

Di Iasio, Valentina; Wahba, Jackline

**Working Paper**

## Expecting Brexit and UK Migration: Should I Go?

IZA Discussion Papers, No. 16156

**Provided in Cooperation with:**

IZA – Institute of Labor Economics

*Suggested Citation:* Di Iasio, Valentina; Wahba, Jackline (2023) : Expecting Brexit and UK Migration: Should I Go?, IZA Discussion Papers, No. 16156, Institute of Labor Economics (IZA), Bonn

This Version is available at:

<https://hdl.handle.net/10419/278854>

**Standard-Nutzungsbedingungen:**

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

**Terms of use:**

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*

DISCUSSION PAPER SERIES

IZA DP No. 16156

**Expecting Brexit and UK Migration:  
Should I Go?**

Valentina Di Iasio  
Jackline Wahba

MAY 2023

## DISCUSSION PAPER SERIES

IZA DP No. 16156

# Expecting Brexit and UK Migration: Should I Go?

**Valentina Di Iasio**

*University of Southampton*

**Jackline Wahba**

*University of Southampton and IZA*

MAY 2023

Any opinions expressed in this paper are those of the author(s) and not those of IZA. Research published in this series may include views on policy, but IZA takes no institutional policy positions. The IZA research network is committed to the IZA Guiding Principles of Research Integrity.

The IZA Institute of Labor Economics is an independent economic research institute that conducts research in labor economics and offers evidence-based policy advice on labor market issues. Supported by the Deutsche Post Foundation, IZA runs the world's largest network of economists, whose research aims to provide answers to the global labor market challenges of our time. Our key objective is to build bridges between academic research, policymakers and society.

IZA Discussion Papers often represent preliminary work and are circulated to encourage discussion. Citation of such a paper should account for its provisional character. A revised version may be available directly from the author.

ISSN: 2365-9793

**IZA – Institute of Labor Economics**

Schaumburg-Lippe-Straße 5–9  
53113 Bonn, Germany

Phone: +49-228-3894-0  
Email: [publications@iza.org](mailto:publications@iza.org)

[www.iza.org](http://www.iza.org)

## ABSTRACT

---

### Expecting Brexit and UK Migration: Should I Go?\*

This paper examines the impact of the 2016 UK referendum and expecting Brexit on migration flows and net migration in the UK. We employ a Difference-in-Differences strategy and compare EU migration to non-EU migration before and immediately after the UK referendum of June 2016. We also investigate the potential secondary effects of the referendum on non-EU migrants by using different methodologies and various robustness checks. Our results show that after the referendum (i) migration inflows from the EU declined, (ii) emigration of EU migrants increased and (iii) net migration flows from EU countries to the UK fell. Our results are not driven by the potential spillover impacts on non-EU migrant workers. Overall, the findings show that migration in the UK declined after the Brexit referendum, even before any policy change.

**JEL Classification:** F22, J61, J48

**Keywords:** UK migration, EU migration, Brexit

**Corresponding author:**

Jackline Wahba  
Department of Economics  
University of Southampton  
Southampton  
United Kingdom  
E-mail: [j.wahba@soton.ac.uk](mailto:j.wahba@soton.ac.uk)

---

\* This work has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 870299 QuantMig: Quantifying Migration Scenarios for Better Policy. We would like to thank Emily Barker, Jakub Bijak and Corrado Giulietti for useful comments and suggestions.

# 1 Introduction

Migration policy shapes migration flows and stocks as it influences the size, type and characteristics of migration flows. Many studies have focused on the impact of immigration policy, in particular in terms of changes in restrictiveness, on the selectivity of migrants. However, little is known about the effects of uncertain migration policy changes on the size and selectivity of migration flows. We examine the role played by the United Kingdom (UK) Brexit referendum in June 2016, during the immediate period that followed and prior to the official exiting, on UK migration. The UK, narrowly, voted to leave the European Union (EU), where one of the main principles is the freedom of movement of EU nationals between the member States. The outcome of the referendum triggered an immediate period of uncertainty on how future migration flows between the UK and the EU would be regulated. Although the referendum’s result provided a popular mandate to leaving the EU, there was no clarity or agreement on the form of the future UK-EU relationship. Moreover, migration was used as a potential bargaining chip for negotiations by the UK. In this context, the referendum outcome could have led to either no change in pre-Brexit migration policy, if there is a deal between the UK and the EU or if the Brexit doesn’t materialise at all, or in the case of no deal to more restrictive migration policy; i.e. the uncertainty was about how unfavourable those policies will be. This resulted in a period of continued uncertainty regarding post-Brexit migration policy until the actual withdrawal in January 2020; i.e. a waiting period expecting Brexit.<sup>1</sup> This policy uncertainty not only involved potential EU immigrants but also EU nationals already resident in the UK, who did not know what exact rights the ultimate agreement would guarantee them post the UK exiting the EU. This represented a significant shock given that EU nationals had similar rights to the UK natives and freedom of movement which have led to a substantial increase in EU immigration to the UK since 2004, amounting to roughly 5.5% of the total UK population at the time of the referendum. Hence, any change to those rights experienced by EU nationals and more importantly the lack of clear definite policy change resulted in a period of frustration and uncertainty.

This paper uses this quasi-experimental setting to establish the impact of the Brexit referendum on UK migration. More specifically, we examine the immediate impact of the UK referendum and expecting Brexit, using a Difference-in-Differences identification strategy. The referendum provides us with a treatment group (EU immigrants) and a control group (non-EU immigrants), which we use to compare pre and post-referendum, while controlling for all other potential confounding factors. First, by using both aggregate data based on Office for National Statistics Long Term International Migration (LTIM) and micro data from the UK Labour Force Survey, we estimate the effect on inflows, outflows, and net flows of EU migration in the UK. We distinguish migrants by their main reason at entry for immigration to the UK and by their socioeconomic characteristics. We also investigate whether EU14 and new EU member States immigrants responded differently to this uncertainty.

This paper contributes to the literature on the determinants of migration, in particular those on the effects of migration policies. There is a rather large literature on the determinants of migration focusing on the scale and selectivity of migration; see for example [Grogger and](#)

---

<sup>1</sup>See [Dhingra and Sampson \(2022\)](#) who refers to this period as “Expecting Brexit”.

Hanson (2011) and Belot and Hatton (2012). Some studies suggest a crucial effect of policies on migration flows, although concurring with other determinants; e.g. (Czaika and De Haas, 2013). Intuitively, less restrictive migration policies encourage migration flows, while the opposite is true for more restrictive policies, which increase migration costs (Beine et al., 2016). For example, Hatton (2005) finds that less restrictive policies increased net migration to the UK between the years 1976 and 2000. Mayda (2010), analysing migration inflows to 14 OECD countries, shows that migration policy interplay with other push and pull factors in shaping migration flows. Similarly, Ortega and Peri (2013) confirm the role of migration policies, and find evidence that the European process of integration significantly increased intra-Europe migration. Beine et al. (2019) show that the Schengen agreements significantly increased the international mobility of workers between the member countries. Also, Razin and Wahba (2015) find that migration regimes, and whether migration is free or restricted, affect the selectivity of migrants in the EU. A few studies examine the impact of immigration policies on the economy and the labour market. For example, Chassamboulli and Peri (2020) study the economic effects of different immigration policies on the different migration channels in the US, while Clemens et al. (2018) examine the impact of restrictive immigration policies on labor shortages. Finally, a strand of the literature on the drivers of migration has also focused on the impact of other public policy changes on international migration. Agersnap et al. (2020) investigate the effects of reforms of immigrant welfare benefits for non-EU immigrants in Denmark on international migration and find support for the welfare magnet hypothesis. Kleven et al. (2020) review the empirical literature on the effects of taxation on migration selectivity. Nielsen et al. (2009) studies the impact of more restrictive regulations of marriage migration. Thus, overall there is ample empirical evidence on the potential important role played by policy on immigration, but not on the impact of expected or uncertain migration policy change.<sup>2</sup>

Our paper is also connected to studies examining the determinants of out-migration. There is a growing literature on the selectivity of out-migration, see Borjas and Bratsberg (1996), Bijwaard et al. (2014), Bijwaard and Wahba (2014) and Dustmann and Görlach (2016). Very few have studied the role of policy change on out-migration. An exception is Bratu et al. (2020) that, using a Difference-in-Differences identification strategy, studies the impact of a more restrictive policy on family reunification on migration in Denmark. They find a significant increase in the outflows of Danish citizens with immigrant background and evidence of a spillover effect of the policy as most of these emigrants moved to Sweden, a neighbouring country in which reunification was less restrictive.

Unlike these previous studies, we contribute to this literature by investigating the impact of a shock to migration policy expectations and uncertain migration policy changes. Despite a large literature on the impact of policy uncertainty on several micro and macro outcomes - e.g. Baker et al. (2016) find micro and macro evidence that policy uncertainty reduces

---

<sup>2</sup>Our paper is also related to the recent strand of literature on how migration policy changes do not only impact flows to the country imposing them, but also affect migration to other destination countries, which is referred to as Multilateral Resistance to Migration, see for example Artuc and Ozden (2018), Bertoli and Fernández-Huertas Moraga (2015) and Bertoli et al. (2016). Following this strand, we estimate the indirect impact of the Brexit referendum on migration to other EU countries as alternative destinations and find no evidence of it. This additional analysis is presented in Appendix J.

investment, hiring, and growth - the impact of policy uncertainty on migration has not been studied before. As argued by [Bloom et al. \(2018\)](#) the Brexit vote led to unprecedented rise in levels of Media-report-based measures of uncertainty whilst there was very little increase in other uncertainty measures such as stock market volatility as well as little anticipation effects by businesses.<sup>3</sup> There is evidence that policy uncertainty increased post the referendum as reflected by the Economic Policy Uncertainty (EPU) index which is based on newspaper coverage frequency and developed by [Baker et al. \(2016\)](#) to measure policy uncertainty. Indeed, economic policy uncertainty in the UK increased from 112 between Q1 2013 - Q2 2016 to 211 between Q3 2016 - Q4 2019 using the EPU Index. Moreover, the EPU-Migration Index doubled from 679 to 1357 showing that uncertainty regarding migration policy doubled.<sup>4</sup>

The Brexit referendum offers an ideal setting since, between the referendum vote on 23 June 2016 and the UK finalising its agreement with the EU about its relationship post the transition period ending on 31 January 2020, there was over a four year period in which there was still freedom of movements of EU citizens to the UK (and vice versa) but there was no certainty about the future. Our empirical strategy relies on comparing the migration behaviour of EU migrants relative to non-EU migrants in each quarter before (Q1 2013 - Q2 2016) and after (Q3 2016 - Q4 2019) the referendum and enables us to control for various potential confounding factors as discussed below. Given that during the period of interest between 2016 and 2019 Brexit was expected though there were no changes in EU migration policy implemented, one would expect that the change in future relationship between the UK and the EU might trigger less inflows and more outflows due to the difficulty that EU immigrants have to face in making plans for themselves and their families, but also might encourage some to move to the UK before the change in policy.<sup>5</sup> Thus, the overall impact of expecting Brexit on UK migration is ambiguous.

