2006), since the EU-15 countries began to lift the transitional agreement around 2007 (Malta and Cyprus were excluded from the data because free access has been available to the EU-15 since 2004). The treatment group includes the UK and Sweden. These countries have allowed free movement since 2004. The control group includes the rest of the EU-15 (excluding Portugal and Greece due to the lack of data for the immigrant population). All regressions were estimated using PPML.

2.5.3 Time variant DID estimation using the PPML

This section of the analysis will apply the DID estimation with a different specification. This section's specification is the primary specification for this chapter. First, the time period in this part is extended until 2017. As explained previously, each country of the EU-15 removed its immigration restrictions at a certain point of time that is different among the EU members (see Figure 4). Therefore, the DID was constructed in such a way to include each country in the year when the policy of the free movement was implemented. This was done by having a dummy variable that equals to zero if the host country does not allow free movement during that year or before and equal to one for

the years after allowing the free movement of immigration[27]. This design was intended to capture the policy effect on trade creation. Moreover, adding the immigration stock to this specification will capture the average effect of immigration on the trade creation for the countries included in this section of the study, and extend the timeframe compared to the previous step. Since this part involved an extended time frame, the treatment group will include all of the EU-15 after 2011, which was the last year in which the last group of EU-15 countries allowed unrestricted EU-13 immigration movement to them (Austria and Germany). The variation between the time of free access and the number of immigrants moving to the EU-15 in a bilateral data environment (as DID) is the straightforward method of identification[28]. Table (13) shows the clear result of the estimation using this approach. Column 1 and 4 demonstrates the result of the policy implementation, which is negative for export and positive for import (although not significant for import). In models 2 and 5, the whole trade gravity model was estimated utilising immigration stock as the measurement for immigration. The immigration effect coefficient for this model is determined by the interaction between the immigration stock variable and the time of implementing the policy variable (Ln (IMMI-stock) * Dummy of country by period of free access). The impact is positive and significant for both exports and imports. However, the value of the coefficient is smaller than the one estimated in Table (11) as expected with the longer period of time estimated. In addition, utilising the immigration ratio in models 3 and 6 resulted in greater value than model 2 and 5. Where a one percent rise in the immigration ratio results in an average increase of 0.6% for exports and 1.4% for imports. In this section of the analysis, the gravity model's control variables are consistent with the prior estimation results.

This part confirms the findings in previous studies that immigrants moving to the host country enhances the bilateral trade between the country of origin and the host country. Additionally, this empirical approach overcomes the problem of endogeneity of the causal direction of the effect of immigration on tread creation, which is a problem associated with immigration impact studies. The natural experiment is one approach that has been used to

[27] In this specification, if the host country (EU-15) does not allow free movement, it will be considered in the control group and as soon as it removes the restriction at a certain point between 2004 and 2011, it will be in the treatment group.

[28] The country of origin and country of distention sets of the FE together with the dummy variable for the time when the free movement policy was adopted are implementing the DID estimate as a natural experiment.

address the endogeneity issue in prior studies(Parsons & Vézina, 2018). As previously stated, in this chapter, enlargement is used as a natural experiment (i.e., an exogenous shock to immigration flow) to avoid the endogeneity problem, which is reverse causality, and to identify the causal effects of immigration on trade. In addition, the DID is a quasi-experimental method used to analyse the differences in outcomes between a treatment group and a control group, which assists in identifying causal effects.

Conversely, the immigration from the EU-13 and moving to the EU-15 countries after the border was opened for them is simply because they can inter, even though they would prefer to move earlier, they were not allowed. As a result, the increase in immigration numbers from the EU-13 into one of the EU-15 countries in this sitting is because the border was open for them at a certain point of time, which is considered through the dynamic DID used in this section. By tying the cause of the immigration movement to an open border as a natural experimental explanation for the increasing number of immigration, the results of this section demonstrated the direction of the effect of immigration stock on bilateral trade. Some may argue that immigration to one of the EU-15 countries is still motivated by the pursuit of a better standard of living, and this could be true. After EU-13 joined the EU, immigration from the EU to one of the EU-13 had not changed as significantly as it has for the EU-15 (see Appendix (2:4). Therefore, the study proceeds into the next section by introducing a well-known strategy for investigating this issue further and as a sensitivity check for the main estimation results.

Table 13: Estimation results of the DID trade gravity model using the immigration stock and immigration ratio (2000-2017).

VARIABLES	(1) Log(Export)	(2) Log(Export)	(3) Log(Export)	(4) Log(Import)	(5) Log(Import)	(6) Log(Import)
Dummy of country by time of free access	-0.00664*	-0.0258***	-0.00182	0.00306	0.0252***	0.00619**
	(0.00383)	(0.00578)	(0.00195)	(0.00368)	(0.00703)	(0.00270)
Ln(IMMI-stock) * Dummy of country by time of free access		0.00230***			0.00111*	
		(0.000593)			(0.000735)	1.427***
Ln(IMMI- ratio) * Dummy of country by time of free access			0.565*			(0.522)
			(0.328)			
Log (IMMI-stock)	0.0269***	0.00154**		0.0326***	0.00285***	
	(0.000721)	(0.000700)		(0.000784)	(0.000865)	
Immigration ratio			1.126***			2.900***
			(0.311)			(0.514)
Log (GDP_org)		0.0486***	0.0545***		0.0346***	0.0286***
		(0.00815)	(0.00457)		(0.00854)	(0.00607)
Log (GDP_des)		0.0139***	0.000525		0.0108***	0.00523***
		(0.00289)	(0.00150)		(0.00215)	(0.00199)
Log (population-org)		0.00349	0.00355		0.0246	0.0245
		(0.0178)	(0.0123)		(0.0236)	(0.0174)
Log (population-des)		0.0323***	0.0570**		0.0379***	0.192***
		(0.00233)	(0.0232)		(0.00212)	(0.0375)
Log (distance)		-0.0666***	-0.0711***		-0.0621***	-0.0730***
		(0.00165)	(0.00152)		(0.00206)	(0.00171)
Year FE	YES	YES	YES	YES	YES	YES
Origin Country FE	YES	YES	YES	YES	YES	YES
Receiving Country FE	YES	YES	YES	YES	YES	YES
Constant	2.807***	2.129***	1.892***	2.729***	1.799***	-0.719
	(0.0108)	(0.367)	(0.491)	(0.0109)	(0.459)	(0.773)
Observations	1,849	1,849	1,849	1,849	1,849	1,849
R-squared	0.657	0.887	0.871	0.706	0.880	0.898

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. The estimation methods used in this table is the PPML, the first three columns reporting the results for the export DID gravity model using the different point in time of the free access policy implementation and the last 3 columns reports the DID estimation for the using the same time variant policy. The data used is a bilateral data between EU-15 and EU-13 covering the time period covered in this table is between (2000-and 2017).

2.5.4 Multilateral resistance to trad

Anderson and van Wincoop (2003) introduced one of the most commonly used forms of a theory-based gravity equation. In the gravity model, they discussed multilateral resistance, which is an important issue in employing the gravity model. According to their definition of "multilateral resistance," bilateral trade flows between two areas depend on the production of both regions and bilateral trade costs in relation to the trade costs of other countries (MR)[29]. Furthermore, they advised specifying exporter- and importer-specific terms as a function of the economic model's variables in order to limit the computational problems of a structural estimation (2003).

Over time, scholars have developed several strategies for addressing multilateral resistance terms in the gravity model. Baier and Bergstrand (2009) used remoteness indexes, which are built as weighted averages of bilateral distance using GDPs as weights to approximate multilateral resistance. Following this concept in the last decade, the term "multilateral resistance to immigration" has been used to describe the immigration choices of a new country in which to settle. One of the first studies to refer to this term was conducted by Bertoli and Fernández-Huertas Moraga (2013).Bertoli and Fernández-Huertas Moraga (2013). They related the term to "multilateral resistance to trade" in the literature, and they used the same term to explain migration flows between a country of origin and a country of destination, noting that they are dependent not only on the attractiveness of one or the other but also on the options for travelling to other destinations (Bertoli and Fernández-Huertas Moraga, 2013). Hence, the idea of multilateral resistance to immigration depends on the alternatives available for immigration and their suitability[30]. Several studies in the literature have addressed this

[29] As an example of MR, trade between Germany and Spain relies on how expensive it is for one country to trade with the other compared with the cost of dealing with other countries. Consequently, a reduction in the bilateral trade restrictions between Germany and a third country, such as the UK, would decrease Germany's multilateral trade resistance. Although the bilateral trade restriction between Germany and Spain is unaltered, the drop in Germany's MR due to the decline in the UK-Germany bilateral trade resistance results in a redirection of bilateral trade away from Germany–Spain trade towards Germany–UK trade.

[30] Typically, if a person is going to migrate from a country of origin (A) to a country of destination (B), he/she will take into account the alternative destination country (C, D, etc.) and the reason he/she picked country (B) depends on the alternative because he/she did not favour the other choice.

issue using the immigration gravity model to investigate immigration flows to different destination countries (Belot and Hatton, 2012; Czaika and Parsons,2017). Although this chapter applies the gravity model to address the effects of immigration, it is still a trade gravity model. Thus, this section will address multilateral resistance to trade. Following Baier and Bergstrand's (2009) approach, this analysis will add the multilateral resistance term (MRT) to the gravity estimation. First, the MRT term is calculated as follows:

$$MRT_{ijt} = \left[\left(\sum_{k=1}^{N} \theta_{kt} lnDis_{ik}\right) + \left(\sum_{m=1}^{N} \theta_{mt} lnDis_{mj}\right) - \left(\sum_{k=1}^{N} \sum_{m=1}^{N} \theta_{kt}\theta_{mt} lnDis_{km}\right)\right] \quad ..(2:7)$$

where θ refers to a country's proportional share of the global GDP, $GDP_{kt}/_{GDP}$ $GDP_{mt}/_{GDP}$. Dis represents the unit of measure for bilateral distances between EU countries. Then, the MRT is added to the gravity model. As shown in Table 14, Equation (2:6) was estimated after adding MRT using the PPML. In the first two columns, the year* origin FE and the Year*Receiving country FE were added to the gravity model using Anderson and van Wincoop's (2003) method to deal with MR. The results of the export and import estimations were slightly improved. Moreover, the coefficient of the first variable (dummy of country by time of free access) was positive compared with the results shown in Table 13.

However, using this method to capture the MR has been argued to be suitable only for the data set that was used by Anderson and van Wincoop (2003) in their analysis (Baier and Bergstrand 2009). Therefore, as shown in columns 3 and 4 of Table 14, the estimation excluded the origin and destination* year effects and added the MRT that was calculated in Equation (2:7). The results were closer to those in the previous section, with a slight increase in the significance level of the gravity model variable.

Table 14: Estimation results of the DID trade gravity model using the immigration stock and MRT.

VARIABLES	(1) Log(Export)	(2) Log(Import)	(3) Log(Export)	(4) Log(Import)
Dummy of country by time of free access	0.0203***	0.0369***	0.0178***	0.0354***
	(0.00446)	(0.00644)	(0.00441)	(0.00632)
Ln(IMMI-stock) * Dummy of country by time of free access	0.00186***	0.00349***	0.00200***	0.00340***
	(0.000482)	(0.000683)	(0.000474)	(0.000665)
Log (IMMI-stock)	0.00185***	0.00635***	0.00129***	0.00629***
	(0.000511)	(0.000664)	(0.000493)	(0.000645)
Log (GDP_org)	0.0553***	0.0292***	0.0561***	0.0295***
	(0.00545)	(0.00663)	(0.00547)	(0.00662)
Log (GDP_des)	0.0143***	0.0105***	0.0110***	0.00974***
	(0.00209)	(0.00191)	(0.00207)	(0.00188)
Log (population-org)	0.000830	0.0276	-0.000442	0.0280
	(0.0142)	(0.0195)	(0.0141)	(0.0194)
Log (population-des)	0.0331***	0.0424***	0.0365***	0.0431***
	(0.00181)	(0.00189)	(0.00177)	(0.00185)
Log (distance)	-0.0653***	-0.0647***	-0.0693***	-0.0662***
	(0.00148)	(0.00171)	(0.00141)	(0.00162)
MRT			-0.0319***	-0.0453***
			(0.0903)	(0.00305)
Year FE	YES	YES	YES	YES
Origin Country FE	YES	YES	YES	YES
Receiving Country FE	YES	YES	YES	YES
Year* Origin Country FE	YES	YES	NO	NO
Year*Receiving Country FE	YES	YES	NO	NO
Constant	1.892***	-0.719	2.807***	2.729***
	(0.491)	(0.773)	(0.0108)	(0.0109)
Observations	1,849	1,849	1,849	1,849
R-squared	0.871	0.898	0.876	0.886

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. . The estimation methods used in this table is the PPML, the first two columns reporting the results for the export and import DID gravity model using the different point in time of the free access policy implementation adding the MRT , and the last two columns reports the DID estimation for the using the same time variant policy with Year* Origin Country FE and Year* Receiving Country FE . The data used is a bilateral data between EU-15 and EU-13 covering the time period covered in this table is between (2000-and 2017).

2.5.5 The instrumental variable approach with the DID

In this section, the instrumental variable (IV) will be included with the trade gravity model as part of the sensitivity test. The endogeneity problem was explored before in this chapter as a possible concern. This section will address the problem by following the relevant literature. The IV method is a well-known method in the literature for avoiding endogeneity[31]. The IV approach is relevant because it can be used effectively to predict causal relationships between variables when relationships within the dataset are not established or predicted in a controlled environment. In a similar manner, the IV estimation is also adopted when the least squares method does not produce unbiased results, and IV establishes the correlation with the error terms. In this chapter, which examines the effects of immigration on trade, the endogeneity problem of reverse causality is a concern, as previously mentioned. The use of the IV helps in dealing with this problem. Moreover, The IV approach differs from the shift-share design because it focuses on measurement errors and casual interferences, whereas the shift–share design focuses on factors that are responsible for either economic growth or economic decline.

Card (2009) examines the influence of immigration on inequality, where he employed the immigration settlement pattern as a type of identifying information. This section will utilise a form of immigrant settlement across the EU-15 countries prior to 2004 for the IV approach, as a result, the following instrumental variable is produced:

$$immigrationIV = \left\{immi_{stock_{ijt}}/pop_{it}\right\}\left\{immi_{stock_{befor2004ij}}/totimmisto_{befor2004j}\right\} \quad \text{...(2:7)}$$

Whereas the first part $\left\{immi_{stock_{ijt}}/pop_{it}\right\}$ presents the immigration ratio utilised earlier, and the second part is a component of $immi_{stock_{befor2004ij}}$ which is the total immigration stock from the country of origin (one of the EU-13) before 2004 to a country of destination i, and $totimmisto_j$ which is the total immigration stock from the country of origin j before 2004. Immigrants are known to migrate toward country-specific settlements[32] and

[31] Other studies employed different IV method to solve endogeneity see (Damm, 2009; Ottaviano and Peri, 2006).

[32] Several studies in the literature describe the historical settlement of immigration from a particular country to a specific area or city in the host country, such as the research by Goode et al. (2002) that discusses Arab immigration in Detroit. Nevertheless, this chapter applies the IV method to the trade gravity model on a bigger scale based on immigration and settlement history. Where instead of utilising the historical settlement in a city or area, the historical settlement of immigrants from EU-13 to EU-15 prior to 2004 will be utilised.

employing this instrument helps to capture the influence of immigration on trade by using the early immigration settlement as the IV instead of the immigration stock to avoid endogeneity issues. The estimation of equations (2:5 and 2:6) using the IV specification in equation (2:7) to instrument the immigrants' stock using the IV method is presented in Table (15). The first two columns (1,2) include the estimation of the basic gravity model for export and import, respectively, expressed by equation (2:5). The findings are similar to those in Table (10). Additionally, columns (3 and 4) presenting the estimation of the second-stage results of applying the DID with the IV for the exports and imports. This section begins by generating the *immigrationIV* variable, which is then multiplied by the (Dummy of country by period of free access) to yield the (immigrationIV * Dummy of country by period of free access) variable, which was used to instrument the (Ln (IMMI-stock) * Dummy of country by period of free access) variable in equation (2:6). These estimates provide comparable findings to those presented in the table (13). The results of this section confirm the causal positive impact of immigration from the EU-13 on the export and import of the EU-15 to and from the EU-13. An increase in immigration in one of the EU-15 countries after it allows free movement boosts exports and imports by 0.5 and 0.9%, respectively. Panel B in Table 15 shows the post-estimation diagnostic F-statistic in the first stage of the regression analysis. The F-statistic reports highly significant results. Moreover, the indicator " 2SLS relative bias at 5%" reports the value of 16.38, and the F-test value in all estimations was greater than 16.38, indicating that the instrument applied in the first stage was not weak.

Table 15: The estimation results of the trade gravity model and the DID gravity model using the IV approach.

VARIABLES	(1) Log(Export)	(2) Log(Import)	(3) Log(Export)	(4) Log(Import)
Dummy of country by time of free access			-0.424***	0.617***
			(0.116)	(0.168)
Ln (IMMI-stock) * Dummy of country by time of free access			0.0514***	0.0895***
			(0.0140)	(0.0203)
Ln (IMMI-stock)	0.176***	0.260***	0.105***	0.199***
	(0.0379)	(0.0573)	(0.0114)	(0.0151)
Ln (population-org)	0.656***	1.328***	0.204	0.655**
	(0.253)	(0.383)	(0.219)	(0.317)
Ln (population-dis)	-0.353	1.641**	0.775**	3.066***
	(0.425)	(0.643)	(0.335)	(0.485)
Ln (GDP_org)	1.115***	0.619***	0.960***	0.469***
	(0.0856)	(0.129)	(0.0845)	(0.122)
Ln (GDP_dis)	0.0153	0.0594	-0.00634	0.103*
	(0.0438)	(0.0663)	(0.0369)	(0.0535)
Ln (distance)	-0.987***	-0.987***	-1.292***	-1.377***
	(0.0611)	(0.0924)	(0.0227)	(0.0328)
Year FE	YES	YES	YES	YES
Origin Country FE	YES	YES	YES	YES
Receiving Country FE	YES	YES	YES	YES
Constant	2.372	-31.04***	1.142	-32.65
	(6.261)	(9.468)	(6.352)	(9.197)
Observations	1,849	1,849	1,849	1,849
R-squared	0.846	0.818	0.746	0.715
Panel B				
First-stage f-test	49.8022	49.8022	50.0572	50.0572
P value	0.0000	0.0000	0.0000	0.0000
2SLS relative bias at 5%	16.38	16.38	16.38	16.38

The numbers included in parenthesis represent robust standard errors; * denotes statistical significance at the 10% level, ** at the 5% level, and *** at the 1% level. The estimation methods used in this table are the two stage IV regression, the results reported in this table are for the second stage, the first two columns reporting the results for the export and import gravity model using the $immigrationIV$ to instrument *(Ln (IMMI-stock))* and the last 2 columns reports the DID estimation for the export and import gravity model using the *(immigrationIV * Dummy of country by period of free access)* to instrument *(Ln (IMMI-stock) * Dummy of country by time of free access)*. The data used is a bilateral data between EU-15 and EU-13 covering the time period covered in this table is between (2000-and 2017).

2.6 Conclusion

This chapter's objective was to determine to what degree, in the context of accession of new countries to the EU, immigration from the new EU states had an influence on exports and imports from and to the old EU's markets, by analysing data on bilateral trade within the EU from 2000 to 2017. This chapter has extended the previous studies on the relationship between immigration and bilateral international trade by the use of the DID estimator. Moreover, it models the influence of the immigrant communities (network) in the host country on the bilateral trade with the country of origin. This study used the EU enlargement in 2004 as a natural experiment to establish a causal effect from immigration to international trade. The immigration stock and immigration ratio were used as measures of immigration. First, the result of immigration impact was similar to the findings in the previous studies where immigration was found to have a positive impact on both exports and imports. However, the results are relatively small compared to the previous studies when using the immigration stock, while they become closer when using the immigration ratio. Additionally, this study extended the use of the DID analysis for more than two time periods and multiple groups.

In addition, the instrumental variable (IV) methodology was utilised in combination with the DID for robustness check and to account for any endogeneity issues if they presented in the primary estimations using the DID method. The estimated coefficients in all the specifications move in the same direction as earlier research, indicating that immigration positively affects bilateral trade. The findings of this chapter showed that immigration from new EU countries had a positive effect on imports and exports, with a larger effect on imports. According to the results shown in Table 13, a 10% rise in the immigration stock from the new EU country in old EU countries resulted in an average rise of 0.02% in exports and an increase of 0.01% in imports (the effect in this case was not highly significant). However, the immigration ratio had larger coefficient values; a 1% rise in the immigration ratio resulted in export and import increases of 0.5% and 1.4%, respectively. Using the IV estimator to examine the impact of immigration stock on exports and imports yielded comparable results. According to the results shown in Table 15, a 1% increase in immigration stock corresponded to a 0.05% increase in exports and a 0.08%

increase in imports. On the other hand, the results indicate a marginally negative impact of applying the policy of free immigration movement on export only. One way to interpret this result of the policy variable is that the free movement policy increases the amount of immigration in the host country, which could lead to a reduction in the demand for the host country's goods (export) in the country of origin's market. Another way to interpret this negative impact is related to the estimation issue where the argument is that the impact of the policy variable could be observed by the FE. However, according to the findings in this chapter, the impact of immigration on imports is slightly greater than its impact on exports in the majority of estimates. This could be an indicator that the impact of immigration preferences is greater than their network in the EU country. Future research may investigate this association in further depth, by differentiating between the type of goods, as suggested by Rauch (1999). The findings of this chapter are valuable for designing future immigration policies for policymakers, as immigration clearly helps promote bilateral trade in both the home country and host country.

Appendix 2

Appendix (A2:1) A map displaying the trade agreements between the European Union and countries across the world.

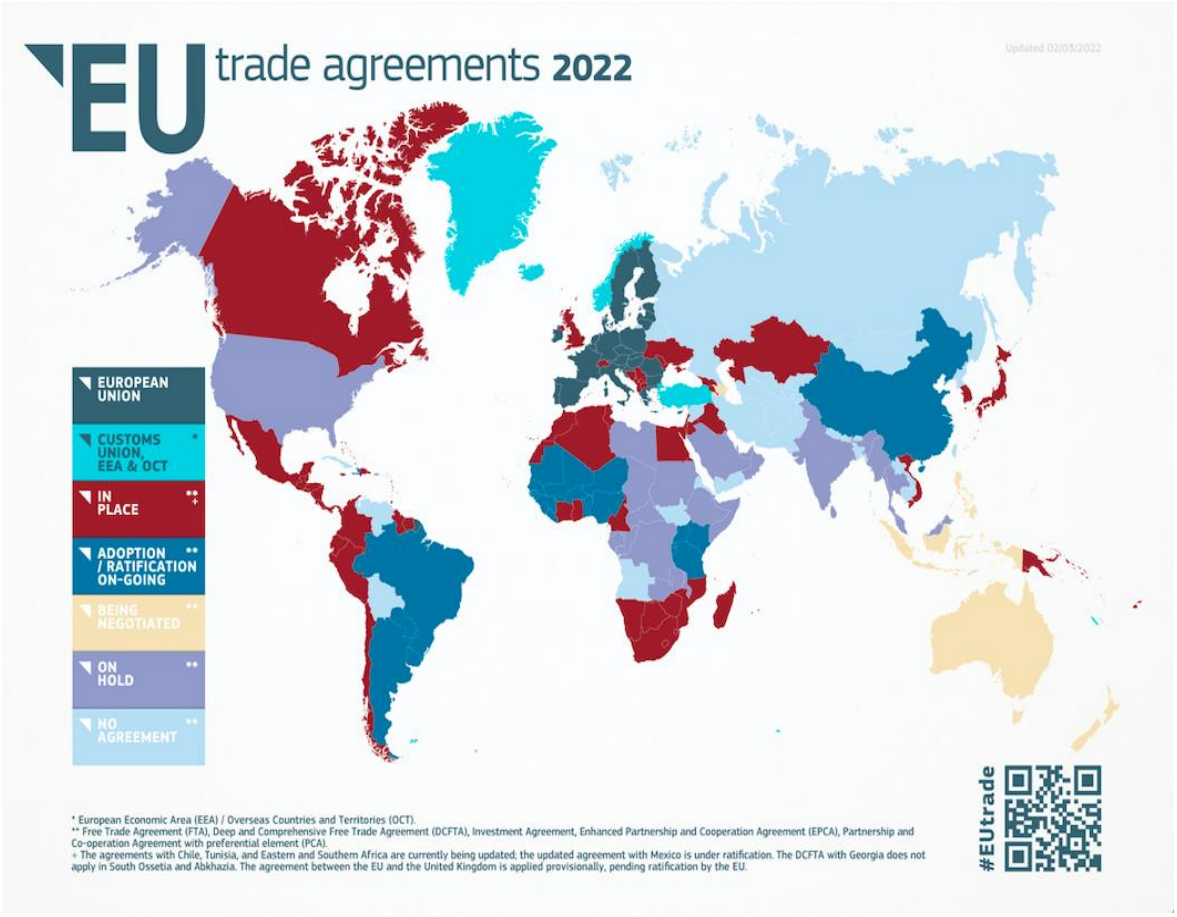


Figure (A2:1) World Map EU Trade Agreement

(source : https://circabc.europa.eu/ui/group/09242a36-a438-40fd-a7af-fe32e36cbd0e/library/0e05d6f3-64f5-4661-ae0c-aefb68094d19/details)

Appendix (A2:2) General concept of difference in differences estimation:

$$Y = \beta_0 + \beta_1 d2Time + \beta_2 dTreat + \beta_3 d2Time * dTreat + \varepsilon ....$$

The Y is the outcome. $d2Time$ is a dummy variable for the second period that captures aggregate factors which could have any effect on the outcome, even if the policy was not implemented. $dTreat$ is a dummy variable for the treatment group that captures any difference between the control and treatment group before the new policy to took place. $d2Time * dTreat$ is the difference in differences and it is the interaction term between the second period time dummy and the treatment dummy, and it will equal to one if the individual is in the second period and in the treatment group. The parameter for the difference in differences $\beta_3$is estimated by the following equation:

$$\hat{\beta_3} = (y_{Treat,2} - y_{Treat,1}) - (y_{control,2} - y_{control,1})$$

Where as $(y_{Treat,2} - y_{Treat,1})$ is the different tin the outcome for the treatment group before and after the policy implemented, and $(y_{control,2} - y_{control,1})$ is the different of the outcome of the control group before and after the policy implemented and the different between these two are presenting the β_3 which is the difference in difference coefficient.

Appendix (A2:3): Summary statistics by each EU-28 country.