Our findings show that after the referendum vote, there was a negative and significant decline in the inflows of EU immigrants. The results suggest a relative decrease of around 30% of EU immigration. We also find a positive and significant increase in the outflows suggesting a relative increase in EU emigration which has doubled. When analysing the net flows of EU migrants to the UK, our estimates show a substantial negative decline, thus

---

<sup>3</sup>A few studies examine the impact of the Brexit referendum on trade, investment, financial markets, and prices; see [Dhingra and Sampson \(2022\)](#) for an excellent review. The findings show that the Brexit vote had immediate negative effects on the UK economy, for example, higher import and consumer prices, lower investment, and slower real wage and GDP growth. However, there was little, if any, trade diversion away from the EU, suggesting that the anticipated effects of Brexit did not happen before the actual exit of the UK from the EU in 2021, see [Dhingra and Sampson \(2022\)](#). None of these papers have examined the impact of expecting Brexit on UK migration.

<sup>4</sup>Data based on EPU index developed by [Baker et al. \(2016\)](#), see [https://www.policyuncertainty.com/uk\\_monthly.html](https://www.policyuncertainty.com/uk_monthly.html), for data and details on the construction of both Indices.

<sup>5</sup>A closely related paper to ours by [Falkingham et al. \(2021\)](#) studies the causal impact of Brexit on the post-graduation mobility decisions of EU students in the UK. They study the impact of the British government's formal withdrawal notification under Article 50 using data from a survey of graduating international students administered before and after the triggering of Article 50. They find that EU students are significantly more likely than non-EU students to plan on leaving the UK upon graduation immediately after the announcement. Results are driven by students from the new EU countries and students from the EU14 countries who do not have firm migration plans.

confirming the results on the inflows and outflows. Although uncertainty in migration policy might have played an important role, we also discuss other possible channels.

We subject our analysis to various checks. A potential concern is whether our findings are driven by the potential secondary effects of the referendum, due to the fall in EU migrant workers, potentially leading to an increase in non-EU work migration; i.e. spillover effect resulting in substitution of EU migrant workers with non-EU migrant workers. First we use an alternative methodology rather than Difference-in Differences where we do not use non-EU migration as a control group. These results confirm the decline in EU migration and no change in non-EU migration. Secondly, we exclude possible interference, by dropping later years from the analysis and particular occupations, and we also use an alternative control group namely non-working non-EU migrants. All of which confirm that our findings are not driven by any potential spillover effects. We also provide a sensitivity analysis on the validity of the pre-trends using the recent developed techniques, “honest approach” to parallel trends, by [Rambachan and Roth \(2023\)](#). We subject our analysis further to a number of robustness checks using different data sources, specifications and definitions of immigrants. We also provide several placebo tests using pseudo dates to test for the validity of our identification strategy; i.e. parallel trend assumption between EU and non-EU migration. All our results are robust to these checks and quantitatively similar in magnitude.

This paper provides evidence on the changes in UK migration in the after the UK Brexit referendum vote and before the actual withdrawal of the UK from the EU. The findings highlight that, for host countries, periods of uncertainty and expected but undefined changes in migration policy encourage foreign residents to leave and discourage would-be migrants to come. It underscores the importance of clear devised migration policies as a driver of migration. It also suggests that reasonable time leads in announcements and implementation of migration policy changes might be effective in reducing the instability experienced by migrants due to policies with very short lead period.<sup>6</sup>

The remaining of the paper is organised as follows: Section 2 describes the referendum and the context of the ensuing uncertainty; Section 3 presents the data, while the empirical methodology and findings are presented in Section 4. Section 5 discusses the potential spillover effects. Section 6 shows further heterogeneity analysis and further robustness checks. Section 7 discusses the main implications of the findings and concludes.

## 2 The Brexit referendum

Between 1995 and 2015, the number of EU immigrants residing in the UK tripled from 0.9 to 3.3 millions, ([Wadsworth et al., 2016](#)). Net migration from EU countries started to rise significantly with the enlargement of the EU in 2004<sup>7</sup> and in June 2016 it was at a peak of about 200,000 migrants ([Portes, 2022](#)). This was underpinned by freedom of movement, which has been one of the main principles of the European Union ensuring to all

---

<sup>6</sup>[Vono de Vihena and Bijak \(2021\)](#) also argue that migration needs “concrete, rapid and targeted policy responses”.

<sup>7</sup>The countries that joined in 2004 are Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia and Slovenia.



EU nationals the right to reside, look for a job, and enjoy equal treatment with nationals in access to employment, working conditions, rights and social care, in all EU member States. In other words, prior to the Brexit, EU workers residing in the UK had full access to welfare benefits, while non-EU migrants faced restrictive immigration policies and had limited access to benefits and public funds for the first few years of residing in the UK.<sup>8</sup>

With the referendum of the 23 June 2016 the UK voted in favour of leaving the European Union, and this started a long period of uncertainty on how migration movements between the EU and the UK would be regulated, and on what rights new and existing EU immigrants will have.<sup>9</sup> At the time of the referendum it was not clear whether the UK would leave the Single Market or try to retain the benefits of the membership via bilateral agreements or membership in the European Free Trade Area countries (Portes, 2022). In January 2017, the speech of the Prime Minister Theresa May confirmed the intention of leaving the EU's single market.<sup>10</sup> In March of the same year the UK Government gave formal notification of the intention to leave the EU under Article 50 of the Lisbon agreement, officially starting the Brexit process.<sup>11</sup> As mentioned by the Migration Observatory (2017), despite Article 50 and the UK Government's promises, "One of the biggest issues affecting EU nationals living in the UK – and UK nationals living in the EU is what rights they will have to live and work in the UK after Brexit." Over the following three years and until December 2020, negotiations between the UK and the EU focused on the withdrawal agreement and what sort of relationship the UK will have with the EU. Needless to say, immigration was seen as a bargaining chip. In December 2018, the Government published its Migration White paper setting out its plans to have one migration system where EU migrants would face the same immigration restrictions as non-EU migrants. That Migration White paper stated "However, there will be a key difference from now. There will no longer be one immigration system for non-Europeans, and another for EU citizens. The future system will apply in the same way to all nationalities – EU and non-EU citizens alike – except where there are objective grounds to differentiate. This could, for example, be in the context of a trade agreement, or on the basis of risk."<sup>12</sup> This highlights that the Government was sending mixed messages adding to the uncertainty about migration policy. In April 2019, the UK Government rolled out the EU Settlement Scheme, which EU citizens in the UK have to apply to if they want to continue living in the UK.<sup>13</sup> Although this was designed as a simple online application to enable the UK Government to establish how many EU citizens were living in the UK and provide EU citizens with a settled status, it has been seen by some as a rather "unsettling" process, according to the Migration Observatory (2020), for many EU migrants in the UK creating more anxiety and uncertainty<sup>14</sup> that was fuelled by headlines in the popular media

---

<sup>8</sup>See <https://www.nidirect.gov.uk/articles/benefits-non-uk-nationals#toc-1>

<sup>9</sup>See Dhingra and Sampson (2022) for a detailed timeline of the Brexit and a summary of the immediate impact on various aspects of the economy.

<sup>10</sup>See <https://www.theguardian.com/politics/2017/jan/16/theresa-may-to-confirm-uk-exit-from-eu-single-market-speech>

<sup>11</sup>The referendum's outcome was not legally binding. The official Brexit process only started when the UK Government triggered Article 50.

<sup>12</sup>See the UK Government White Paper on Immigration in 2018.

<sup>13</sup>Note the EU settlement scheme also created further uncertainty, but only to those EU migrants already in the UK. As a robustness we exclude 2018 and 2018-2019 as a robustness. See Section 4.

<sup>14</sup>For example, an Italian in the UK who decided to leave was quoted in the Financial Times saying,

about unsuccessful EU settlement applications to remain in the UK.<sup>15</sup>

Despite this, the planned date of the UK leaving the EU (March 2019) was postponed as the Prime Minister at the time Theresa May failed to get Parliament agreement on the terms of the Brexit. When Boris Johnson took over as Prime Minister in July 2019 it was still uncertain whether the UK would leave the EU given the failure of the UK Parliament agreeing on what form the Brexit would be. The UK Parliament eventually accepted the EU Withdrawal bill in January 2020 and a week later the UK officially left the EU on the 31 January 2020. This was followed by a transition period, formally ending on the 31 December 2020, in which the UK was still bound to the EU rules. The UK left the European single market on 31 December 2020, 11:00pm GMT. A points-based immigration system, that treats EU and non-EU citizens equally, was introduced in 2020, and became effective in 2021. Even few months after exiting, some employers and people have not been clear about the new rules related to employing EU workers, and many EU residents in the UK have not applied for settlement. Thus, this environment, in particular between the referendum vote in 2016 and the end of January 2020, provides the setting for a rather unclear and undefined migration policy leading to great uncertainty and anxiety for many current and potential migrants.

We study the impact of the Brexit referendum and expecting Brexit on migration flows between 2016-2019. The referendum represents an exogenous shock that is likely to affect the propensity of EU immigrants to choose the UK as destination and/or to remain in the UK. As the referendum only affected freedom of movement of EU nationals within the EU, it provides a treatment group (EU immigrants) and a control group (non-EU immigrants). It is important to note that during the period after the referendum, there were no changes to non-EU migration policies in the UK. However, the cap on Tier 2 visas for non-EU migrants (high-skilled workers) was relaxed, mainly for those coming to work in the Health Sector in late 2018 (Portes, 2022). This is not seen as a major policy change, nonetheless we investigate this further by excluding that group (non-EU Health workers) as well as those 2 years (2018 and 2019) as a robustness. The Brexit referendum could have potentially affected UK migration through several channels, though the uncertainty about the policy changes affecting EU migrants might have played an important role, as there is little evidence that uncertainty has affected non-EU migrants or made the UK less attractive to non-EU migrants. On the other hand, Portes (2022) argues that a significant fall in EU migration post the referendum was anticipated due to several reasons including the overall economic impact of Brexit on growth, output, and employment, and partly because migration from some EU countries appears to respond to exchange rate changes, with a fall in the pound making the UK less attractive as a destination country. However, the overall economic conditions remained relatively favourable but the legal and psychological factors, relating to the uncertainty about the future rights that EU citizens resident might enjoy, and the more general political and social climate, with the UK no longer seen as a hospitable destination for EU migrants i.e. psychological impact

---

“Everything felt so touch and go about whether I would get granted [settled status],” she says. “I know people who have been turned down for not being able to prove they have been here continuously — I just could not cope with it mentally any more.”

<sup>15</sup>Newspapers such as the Daily Mail on 31 August 2019 reported that “MPs and campaigners claim the scheme is ‘shambolic’ and ‘failing’, insisting that genuine candidates have been turned away despite living in Britain for decades.”

of Brexit on past and prospective migrants from elsewhere in the EU, was considerable (see [Portes \(2022\)](#)). In addition, [Carr et al. \(2020\)](#) show that although there was a spike in hate crime following the referendum, this was short lived and only lasted until August 2016. Given that non-EU migrants tend to be more constrained in their choice of destination, any impact on non-EU is likely to be very small, if at all. We discuss below possible channels to explain our results. In Section 3, we describe our methodology, and in section 4 we discuss those possible threats to our identification and how we address those empirical challenges in our analysis.