	After the enlargement				Before 2004			
EU	Export	Import	Population	GDP	Export	Import	Population	GDP
Austria	3.767e+09	3.247e+09	8.461e+06	316,930	2.561e+09	1.962e+09	8.013e+06	210,697
	(4.904e+08)	(3.351e+08)	(10,553)	(2,151)	(4.658e+08)	(3.049e+08)	(3,778)	(1,228)
Belgium	7.452e+09	8.376e+09	1.096e+07	382,829	5.752e+09	5.986e+09	1.024e+07	252,327
	(6.743e+08)	(7.314e+08)	(16,835)	(2,483)	(6.845e+08)	(7.004e+08)	(5,234)	(1,614)
Bulgaria	5.055e+08	4.076e+08	7.385e+06	39,226	1.605e+08	1.392e+08	8.138e+06	14,742
	(3.368e+07)	(3.123e+07)	(10,396)	(475.7)	(1.715e+07)	(1.468e+07)	(15,449)	(206.1)
Cyprus	2.065e+08	7.090e+07	816,774	18,408	1.251e+08	3.685e+07	687,018	10,501
	(1.573e+07)	(6.728e+06)	(2,478)	(97.49)	(1.193e+07)	(5.398e+06)	(1,508)	(128.6)
Czech Republic	2.943e+09	3.330e+09	1.044e+07	158,799	1.091e+09	9.963e+08	1.026e+07	69,105
	(2.942e+08)	(3.307e+08)	(7,039)	(1,514)	(1.885e+08)	(1.817e+08)	(3,629)	(1,044)
Germany	2.074e+10	2.272e+10	8.184e+07	2.774e+06	1.534e+10	1.599e+10	8.188e+07	2.028e+06
	(1.300e+09)	(1.225e+09)	(42,975)	(17,642)	(1.103e+09)	(1.110e+09)	(47,713)	(12,526)
Denmark	1.893e+09	1.807e+09	5.580e+06	254,98	1.496e+09	1.467e+09	5.289e+06	161,537
	(1.604e+08)	(1.423e+08)	(6,218)	(1,462)	(1.389e+08)	(1.331e+08)	(5,230)	(1,802)
Estonia	3.545e+08	2.550e+08	1.332e+06	18,227	1.412e+08	1.151e+08	1.396e+06	6,168
	(2.315e+07)	(2.077e+07)	(752.5)	(237.9)	(1.969e+07)	(1.470e+07)	(1,487)	(128.5)
Spain	6.094e+09	5.158e+09	4.580e+07	1.067e+06	5.036e+09	3.762e+09	4.059e+07	647,360
	(4.798e+08)	(4.134e+08)	(63,981)	(4,423)	(5.841e+08)	(4.244e+08)	(48,464)	(7,948)
Finland	1.378e+09	1.257e+09	5.373e+06	196,462	9.769e+08	1.108e+09	5.134e+06	123,388
	(1.120e+08)	(8.793e+07)	(4,845)	(1,038)	(8.857e+07)	(8.174e+07)	(4,407)	(1,511)
France	1.284e+10	9.519e+09	6.506e+07	2.069e+06	1.104e+10	9.540e+09	6.018e+07	1.377e+06
	(1.053e+09)	(7.302e+08)	(72,588)	(9,545)	(9.863e+08)	(8.165e+08)	(73,969)	(13,005)
United Kingdom	9.925e+09	6.647e+09	6.323e+07	2.178e+06	8.891e+09	7.279e+09	5.850e+07	1.476e+06
	(7.661e+08)	(4.742e+08)	(103,716)	(12,024)	(7.362e+08)	(5.465e+08)	(45,725)	(25,379)
Greece	1.015e+09	4.336e+08	1.095e+07	200,766	9.743e+08	3.106e+08	1.077e+07	145,285
	(7.350e+07)	(2.762e+07)	(6,473)	(1,080)	(1.022e+08)	(3.231e+07)	(8,844)	(1,596)
Croatia	4.724e+08	2.132e+08	4.261e+06	44,008	2.796e+08	1.190e+08	4.442e+06	24,335
	(3.702e+07)	(1.901e+07)	(3,138)	(219.6)	(3.436e+07)	(1.642e+07)	(9,350)	(299.6)
Hungary	1.968e+09	2.119e+09	9.949e+06	106,987	9.602e+08	9.336e+08	1.023e+07	54,648
	(1.740e+08)	(1.842e+08)	(5,583)	(754.6)	(1.426e+08)	(1.423e+08)	(4,561)	(1,031)
Ireland	1.562e+09	2.371e+09	4.535e+06	216,394	1.444e+09	2.060e+09	3.786e+06	105,728
	(2.043e+08)	(2.038e+08)	(11,739)	(2,921)	(2.865e+08)	(2.653e+08)	(8,742)	(2,246)
Italy	7.880e+09	7.527e+09	5.942e+07	1.631e+06	6.673e+09	6.319e+09	5.695e+07	1.222e+06
	(6.067e+08)	(5.393e+08)	(52,322)	(4,177)	(7.532e+08)	(6.656e+08)	(6,479)	(10,526)
Lithuania	4.598e+08	4.068e+08	3.065e+06	33,071	1.523e+08	1.082e+08	3.519e+06	11,897
	(3.125e+07)	(2.668e+07)	(9,227)	(393.5)	(1.814e+07)	(1.056e+07)	(4,819)	(257.9)
Luxembourg	6.140e+08	5.199e+08	519,761	43,443	4.398e+08	3.308e+08	438,699	23,858
	(7.172e+07)	(4.470e+07)	(2,322)	(472.0)	(8.811e+07)	(5.634e+07)	(657.3)	(160.7)
Latvia	3.278e+08	2.329e+08	2.084e+06	21,956	1.184e+08	8.309e+07	2.383e+06	7,967
	(2.361e+07)	(1.777e+07)	(5,674)	(240.6)	(1.202e+07)	(9.048e+06)	(4,513)	(156.9)
Malta	1.515e+08	6.156e+07	428,280	7,950	1.139e+08	4.756e+07	388,283	4,079
	(1.410e+07)	(4.949e+06)	(1,321)	(124.4)	(1.448e+07)	(6.038e+06)	(480.4)	(49.92)
Netherlands	7.540e+09	1.234e+10	1.670e+07	659,830	5.903e+09	8.012e+09	1.586e+07	443,058
	(7.144e+08)	(1.172e+09)	(15,303)	(3,490)	(7.028e+08)	(9.719e+08)	(18,492)	(4,318)
Poland	4.150e+09	3.873e+09	3.806e+07	375,906	1.492e+09	1.074e+09	3.842e+07	174,432
	(4.039e+08)	(3.532e+08)	(3,594)	(4,116)	(2.012e+08)	(1.656e+08)	(14,340)	(2,415)
Portugal	1.635e+09	1.093e+09	1.046e+07	178,411	1.559e+09	9.769e+08	1.025e+07	124,911
	(1.711e+08)	(1.057e+08)	(4,956)	(728.6)	(1.985e+08)	(1.128e+08)	(10,649)	(1,340)
Romania	1.434e+09	1.062e+09	2.038e+07	136,275	4.139e+08	3.518e+08	2.229e+07	40,256
	(1.122e+08)	(9.484e+07)	(31,602)	(1,831)	(5.435e+07)	(4.855e+07)	(27,629)	(585.4)
Sweden	3.047e+09	2.783e+09	9.500e+06	401,373	2.283e+09	2.296e+09	8.858e+06	254,330
	(2.195e+08)	(1.720e+08)	(18,812)	(2,962)	(2.047e+08)	(1.731e+08)	(4,267)	(2,448)
Slovenia	6.474e+08	6.214e+08	2.042e+06	37,354	3.847e+08	3.171e+08	1.989e+06	21,843
	(5.117e+07)	(4.812e+07)	(1,330)	(251.1)	(4.528e+07)	(4.086e+07)	(378.9)	(232.5)
Slovak Republic	1.529e+09	1.574e+09	5.403e+06	68,741	3.996e+08	4.101e+08	5.381e+06	22,575
	(1.331e+08)	(1.287e+08)	(1,271)	(804.4)	(6.007e+07)	(6.566e+07)	(844.4)	(319.6)
Observations	11,981	11,981	11,981	11,981	5,341	5,341	5,341	5,341

This table includes the average (mean) of import, export, population and the Gross Domestic production GDP, for all EU countries members before and after 2004 (the standard deviation between parentheses) from (1990-2017).

Appendix (A2:4) : Average yearly immigration population and flow from EU-8 to EU-15 before and after the enlargement.

	Before the enlargement		***After the enlargement***			
Over	***Mean***	***Std.DIV***	***Mean***	***Std.DIV***	***Different***	***SE***
Immigration stock						
Czech Republic	2693.64	4173.017	10184.1	21950.39	7490.46	3506.152
Estonia	629.581	1291.384	700.571	1242.808	70.99	221.0062
Hungary	17960	46896.4	18770.9	54269.61	810.9	7966.587
Latavia	3826.84	8985.248	2375.98	5794.765	-1450.86	1119.68
Lithuania	3346.91	3630.394	1599.77	2842.201	-1747.14	817.0483
Poland	14719.9	28755.8	6678.64	14082.87	-8041.26	3356.435
Slovakia	9639.52	28899.89	12226.4	29191.45	2586.88	5613.978
Slovenia	136.569	159.203	259.309	278.588	122.74	35.01488
Bulgaria Croatia	-	-	1626.25	2281.431	-	-
Cyprus	-	-	-	-	-	-
Malta	-	-	-	-	-	-
Romania	-	-	4628.58	9291.791	-	-

**This table includes the mean and standard deviation for immigration population from all the EU to the new EU-10 which are (Czech Republic, Cyprus, Estonia, Latvia, Lithuania, Hungary, Malta, Poland, Slovenia and Slovakia).*
** There are some missing data due to the lack of availability in both site and this immigration data was not included in the Maine analysis part it is included in the appendix just for the sack of comparability between the immigration moving from the EU15 to the EU-13 to immigration stock moving from the EU-13 to the EU-15 before and after the enlargement*

Appendix (A2:5) the list of the EU country included in this chapter

EU-15	**EU-13**	
Austria	Bulgaria	EU-2
Belgium	Czech Republic	EU-10
Germany	Estonia	EU-10
Denmark	Hungary	EU-10
Greece	Latavia	EU-10
Spain	Lithuania	EU-10
Finland	Poland	EU-10
France	Slovakia	EU-10
Ireland	Slovenia	EU-10
Italy	Croatia	-
Luxemburg	Cyprus	EU-10
Netherland	Malta	EU-10
Portugal	Romania	EU-2
Sweden		
United Kingdom		

The EU-15 includes the EU member states that joined prior to 2004. The EU-13 are the countries that joined the EU after 2004, and they are divided into three groups: the first group is the countries that joined in 2004 and are referred to as EU-10 in this chapter; the second group is the countries that joined in 2007 and are referred to as EU-2; and the third group is Croatia, which joined in 2013.

Chapter 3: Immigration Impact on Foreign Direct Investment

Abstract: In a world that is becoming increasingly interconnected, the intricacies and depth of a country's network within a global society, and how this is maintained, is not yet known in its entirety. Within this context, this chapter examines how the growth of immigration stock following the enlargement of the European Union may be connected to bilateral Foreign Direct Investment exchanges. Using bilateral data between the old European Union member states, which were noted as destination countries for immigration and 53 other countries (including old and new European Union member states) as the immigrations' country of origin, the results of this chapter demonstrate a positive and significant impact of immigration for both FDI inflow and outflow. The results were obtained by using the standard gravity model with the difference in differences estimation. Almost all the results were consistent across the different specifications used in this chapter.This chapter differs from Chapter 2, as mentioned above. Chapter 2 focuses on the effects of immigration on trade creation within the EU before and after the 2004 EU enlargement, whereas Chapter 3 focuses on the relationship between immigration and foreign direct investment in both EU countries and non-EU countries. Moreover, in Chapter 2, the analysis begins by focusing on the period between 2000 and 2006 and then on a longer period from 2000 to 2017. In this chapter, only a longer period of time is considered.

3.1 Introduction

Despite global trends of restricting human movement, the proportion of the global population that are migrants has increased dramatically over the past several decades. This is particularly the case in the European Union (EU). After the 2004 enlargement, there was a significant rise in the number of immigrants moving inside the EU region. Despite the increasing number of immigrants within the EU, most EU states became countries that had the largest immigration share of the total population (see Figure 6). Accordingly, it is important to explore the global economic effects of international

immigration. Even though the flow of goods, people, and money has propagated and grown concurrently, most of the research on the effects of migration on economic exchanges has focused exclusively on trade. To that extent, the link between Foreign Direct Investment (FDI) and immigration has not been given much attention in the literature. On the other hand, the majority of research on FDI, which investigates FDI's determinants, focused on the ways in which the size of the regional market, the quality of the infrastructure, commercial openness, the intensity of human capital, and political stability influences the FDI (Haufler et al., 2018; Ozturk, 2007; Zhao, 2003). However, foreign investors may encounter additional challenges if they are inexperienced with the host country's legal system, language, and commercial contacts. Immigration could minimise these difficulties throughout the network channel, in that they could assist the investor in their home country and the distention country (Foad, 2012a). The relationship between investments and migration has similarly received minimal focus in the research, even though migration is an important way to obtain information, reduce uncertainty, and cut down on the transaction costs that limit FDI flow.

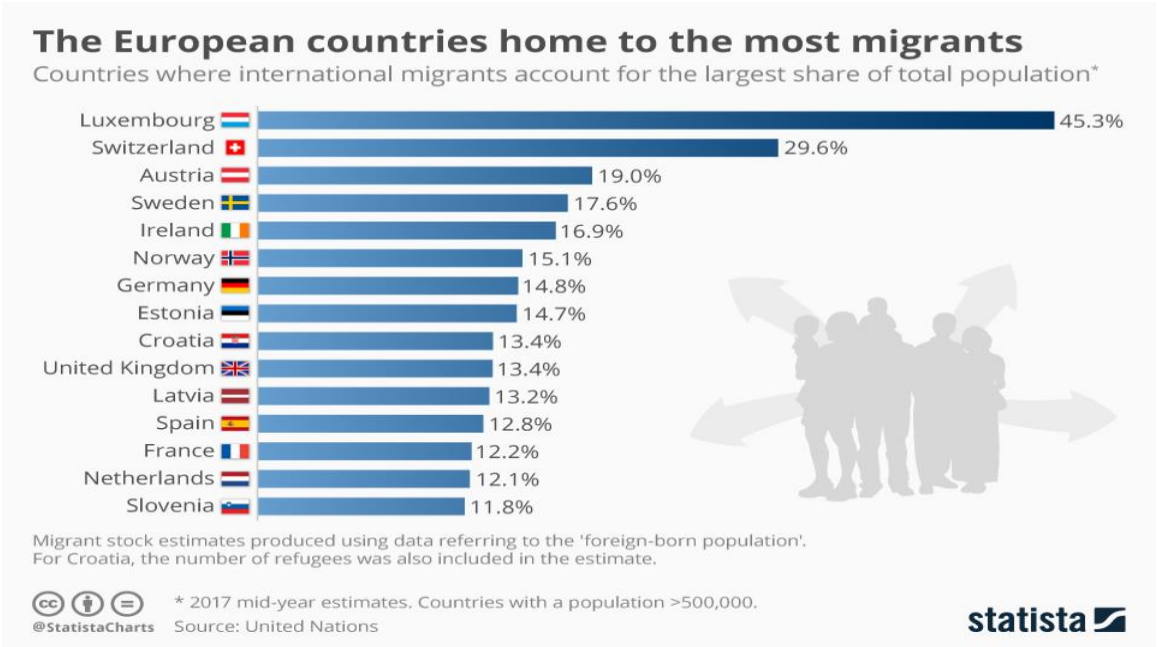


Figure 5: The countries with the highest immigration shar of population and most of them are from the EU.

Globalization's impact, as well as the rapid increase of the foreign population and investment in many countries in recent years, has prompted the examination of the factors that influence migration and FDI flows. The concept of social network theory is becoming increasingly important in the study of international trades. To be more precise, this idea may be utilized to analyse and comprehend how social networks affect organizations (Zhou et al., 2007). Additionally, immigrants transport personal and institutional data from their countries of origin to their destination countries. The information from these social networks has the ability to alleviate possible challenges and limitations to foreign investment since immigrants often possess critical knowledge about market features, preferences, business ethics, and business norms. This results in the promotion of bilateral FDI flow.

According to emerging international economics literature, immigrant networks can assist in overcoming knowledge barriers to international capital flows and may result in an increase of inward FDI to their country of origin(Flisi and Murat, 2011). Foreign investors who are unfamiliar with the market in which they intend to invest may face several problems. Generally, foreign investors should be confident in the legal system of the country in which they are investing in order to ensure the trustworthiness of agreements with their partners. As a result, in a country where institutional performance is low and the legal environment lacks appropriate security, investment obstacles might be significant. Finding a reliable source of information on the foreign market, particularly in a developing country, is not always possible via conventional channels such as email and websites, or even via phone calls. On the other hand, if it is accessible via these well-known routes (mainly in developed countries), the language barrier and lack of experience with the technology and using advanced communication might act as a deterrent to investment. Although the role of immigration in all international transactions has been discussed in the literature, the impact of immigration on trade has been addressed specifically in relation to its impact on FDI.

This chapter will address the link between immigration and the movement of FDI flow inward and outward of the ‘old’ 15 European member states. In doing so, it will employ the gravity model to be in line with the literature. However, it will use the Difference in

Differences (DID) estimation technique to implement the natural experiment related to the boost of immigration inflow which happened after the 2004 enlargement. This technique is widely used to assess the policy change and the results following this policy change, particularly in relation to its timing for the immigration movement into the older 15 EU member states from 2004. This chapter takes advantage of the time difference to apply the DID and precisely measure the impact of immigration on FDI. Following this analytical strategy will provide a new angle to assess this impact. This chapter's original contribution to the literature is the use of the difference in time of entry for immigration to a destination country, which is only related to the changing of policy and regulation, in order to avoid the causality problem and examine the direct relationship between immigration and FDI.

The exogenies variation of changing this policy using the DID is the form of identification in the estimation. In addition, this study is covering a long period of time and compares a number of countries, including developing and developed countries, in terms of their influence on FDI. The results indicate that allowing free movement of immigration across territories benefits both the host and the origin country's economies through the FDI flow.

The rest of the chapter is organized as follows: first, it will review the previous research on the impact of immigration on FDI, then the next section will introduce the analytical framework, enclosing the gravity model data and the econometric illustration. Then the result of the estimation, including the robustness check. The last section will be the conclusion.

3.2 Previous studies

One of the earliest definitions of a global immigration network is the connection that the immigration community can tap into in both their country of origin and their destination country. This network can enable specific economic outcomes, such as making it easier to find a job or hire someone or making it easier to trade, move money and so. This is the form of social capital that is mobilised as a result of immigration(Munshi, 2003). In the last few decades, a lot of research has explored immigration networks as unofficial

organisations and how they affect both individual and group outcomes (Dustmann et al., 1991; Munshi, 2003). Consequently, immigration networks are also successfully promoting bilateral international economic exchanges.

As previously stated, the relationship between immigrant networks and bilateral trade has been thoroughly explored in the literature (Gould, 1994a; Rauch, 1999; Rauch and Trindade, 2002). However, the study of the effects of immigration networks on bilateral economic exchanges has expanded over the past decade to include FDI (Gheasi and Nijkamp, 2017).To investigate the impact of immigration on FDI, existing research has adopted a range of methodologies, many of which were similar to those previously used in examining the link between immigration and trade, finding different conclusions.

Additionally, the theoretical literature on multinational firms is primarily concerned with the trade-off between the fixed cost of establishing production facilities overseas and the advantage of avoiding trade expenses, or the benefit of cheaper production inputs. Companies will invest overseas when the advantages of moving production outweigh the costs of retaining the same capacity in other markets (Javorcik et al., 2011). The cost of physical production facilities and the cost of acquiring knowledge about the current business environment is included in the fixed cost of establishing production abroad. The local rules, labour relations, and supplier availability are valuable information that must be accessible to investors. FDI movements are impeded by information asymmetries, which raises concerns regarding the high cost of acquiring such data (Portes and Rey, 2005). Furthermore, foreign transactions are extremely hazardous and incur significant transaction expenses. Foreign investment is riskier than trade since it entails significant upfront expenses.

To compete with native investors, a foreign investor needs not only to have a knowledge advantage of their firm's specialised assets but also knowledge regarding how the country's official and informal institutions function. Additionally, awareness of other informal barriers such as language, customs, attitudes, customer preferences and social norms is critical for investor decisions in host economies. Accordingly, international

investors will spend significant transaction costs in order to obtain knowledge about foreign markets.

Due to the relatively high fixed cost associated with obtaining the information essential to conduct a foreign investment, investors, particularly from smaller firms, tend to avoid investing abroad. Rather, they move towards other international activities such as exporting (Caves, 1971). That transaction cost and the internalisation decisions associated with it are inextricably intertwined and have a significant role in FDI decision-making. To overcome these impediments, the contribution of migrants has been acknowledged by researchers in the early 1970s. Granovetter (1973) was one of the first researchers who examined the theoretical components of the role of social networks in the provision of information. Subsequently, later literature explores the role of social networks on an international transaction scale (Flisi and Murat, 2011; Javorcik et al., 2011; Rauch, 1999; White, 2007; Zhou et al., 2007).

Kugler and Rapoport (2005) developed a model based on a Cobb Douglas production function using skilled and unskilled immigration and discovered that skilled immigration has a positive and negative impact on FDI[33]. They argue that skilled immigration benefits FDI through two channels: the increased return on education and the strong networks. According to their study, the outflow of immigrants will first lead to a decrease in labour. In the case of skilled immigration's outflow, the effect will not be limited to reducing labour; it will also decrease labour productivity, which is a factor of human capital leading to reduce the return on capital. As a result, the increase in the outflow of skilled immigrants will lead to a decrease in FDI (in this case immigration and FDI are substitutes). However, when immigrants settled abroad, they started to establish a strong network which provided potential investors with all the information about their home country. Also, they could reflect the productivity of the labour force in their home country if they joined the labour force in the host country. According to Kugler and Rapoport (2005), this will help investors with the uncertainty they are facing in their decision.

[33] The Cobb Douglas production function that is used in the Kugler and Rapoport (2005) is ($Y_t = A(H_t)K_t^{1-\propto}L_t^{\propto}$) which is the standard Cobb Douglas. The impact of immigration in a country will be through redosing L in the country and A(H) which is the total factor productivity.

Similarly, Murat and Flisi (2007) used a Cobb-Douglas production function to build up their theriacal model with slightly a different context to distinguish between the different impacts of skilled and unskilled immigration on developed and developing countries[34]. The immigration of skilled individuals boosts capital accumulation in developed countries while having the reverse effect on developing countries. This is the "brain drain" caused by immigration, which harms developing countries. In contrast, brain gain benefits developing countries[35]. This can be further discussed in light of the perspective of Surani (2018), who found that for several years, developing countries could be little more than moot spectators of several talented citizens who migrated to the West to pursue higher studies or better employment opportunities. However, increasing research and analyses of the "brain drain" and skilled migration led to the emergence of a transnational mode of thinking that acknowledged the significance of global association for human capital in the country. Countries that have suffered from the issue of emigration could seek benefits by utilising the potential and skills of people settled overseas. These ideas have led to an increased interest in reaching the diaspora and utilising the skills and efficiency that they could offer. In light of this development, the literature also argues that the "brain drain" must be perceived as a phenomenon that is harmful to the home country but is an opportunity for economic growth and development. This perspective has also persuaded scholars to consider the manner in which the transfer of knowledge facilitated by a diaspora community can benefit the country of origin and serve as a "brain gain". The "brain gain" allows developing countries to explore suitable ways to utilise the skills and abilities of the diaspora to fill the gaps in knowledge and skills in the home country. However, the indirect effects of skilled immigration networks reduce the risk factors associated with the country of origin. When the influence on the risk factor is high enough, it can offset the negative effects of the "brain drain". In this context, the "brain gain" can be undertaken in two ways Straubhaar (2000): the return of expatriates to their homeland; and their contribution to the development of their home country by pursuing remote mobilisation, which is also termed the diaspora option. The second way has been undertaken by several developing countries, where diaspora institutions have been

[34] The skilled immigration flow out of a developing country to a developed country might be a case of brain drain. It is frequently supported by selective immigration policies in developed countries(Beine et al., 2008)
[35] The neologism "brain drain" refers to the international movement of human capital, mainly the immigration of highly educated individuals from developing to developed countries (Beine et al., 2008).

established for the effective management of relationships and engagement with the diaspora. They operate as formal state offices that deal with emigrants and their descendants. offices that deal with emigrants and their descendants. Moreover, countries such as China, India, Mexico, Brazil, Kenya, Afghanistan and South Africa have undertaken several key measures to engage with their diaspora, and their initiatives have been successful (Surani, 2018).

This also implies that skilled immigration has a positive impact on developing countries, particularly on the FDI flow. On the other hand, unskilled immigrants have an uncertain impact on both developed and developing countries. Unskilled immigration directly impacts the labour force, reducing productivity. This indicates that the developed countries will employ more labour-intensive productions, whereas the developing economy will adopt more skilled labour-intensive techniques. Additionally, the unskilled immigrants' network has an impact on the risk factor. If these impacts are not strong, and if more labour-intensive productions in destination countries of unskilled immigration substitute prospective investment abroad, then the impact of unskilled immigration on the developing country's domestic and foreign investments may be negative. Accordingly, unskilled immigration and FDI imports may serve as substitutes.

Their model predicts that overall, immigration has a positive impact on FDI, but that this impact is mostly attributable to the presence of skilled immigrants. In addition, because the risk factors, or informal barriers of developing countries, are greater than those of developed countries, the model anticipates that immigration from developing countries will have a greater effect on bilateral FDI than immigrants from developed nations.

Theoretical models anticipated that the link between immigration and FDI could be complementary or substitute. Additionally, the empirical research yields varying results, with some suggesting a complementarity relationship and others a substitution one. Immigration and FDI can be complementarity in relation to the idea of business and the immigration network impact (Docquier and Lodigiani, 2010). Moreover, the network of immigration could establish a link between countries, facilitating FDI by reducing the information barriers, and indicating opportunities to possible business partners in both their countries of origin and destination countries (Cuadros et al., 2016). On the other hand, the substitution between immigration and FDI is related to the productivity of

individuals, particularly highly skilled individuals. Increasing the outflow of immigration leads to a decrease in productivity, which is the primary incentive that drives investing abroad, hence the substitution relationship(Checchi et al., 2007).

The empirical findings of Kugler and Rapoport (2005) reveal a positive relationship between FDI inflow and immigration outflow if the immigrants is highly educated (skilled immigration). However, a negative (substitution) impact on FDI inflow is predicted when less skilled immigration is considered. Additionally, Flisi and Murat (2011) report a positive link between bilateral immigration flows and investment flows, implying that the information channel created by the foreign worker communities' ethnic ties to their country of origin may be useful for businesses seeking to invest there.

Several studies show that the outward flow of FDI from the host country to the immigrations country of origin is affected positively by immigration in the host country (De Simone and Manchin, 2012; Gheasi et al., 2013; Javorcik et al., 2011). Moreover, Mayda et al. (2022) conducted another recent study that addresses the impact of foreign-born individuals on FDI outflows through the lens of refugees. Their finding shows that refugees contribute to the development of the country of origin through FDI. However, Other studies show that immigration boosts the FDI inflow from their country of origin to the host country (Foad, 2012b; Tomohara, 2017). Both impacts can be attributed to the international immigration network that will assist investors in avoiding risks and even lowering the cost of acquiring knowledge about the foreign market.

This can be further supported by the findings of Grossmann, (2016), who showed that the measures of FDI flow helped capture the movements of physical capital in international marketing instead of other financial assets. FDI serves as a suitable channel that migrants can use to influence labour productivity in both the home country and the host country. This can be attributed to the ability of immigrants to minimise information barriers that usually lead to firms' bias against promoting investments in businesses situated in foreign countries, about which they have significantly less knowledge than about the home country of the immigrants. An increase in FDI leads to an increase in the physical capital stock and improves access to advanced technology, which eventually leads to higher productivity. (Cuadros et al., 2018) supported these perspectives and explained that

migrants serve as information-revealing networks, thus helping to minimise transaction costs. Therefore, they play a key role in encouraging bilateral investment. They are able to understand the culture, language, practices and values of their home country and their host country. This positive association between ethnic networks and FDI is established through them. The primary mechanisms that help establish this association are demand and channels of information. The former takes place when people living overseas demand goods and services from the home country, and companies endeavour to meet these needs by undertaking foreign investment. Information channels can be less direct, but they play a key role in FDI decisions. FDI involves a high risk of expropriation, a robust legal framework and key investment information. In such circumstances, migrants play an important role in fostering trust in countries where the rule of law is not certain and performing business activities with foreigners involves insecurity. Additionally, individuals have social networks that help create a competitive advantage for firms in their home countries, thereby opening new channels for profitable investments. They play an important role in helping the host country to explore business opportunities, gain an understanding of local tastes and preferences and assist investors in identifying partners for joint ventures.

In the case where immigration helps increase the outward flow of FDI, immigrations provide the native investors in the host country with foreign market information to avoid the risk of investing abroad. In the case where immigration enhances the FDI inward flow to the host country, they provide information and easy access to the host country market for the investor from the countries of origin. Javorcik et al (2011) addressed the relationship between immigration from different countries to the US and the FDI outward flow to their countries of origin. Their results show that increasingly, immigration from a country leads to FDI outflow from the US to their country of origin (which is evidence of complementarity). Foad (2012) also explored the US case, but he looked at a regional level rather than a national level. Moreover, he examined the relationship between immigration and the inflow of FDI from their countries of origin to a specific region in the US. His result shows that, in the long term, immigration can positively affect the FDI inflow to the US. (Tomohara, 2017) Using Japanese data, he argues that the Ricardian approach, which was used in previous studies, does not capture the characteristics of the interactions among simultaneous factors regarding inflow, because it treated the inflow

of both labour and capital as a single factor. Tomohara used the net inflow in his empirical model to introduce interactions between immigration and FDI, which allowed him to account for the exit of immigration and the withdrawal of FDI. The results in his chapter show that immigration inflow has a negative effect on the FDI inflow, while the immigration stock has a positive effect on it. Accordingly, this means that in the short term, immigration inflow could offset the FDI inflow, but in the long term the ethnic network's externalities from immigration stock positively impact the inflow of the FDI.

Elsewhere, De Simone and Manchin (2012) focused on the relationship between immigration outward flow to a host country and FDI inward flow to their country of origin in the European Union Area. They applied a conceptual framework to redefine the model of multinational production, assuming that immigration in the host country provides information about their countries of origin markets. They argue that this helps the host country investors to offshore the production of intermediate goods to the foreign country (which is needed for the final multinational production of goods). Their study specifically considers EU member states between 1995 and 2007. They investigate the effect of immigration from new EU members into the older EU states through the FDI of the old EU member to the new EU member. Empirically, they used a gravity model with an IV strategy and fixed effect to overcome the endogeneity and unobserved heterogeneity problem. They found a positive impact on the FDI.

Additionally, a recent study by Chan and Zheng (2022) addressed the link between Chinese immigration networks in a hosting country and the FDI. They focused on the FDI outflow from China to the host country, using a simple gravity model. They cover the period between 2003 and 2014. Using a variety of econometric approaches, including instrumental variables in their analysis, their results show a strong impact of the Chinese immigration network on outflow FDI, especially for less experienced investors, between unlisted service companies and in host countries with strong factor market rules and weak legal frameworks.

Moreover, some research reported adverse impacts of immigration on the FDI. Aroca and Maloney (2005) investigated the relationship between immigration outflow from Mexico

to the USA and FDI inflow from the USA to Mexico. They found a negative correlation between them which means that they are substitutes. Kugler and Rapoport (2007) examined the FDI-migration link by focusing only on the United States as a destination country and evaluating FDI flows toward a wide collection of migrants' origin countries. By distinguishing between a static and a dynamic perspective, they found that while there is evidence of substitution effect when data are studied statically, the relationship shifts in favour of complementarity when a dynamic perspective is used.

Theoretically, scholars argue about whether complementarity or substitutability is more dominant. However, empirically, complementarity is dominated because immigration seems to be very effective at reducing informational gaps that affect bilateral FDI.

Although immigration's impact on a host country has been extensively addressed over different aspects such as wage, employment and so on, there is less research exploring the relationship between the FDI and immigration. In light of this, this chapter will investigate how immigration stock and flow could relate to the FDI[36], in particular in the European Union (EU) as a host country and it will extend this further, using countries that are not within the EU as the country of origin. This chapter will use bilateral data between the host country and the country of origin and take advantage of the time of free entry for immigration from the new members of the EU after the enlargement in 2004 to the older member states. This chapter will expand the time period to 2018 and distinguish between the impact on the inflow and outflow of FDI for the older EU members so as to enable a more in-depth view of the immigration impact on the FDI. Moreover, it will employ a new empirical strategy for investigating the immigration-FDI link.