### 3 Data and descriptive statistics

In this sub-section we describe the various data sets we use to analyse the impact of the Brexit referendum on migration in the UK. We use two main data sources for the UK: the Long Term International Migration estimates (LTIM)<sup>16</sup> which are aggregate quarterly data and the UK Labour Force Survey (UK LFS) which are individual level data. We analyse migrant inflows to, outflows from, and net migration flows<sup>17</sup> to the UK using the LTIM, which are quarterly released by the Office for National Statistics (ONS), and the most comprehensive estimates of immigration and emigration to and from the UK. The estimates are mainly based on data from the International Passenger Survey (IPS), a survey that collects face-to-face interviews from a random sample of passengers to identify migrants as they enter or leave the UK, and adjusted on the basis of administrative data.<sup>18</sup>

The period of analysis is based on Quarter 1 (January-March) 2013 to Quarter 4 (October-December) 2019, a total of 28 quarters (14 before and 14 after the Brexit referendum). We define pre-referendum period as Quarter 1 of 2013 to Quarter 2 of 2016, and the post-referendum as Quarter 3 of 2016 to Quarter 4 of 2019. We stop the analysis before Quarter 1 of 2020, when the Covid-19 epidemic started. Though the LTIM data do not report the exact immigrants' country of citizenship, it is possible to distinguish 14 regions, which are

---

<sup>16</sup>ONS (2020). Provisional long-term international migration estimates (<https://www.ons.gov.uk/provisionallongterminternationalmigrationltimestimates>). A long-term international migrant, in accordance with the definition from the UN, is defined as someone who changes their country of residence for a period of at least one year, so that the country of destination effectively becomes the country of usual residence.

<sup>17</sup>Net migration flows are calculated by subtracting outflows from inflows.

<sup>18</sup>The data are adjusted based on Census data, the UK Labour Force Survey, the data on asylum seekers and enforced removal from the Home Office, the Irish Central Statistics Office which provides estimates on migration between the UK and the Republic of Ireland, and the Northern Ireland Statistic and Research Agency which provides estimates on migration between the UK and the Northern Ireland. The ONS acknowledges the limitations of the LTIM data, and plans to transform migration statistics in the UK and provide estimates of migration based on administrative data with statistical modelling. Currently, and as mentioned by the ONS the LTIM are the best estimates of migration statistics, though estimates may get revised in particular once the results of the 2021 Census results become available, see ONS (2021), Population and migration statistics system transformation – overview: <https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/internationalmigration/articles/transformationofthepopulationandmigrationstatisticssystemoverview/2019-06-21>.

our unit of analysis.<sup>19</sup> These are 4 EU regions: EU14; EU8; EU2; and other EU.<sup>20</sup> Non-EU are comprised of 10 regions: Other European countries;<sup>21</sup> Middle East and Central Asia; East Asia; South Asia; South East Asia; Sub-Saharan Africa; North Africa; North America (USA and Canada); Central and South America; and Oceania.

The LTIM data allow us to identify migrants' main reason for migration to the UK at time of arrival, both for inflows and outflows. For the latter, it refers to the main reason for previously entering the UK. In our analysis we include 3 selected migration reasons: i) *Work*, that refers to migrants entering the UK for work related reasons, including holding definite job and seeking for work; ii) *Family*, which includes migrants entering the UK to join or accompany a family member; iii) *Study*, that includes migrants entering the UK to pursue formal study. The total inflow/outflow is not only the sum of the three selected reasons, but also includes migrants entering for other or non-specified reasons.

We complement our analysis using the LTIM estimates with the UK LFS, a quarterly representative survey conducted by the ONS on households living in private addresses in Great Britain. Though the UK LFS is specifically targeted at offering precise information on the labour market and employment status, it reports information on the respondents' country of birth, nationality, age, gender, and highest level of qualification attained.<sup>22</sup> For the baseline results, we use the information on the respondents' country of birth to define immigrants. We use country of birth rather than nationality in the main analysis here as there is evidence that after the Brexit referendum the number of EU citizens granted UK citizenship increased sharply (Migration Observatory, 2019). In Table I.27 of Appendix I we present a robustness check in which we define immigrants based on their nationality. The results are consistent with the baseline analysis. Similarly to the LTIM data we distinguish 14 regions of birth, which are our unit of analysis.

The UK LFS is a rotating panel where each household is interviewed for five successive waves before exiting the sample. To estimate the quarterly migration inflows to the UK, we build a repeated cross-sectional database from Q1 2013 to Q4 2019 including only respondents at their first wave of interview to avoid double counting.<sup>23</sup> We use the information on the month of arrival to assign each respondent to the quarter of arrival. However, as

---

<sup>19</sup>The main drawback of not having information on the exact migrants' country of citizenship, is that we are not able to exclude Irish immigrants from the sample, even though freedom of movements between the UK and Ireland has not been affected by Brexit.

<sup>20</sup>EU14: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden. EU8: Czech Republic, Estonia, Latvia, Lithuania, Hungary, Poland, Slovakia, and Slovenia. EU2: Bulgaria and Romania. EU other: Cyprus and Malta. It is also worth noting that Bulgarians and Romanians were able to have full free movement from 1st January 2014. As a check, we exclude EU new (which includes Bulgarians and Romanians) and focus on EU14, our results are robust and are not driven by Bulgarians and Romanians.

<sup>21</sup>Other Europe are EFTA and countries that geographically belong to Europe but are not part of the European Union. Since we can't exclude EFTA who have a free movement agreement with the EU, we exclude the whole Other Europe in the robustness, and our results are robust- Appendix H.

<sup>22</sup>To rule out the possibility that our estimates are driven by demographic changes, especially when analysing stocks, we keep in the sample only respondents aged between 16 and 67.

<sup>23</sup>The only exception is the first quarter of the analysis, January-March 2013, in which we include all the respondents. Note that our unit of observation is quarter and region of origin.

this information is only available for respondents who arrived in the two years preceding the quarter under consideration, and that the last available quarter is April-June 2020, there is the possibility that the number of new arrivals in the last quarters of analysis is underestimated. A related issue is that due to the Covid-19 pandemic, in March 2020 the UK LFS responses were only collected through telephone interviews. This change introduced some biases, one of these is that the 2020 quarters underestimate the number of non-UK born and nationals.<sup>24</sup> Another limitation of these data is that the survey only includes individuals who have been resident in their household for at least six months, meaning that the number of recent immigrants is likely to be underestimated.<sup>25</sup> Despite these limitations, the UK LFS is the best available source of individual level data on immigrant population in the UK and has been widely used to analyse questions related to the impact of immigration on the labour market outcomes of natives, for example, [Dustmann et al. \(2013\)](#); [Manacorda et al. \(2012\)](#), and on the fiscal system [Dustmann and Frattini \(2014\)](#), among others.<sup>26</sup>

First, using LTIM, we describe the inflows to the UK before and after the 2016 UK referendum. Table 1 reports some basic statistics on the inflows of migrants broken down by main motivation for migration. The upper panel reports the statistics for EU countries, and the lower panel for non-EU countries. Column 1 reports the average for the total period of analysis, Columns 3 and 5 respectively for the pre (Q1 2013 - Q2 2016) and post (Q3 2016 - Q4 2019) referendum period, and Column 7 the difference between the two periods. The average number of immigrants coming from EU countries in the total period is higher for the *Total* and *Work* inflows, and lower for *Family* and *Study*. Between the pre and post-referendum period, EU immigrants *Total* and *Work* inflows experienced a sharp decrease, and the difference is statistically significant. *Family* and *Study* inflows show only a minor increase, which is non-significant. Non-EU countries experienced the opposite trend for the *Total* and *Work* inflows, showing a positive and significant difference between the pre and post period. Also in this case, *Family* and *Study* only had a minor variation. Note that the *Total* includes also migrants entering for “Other” reasons or for non-specified reasons.

---

<sup>24</sup>See [ONS \(2021\)](#). To rule out that our results are driven by measurement biases rather than the Brexit referendum, in the Appendix Table I.29 we run a robustness check calculating migration inflows excluding the 2020 quarters. The results are consistent with the baseline analysis.

<sup>25</sup>The UK LFS provides individual weights to compensate for non-response among different groups of the population. However, in our analysis on the inflows we cannot use the weights for two reasons. First, as the weights are constructed without taking nationality or country of birth into account, they are likely to be inadequate to determine the size of the immigrant population. Second, as we are only including respondents in their first wave of the survey and the weights calculation is based on all waves, they would be incorrect because they will no longer sum to the population estimate. Therefore, the statistics on the inflows should not be interpreted as an estimate of the size of the immigrant flow to the UK, but rather as an analysis on a representative sample.

<sup>26</sup>See [Wadsworth et al. \(2016\)](#) for comparison between LFS, NiNo and Annual Population Surveys as data sources on immigration. However, it is important to note that the UK LFS is not suitable for studying outflows given its nature. We use the ONS LTIM data for studying outflows.

**Table 1:** Descriptive statistics of UK migration inflows 2013-2019, (LTIM)

UK migration inflows from EU countries							
	Total		Before		After		Difference
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	mean	sd	mean	sd	mean	sd	(5-3)
All	244.93	36.80	266.36	35.48	223.50	23.77	-42.86***
Work	135.39	31.69	148.21	25.38	122.57	32.98	-25.64**
Family	19.07	4.88	19.00	4.67	19.14	5.26	0.143
Study	40.11	7.97	38.36	6.34	41.86	9.22	3.500
UK migration inflows from Non-EU countries							
	Total		Before		After		Difference
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	mean	sd	mean	sd	mean	sd	(5-3)
All	294.64	41.65	270.36	19.56	318.93	44.16	48.57***
Work	86.32	17.90	73.64	14.05	99.00	11.02	25.36***
Family	45.21	6.61	45.43	5.47	45.00	7.79	-0.429
Study	128.61	22.68	124.29	8.84	132.93	30.82	8.643

**Source:** Authors' calculations based on quarterly ONS LTIM data, Q1 2013 - Q4 2019.  
**Notes:** All statistics are expressed in thousands. Column 7 reports the results from a t-test of mean difference. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.001$ . The sample of the test is based on 14 regions of origin classified by EU and non-EU and observed for 28 quarters.

Table 2 displays basic statistics on the immigrant inflows calculated using the UK LFS, distinguishing by educational level, age groups, and gender. Consistent with the LTIM data, Column 1 shows a higher average total inflow of non-EU than EU immigrants in the total period. This confirms that, albeit the many limitations discussed above, the UK LFS data offer a reliable representation of the immigrant population in the UK. Column 7 shows a negative and significant difference between the pre and post period for the inflows of EU immigrants, and a non-significant difference for non-EU immigrants. In the baseline analysis we consider high-educated to be all individuals with a university degree. The inflows of non-EU immigrants are always higher when breaking down the data by respondents' characteristics. As this result is consistent for all rows, it suggests that the referendum discouraged migration inflows from the EU regardless of the respondents' socioeconomic characteristics.



**Table 2:** Descriptive statistics of UK migration inflows by socio-economic characteristics 2013-2019, (UK LFS)

	Total		Before referendum		After referendum		Difference
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	mean	sd	mean	sd	mean	sd	(5-3)
<b>All</b>							
EU	55.14	22.05	69.21	14.36	41.07	19.41	-28.14***
Non-EU	72.14	23.23	77.93	21.67	66.36	24.06	-11.57
<b>High-educated</b>							
EU	19.11	8.60	23.29	7.04	14.93	8.15	-8.357***
Non-EU	40.36	14.60	42.21	14.21	38.50	15.28	-3.714
<b>Low-educated</b>							
EU	36.04	14.93	45.93	9.60	26.14	12.64	-19.79***
Non-EU	31.79	11.14	35.71	9.86	27.86	11.27	-7.857*
<b>Age 16-39</b>							
EU	44.82	18.22	56.64	11.52	33.00	15.99	-23.64***
Non-EU	55.71	19.01	59.86	18.45	51.57	19.32	-8.286
<b>Age 40-67</b>							
EU	10.32	5.03	12.57	4.38	8.07	4.75	-4.500**
Non-EU	16.43	6.09	18.07	5.46	14.79	6.44	-3.286
<b>Women</b>							
EU	28.57	12.38	34.36	9.99	22.79	12.10	-11.57**
Non-EU	40.11	13.66	42.07	12.52	38.14	14.92	-3.929
<b>Men</b>							
EU	26.57	11.24	34.86	6.51	18.29	8.49	-16.57**
Non-EU	32.04	10.81	35.86	9.68	28.21	10.84	-7.643*

**Source:** Authors' calculations based on quarterly UK LFS, Q1 2013 - Q1 2020. **Notes:** Column 7 reports the results of a t-test of mean difference. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.001$ . The sample of the test is based on 14 region grouped by EU and non-EU and observed for 28 quarters.

Looking at the outflows which are only available using the LTIM data, Table 3 presents the patterns and trends on the outflows of migrants from the UK. As for the inflows, we notice that for the total period the average of EU migrants who left the UK is higher for the *Total* and *Work* outflows, and lower for *Family* and *Study* compared to non-EU migrants' outflow. Comparing the pre and post-referendum period, EU *Total* and *Work* outflows show a positive and statistically significant difference. Non-EU outflows show in general little variation, that is negative and significant in particular for the *Total* outflow. This suggests that EU migrants were more likely to leave the UK compared to non-EU migrants post the referendum.

**Table 3:** Descriptive statistics of UK migration outflows by initial migration reason 2013-2019, (LTIM)

UK migration outflows of EU migrants							
	Total		Before		After		Difference
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	mean	sd	mean	sd	mean	sd	(5-3)
All	109.46	28.03	84.07	5.31	134.86	14.66	50.79***
Work	62.79	21.12	44.07	5.58	81.50	11.89	37.43***
Family	4.36	1.37	4.43	1.60	4.29	1.14	-0.143
Study	17.82	2.20	17.21	1.93	18.43	2.34	1.214
UK migration outflows of non-EU migrants							
	Total		Before		After		Difference
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	mean	sd	mean	sd	mean	sd	(5-3)
All	92.64	8.09	96.93	7.63	88.36	6.18	-8.571***
Work	23.93	2.14	24.43	1.91	23.43	2.31	-1
Family	5.11	2.39	5.00	1.80	5.21	2.94	0.214
Study	43.39	4.62	45.79	4.48	41.00	3.46	-4.786***

**Source:** Authors' calculations based on quarterly ONS LTIM data, Q1 2013 - Q4 2019. **Notes:** All statistics are expressed in thousands. Column 7 reports the results from a t-test of mean difference. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.001$ . The sample of the test is based on 14 regions of origin classified by EU and non-EU and observed for 28 quarters.

We also calculate net migration as the difference between inflows and outflows based on the ONS LTIM data. Table 4 shows the average net migration before and after the referendum. We can notice that the net flow of immigrants from EU countries has decreased between the pre and post-referendum period, and that the difference between the two periods is statistically significant. On the other hand, the difference in the net flow of immigrants from non-EU countries is positive and statistically significant. Below we examine whether those differences are robust to controlling for other characteristics and macroeconomic factors.



**Table 4:** Descriptive statistics of UK net migration, 2013-2019, (LTIM)

UK net migration from EU countries							
	Total		Before		After		Difference
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	mean	sd	mean	sd	mean	sd	(5-3)
Total	135.46	57.66	182.29	31.40	88.64	34.60	-93.64***
UK net migration from non-EU countries							
	Total		Before		After		Difference
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	mean	sd	mean	sd	mean	sd	(5-3)
Total	202.00	46.58	173.43	25.31	230.57	45.90	57.14***

**Source:** Authors' calculations based on quarterly ONS LTIM data, January 2013 - December 2019. **Notes:** All statistics are expressed in thousands. Column 7 reports the results from a t-test of mean difference. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.001$ . The sample of the test is based on 14 sub-regions of origin classified by EU and non-EU and observed for 28 quarters.

## 4 Empirical Methodology and Main Findings

### 4.1 Empirical Methodology

To estimate the impact of the Brexit referendum on the inflows, outflows, and net flows of migrants coming from EU countries we use a Difference-in-Differences strategy. Our identification is based on the assumption that the Brexit referendum and resulting uncertainty in immigration policies and migrant rights only affected EU migrants but have no impact on non-EU, whose immigration policies and rights are considered separately and there were no changes or uncertainty regarding non-EU migrants. The UK was not a signatory of the Schengen agreement and as such always managed non-EU migration independently from the rest of the EU. The period between the referendum and the end of the transition period, was a prolonged period of uncertainty about whether the UK would have a deal with the EU before exiting, for the public, migrants and employers. We utilise this setting, and define immigrants coming from EU countries as the treatment group, and immigrants coming from non-EU countries as the control group. Our interest is in estimating the difference between those two groups by comparing the difference in their migration behaviour before and after the referendum. However, we also check below possible threats to our identification assumption and the potential spillover effects on the control group in Section 5.

As previously mentioned, our period of analysis goes from the Q1 of 2013 to Q4 of 2019. We define this time span for two reasons. We allow the same number of time periods (14 quarters) in the pre and post-referendum period. We first estimate a Difference in-Differences model as follows:

$$Y_{it} = \alpha_i + \beta_1 EU_i + \beta_2 Post\_ref_t + \beta_3 EU_i * Post\_ref_t + \beta_4 X_t + \epsilon_{it} \quad (1)$$

where  $Y_{it}$  is in turn the log (n+1) of the number of inflows, outflows, or net flows of immigrants from region  $i$  in quarter  $t$ ;  $EU_i$  is a dummy that takes the value 1 if the region  $i$  belongs to the European Union, and zero for all non-EU regions;  $Post\_ref_t$  is a dummy that takes the value 1 if the quarter  $t$  is in the post-referendum period, and  $Post\_ref * EU_{it}$  is the interaction between these two dummy variables. Since the referendum took place at the end of June 2016 we do not need to exclude Q2 of 2016 from the analysis, but include it in the pre-referendum period. The post-referendum period starts from Q3 of 2016. The coefficient  $\beta_1$  quantifies the impact of the referendum on the inflows, outflows, and net EU immigration, and is our main coefficient of interest. We add a vector of controls  $X_t$  to account for the effects of economic confounding factors in the UK: we include real GDP per capita (log-transformed) from OECD stats and unemployment rate from the ONS, both lagged 4 quarters.

We then estimate a Two Way Fixed Effects Difference in Differences model which we use as our main specification:

$$Y_{it} = \alpha_i + \beta_1 EU_i * Post\_ref_t + \gamma_y + \delta_i + \epsilon_{it} \quad (2)$$

In this specification, we use quarter  $\gamma_y$  and region of origin  $\delta_i$  fixed effects to fully capture all confounding factors.<sup>27</sup>  $Post\_ref * EU_{it}$  is the interaction between  $EU_i$  and  $Post\_ref_t$  and captures the referendum effect.<sup>28</sup> We have 4 EU regions and 10 non-EU regions, and 28 quarters. We run separate regressions by reason of migration when using LTIM. We also distinguish between EU14 and new EU member States to account for heterogeneous response to the policy change where we include in the treatment group immigrants coming from EU14 countries or new EU member States in turn, while the control group does not vary.

Our identification relies on the use of non-EU migrants as a control group, but we discuss threats to our identification in the next section. It is important though to underscore that during the period of focus 2016-2019, there were no changes in non-EU immigration policies.<sup>29</sup> Also, as documented in several studies, see for example, [Bloom et al. \(2019\)](#), and [Dhingra et al. \(2017\)](#), the referendum, prior to the Covid19 pandemic, had no significant impact on employment growth and unemployment rate. In any case we control for the macro economy to shut down any potential confounding factors, and in the main specification we use time (quarter) fixed effects to absorb any other confounding factors.

An important condition that our data must satisfy to give reliable estimates, is the assumption of parallel trends in the pre-referendum period, see ([Angrist and Pischke, 2008](#)). Figure 1 suggests that for the inflows calculated with the LTIM data the parallel trend assumption plausibly holds for the *Work*, *Family*, and *Study* inflows, even before conditioning on the fixed effects. However, the Figure for the *Total* inflow does not show a clear parallel

---

<sup>27</sup>Robust standard errors are used throughout. However, we are unable to control for clustering across sub-regions as we have too few clusters; i.e. we only have 14 regions.

<sup>28</sup>We also use Inverse Hyperbolic Sine (IHS) transformation of our dependent variables as a robustness. We present these estimates in the Appendix B.

<sup>29</sup>Note there has been a relaxation of Tier 2 cap at the end of 2018, which we test the implications for by excluding year 2019 and 2018 and 2019 in Section 5.

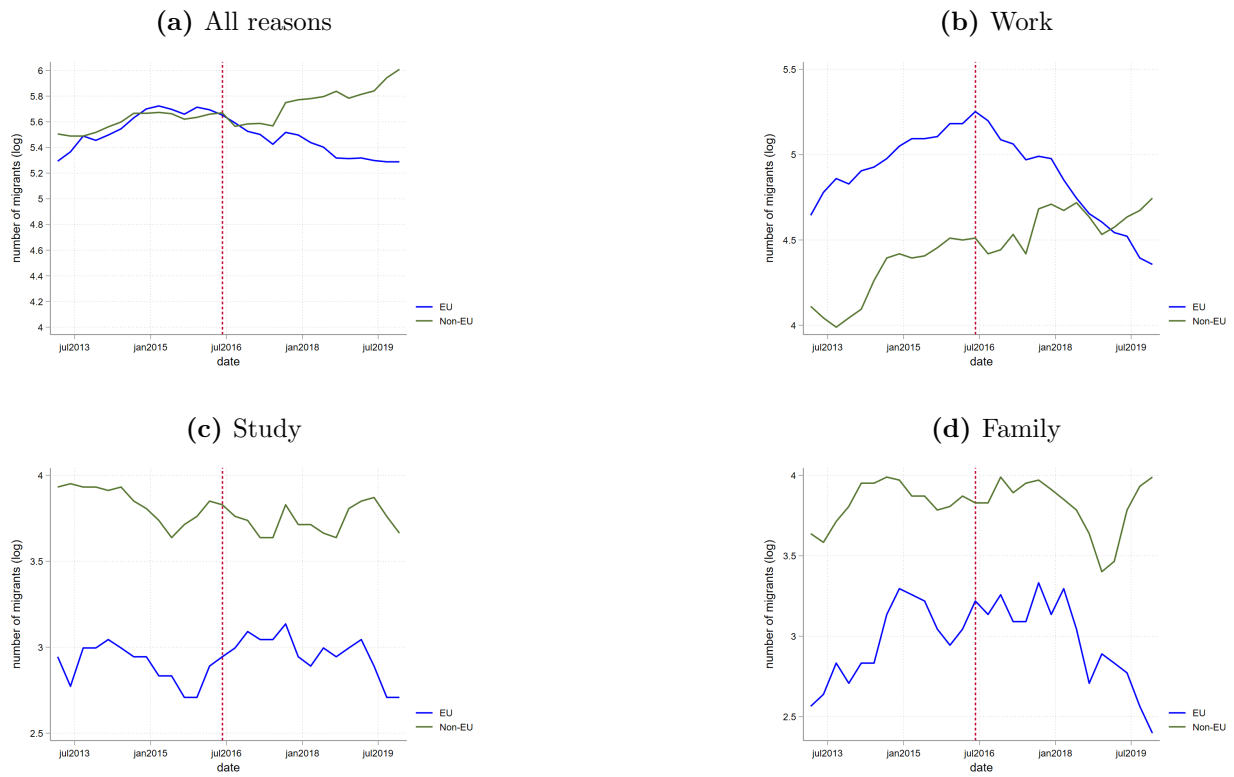
trend. This might be because it is the aggregate of different trends, namely: *Work*, *Study*, *Family* and *Other inflows*, which mask different patterns. Note that *Total* and *Work* EU inflows are higher than non-EU inflows but for *Family* and *Study*, non-EU inflows are higher.<sup>30</sup> To investigate the plausibility of the pre-trend assumption, in Figure 2 we estimate the quarterly difference between the inflows of EU and non-EU immigrants, also in this case without conditioning on controls and fixed effects. Figure 2 shows that the difference is never significant in the pre-referendum period for all inflows. From Figures 1 and 2 we can also detect a decrease in the *Total* and *Work* inflow of immigrants coming from EU countries in the post-referendum period. Figure 3 suggests that the parallel trend assumption holds overall also for the inflows calculated using the UK LFS, and in the pre-referendum period the difference between EU and non-EU is never statistically significant (Figure 3b).