[36] The literature examines this topic via the lens of several types of immigration measurement. Some research addresses the impact on FDI using highly skilled immigration like Flisi and Murat (2011). Others use the immigration flow like Cuadros et al., (2018), and the majority used the immigration stock (see Buch et al., 2006; Foad, 2012a; Javorcik et al., 2011). The results found in the previous studies, varies related to the methodology and the countries used to examine the relationship.

3.3 Analytical framework

3.3.1 The gravity model and the FDI

The majority of research has used a gravity framework to examine the impact of migration on FDI. General gravity models have been used to examine immigration, international trade (exports and imports), and FDI. According to the gravity model, bilateral FDI is positively connected to both the country of origin and destination countries' GDP and negatively related to their distance as a measure of trade and investment costs. As mentioned before, the gravity model was more popular to address international trade issues, however more recently, it became more and more popular to address the FDI issue. Anderson et al (2019) developed a structured gravity model for bilateral FDI along with a dynamic model of trade, capital, and FDI. They explain that their FDI gravity model is different from traditional gravity models in many ways and elaborate on how the FDI stock is dependent on different factors included in their gravity model specification[37]. Although their model was not meant to address any link between immigration and FDI, it is one of the well explanatory gravity models for FDI and its components.

Researchers such Javorcik et al. (2010) extended the model by integrating factors linked to migration in order to study the influence of migration on FDI. The fundamental shortcoming of the gravity model is that it treats bilateral ties in isolation from the entire collection of relationships in which a country may be involved (which are usually very numerous in international economic networks). Nonetheless, economic actors' conduct cannot be evaluated separately from the intricate web of interactions in which they are

[37] Anderson et al. (2019) started from the dynamic model of trade, capital and FDI using Cobb-Douglas production function and end up with a structural gravity model for FDI, the central focus on their study is to highlight the relationship between the trad and the FDI in general equilibrium frame. According to their model the FDI is directly related to the size of the country of orgone, the size of host country, and the FDI openness. Theas three relationship are already established in international trade; however, they point out in their model the link between bilateral FDI and trad through the multilateral resistance which presented in the inward multilateral resistance in country of origin. They distinguish the between the FDI gravity model and the trad gravity model by including the inward multilateral resistance and excluding the outward multilateral resistance. finally, the FDI in their model also depend in the tocology capital of the country of origin.

situated. This problem along with other challenges for gravity estimation was discussed thoroughly by Yotov et al., (2016)[38].

As scholars have argued, this model provides the best estimation results for this type of data for a variety of reasons. The most common of these is that the gravity model setting is a very adaptable framework that may be used in a wide range of wider general equilibrium models to investigate the relationships between trade and labour markets, investment, the environment, and so on. Additionally, it is a structural model with substantial theoretical foundations (Yotov et al., 2016). A large amount of research has used this model to investigate FDI using bilateral data such as Bang and MacDermott, (2019), Mishra and Jena (2019) and Tham et al. (2018).

Guided by the review of the literature on modelling, it was determined that the gravity model was the best means through which to explain the bilateral data and its relationship between immigration and FDI. As a result, this study will use the gravity model as the framework to examine this impact. The general gravity model's illustrated equation for bilateral FDI is summarized as follows:

$FDI_{flow_{ijt}} = \ (GDP_{it})(GDP_{jt})/\ (Des_{ij})\ \prod_z X_z$ ….(3:1)

Where $FDI_{flow_{ijt}}$ is the in/out FDI flow from the country of origin i to the country of the destination j in time t. The FDI flow is affected positively by the origin country's economic size (GDP_{it}) which is measured by the Gross Domestic Product, due to the fact that larger economies have the ability to invest more. Additionally, the size of the destination country which is measured by the (GDP_{jt}) has a beneficial effect on the bilateral FDI flow, since larger economies may theoretically absorb more foreign investment opportunities. The logistics and communication cost has a negative impact on the FDI flow. The destination between the country of origin and the destination country (Des_{ij}) here is a proxy for the logistic and transportation cost. $\prod_z X_z$ is a factor of a variable that was

[38] Yotov et al in 2016 addressed the 8 following challenges for the gravity model and explained how the literature considered them as the solution to these challenges 1) multilateral resistance, 2) zero trade flows 3) heteroscedasticity for trade data 4) bilateral trade cost 5) endogeneity if trade policy 6) non-discriminatory trade policy 7) adjustment to trade policy 8) gravity with disaggregated data. Some of these problems are mainly related to the international trade, moreover the structural gravity model which is not used in this study.

added to the gravity model to absorb other factors that could affect the FDI flow besides the immigration stock, which is the number of total populations for both country of origin and the destination country.

3.3.2 Estimation Techniques

The goal of this study is to assess the impact of immigration on FDI. The novelty is to examine this relationship using Difference in Difference estimation (DID), to see how the different immigrant communities who settled down in the older EU member states affected the inflow/outflow of Foreign Direct Investment for these countries. Since the enlargement of the EU in 2004, the number of immigrants from the new EU member countries to the old EU member countries increased rapidly because of the free access to it. This difference between the time of free access gives the DID estimation an advantage point, because treating this event as a natural experiment helps eliminate some of the major technical estimation problems[39].

As mentioned before, a basic gravity model will be used in this paper. The linearizing expression might be obtained by utilising the logarithm in equation (3:1) as the following:

$$FDI_{flow_{ijt}} = \beta_0 + \beta_1 IMMIstock_{ijt} + \beta_2 GDP_{it} + \beta_3 GDP_{jt} + \beta_4 Des_{ij} + \beta' X' + \tau_t + \delta_j + \varepsilon_{ijt} \dots (3:2)$$

Where $IMMIstock_{ijt}$ is the number of the immigration population from a country I in country j at time t. X' refers to the control variables. τ_t, δ_j are a set of dummies for the year and the country of destination. ε_{ijt} denote the error term. $IMMIstock_{ijt}$ is the variable of interest. The estimation will be focused on how the immigration stock in country j from country i will impact the FDI in/out flow, and whether there will be a

[39] That standard gravity methodologies alone would be incapable of detecting endogeneity and selectivity in these combinations. This is due in part to the gravity model's unique structure, which has time-invariant structural relationships that are collinear with fixed effects in the units of observation. Wolf and Ritschl (2011) argue that the estimators provided to overcome this collinearity issue fail to discover treatment effects when random selection is violated. Therefore, the observed coefficients on policy dummy variables do not yield estimators of the impacts of policy that are unbiased. They proposed exploring difference in differences (DID) estimates as a potential way out of these problems.

difference between the effect on inflow and outflow of the destination country throughout the period under consideration. The destination countries in this study are the 15 EU member nations that joined the EU prior to the 2004 enlargement They will be referred to as the “Old-EU member”" for the purposes of this study. After the 2004 enlargement, ten countries joined the EU. Following this in 2007, another two countries become members of the EU and finally in 2013 another country joined the EU, resulting in 13 new EU members between 2004 and 2013 in total. They will be referred to in this study as the "New EU members". Although the EU expanded from 2004 to 2013, the bulk of new members joined in 2004. Prior to 2004, immigration (labour mobility) between these New EU members and the destination countries, who are the Old EU members, was restricted. Following enlargement, the Old EU members started to lift the restrictions. In addition to that, only two of the Old EU members withdrew the limitations immediately after 2004, allowing for the free movement of New EU immigrants, the remaining countries granted the free movement across different years between 2006 and 2011. The variation of timing of this occurrence could provide accurate measures for the immigration impact on the FDI.

For gravity estimation to be accurate and compatible with its theoretical assumptions, significant data and econometric issues must be addressed. Measuring the immigration impact on any economic outcome of the destination countries has been and continues to be a contentious issue for many reasons, and one of the most perplexing issues confronting researchers on this subject is determining the direction of causality (the endogeneity). Often, when applied to bilateral trade flows, the gravity equation indicates an endogeneity problem in the relationship between immigration and FDI flow. Immigration is more likely to relocate to countries with a high investment rate in search of new opportunities to invest, and because a high investment rate implies a high probability of finding work. This is not an issue in this study because treating the enlargement event as a natural experiment eliminates any possibility of multi duration for causality (the endogeneity), because in this case, the reason for increased immigration is unrelated to the dependent variable, FDI. Rather, it is solely a result of restrictions being lifted, allowing them to freely move. When the gravity model is applied in the literature, a frequently used solution for resolving the endogeneity problem is the pair-fixed effect.

This accounts for both the observable and unobservable relationships between the endogenous FDI covariate and the error term, as well as the endogeneity of immigrant movement. Although the endogeneity problem is addressed in this study through the use of a natural experiment, a set of pair-fixed effects will be included at a later stage of the analysis for sensitivity checks and to be consistent with the generally used technique in the literature. Moreover, the most common estimation approach for the gravity model is the pseudo-Poisson maximum likelihood (PPML), because it successfully compensates for the presence of heteroskedasticity in FDI data by accounting for zero bilateral FDI flows. However, it must be noted that the statistics on bilateral FDI are of lower quality than those on bilateral trade.

As noted previously, the estimate approach employed in this research is DID estimation, which is not extensively known for the gravity model, as its estimate method. However, it is critical to emphasise that the data setting and the event mentioned in this study are better explained through DID estimation. This study will compare two groups which are the control group and the treatment group. The DID estimation technique is frequently used to examine the effect of a policy change or the implementation of a new policy on the treatment group, to compare the treatment group's average outcome before and after the policy change occurred, and to compare the treatment group's average outcome to that of a control group. The treatment group in this study is the New-EU members who demonstrated a policy change allowing for the free movement of immigration between the Old-EU and New-EU members as a result of EU enlargement. Furthermore, this study will include non-EU members to investigate the differences in the influence of immigration networks from countries other than the EU.

3.3.3 Data and Descriptive

The data used in this chapter is bilateral data which covers the time period between (1998-2018). They were gathered from two general data sources pertaining to FDI flow, which were obtained from business statistics on globalization provided by the official Eurostat databases (Eurostat), and the International Direct Investment database provided

by the Organization of Economic Co-operation and Development (OECD.Stat). Both sources used similar definitions for the FDI flows[40]. The data on FDI flows was available until 2011 in the OECD database, after which the remainder was collected from the Eurostat database until 2018. The data was carefully collected and if there a missing data a supplement from the partner country is used if found or completing any missing data from the other source if available.

A total of 58 countries of origin were considered for the study, the New EU member which are 13 countries, the Old EU members which are 15 countries, and the rest are the Non-EU member, a total of 18832 observations are collected in the database for this study. Notably, in the case of the destination countries, the paper used a balanced sample of (n = 1254) for each of the 15 destination countries.

The data about immigration was collected using three sources of public databases which are the OECD, Eurostat, and the Office for National Statistics (ONS). The immigration stock (or immigration population, as some sources referred to it) is also a form of bilateral data. The immigrant stock by country of birth was utilised for the primary analysis; it has been extensively used in the literature to explore the impact of immigration using the gravity model, and the immigration flow by country of birth was gathered for the sensitivity analysis. The reason for using three sources of data is to replace as much as possible from the missing data. The immigration stock is a measure of the size of the immigration community in the destination country. It is the best way to determine how the networking of immigration could affect the flow of the FDI from and to the country of origin.

[40] *According to (Eurostat) Foreign Direct Investment (FDI) is the category of international investment made by an entity (direct investor) to acquire a lasting interest in an entity operating in an economy other than that of the investor. The lasting interest is deemed to exist if the investor acquires at least 10% of the equity capital of an enterprise.
*OECD recommends that a direct investment enterprise be defined as an incorporated or unincorporated enterprise in which a foreign investor owns 10% or more of the ordinary shares or voting power of an incorporated enterprise or the equivalent of an unincorporated enterprise.

The database was expanded to include control variables which would be used in the gravity model. The population variable is a proxy for the nation's size since it represents the total number of people living in the country as recorded each year. GDP is the market worth of all completed products and services produced inside a country's borders, which is reported annually. The GDP is a proxy of how developed the country is, and it could be a way of measuring the technology level for the country which could be one reason for the FDI flow. The population and GDP for the origin and destination countries were acquired from Eurostat for EU countries and from the OECD for non-EU countries. The destination variable is the distance in miles between the capital cities of the countries of origin and destination. This value was calculated using the distance calculator on the (Globefeed) website.

These control factors have the potential to influence an investor's choice, and by including them in the gravity model for FDI, this effect on FDI will be absorbed. Table (15) shows a descriptive analysis for the full data which are included in this chapter. The FDI flows are in millions of dollars. Immigration stock and populations in the host and the country of origin in Table (15) are in thousands and the GDP for both countries of origin and the hosting country are in millions of US dollars[41].

Table 16: Descriptive statistics.

Variable	Obs	Mean	Std. Dev.
FDI Inflow (in millions)	15485	603.1645	6989.268
FDI Outflow (in millions)	16105	727.4834	7386.096
Immigration stock	17007	24837.688	93689.228
Destination country Population	18832	26204514	26679863
Destination country GDP	18832	944433.07	1019211.4
Country of origin Population	18832	88491400	2.338e+08
Country of origin GDP	18832	1.613e+14	5.682e+15

The data in this table is a summary for bilateral data between the country of origin, and the country of destination between (1998-2018).

Table (16) includes a comparison of the main variables in this study, it compares the immigration stock and FDI in and outflow of new EU members to that of Non-EU

[41] During the data collection process, every currency was converted to US dollars. As the data were obtained from different sources.

countries. The top panel from Table (16) shows that the rise in the immigration stock of new EU members to the host country tripled after 2004, whereas the immigration stock of Non-EU countries rose marginally. Furthermore, FDI inflows increased sharply from roughly 9 million before 2004 to 53 million on average after 2004. This figure has increased four times since 2004, although FDI inflows from Non-EU countries have nearly double on average since 2004. The rest of Table (16) shows the average comparison for each of the host countries.

Table 17: Average comparison of Immigration stock and FDI inflow/outflow between New EU and Non-EU for the period before and after 2004 in general.