Figure 4 shows the outflows trends by initial reason for migration. Figure 5 shows the difference in outflows trends between EU and non-EU, and suggests that the assumption on the parallel trends also seems to hold for the outflows as the difference between EU and non-EU is never significant in the pre-referendum period. We can also detect an increase in the outflows in the post-referendum period, especially when considering the *Work* outflow. Finally, Figure 6 presents the trend for net migration. We can notice that the trends are parallel in the pre-referendum period, and a sharp decrease in the net flows of migrants coming from EU countries in the post-referendum period. Figure 6 shows that the difference between EU and non-EU is in general not significant in the pre-referendum period. This suggests that overall the assumption of parallel trend plausibly holds also for net migration flows. We check below the parallel trend assumptions using several placebo tests. In addition, we examine the sensitivity of our results to the pre-trends assumption in Section 5.

---

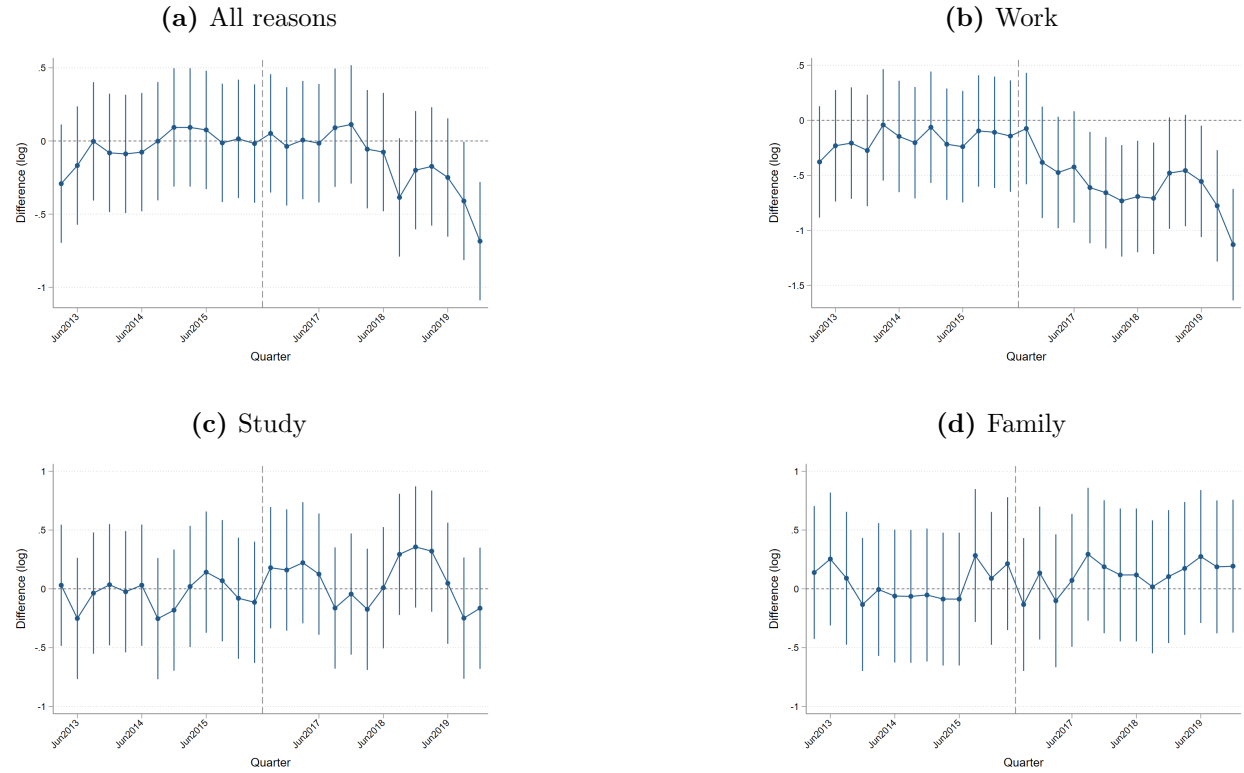
<sup>30</sup>Note that non-EU Family category includes non-EU dependents of non-EU migrants, EU migrants and UK born citizens. Similarly for EU Family these are EU dependents of EU migrants, non-EU migrants and UK born as well.

**Figure 1:** Parallel trends of inflows (log) to the UK, (LTIM)



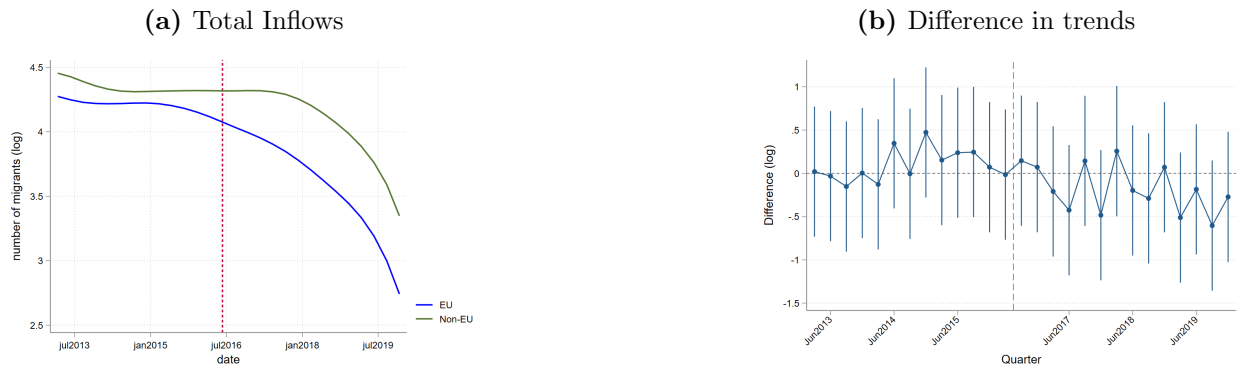
**Source:** Authors' calculations based on LTIM data, Q1 2013 - Q4 2019. **Notes:** Statistics are the sum (in logs) of EU/non-EU in each quarter. The red line indicates the quarter when the referendum took place.

**Figure 2:** Difference between EU and non-EU trends of inflows (log) to the UK, (LTIM)



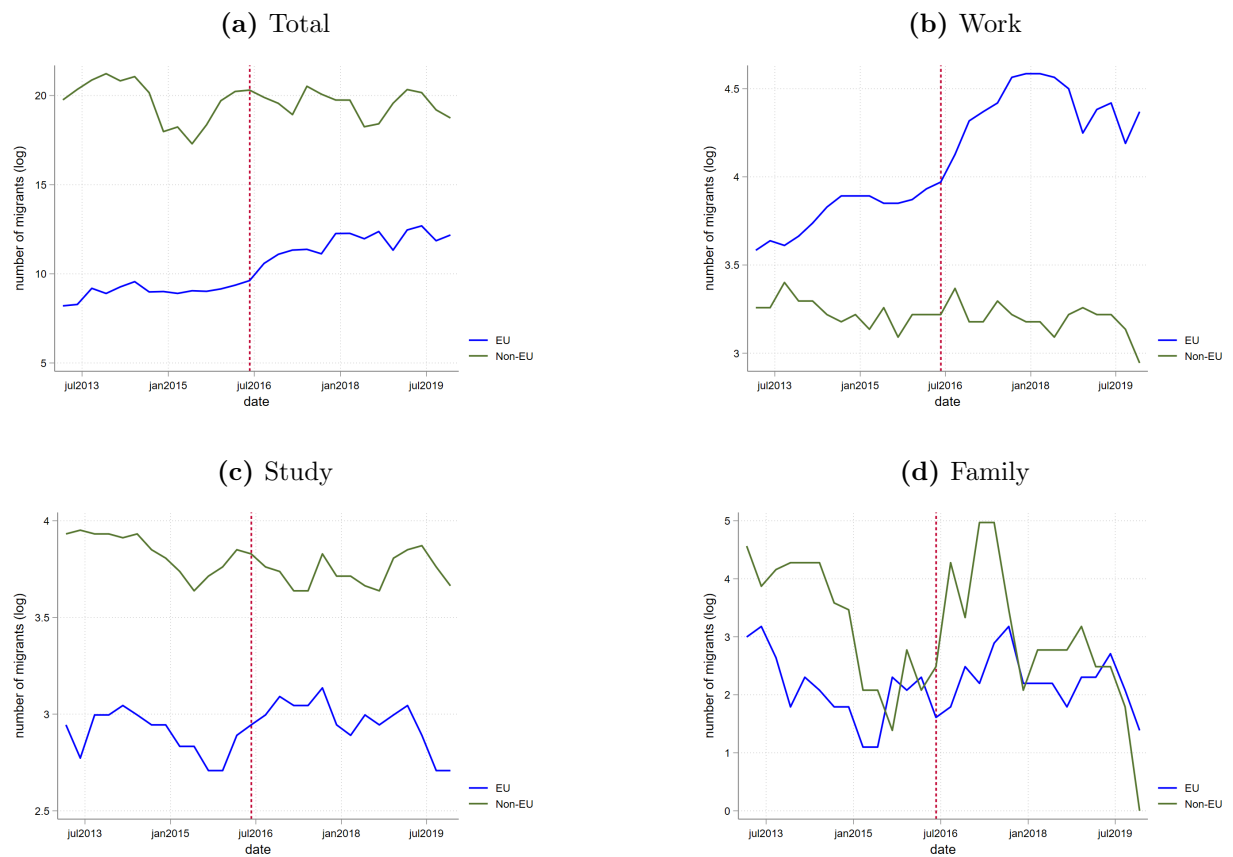
**Source:** Authors' calculations based on quarterly LTIM data, Q1 2013 - Q4 2019. **Notes:** The graphs show the estimated difference in the log of inflows from EU countries relative to non-EU countries, without conditioning on controls nor fixed effects. The baseline level is the quarter in which the Brexit referendum took place (June 2016, indicated with the dash line). 95% confidence interval for each difference is shown.