	New EU		Non EU	
Host countries, Old EU	**Before 2004**	**After2004**	**Before 2004**	**After2004**
All Old EU countries				
Immigration stock	12657.33	32352.29	22561.54	24804.59
FDI inflow	9.021	53.603	266.967	416.997
FDI outflow	111.261	223.361	537.25	569.732
Austria				
Immigration stock	9977.373	19969.47	8290.882	6976.077
FDI inflow	5.211	10.255	38.081	62.791
FDI outflow	229.264	328.07	19.634	154.258
Belgium				
Immigration stock	1700.754	9243.29	9603.052	6965.952
FDI inflow	16.659	47.706	144.132	406.505
FDI outflow	131.581	186.324	179.708	161.351
Denmark				
Immigration stock	814.792	4151.567	3551.434	3977.613
FDI inflow	9.581	1.997	132.889	5.544
FDI outflow	30.164	7.424	108.338	75.156
Finland				
Immigration stock	1001.107	3100.562	1173.313	2170.5
FDI inflow	8.063	11.637	12.153	16.213
FDI outflow	28.892	26.077	123.48	40.887
France				
Immigration stock	651.406	10320.51	24702.39	37142.92
FDI inflow	18.261	29.358	259.249	270.865
FDI outflow	221.107	220.296	1122.708	630.96
Germany				
Immigration stock	71569.21	115160.2	103115.6	90441.35
FDI inflow	51.683	237.653	271.605	436.093
FDI outflow	343.927	699.349	1036.712	1035.401
Greece				
Immigration stock	2610.529	6672.728	1682.435	2521.192
FDI inflow	.526	18.955	.797	22.786
FDI outflow	6.811	41.544	3.265	23.734
Ireland				
Immigration stock	1953.429	10119.73	3415.846	3780.717
FDI inflow	21.487	8.99	72.146	128.15
FDI outflow	.155	20.145	36.535	430.426
Italy				
Immigration stock	9188.19	68909.28	15764.85	45054.23
FDI inflow	7.128	22.342	84.631	130.658
FDI outflow	55.639	276.97	76.351	305.556
Luxembourg				
Immigration stock	215.695	827.746	205.049	409.619
FDI inflow	9.482	172.381	408.154	2490.188
FDI outflow	18.229	814.481	130.199	2003.187
Netherland				
Immigration stock	1436.882	8317.384	10326.37	9443.002
FDI inflow	4.063	128.473	551.881	61.219
FDI outflow	143.252	49.731	733.105	727.955
Portugal				
Immigration stock	533.333	2600.92	3639.023	6120.783
FDI inflow	10.835	30.309	63.648	39.795
FDI outflow	9.658	6.437	70.91	8.315
Spain				
Immigration stock	5862.512	63396.34	17207.6	52260.61
FDI inflow	12.242	109.858	417.983	425.632

FDI outflow	94.014	409.75	601.528	1283.971
Sweden				
Immigration stock	2566.548	5729.969	3736.927	4788.204
FDI inflow	2.931	7.434	177.028	159.753
FDI outflow	45.571	120.535	116.831	316.693
United Kingdom				
Immigration stock	9235.508	82361.5	30695.25	42541.32
FDI inflow	6.347	31.145	1287.422	1924.25
FDI outflow	186.638	94.918	2245.434	1540.566

This table includes the mean for the immigration stock which is presented in thousands and FDI flows which are presented in millions of dollars. The data is covering the time period between 1998 and 2018. The countries included in the New EU group are Bulgaria, Cyprus, Czech Republic, Estonia, Hungary, Lithuania, Latvia, Malta, Poland, Romania, Slovakia, Slovenia, and Croatia). The Non-EU countries include 31 countries that are randomly selected from all around the world such as the US, Canada, Australia and Mexico.

3.3.4 Empirical illustration for DID

As aforementioned, this chapter will use a DID estimation and it will compare two different control groups to the treatment group, then conduct the DID on one group at a time. The first control group consists of members of the Old EU. Because this study is concentrating on the Old EU member states as the destination countries, and because they are already a member of the EU, they did not have any restrictions on immigration movements between them prior to enlargement. that means for this control group the immigration is freely moving before and after the time period considered in this study.

The second control group includes countries that are not a member of the EU during the time considered in this study. This suggests that they are comparable to the treatment group in terms of immigrant mobility prior to the enlargement and then continue to face constraints following the enlargement while the treatment group have these restrictions lifted.

After establishing the treatment and control groups for DID estimation, the study will begin with the commonly used baseline estimation equation for DID:

$$Y_{ijt} = \beta_0 + \beta_1 post\ + \beta_2 treated\ group + \beta_3\ treated\ group * post + \beta' X' + \varepsilon_{ijt} \dots\dots (3{:}3)$$

Where $post$ is the time period during which the treatment occurred, that takes the value of (1) if the time is after the treatment started and the value of (0) if the time is before

the treatment started. $treated\ group$ is a collection of units that are included in the treatment group, which is a binary variable with a value of (1) if the unit is in the treatment group and (0) if it is in the control group. $treated\ group * post$ is the interaction between the post period and treated unit which takes the value of (1) if the unit was treated and the time is post and (0) otherwise.

In the above scenario, there are two time periods, which are 'before' and 'after'. Applying this approach to the EU enlargement case would result in two time periods, before and after 2004. The treatment group, in this case, are the new members of the EU which include Bulgaria, Cyprus, Czech, Republic, Estonia, Hungary, Lithuania, Latvia, Malta, Poland, Romania, Slovakia, Slovenia and Croatia. The control group are the old countries member of the EU which includes Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden and the United Kingdom. Both the treatment and control groups here are presenting the country of origin, whereas the destination country, in this case, will be the Old EU countries only. A destination country (one of 15 Old EU members), for example, the UK, will be receiving immigration from the New EU country (treatment group) as well as the other Old EU members (control group). The difference is that the UK received immigration without restrictions from other Old EU states before and after 2004, while it started to receive immigration without restrictions from New EU members only after 2004, and the same goes

for the rest of the countries. Then the new baseline estimation equation for DID according to this scenario is the following:

$$FDI_{flow_{ijt}} = \beta_0 + \beta_1 post2004 + \beta_2 NewEU + \beta_3\, post2004 * NewEU + \beta' X' + \varepsilon_{ijt} \dots (3:4)$$

Where $post2004$ is taking the value of (1) if the year is after 2004 and (0) otherwise, $NewEU$ is taking the value of (1) if the country is a new member of EU who joined to the EU after the 2004 enlargement and (0) otherwise, $post2004 * NewEU$ is the variable of interest which takes the value of (1) if the country is a new member of the EU and the time is after 2004. X is I set of control variables of the simple gravity model that includes $IMMI\ stock_{\ ijt}$ Is the immigration stuck from country i to country j at time t. *POPori and POPdes* are the populations for country i and country j at time t, respectively. GDPori and

GDPdes is the Gross Domestic Production for country i and country j at time t, respectively. des_{ij} is the distance between the capital of country i the capital of country j as a proxy for transportation fee.

The results of equation (3:4) are presented in column (1) in Table (17) Part A. the result of the variable of interest ($post2004 * NewEU$) was not significant. The problem in this case is the data includes multiple groups which need to be identified as a result of a set of dummy variables for a destination country and time was added to absorb countries' characteristics and the time-specific effect[42]. This special specification for $\beta_3\ post2004 * NewEU$ is unbiased under DID parallel trend assumption because the treatment is binary, and it follows a staggered design[43] , and treatment timing does not vary across New EU country members, which means all New EU countries are considered and treated at the same date which is 2004. The results proved to be significant (Table (17) see columns 2 part A).

Moreover, to get the main goal of this study, which is the impact of immigration on the FDI, the flowing equation was estimated:

$$Y_{ijt} = \beta_0 + \beta_1 post2004 + \beta_2 NewEU + \beta_3\ post2004 * NewEU + \beta_4 IMMIstock * post2004 * NewEU + \beta' X' + \tau_t + \delta_j + \varepsilon_{ijt} \dots (3:5)$$

Where $IMMIstock * post2004 * NewEU$ is a continuous variable that equals to the immigration stock from the country of origin (sending) to the destination country (receiving) if the country of origin is in the treatment country group New EU and the time is after 2004. Adding this regressor will allow the research to capture the immigration impact after the 2004 enlargement.τ_t, δ_j are a set of dummy variables for destination countries, and years. Models 3 and 4 in Table (17) illustrate the outcome of Equation (3:5) using two types of estimation. The reported findings for the variable of interest are positive and highly significant.

[42] Due to the collinearity between the dummy variable and the treatment group variable (new EU), which is part of the country of origin, the country of origin dummy variable was excluded from the primary analyses.
[43] The staggered design in this case means that the new EU country member can switch into treatment but cannot switch out of treatment after that.

However, as previously mentioned, there was a chronological difference between the old EU countries when it came to permitting free immigration movement. This means, in the treatment group, there was a difference in timing for a new EU country to be considered as treated. To employ the DID with variation treatment timing, the approach is to generalize the regression equation, and – in addition to having the dummy variable for the treatment group – it should include a unit of the dummy which put different dummies for every single country for more flexibility. This step was already covered by adding the country of destination dummy to the regression. Additionally, instead of only using one dummy for the time variable ($post$) because it is different for countries in the treatment group, it will add a dummy for each year to enable more flexibility. Moreover, the construction of this variable $post2004$ will change to be equal to 1 at the year when the distinction country permits unrestricted migration and zero before that (the year of allowing for free movement is different between countries of destination).

The DID research design is used to examine variations in treatments, but parallel trends help in making inferences and identifying estimates of the causal effects between two or more variables, such as foreign direct investment and immigration.

Consequently, the variable $post * NewEU$ will be changed and takes the value of one if the country is in the treatment group and the year is after the limitation on immigration movement was relaxed, and zero otherwise. The variable $\beta_2 IMMIstock * post * NewEU$ is a continuous variable which equals the number of immigrants stuck from the treatment group ($NewEU$) if the year is after the country of destination allows free movement. The treatment here takes many values which may not be defined due to the fact that in the control group, there is no unit that has the same value. However, the variable of immigration stock from all origin countries is included in the regression to solve this problem. The following equation was used for the estimation:

$$Y_{ijt} = \beta_0 + \beta_1 post + \beta_2 NewEU + \beta_3 post * NewEU + \beta_4 MMIstock * post * NewEU + \beta_5 IMMIstock + \beta' X' + \propto_i + \tau_t + \delta_j + \varepsilon_{ijt}.. \quad (3:6)$$

The result of the estimation of equation (3:6) is presented in Table (17) column 3 Part B. The results reported are positive and highly significant. In line with previous research, this study also utilized a Pseudo-Poisson maximum likelihood (PPML) estimator, which successfully deals with zero bilateral FDI via in and outflows and accounts for the

presence of heteroskedasticity in FDI data (Santos Silva and Tenreyro, 2006). The PPML estimation results are provided in section B of column 4 of Table (17). Furthermore, to account for any unobservable time-invariant FDI and trade cost components, this analysis used country-pair-fixed effects with the PPML in later stages.

The DID variable ($NewEU * post$) captures the average difference in FDI following the liberalization of immigration with time variation. This implies that all the effects of changing free movement policies are included in the coefficient ($NewEU * post$), but because immigration stocks vary by country, adding the immigration stock to the DID variable ($NewEU * post$) allows for the exact impact of the immigration network to be captured. Additionally, it is worth noting that when immigration is included in the gravity model as a proxy for transaction costs, the magnitude of the destination coefficient decreases from 0.9 to 0.7 (see Table (17) Part B columns 2 and 3), which means that the immigration stock and the destination coefficient are related, indicating that the immigration network is included in the variable that reflects transaction costs. In fact, it reduces the transaction cost that is measured by destination, which supports this analysis claim that immigration networks help to reduce the information and transaction cost[44].

As a result of this, the equation for baseline estimation that will be utilised for the remaining analyses will be equation (3:6). The following two sections will apply this equation with two different control groups to determine the main outcome of the study, and the subsequent analyses will demonstrate the sensitivity cheek.

[44] Certain papers specifically address this relationship in their work by utilizing a single variable for each immigrant group with a distinct country of origin to account for the effect of immigration and the difference in influence on the country of destination between distant and close country of origin. Like Murat and Pistoresi (2009) estimated a single estimate for immigrants from various countries of origin and correlated it with the distance variable. The authors discovered that Chinese immigrants had a greater impact on inflow and outflow FDI to Italy than French immigrants did due to lower transaction costs, given China is located further away from Italy than France.

Table 18: OLS and PPML estimations of the impact of immigration on the FDI inflow.

	VARIABLES	(1) Ln (FDI inflow) OLS	(2) Ln (FDI inflow) OLS	(3) Ln (FDI inflow) OLS	(4) Ln(FDI inflow) PPML
Part A: Using 2-time period before and after 2004	New EU	-0.637***	4.731***	4.689***	0.202**
		(0.209)	(1.448)	(1.540)	(0.0925)
	post2004	-1.168***	0.441	2.180***	0.124***
		(0.100)	(0.383)	(0.279)	(0.0151)
	post2004P*newEU	0.0174	0.775***	1.680***	0.0862***
		(0.152)	(0.141)	(0.242)	(0.0155)
	IMMIstock* NewEU*Post2004			0.149***	0.519***
				(0.0285)	(0.00163)
	Ln (IMMIstock)	0.161***	0.137***	0.256***	0.0137***
		(0.0225)	(0.0224)	(0.0237)	(0.00130)
	Ln (POPdes)	-1.748***	3.244***	2.613***	0.143***
		(0.104)	(0.869)	(0.100)	(0.00596)
	Ln (GDPdes)	2.034***	0.658*	2.963***	0.161***
		(0.124)	(0.390)	(0.118)	(0.00690)
	Ln (POPori)	-1.801***	2.749***	2.568***	0.114***
		(0.0865)	(0.536)	(0.575)	(0.0335)
	Ln (GDPori)	2.127***	1.291***	1.295***	0.0753***
		(0.0908)	(0.204)	(0.219)	(0.0130)
	Ln(dis)	-0.757***	-0.896***	-0.677***	-0.0324***
		(0.0467)	(0.0574)	(0.0560)	(0.00297)
	Time dummy	NO	YES	YES	YES
	Destination dummy	NO	YES	YES	YES
	Origin Dummy	NO	NO	NO	NO
	Observations	4,326	4,326	4,326	4,326
	R-squared	0.605	0.760	0.759	
	Pseudo R2				0.2356
Part B: Using variation treatment timing	NewEU	-1.113***	5.036***	4.634***	0.0739
		(0.168)	(1.440)	(1.720)	(0.338)
	Post	-0.917***	-0.0428	-0.256**	-0.0120
		(0.0858)	(0.114)	(0.108)	(0.0215)
	NewEU*Post	0.264**	0.682***	1.074***	0.0768
		(0.126)	(0.120)	(0.237)	(0.0753)
	IMMIstock* NewEU*Post			0.132***	0.0204**
				(0.0269)	(0.00829)
	Ln (IMMIstock)	0.143***	0.126***	0.156***	0.0910***
		(0.0227)	(0.0226)	(0.0254)	(0.00636)
	Ln (POPdes)	-1.749***	3.540***	2.210**	0.628***
		(0.106)	(0.878)	(1.033)	(0.180)
	Ln (GDPdes)	2.055***	0.894**	-0.755	-0.108
		(0.126)	(0.402)	(0.473)	(0.104)
	Ln (POPori)	-1.596***	2.865***	-2.026***	-0.0782
		(0.0812)	(0.540)	(0.0907)	(0.151)
	Ln (GDPori)	1.910***	1.264***	2.449***	0.463***
		(0.0845)	(0.206)	(0.0951)	(0.0583)
	Ln(dis)	-0.778***	-0.916***	-0.727***	-0.120***
		(0.0472)	(0.0576)	(0.0471)	(0.0129)
	Time dummy	NO	YES	YES	YES
	Destination dummy	NO	YES	YES	YES
	Origin Dummy	NO	NO	NO	YES
	Observations	4,326	4,326	4,326	4,326
	R-squared	0.603	0.674	0.726	0.5572

Standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1. This table is presenting the results of the econometric estimation of equation (4) (5) for part A and equation (6) for Part B. The estimation method used from columns (1) to (3) is the DID using OLS estimation. The estimation presented in the last column is the DID using the PPML estimation. The data used in this table includes EU countries from 1998 to 2018. Ln (FDI inflow) is the natural logarithm of total FDI inflow to the destination country. The independent variable includes the DID set of variables, the treatment group is the New EU country, and the control group is the old EU country.