**Figure 3:** Trends of inflows (log) to the UK, (UK LFS)



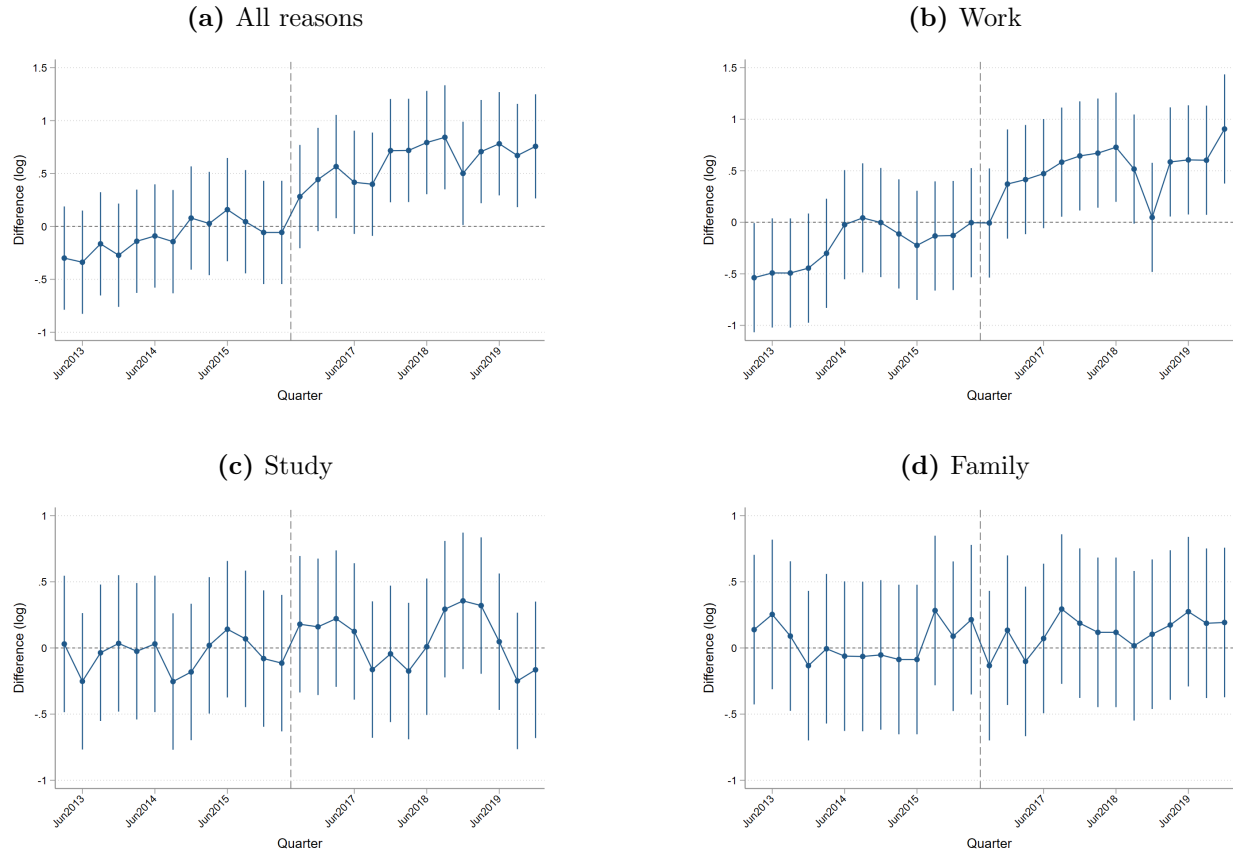
**Source:** Authors' calculations based on quarterly UK LFS, Q1 2013 - Q1 2020. **Notes:** The red line indicates the quarter when the referendum took place. Graph (a) Trends in logs. Graph (b) show the estimated difference in the log of inflows from EU countries relative to non-EU countries, without conditioning on controls nor fixed effects. The baseline level is the quarter in which the Brexit referendum took place (June 2016, indicated with the dash line). 95% confidence interval for each difference is shown.

**Figure 4:** Parallel trends of the outflows from the UK, Based on LTIM



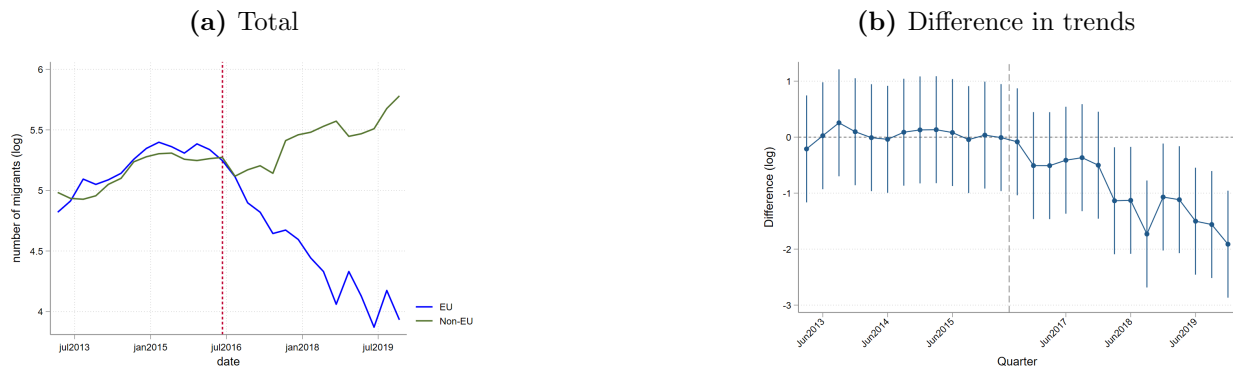
**Source:** Authors' calculations based on quarterly LTIM estimations, January 2013 - December 2019. **Notes:** All statistics are expressed in thousands.

**Figure 5:** Difference between EU and non-EU trends of outflows (log) from the UK, (LTIM)



**Source:** Authors' calculations based on quarterly LTIM data, Q1 2013 - Q4 2019. **Notes:** The graphs show the estimated difference in the log of inflows from EU countries relative to non-EU countries, without conditioning on controls nor fixed effects. The baseline level is the quarter in which the Brexit referendum took place (June 2016, indicated with the dash line). 95% confidence interval for each difference is shown.

**Figure 6:** Trends of net migration (log) to the UK, (LTIM)



**Source:** Authors' calculations based on quarterly LTIM estimations, Q1 2013 - Q4 2019. **Notes:** The red line indicates the quarter when the referendum took place. Graph (a) Trends in logs. Graph (b) show the estimated difference in the log of net migration from EU countries relative to non-EU countries, without conditioning on controls nor fixed effects. The baseline level is the quarter in which the Brexit referendum took place (June 2016, indicated with the dash line). 95% confidence interval for each difference is shown.

## 4.2 Empirical results on effects of Brexit referendum on UK migration

### 4.2.1 Immigration flows to the UK

To examine the impact of the referendum and expecting Brexit on immigration, Table 5 presents first the results on the total inflows to the UK using the LTIM data. Column 1 reports the results of equation (1) estimated without controls and fixed effects, in Column 2 we add region of citizenship fixed effects, in Column 3 we also control for the macroeconomic conditions using lagged real GDP per capita and lagged unemployment rates. In Column 4 we estimate equation 2 where we control for both the region of origin (based on country of birth) and time (quarter) fixed effects.<sup>31</sup> The coefficient for the interaction between *EU* and *Post\_ref* is negative, though not statistically significant. Table 6 presents the results by migration reason using the specification with the regional and time fixed effects (Column 4 of Table 5). The upper panel presents the results for all EU countries inflows, the middle panel only for the EU14 countries, and the lower panel for the new EU member States.<sup>32</sup> We also provide the quantification of our estimates which we refer to as the DiD effect, which is the difference in differences coefficient expressed in percentage; i.e. estimated effect of the referendum on the group of EU countries, relative to the non-EU countries, expressed in percentage.<sup>33</sup> The coefficients of the Difference-in-Differences for the *Total* and *Work* inflows are negative and strongly statistically significant for *Work* inflows for both EU14 and EU new. The DiD effect indicates a decrease of around 29%, suggesting that the referendum had a negative impact on the inflows of immigrants coming from EU countries compared to inflows from non-EU countries when comparing the difference between the two inflows before and after the referendum. The coefficients for the *Family* inflow and for the *Study* inflow are not statistically significant. In particular, for *Study* it could be due that during the transition period students coming from EU countries could still benefit from the same rate of fees applied to British students, and this could have encouraged or at minimum not discouraged them to move to the UK before the end of the transition period.

To ensure that the results are driven by the Brexit referendum, rather than any pre-existing trend, we run a placebo test checking the effect of a pseudo-policy change set in the pre-referendum period. In this analysis we define the time span from April 2010 to March 2016 and set the pseudo-referendum on the 31st March 2013. The results are presented in Table A.1 in Appendix A. We find a positive and significant coefficient for the *Total*, *Work*, and *Family* inflows, which suggests that in the pre-referendum period there was an increase in the inflows of immigrants coming from EU countries. For the *Study* inflow we find a positive but not significant coefficient in the placebo test. We can therefore conclude that, in absence of the referendum, we would have expected an increasing trend of the inflows for the *Total*, *Work*, and *Family* inflows, and a stable trend for the *Study* inflow. As a further robustness, we also run a placebo using each available quarter before the referendum that would provide

---

<sup>31</sup>Note that we have four EU and ten non-EU origin sub-origins; i.e. in total we have 14 origin sub-regions. We also have 28 quarters.

<sup>32</sup>We have also checked the robustness of those results using UK LFS secure access data where the reasons for migration are provided. All our results using inflows by reason for migration are robust.

<sup>33</sup>The formula we use to calculate it is the following:  $\exp(\beta_1) - 1$ .



us with a minimum of one year before and one year after the pseudo-referendum date. We present those results in the Appendix A and compare them to the actual effect. All the placebo tests confirm our earlier results.

We also estimate the impact of the referendum on the total inflow using the UK LFS as shown in Table 7. The coefficient of interest, the Difference-in-Differences, is negative, statistically significant, and robust to the inclusion of the fixed effects and the controls. The relative effect is around -27% which is similar in magnitude to the impact from the LTIM data, and also suggesting that the Brexit referendum had a considerable negative effect on migration inflows from the EU for both EU14 and EU new. We repeat the placebo test also for the inflows calculated with the UK LFS data. The results are presented in Table A.3 in Appendix A. The coefficient of the Difference-in-Differences is positive and only slightly significant when considering all EU countries, while is non-significant when we account for the heterogeneity between EU14 and new EU member States. Also in this case the results of the placebo test confirm our conclusion that the Brexit referendum had negative impact on inflows of immigrants coming from EU countries.