3.4 Main results

3.4.1 FDI inflow and outflow using the old EU as control group

This section presents the baseline regression results using different estimation methods. After determining that the best estimate of DID was generated using equation (3:6) to address the effect of immigration on the bilateral FDI flows (With both approaches using the OLS and the PPML), the analysis continued with a comparison between the impact of immigration on the FDI in/out-flow. Table (18) shows the estimates using different specification of equation (3:6). All regressions in this section include time dummies for each year to account for any missing variables that vary over time. Model 1 in Table (18) is identical to model 3 part B in Table (17), hence this column was added to facilitate comparison. As shown in column 1 in Table (18), the results for the DID variables are highly significant. In this model, the method of estimation is the OLS with time and destination dummy added to the model. The same was applied in model 4 for the FDI outflow. The coefficient of interest is (IMMIstock* NewEU*Post), which illustrates the effect of immigration on FDI inflow and outflow in the model (1 and 4), respectively. Increasing immigration from the new EU after the restrictions were lifted by 10% led to an increase in the FDI inflow by 1.3% and an increase in the FDI outflow by 0.8 %. A dummy for destination countries was included in both estimations. The remaining of Table (18) presents the PPML estimation for equation (3:6). The provided results in Table (17) part B, model 4 is similar to model 3's OLS specification but employs the PPML estimation technique with a full set of dummies for destination, origin and time. The inclusion of the pair-country effect distinguishes these models from the models reported in Table (18). Utilizing these pair-fixed effects as a proxy for bilateral costs has been shown to be more accurate (Zhou et al., 2007). Moreover, it will also contribute to dealing with the endogeneity problem of immigration. Due to the inclusion of pair-fixed effects in equation (3:6), it is possible to successfully absorb the bilateral time-invariant variables used in the traditional gravity model like contiguity, language, and colonial ties. In model 2, Table (18) displays statistically significant findings of the PPML without adding the pair-fixed effects.

However, adding the pair-fixed effects to the PPML generally requires the use of a dummy variable to absorb all non-absorbable effects for each country pair, which will impact any variable in the estimation that does not vary over time across the country pairs. In this case, the destination variable does not vary over time, therefore it is considered as weakly identified in the model when the pair-fixed effects are added. Hence, it was eliminated from models 3 and 6 along with the destination dummy. Model explanatory power rises when comparing models 2 and 3 for FDI inflow and models 5 and 6 for FDI outflow, as demonstrated by an increase in the Pseudo R2 squared from 0.2912 to 0.6742 for model 3 and from 0.1714 to 0.6672 for model 6. The value of the variable of the interest's coefficient (IMMIstock* NewEU*Post) drops while employing PPML with pair-fixed effects as opposed to OLS. In models 3 and 6, a 10% increase in immigration stock from the treatment group results in a 0.64% increase in FDI inflow to Old EU countries, and a 0.55% increase in FDI outflow from the Old EU countries to the countries of origin, which are lower values than those reported in model 1 and model 4. Nevertheless, the results are consistent in terms of the positive sign and significant level.

Table 19: The impact of immigration on FDI inflow and outflow using the Old EU as control group.

	(1)	(2)	(3)	(4)	(5)	(6)
	Ln(FDI inflow)			Ln(FDI outflow)		
	OLS	PPML	PPML	OLS	PPML	PPML
NewEU	4.634***	0.216**	0.205**	0.402***	0.207**	0.174***
	(1.720)	(0.0917)	(0.0921)	(0.153)	(0.0816)	(0.0655)
Post	-0.256**	-0.0140**	-0.0196***	-0.0809	-0.00395	-0.0117**
	(0.108)	(0.00552)	(0.00554)	(0.106)	(0.00529)	(0.00475)
NewEU*Post	1.074***	0.0729***	0.0790***	0.333	0.0106	0.0692***
	(0.237)	(0.0151)	(0.0154)	(0.227)	(0.0137)	(0.0138)
IMMIstock* NewEU*Post	0.132***	0.0486***	0.0645***	0.0776***	0.0324**	0.0551***
	(0.0269)	(0.00168)	(0.00175)	(0.0262)	(0.00146)	(0.00149)
Ln (IMMIstock)	0.156***	0.128***	0.120***	0.313***	0.169***	0.276**
	(0.0254)	(0.00126)	(0.00109)	(0.0212)	(0.00114)	(0.00253)
Ln (POPdes)	2.210**	0.144***	0.153***	3.558***	0.190***	0.155***
	(1.033)	(0.00593)	(0.00591)	(0.103)	(0.00640)	(0.0404)
Ln (GDPdes)	-0.755	0.163***	0.167***	4.071***	0.217***	0.0539***
	(0.473)	(0.00688)	(0.00705)	(0.120)	(0.00742)	(0.0198)
Ln (POPori)	-2.026***	0.113***	0.109***	0.846	0.0302	-0.00591
	(0.0907)	(0.0338)	(0.0343)	(0.554)	(0.0306)	(0.0239)
Ln (GDPori)	2.449***	0.0763***	0.0740***	1.279***	0.0732***	0.0667***
	(0.0951)	(0.0128)	(0.0130)	(0.197)	(0.0106)	(0.00845)
Ln(dis)	-0.727***	-0.0329***		-0.895***	-0.0437***	
	(0.0471)	(0.00302)		(0.0538)	(0.00302)	
Time dummy	YES	YES	YES	YES	YES	YES
Destination dummy	YES	YES	NO	YES	YES	NO
Origin Dummy	NO	NO	NO	NO	NO	NO
Pair-fixed effects	NO	NO	YES	NO	NO	YES
Observations	4,326	4,326	4,326	4,976	4,976	4,958
R-squared	0.726			0.630		
Pseudo R2		0.2912	0.6742		0.1714	0.6672

This table presents the estimates from OLS regression and PPML regression of FDI inflow and outflow. The dependent variable, Ln (FDI inflow) and Ln(FDI outflow) is the natural logarithm of total FDI inflow and outflow to and from the destination country. The independent variable includes the DID set of variables, the treatment group is the New EU country, and the control group is the old EU country. the control variables for the standard gravity model of equation (3:6) are included. *t*-statistics are reported in parentheses. *, ** and *** indicate statistical significance at the 10%, 5% and 1% level, respectively.

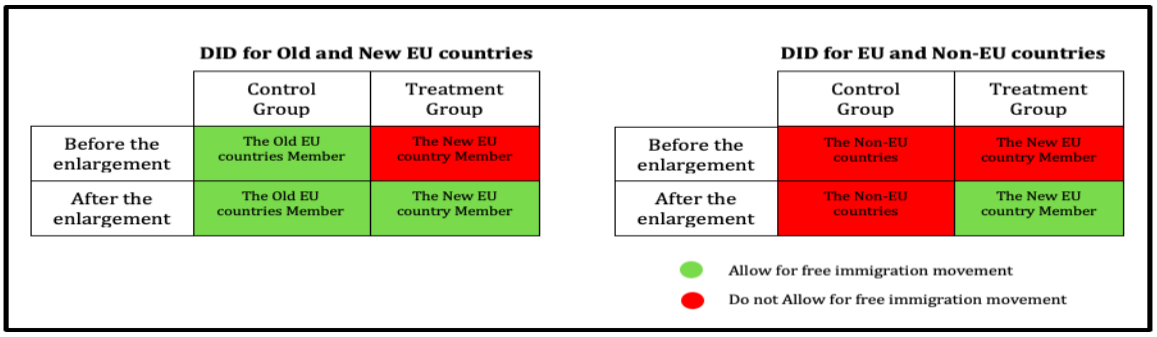
3.4.2 FDI inflow and outflow using the non-EU as a control group

In the previous section, DID analyses compared two types of EU countries before and after the enlargement. The control group consists of EU country members who were allowed free immigrant movement both before and after 2004's enlargement, whereas the treatment group consists of EU country members who were not allowed free immigrant movement before 2004's enlargement. Instead of utilising the Old EU

countries as a control group in this section of the analysis, this study will include a new control group consisting of non-EU countries. This is a set of randomly picked countries that are not members of the European Union. The treatment group, which is the new EU, will remain unchanged.

In this case, the DID will compare the control group, which includes countries that are not members of the EU and do not have free movement prior to or following enlargement, to the treatment group. The treatment group includes countries that were not members of the EU prior to 2004 and did not have free immigration movement but became members of the EU after 2004 and now have free immigration movement. See Figure 6 for more clarification.

Figure 6: The difference between using Old EU countries and Non-EU countries as control group.



This step will extend the scope of the research outside the borders of the EU and to compare other types of immigrant populations with varying backgrounds by using this group as the control group. Furthermore, the study continues with the use of the baseline equation (3:6), followed by the application of the OLS and the PPML estimation techniques to the new set of data. The findings are provided in the following Table (19).

The coefficient of the main variable (IMMIstock* NewEU*Post) is positive and significant and it is larger in magnitude comparing to the previous section. The impact of immigration of the new EU that is reported in Table (19) indicates an increase of 10% of immigration stock on the destination country, leading to an increase in FDI inflow by approximately 1.8%. However, when the PPLM with the Pair-fixed effect is used, the

effect that immigration has on FDI inflows is reduced to roughly 0.6%. Additionally, the impact on FDI outflows is rather significant when non-EU countries are included as a control group. In comparison to the results in Table (18), Table (19) indicates a larger magnitude for the influence of immigration on FDI outflow. According to the results in Table (19), increasing immigration stock by 10% on the Old EU countries, resulted in an increase in the FDI outflow by 1.6% using the OLS estimation and 0.6% using PPLM with a Pair-fixed affect. The rest of the control variable for the gravity model is consistent and relatively close to what was expected from the model throughout the various estimation specifications utilised.

To sum up, this section, using the non-EU country as a control group enhanced the results of the DID estimation in terms of the coefficient magnitude, compared to using the Old EU as a control variable. The reason for this could be that the number of countries included in the control group increases from 14 to 30, and the variety of countries, cultures, restrictions, and backgrounds all contribute to slightly intensifying the impact of immigration from the New EU when the DID and non-EU are used as control groups rather than the Old EU.
In the European Union, immigration has positively influenced the inflow of foreign direct investment. In addition, the impact on FDI outflow is greater when the non-EU is used as a control group for comparison, due to the substantial increase of immigration stock from the new EU to the old EU compared to immigration stock from non-EU (see Table (16)), which means increased networking channels for the new EU country.

The effect of the control variables for the gravity model in all specifications is often strong and significant with the anticipated sign. However, some variables, such as population and GDP for both the country of origin and the country of destination, lack statistical significance and display unexpected signs. A possible explanation is that adding the dummy variables for origin and destination countries and the pair-fixed effect to the estimations eliminates the impact of these variables.

Table 20: The impact of immigration on FDI inflow and outflow using the non-EU as control group.

	(1)	(2)	(3)	(4)	(5)	(6)
	Ln(FDI inflow)			Ln(FDI outflow)		
	OLS	PPML	PPML	OLS	PPML	PPML
NewEU	-0.959	0.604***	0.230**	-0.869	-0.284	0.713***
	(1.849)	(0.578)	(0.101)	(1.503)	(0.339)	(0.0948)
Post	0.230**	0.0415	0.0108**	0.0284	0.00628	0.00225
	(0.104)	(0.0295)	(0.00528)	(0.0772)	(0.0176)	(0.00371)
NewEU*Post	1.586***	0.330***	0.0757***	0.877***	0.149***	0.0471***
	(0.262)	(0.0789)	(0.0199)	(0.243)	(0.0568)	(0.0138)
IMMIstock* NewEU*Post	0.187***	0.0258***	0.0570***	0.164***	0.0230***	0.0625***
	(0.0297)	(0.00860)	(0.00220)	(0.0260)	(0.00584)	(0.00147)
Ln (IMMIstock)	0.312***	0.0918***	0.00274	0.326***	0.0598***	0.000589
	(0.0212)	(0.00721)	(0.00283)	(0.0178)	(0.00419)	(0.00221)
Ln (POPdes)	-3.505***	1.034***	0.361***	-4.131***	1.141***	0.340***
	(0.101)	(0.240)	(0.0453)	(0.109)	(0.187)	(0.0380)
Ln (GDPdes)	3.865***	0.295**	0.113***	4.834***	-0.0360	0.0311
	(0.115)	(0.146)	(0.0232)	(0.123)	(0.122)	(0.0206)
Ln (POPori)	-0.431	0.505***	-0.0312	-0.157	-0.00823	-0.0326*
	(0.529)	(0.165)	(0.0282)	(0.427)	(0.0964)	(0.0194)
Ln (GDPori)	0.922***	0.400***	0.0706***	0.790***	0.196***	0.0543***
	(0.119)	(0.0323)	(0.00595)	(0.0966)	(0.0189)	(0.00425)
Ln(dis)	-0.494***	-0.207***		-1.188***	-0.372***	
	(0.0783)	(0.0259)		(0.0708)	(0.0184)	
Time dummy	YES	YES	YES	YES	YES	YES
Destination dummy	YES	YES	NO	YES	YES	NO
Origin Dummy	NO	NO	NO	NO	NO	NO
Pair-fixed effects	NO	NO	YES	NO	NO	YES
Observations	5,472	5,472	5,472	7,364	7,364	7,364
R-squared	0.658			0.639		
Pseudo R2		0.2419	0.6673		0.1697	0.6384

Standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1.This table presents the estimates from OLS regression and PPML regression of FDI inflow and outflow. The dependent variable, Ln (FDI inflow) and Ln(FDI outflow) is the natural logarithm of total FDI inflow and outflow to and from the destination country. The independent variable includes the DID set of variables, the treatment group is the New EU country, and the control group is the non-EU country. The control variables for the standard gravity model of equation (3:6) are included.

3.4.3 The Impact of immigration flow on FDI flow

In this section, the study will use the immigration inflow in the analyses instead of immigration stock as a part of robustness check to confirm the positive association of immigration networks and FDI. The immigration inflow is the total number of immigrants who enter a country during a certain period of time, in this example one year. By focusing on immigration inflows rather than immigration stock, this part can capture the short-term impact of immigration on FDI and determine whether or not they have an effect in the short run. As the link between FDI and immigration has been addressed in a significant number of papers, it was not common to research this relationship using immigration flows; rather, scholars examined the influence of the immigration community's network using immigration stock. However, as mentioned previously, Tomohara (2017) employed immigration flow to distinguish between the short- and long-term effects of immigration on FDI. Similarly, this section will introduce the immigration inflow to this study baseline regression. Using the same set of countries of origin from the EU and Non-EU, this part added different regressors to include the immigration inflow from the country of origin to the Old EU counters, the equation followed in this part is:

$$Y_{ijt} = \beta_0 + \beta_1 post + \beta_2 NewEU + \beta_3 post * NewEU + \beta_4 MMIinflow * post * NewEU + \beta_5 IMMIinflow + \beta' X' + \tau_t + \delta_j + \varepsilon_{ijt}.. \quad (3:7)$$

Whereas (MMIinflow*post*NewEU) is the variable of interest and it is equal to the number of immigrations from country i who inter country j at year t if the country i is in the treatment group and the time is after country j allow for free immigration movement, and equal to zero otherwise.

IMMIinflow is the total number of immigrations from country i who enters country j at year t. The results presented in Tables (20) and (21) are in line with the previous results as well as the majority of the literature.

Comparing the immigration stock and immigration flow impacts on the FDI inflow, a decrease in the magnitude of the coefficient of interest (MMIinflow*post*NewEU) is reported in Tables (20) and (21). The result is positive and significant when using the PPML as the estimation method. In Table (20) model 1, the equation (3:7) was estimated

using a full set of dummy variables for the destination country and time with OLS. The results demonstrate a positive but not significant increase in the FDI inflow. However, after using the PPML and adding the pair-fixed effect to it, the results enhanced and changed to be significant in models 2 and 3. According to the results in model 3, an increase in the immigration inflow by 10% leads to an increase in the FDI inflow by 0.06%. This effect is smaller than the results when considering the immigrant stock in the main results of this chapter. However, moving to the immigration flow impact on the FDI outflow presented in model 6, the results indicate a significant and minor rise in the FDI outflow, a 10% increase in immigration flow results in a 0.08% increase in the FDI outflow from the old EU to the new EU. A small effect of immigration flow on the FDI is expected.

Table 21: The estimation results of immigration flow impact on FDI flow using the (old EU) as a control group.

	(1)	(2)	(3)	(4)	(5)	(6)
	Ln(FDI inflow)			Ln(FDI outflow)		
	OLS	PPML	PPML	OLS	PPML	PPML
NewEU	2.601	0.0343	-0.00760	0.369**	0.157*	0.187**
	(1.750)	(0.105)	(0.0111)	(0.170)	(0.0942)	(0.0769)
Post	-0.144	0.00243	0.00463	-0.0349	0.0104*	-0.0130**
	(0.131)	(0.00609)	(0.00738)	(0.131)	(0.00567)	(0.00552)
NewEU*Post	0.716***	0.0712***	0.0515***	0.533**	0.00502	0.0542***
	(0.232)	(0.0146)	(0.0157)	(0.207)	(0.0121)	(0.0125)
IMMIflow* NewEU*Post	0.00115	0.00516***	0.00680***	0.00108	0.00377**	0.00784***
	(0.0326)	(0.00195)	(0.00204)	(0.0276)	(0.00153)	(0.00160)
Ln (IMMIflow)	0.193***	0.0145***	0.00975***	0.309***	0.0145***	0.00889***
	(0.0324)	(0.00143)	(0.00177)	(0.0289)	(0.00133)	(0.00239)
Ln (POPdes)	5.075***	-0.116***	0.179***	4.563***	-0.140***	0.200***
	(1.148)	(0.00756)	(0.0647)	(1.175)	(0.00706)	(0.0474)
Ln (GDPdes)	-0.732	0.131***	-0.0248	0.0672	0.160***	0.0442
	(0.679)	(0.00885)	(0.0390)	(0.693)	(0.00831)	(0.0284)
Ln (POPori)	2.679***	0.0799**	0.117***	-1.145***	-0.00204	-0.00388
	(0.671)	(0.0398)	(0.00600)	(0.0910)	(0.0342)	(0.0279)
Ln (GDPori)	0.783***	0.0506***	0.141***	1.476***	0.0803***	0.0690***
	(0.240)	(0.0143)	(0.00594)	(0.0897)	(0.0113)	(0.00916)
Ln(dis)	-0.753***	-0.0447***		-0.859***	-0.0488***	
	(0.0642)	(0.00336)		(0.0574)	(0.00355)	
Time dummy	YES	YES	YES	YES	YES	YES
Destination dummy	YES	YES	NO	YES	YES	NO
Origin Dummy	NO	NO	NO	NO	NO	NO
Pair-fixed effects	NO	NO	YES	NO	NO	YES
Observations	3,158	3,158	3,158	3,817	3,817	3,817
R-squared	0.729			0.614		
Pseudo R2		0.2558	0.5928		0.1703	0.6097

Standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1.This table presents the estimates from OLS regression and PPML regression of FDI inflow and outflow. The dependent variable, Ln (FDI inflow) and Ln(FDI outflow) is the natural logarithm of total FDI inflow and outflow to and from the destination country. The independent variable includes the DID set of variables, the treatment group is the New EU country, and the control group is the old EU country. the control variables for the standard gravity model of equation (3:7) are included.

Additionally, the robustness extends to adding the non-EU immigration flow as a control group for an alternative measurement of immigration. The result is also in line with the previous estimation results. Compared to the results in Table (20), models 1 and 4 which are estimated using the OLS in Table (21) show significant and positive results, unlike the same specification models in Table (20). This could be explained by the difference in the

countries' characteristics that were included in the control group[45]. It should be noted that across all the models in Table (21), the immigration flow is found to be related to increased FDI inflow and outflow.

Table 22: The estimation results of immigration flow impact on FDI flow using the (non-EU) as a control group.

	(1)	(2)	(3)	(4)	(5)	(6)
	Ln(FDI inflow)			Ln(FDI outflow)		
	OLS	PPML	PPML	OLS	PPML	PPML
NewEU	-1.589	-0.132	-0.142	-0.00648	-0.00815	0.0337***
	(2.105)	(0.118)	(0.122)	(1.482)	(0.0842)	(0.00455)
Post	0.000375	0.00993	-0.000619	0.0720	0.00316	0.00317
	(0.108)	(0.00669)	(0.00606)	(0.0892)	(0.00463)	(0.00522)
NewEU*Post	0.684***	0.0244*	0.0435***	-0.0865	-0.00301	0.0144
	(0.250)	(0.0142)	(0.0140)	(0.189)	(0.0117)	(0.0115)
IMMIflow* NewEU*Post	0.114***	0.00337*	0.00642***	0.0872***	0.00469***	0.00680***
	(0.0353)	(0.00197)	(0.00193)	(0.0267)	(0.00150)	(0.00149)
Ln (IMMIflow)	0.376***	0.0237***	0.0219***	0.508***	0.0278***	0.0208***
	(0.0213)	(0.00142)	(0.00124)	(0.0182)	(0.00109)	(0.000956)
Ln (POPdes)	-3.199***	0.308***	0.182***	7.933***	0.419***	0.423***
	(0.133)	(0.0603)	(0.00816)	(0.897)	(0.0496)	(0.0548)
Ln (GDPdes)	3.450***	-0.0106	0.196***	-0.835	-0.0357	-0.0263
	(0.156)	(0.0372)	(0.00961)	(0.522)	(0.0300)	(0.0331)
Ln (POPori)	-0.783	0.0607*	0.0629*	-0.416	-0.0253	0.0338***
	(0.606)	(0.0342)	(0.0353)	(0.425)	(0.0241)	(0.00112)
Ln (GDPori)	0.976***	0.0664***	0.0638***	0.839***	0.0472***	0.0571***
	(0.124)	(0.00672)	(0.00707)	(0.0942)	(0.00490)	(0.00117)
Ln(dis)	-0.495***	-0.0567***		-1.026***	-0.0798***	
	(0.0934)	(0.00576)		(0.0719)	(0.00457)	
Time dummy	YES	YES	YES	YES	YES	YES
Destination dummy	YES	YES	NO	YES	YES	NO
Origin Dummy	NO	NO	NO	NO	NO	NO
Pair-fixed effects	NO	NO	YES	NO	NO	YES
Observations	4,324	4,324	4,324	5,983	5,983	5,983
R-squared	0.650			0.576		
Pseudo R2		0.2416	0.5035		0.2713	0.5398

Standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1. This table presents the estimates from OLS regression and PPML regression of FDI inflow and outflow. The dependent variable, Ln (FDI inflow) and Ln(FDI outflow) is the natural logarithm of total FDI inflow and outflow to and from the destination country. The independent variable includes the DID set of variables, the treatment group is the New EU country, and the control group is the non-EU country. the control variables for the standard gravity model of equation (3:7) are included

[45] When using the non-EU as a control group the countries included has different criteria than the any of the EU country. Hence, the network impact of the New EU expected to be larger when using the non-EU as a control group instead of old EU.

The results of the estimations in the previous sections appear consistent with positive and mostly significant coefficients, confirming the associated literature's conclusion that immigration networks do help to attract investment. The other variable that is included in the gravity model (the GDP and the population for both country of origin and the destination country) shows almost consistent results

3.5 Conclusions

Immigration movements between countries are expanding globally, and their potential influence on the economic exchanges is substantial, especially in the EU. Therefore, understanding the effects of immigration on bilateral interactions is vital for understanding the mechanisms that control an increasingly linked global economy. Using a gravity model with DID estimation strategy this chapter examines the relationship between the immigration network and FDI inflow and outflow. It focuses on the impact of immigration, who comes from the New EU country members after 2004 to the Old EU members. Unlike the previous studies, the data used in this chapter for immigration from New EU is uniquely structured by the time of free movement. This means it takes into consideration the time variance among the Old EU countries in allowing immigration from the New EU members to freely move without restriction. This variance of time is different from country to country from the first members to allow for immigration movement as soon as the enlargement happen in 2004 to the last member to lift the restriction in 2011. This chapter takes this unique structured data and applies the DID with time variance to capture the impact caused by immigration from the New EU on the FDI inflow and outflow. Additionally, this chapter presents empirical evidence that immigrant networks boost both inward and outward FDI flows. It shows a significant impact of immigration, measuring by immigration stock on the FDI inflow and outflow using both estimation methods (OLS and PPML).

Additionally, and perhaps most significantly, the signs of immigration coefficients are positive and significant at the 1% level at both FDI inflow and FDI outflow across multiple specifications. In line with the production for the impact of immigration network theory and previous studies, an increase of 1% in the immigration stock from new EU countries in

relation to old EU countries resulted in an increase of 0.06% in FDI inflow and an increase of 0.05% in FDI outflow. Moreover, an increase of 1% in immigration from new EU countries compared with immigration from non-EU countries resulted in average rises of 0.05% in FDI inflow and 0.06% in FDI outflow. Similar outcomes are shown in Tables 20 and 21, in which immigration flow is used instead of immigration stock. Overall, when comparing immigration from the EU (both new and old EU countries), the findings indicated that the effect was slightly greater on FDI inflow than on outflow. However, when the effects of immigration from new EU countries were compared with the effects of immigration from non-EU countries, the results showed that the effect was slightly higher on FDI outflow.

A set of other specifications were conducted for a robustness check, including the immigration flow as a measurement instead of immigration stock, and the estimated findings were consistent with the primary conclusions. Moreover, when using the multilateral resistance of immigration for the baseline model, the outcomes of the estimation remain fairly consistent with the rest of the analyses.

The findings of this chapter indicate that immigration benefits the economies of both the country of origin and the host country. Prior to the EU's enlargement until recently, it was widely assumed that immigration had a negative impact on the economy; however, the findings in this chapter suggest otherwise. A country that allows for free immigration movement after enlargement will witness the FDI flow increase in both directions. This result could help policymakers when designing future immigration policies.

Conclusion

The ways in which immigration affects the economies of both the host country and the country of origin has been the subject to much debate for decades. Consistently, narratives have emerged regarding immigration, which has often been deployed by media and nation-states to scaremonger, suggesting that immigration has negative impacts, such as reducing jobs for natives. Prior to the enlargement of the EU, immigration increases were a contentious issue, which has re-emerged once again in the context of Brexit and how this has resulted in a policy shift on immigration between the EU and the UK. This thesis contributes to answering many of the questions raised about immigration and its impact on EU countries and to that extent, the findings of this thesis could help the policymakers in designing future immigration policy.

Firstly, this thesis considers the impact of immigration on the female labour market's outcome. It examines this relationship by focusing on females in the UK. Since this chapter considered females, it utilized the Heckman estimation to solve the sample selection problem using the number of children under the age of 5 and then examined the impact of immigration on native female wages (which disaggregated into white native and non-white native). The sample was disaggregated further based on the level of qualification using a new skill classification system to capture the impact on each skill level. The result was positive across all specifications. However, the results of examining the impact of immigration shares on foreign-born female workers show a reduction in their wage. The findings of this chapter indicate that immigrants have a complementary relationship with native female workers. This could be an indicator of knowledge transfer to the native worker, especially on the high qualification level. Moreover, a supplementary impact was found with foreign-born female workers. This means that the fear of immigrants competing with native UK females for their jobs is not necessary, considering that in actuality, immigrants are only competing with the foreign-born female workers that are involved in the UK labour market.

The second main chapter of this thesis examined the link between immigration and trade by using the natural experiment event to determine the causal impact of immigration on exports and imports within the EU. After the 2004 expansion, individuals from new EU member states were granted free entry to former EU member states. However, some nations had established a transitional arrangement that meant that they could restrict immigration for a few years following enlargement. This chapter considers the difference in time when free movement was allowed as a natural experiment. In accordance with prior research, this study applied the gravity model while adding the Difference in Difference estimation and utilising the variation from different points in time of countries allowing the free movement of immigration from the new EU member to the older EU member. In agreement with findings in the literature, the results imply that immigration has a positive impact on exports and imports, with the effect on imports being, to some extent, greater across the majority of the analysis's specifications.

The last main chapter of this thesis explored the impact of immigration on the FDI. It examined if, and to what extent, the increase in immigration following the enlargement of the European Union was linked to bilateral FDI flows. Using bilateral data between the old European Union country members as a destination countries, and 53 countries (including both old and new EU country members) as a country of origin, the analysis utilised a gravity model with the DID estimation adding the event of the enlargement as the natural experiment to find a series of impacts of immigration on the FDI. The results demonstrate a positive and statistically significant effect of immigration on both FDI inflow and outflow.

The findings of this thesis overall contribute to answering the question of how immigration impacts on economic outcomes, especially in the EU area. The findings show that immigration improves the economic outcome for the host country in 3 different ways. They benefit the female worker through an increase in their wage. They benefit the firms in both home and host countries to reach international markets through their networks. Additionally, they benefit both home and host countries in development by improving the FDI flow to and from their home countries. The findings of this thesis could potentially form a solid basis to inform policymakers in their future design of immigration policy.

However, the author faced a limitation of missing data and accessing different sites to obtain data relating to different skill levels of immigration in chapters 2 and 3. Future research could extend the first chapter by distinguishing between the country of origin of immigration shares included in the analyses and grouping them based on their origin, i.e., EU and non-EU. Moreover, the classification of the qualifications used in the first chapter could be explored using different estimation methods. Additionally, future research could investigate the different impacts of different skill-level groups of immigrants using the same approach provided in the second and third chapters.

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