**Table 5:** Difference-in-Differences estimates, Total migration inflows to the UK, (LTIM)

	Total inflows to the UK (log)			
	(1)	(2)	(3)	(4)
EU*post_ref	-0.112 (0.254)	-0.112 (0.0746)	-0.112 (0.0738)	-0.112 (0.0724)
EU	0.455*** (0.193)			
Post_ref	0.0867 (0.0772)			
GDPpc (log)			2.248 (1.743)	
Unemployment			-0.0383 (0.0360)	
Origin region FE	No	Yes	Yes	Yes
Quarter FE	No	No	No	Yes
Observations	392	392	392	392
R-squared	0.0427	0.918	0.923	0.926

**Source:** Authors' calculations based on quarterly LTIM data, Q1 2013 - Q4 2019. **Notes:** Robust standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.001$ . Unemployment and real GDP per capita are lagged 4 quarters. Origin region is based on nationality.

**Table 6:** Difference-in-Differences estimates, Migration inflows to the UK by migration reason, (LTIM)

	(1)	(2)	(3)	(4)
<b>Total inflows from EU and non EU (log)</b>	All reasons	Work	Family	Study
EU*post_ref	-0.112 (0.0724)	-0.415*** (0.0796)	0.0758 (0.0712)	0.110 (0.0771)
Origin region and quarter FE	Yes	Yes	Yes	Yes
<b>DiD effect</b>	- 29%	- 34%	8%	19%
Observations	392	392	392	392
R-squared	0.926	0.932	0.563	0.861
	(1)	(2)	(3)	(4)
<b>Inflows from EU14 and non EU (log)</b>	All reasons	Work	Family	Study
EU14*post_ref	-0.0877** (0.0443)	-0.422*** (0.0727)	-0.212* (0.112)	0.0454 (0.0638)
Origin region and quarter FE	Yes	Yes	Yes	Yes
<b>DiD effect</b>	- 8%	- 34%	23%	5%
Observations	308	308	308	308
R-squared	0.951	0.938	0.586	0.888
	(1)	(2)	(3)	(4)
<b>Inflows from EU new and non-EU (log)</b>	All reasons	Work	Family	Study
EU new*post_ref	-0.120 (0.0942)	-0.412*** (0.100)	0.172** (0.0778)	0.131 (0.0959)
Origin region and quarter FE	Yes	Yes	Yes	Yes
<b>DiD effect</b>	- 11%	- 33%	19%	14%
Observations	364	364	364	364
R-squared	0.908	0.914	0.388	0.831

**Source:** Authors' calculations based on quarterly LTIM data. **Notes:** Robust standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.001$ . All statistics are expressed in thousands. Origin region is based on nationality.

**Table 7:** Difference-in-Differences estimates, Inflow to the UK by group, Based on UK LFS

	(1)	(2)	(3)
	EU total	EU14	EU new
EU*post_ref	-0.311** (0.107)	-0.359** (0.116)	-0.295** (0.128)
Origin region and quarter FE	Yes	Yes	Yes
<b>DiD effect</b>	-27%	-30%	-26%
Observations	392	308	364
R-squared	0.749	0.686	0.701

**Source:** Authors' calculations based on quarterly LTIM estimations data, January 2013 - December 2019. **Notes:** Robust standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.001$ . All statistics are expressed in thousands. Origin region is based on nationality.

#### 4.2.2 Emigration from the UK

Examining the outflow of migrants from the UK using aggregate data based on the LTIM data, the coefficient of the Difference-in-Differences for the total outflow is positive, strongly significant, and robust to the inclusion of different fixed effects and controls (Table 8). In Table 8 we break down the outflow by main reason for the initial migration to the UK, finding a positive and significant coefficient for *All reasons* and *Work* outflows. The relative effect ranges between 102% and 104%, suggesting a strong positive change in the outflows for

immigrants coming from EU countries relative to immigrants coming from non-EU countries in the post-referendum period. The results on EU14 countries also show a positive and significant coefficient both for *All Reasons* and *Work* outflow, with a relative effect of 42% for the former and 64% for the latter. Also the results for new EU member States show a positive and significant coefficient for *All reasons* and *Work* outflows, with a relative effect much larger than for EU14, ranging between 120% and 127%. The results suggest that the Brexit referendum increased the outflows of EU immigrants from the UK, especially for those who came to the UK for work reasons. Moreover, our results suggest that the effect on leaving the UK is higher for migrant coming from new EU member States.

As for the inflows, we run a placebo test to check the robustness of the estimated effects. For the outflows, the first available quarter is Q4 2012. Therefore we define the time span until March 2016, with a pseudo-shock set on the 30th of June 2014. The results are presented in Table A.2 in Appendix A. The coefficient of the Difference-in-Differences is never statistically significant. We also run a placebo using each available quarter before the referendum that would provide us with a minimum of one year before and one year after the pseudo-referendum date Appendix A and compare them to the actual effect. All the placebo tests confirm our previous results. Hence, it is only post the referendum where we observe an increase in outflows of EU immigrants in the UK.

**Table 8:** Difference-in-Differences estimates, Outflows from the UK by group, (LTIM)

	(1)	(2)	(3)	(4)
<b>Total outflows (log)</b>	All reasons	Work	Family	Study
EU*post	0.702*** (0.0698)	0.714*** (0.0751)	0.0758 (0.0715)	0.110 (0.0748)
Origin region and quarter FE	Yes	Yes	Yes	Yes
<b>DiD effect</b>	102%	104%	8%	12%
Observations	392	392	392	392
R-squared	0.929	0.913	0.579	0.870
	(1)	(2)	(3)	(4)
<b>EU14 (log)</b>	All reasons	Work	Family	Study
EU14*post_ref	0.350*** (0.0610)	0.494*** (0.0767)	-0.212** (0.106)	0.0454 (0.0664)
Origin region and quarter FE	Yes	Yes	Yes	Yes
<b>DiD effect</b>	42%	64%	-24%	4%
Observations	308	308	308	308
R-squared	0.928	0.907	0.604	0.893
	(1)	(2)	(3)	(4)
<b>EU new (log)</b>	All reasons	Work	Family	Study
EU_new*post_ref	0.820*** (0.0833)	0.787*** (0.0911)	0.172** (0.0789)	0.131 (0.0910)
Origin region and quarter FE	Yes	Yes	Yes	Yes
<b>DiD effect</b>	127%	120%	19%	14%
Observations	364	364	364	364
R-squared	0.910	0.879	0.408	0.843

**Source:** Authors' calculations based on quarterly LTIM data, Q1 2013 - Q4 2019.  
**Notes:** Robust standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.001$ . Origin region is based on nationality.

### 4.2.3 Net migration flows in the UK

Finally, we analyse the impact of the referendum on net migration in the UK based on the LTIM data. Table 9 shows that the coefficient of the Difference-in-Differences is negative and strongly significant for all EU countries, EU 14, and new EU member States. The results are consistent with what we find on the inflows and outflows and suggest that the referendum had a negative impact on the net migration flows from EU countries to the UK for both EU 14 countries and new EU member states. The estimate suggests that net EU migration was 63% lower than non-EU migration after the referendum, but that decline was due to a sharper decline in net flows from EU new countries compared to EU14.

To check the parallel trend assumption, we run a placebo test on the pre-referendum period. We define the same time span as for the previous placebo tests, and set the pseudo-shock on the 30th of June 2014. The results are presented in Table A.4 in Appendix A. Similarly when we set the pseudo date at other pseudo dates as in Appendix A, we find that all the placebo tests have non significant coefficients.

To sum up, our findings suggest the referendum had a negative impact on EU inflows, a positive impact on EU outflows and a negative effect on net EU flows to the uK.

**Table 9:** Difference-in-difference estimates, Total net migration to the UK, Based on LTIM

	(1)	(2)	(3)
	EU total	EU14	EU new
EU*post_ref	-1.005*** (0.182)	-0.496*** (0.109)	-1.175*** (0.236)
Origin region and quarter FE	Yes	Yes	Yes
<b>DiD effect</b>	-63%	-39%	-69%
Observations	392	308	364
R-squared	0.711	0.837	0.680

**Source:** Authors' calculations based on quarterly LTIM estimations data, January 2013 - December 2019. **Notes:** Robust standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.001$ . All statistics are expressed in thousands. Origin region is based on nationality.

## 5 Addressing Potential Spillover Effects

An important assumption for our identification and credibility of the Difference in Differences analysis is the Stable Unit Treatment Value Assumption (SUTVA) which is violated if the potential outcomes for any unit vary with the treatments assigned to other units; i.e. if there is an interference affecting the control group as well. Although the literature on the Difference in Differences methodology has been recently advanced substantially, see [Roth et al. \(2022\)](#), one area that has not seen the same advances is the case when the treatment might lead to spillover effects for the untreated/control group.<sup>34</sup> In our case, which is very common in the literature using Difference in Differences, the control group could potentially

<sup>34</sup>Very few papers have attempted to deal with this issue. For the case of regional/geographical spillover see as an example, [Huber and Steinmayr \(2021\)](#).

experience secondary effects due to the impact of the treatment on the treated. In other words, it is possible that due to the impact of the referendum on EU migrants resulting in less EU migration and labour shortage, employers might have to resort to employing non-EU workers to replace/substitute for the lack of EU workers. This case is similar to many other settings for example where there is an increase in the minimum wage for one group of workers (treated) and not for the others (control), resulting in possible (positive or negative) spillover effects where the treatment and its direct impact on the treated lead to a secondary effect on the control group. Despite this concern about the potential spillover of interventions, there has been limited focus on dealing with this issue in studies using Difference-in Differences. To address this potential empirical challenge in our analysis, we test whether our results could be driven by this potential spillover and the choice of our control group.

## 5.1 Relaxing Parallel Trend Assumption: Simple Regressions

First, we relax the parallel trends assumption, and therefore resort to simple linear regressions, rather than Difference in Differences, where we do not compare EU to non-EU migration flows, but run separate regressions for EU migration and for non-EU migration. We control for origin region fixed effects and capture the impact of the referendum using a dummy *Post\_ref*. We expect a decline in the inflow of EU work related migration due to the referendum and no effect on non-EU work migration, or a positive one if there is a secondary spillover effect. We estimate the following equation:

$$Y_{it} = \alpha_i + \omega_1 Post\_ref_t + \omega_2 X_t + \phi_i + \epsilon_{it} \quad (3)$$

where  $Y_{it}$  is the log (n+1) of the number of inflows, outflows, or net flows of immigrants from region  $i$  in quarter  $t$ ;  $Post\_ref_t$  is a dummy that takes the value 1 if the quarter  $t$  is in the post-referendum period. The coefficient  $\omega_1$  quantifies the impact of the referendum on the inflows, outflows, and net EU migration. We add a vector of controls  $X_t$  to account for the effect of economic confounding factors in the UK and we include real GDP per capita (log) and unemployment rate, both lagged 4 quarters. We also use region of origin  $\phi_i$  fixed effects, i.e. 4 regions in the case of EU and 10 regions of origin in the case of non-EU.

Table 10 shows the estimates for the inflows, outflows and net migration estimated separately for EU and non-EU migration. Note here that the *Post\_ref* coefficient provides the impact of the referendum for the group studied in that regression. First, focusing on the inflows, Table 10 shows that for EU inflows based on LTIM, the coefficient of *Post\_ref* for total inflows is not significant but that for work migration is negative. As for non-EU, although the *Post\_ref* coefficient for total inflows is negative and significant, this is not driven by *Work*, *Family* or *Study* inflows but by the group *Other reasons* which include asylum seekers and other unidentified reasons. Indeed, when that group is excluded, there is no significant impact of the referendum on non-EU inflows. Furthermore, and more importantly for the potential spillover concern the *Post\_ref* coefficient for non-EU work migration is also not significant. This suggests that there is no evidence of spillover effect. As for outflows, all the *Post\_ref* coefficients for EU migration are positive and significant, but the the *Post\_ref* coefficients for the total and work non-EU outflows are not significant. Also,

net migration shows significant negative coefficient post referendum for EU. Although for non-EU net migration the *Post\_ref* coefficient is negative this is again driven by the *Other reasons* group as net migration is the difference between inflows and outflows. Again once the *Other reasons* are excluded, there is no significant impact on net flows of non-EU. Also, the estimates using UK LFS show that the referendum had negative significant impact on EU inflows but no impact on non-EU inflows. In addition, Table 11 shows that there is no significant difference in the impact of the referendum between EU14 and EU new inflows, but the referendum had a larger positive effect on EU new outflows relative to EU14. Overall, these estimates using simple regressions are consistent with our Difference in Differences estimates in terms of the direction of the impact confirming that our previous results are not driven by the methodology, or the choice of control group. Interestingly, the OLS estimates suggest that the referendum led to 17% fall in EU inflows and 36% drop in work EU inflows (using LTIM). These estimates unlike the ones from the Difference in Differences are only capturing the impact of the referendum on the EU inflows and not relative to the non-EU, and also not fully controlling for quarterly confounding factors. Nonetheless they show similar patterns and magnitude reassuring us about our main estimates.

**Table 10:** OLS estimates, Migration inflows, outflows and net flows by migration reason

	(1)	(2)	(3)	(4)
	EU Inflows (log), LTIM			
<b>EU(log)</b>	All reasons	Work	Family	Study
Post_ref	-0.190 (0.121)	-0.448*** (0.111)	0.213* (0.119)	0.166 (0.100)
R-squared	0.919	0.929	0.750	0.855
	EU Inflows (log) (UK LFS)			
<b>EU (log)</b>	Total			
Post_ref	-0.308** (0.147)			
R-squared	0.843			
	EU Outflows (log), LTIM			
<b>EU(log)</b>	All reasons	Work	Family	Study
Post_ref	0.462*** (0.0820)	0.362*** (0.0087)	0.213* (0.1186)	0.165** (0.099)
R-squared	0.956	0.938	0.749	0.854
	EU Net migration (log) (LTIM)			
<b>EU(log)</b>	All reasons			
Post_ref	-0.794** (0.272)			
R-squared	0.647			
	Non-EU Inflows (log), LTIM			
<b>Non-EU (log)</b>	All reasons	Work	Family	Study
Post_ref	-0.121*** (0.0330)	-0.0759 (0.0488)	0.254*** (0.0713)	0.0659 (0.0647)
R-squared	0.922	0.896	0.364	0.858
	Non-EU Inflows* (log), LTIM			
<b>Non-EU (log)</b>	All reasons	Work	Family	Study
Post_ref	0.198 (0.0330)	-0.0759 (0.0488)	0.254*** (0.0713)	0.0659 (0.0647)
R-squared	0.921	0.896	0.364	0.858
	Non-EU Inflows (log) (UK LFS)			
<b>Non-EU (log)</b>	Total			
Post_ref	-0.720 (0.170)			
R-squared	0.504			
	Non-EU Outflows (log), LTIM			
<b>Non-EU (log)</b>	All reasons	Work	Family	Study
Post_ref	0.094 (0.0617)	0.049 (0.0629)	0.253*** (0.0712)	0.065 (0.0646)
R-squared	0.868	0.794	0.364	0.868
	Non-EU Net migration (log), LTIM			
<b>Non-EU (log)</b>	All reasons			
Post_ref	-0.284*** (0.0662)			
R-squared	0.773			
	Non-EU Net migration (log)* (LTIM)			
<b>Non-EU (log)</b>	All reasons			
Post_ref	-0.071 (0.0959)			
R-squared	0.757			

**Source:** Authors' calculations based on LTIM estimations data, January 2013 - December 2019 and quarterly UK-LFS, Q1 2013 - Q1 2020. **Notes:** Robust standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.001$ . Origin region is based on nationality for LTIM data and country of birth for UK-LFS data. Estimations are based on 112 observations for EU and 280 observations for non-EU countries. In all columns we control for GDP per capita (log) and unemployment rate lagged of 4 quarters and include origin regions fixed effects. Inflows\* and Net migration\* only include the categories *work*, *family*, and *study* in *All reasons*.

**Table 11:** OLS estimates, EU migration inflows to the UK and EU outflows from the UK, heterogeneity between EU14 and EU new (LTIM)

EU Inflows to the UK (log)				
	(1)	(2)	(3)	(4)
	All reasons	Work	Family	Study
EU_new*post_ref	-0.0319 (0.101)	0.0100 (0.127)	0.384** (0.124)	0.0856 (0.107)
EU Outflows from the UK (log)				
	All reasons	work	family	study
EU_new*post_ref	0.470*** (0.0786)	0.293** (0.104)	0.384** (0.123)	0.0856 (0.106)
Origin region FE	Yes	Yes	Yes	Yes
Observations	112	112	112	112
R-squared	0.919	0.929	0.769	0.855

**Source:** Authors’ calculations based on quarterly LTIM data.  
**Notes:** Robust standard errors in parentheses. \*  $p < 0.10$ , \*\* $p < 0.05$ , \*\*\*  $p < 0.001$ . All statistics are expressed in thousands. Origin region is based on nationality. In all columns we control for GDP per capita (log) and unemployment rate lagged of 4 quarters.

## 5.2 Eliminating Potential Interference

Secondly, as commonly done in the literature to deal with geographical spillover as a result of a treatment, we attempt to eliminate and/or control for the potential interference. In our case, the potential spillover is the potential secondary effects of the drop in EU work inflow leading to a rise in demand for non-EU migrant workers and therefore leading to higher non-EU inflows and lower outflows.

As [Portes \(2022\)](#) argues, the labour shortage due to the fall in EU work-related migration has led to the relaxation of the the cap on Tier 2 visas for non-EU migrants which applies to skilled or highly paid workers, particularly for those coming to work in the Health sector, in late 2018. While this “represented a relatively minor policy change”, it is important to examine this potential spillover impact. Thus we use ONS data on the number of work permit visas by industry issued by quarter to non-EU migrant workers.<sup>35</sup> Although these data are available quarterly, they are only available for the total non-EU and not by sub-region of origin. We exclude all non-EU migrant workers granted work visas to work in “Human Health and Social Work Activities” from the non-EU inflows (control group) and estimate our inflows as before. Table 12 Column 1 shows that our previous results hold, and are not driven by the potential spillover effect.

In addition, we also limit our period of analysis to ensure that any substitution for EU migrant workers by non-EU migrant workers would not have materialised as recruitment of non-EU migrant workers take more time and is governed by strict requirements in terms of qualification and salary. We limit our post referendum period to 2017 only, and then to

<sup>35</sup>ONS data on the number of visas for work using sponsorship certificates (CoS), by tier (Tier 2 and Tier 5) and industry type.



2017 and 2018 only. Table 12 Columns 2 and 3 show that the referendum has a negative significant impact on work inflows even when we limit the period of analysis.<sup>36</sup> Also, as a further robustness check, we estimate an event study model where we replace *Post\_Ref* dummy with year dummies to capture differential effect of referendum by year, see Table C.8. These results show that even after eliminating the potential interference all our previous results hold.

Furthermore, in order to capture the potential substitution, we include a measure of labour shortage, namely, vacancies based on ONS vacancies data which are measured quarterly.<sup>37</sup> We include lagged quarterly vacancies to capture labour shortages and use three and six months lagged vacancies. We also use monthly vacancies lagged one month to ensure that the average vacancies per quarter are not masking labor shortages within the quarters. As Table 13 shows we do not find any impact of vacancies on inflows and that there is still negative impact on EU work inflows.

**Table 12:** Difference-in-Differences estimates, Work migration inflows, (LTIM)

	(1)	(2)	(3)
	Work	Work	Work
EU*post_ref	-0.473*** (0.0902)	-0.304*** (0.072)	-0.379*** (0.075)
Origin region and quarter FE	Yes	Yes	Yes
<b>DiD effect</b>	-37%	-31%	-31%
Observations	52	196	308
R-squared	0.887	0.969	0.957

**Source:** Authors' calculations based on quarterly LTIM, Q1 2013 - Q4 2019.  
**Notes:** Column 1 excludes non-EU health professionals from non-EU control group. Column 2 excludes 2018 and 2019. Column 3 excludes 2019. Robust standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.001$ . Origin region is based on nationality.

<sup>36</sup>See Appendix Tables C.9 and C.10 for the full set of estimates.

<sup>37</sup>Vacancies are based on ONS data, and are defined as positions for which employers are actively seeking recruits from outside their business or organisation. The estimates are based on the Vacancy Survey; this is a survey of employers designed to provide estimates of the stock of vacancies across the economy.

**Table 13:** Difference-in-Differences estimates controlling for vacancies, Migration inflows to the UK, (LTIM)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	All reasons				Work			
EU*post_ref	-0.112 (0.0738)	-0.112 (0.0711)	-0.112 (0.0712)	-0.112 (0.0723)	-0.415*** (0.0833)	-0.415*** (0.0810)	-0.415*** (0.0809)	-0.415*** (0.0820)
Vacancies (log, t-1)		1.193*** (0.267)				1.388*** (0.351)		
Vacancies (log, t-2)			1.369*** (0.321)				1.620*** (0.421)	
Vacancies (monthly, log, t-1)				0.668*** (0.179)				0.734*** (0.222)
Origin region FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<b>DiD effect</b>	- 11%	- 11%	- 11%	- 11%	- 34	- 34 %	- 34 %	- 34
Observations	392	392	392	392	392	392	392	392
R-squared	0.923	0.927	0.927	0.926	0.927	0.931	0.930	0.930

**Source:** Authors' calculations based on quarterly LTIM data. **Notes:** All columns include GDP per capita and Unemployment lagged 4 quarters. Columns 2 and 6 include quarterly vacancies lagged one quarter. Columns 3 and 7 include quarterly vacancies lagged 2 quarters. Columns 4 and 8 include monthly vacancies lagged one month. Robust standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.001$ . All statistics are expressed in thousands. Origin region is based on nationality.

Finally, we also use an alternative control group, namely non-working non-EU migrants. We use the UK LFS data where we are able to identify non-working non-EU (irrespective of the main reason for migration) and we construct an alternative control group which does not suffer from any potential interference. We focus here on EU worker inflows (treated) and non-working non-EU inflows (control). As Figure 7 (a) shows the trends are parallel, and Figure 7 (b) shows that all the difference pre-trends are insignificant. In addition, in figure D.2 we check the trend of this alternative control group- i.e. non-EU non-work and the trend of non-EU work inflows to ensure that there is no positive correlation between the two trend.<sup>38</sup> Table 14 shows that the referendum has had a negative impact on work inflows from the EU, when using this alternative control group. We also check the estimates for the Total EU inflows (not just work inflows) using this alternative control group, see Table D.11 in Appendix D.1. Using this alternative control group further reassures us that when excluding any potential interference all our results hold.

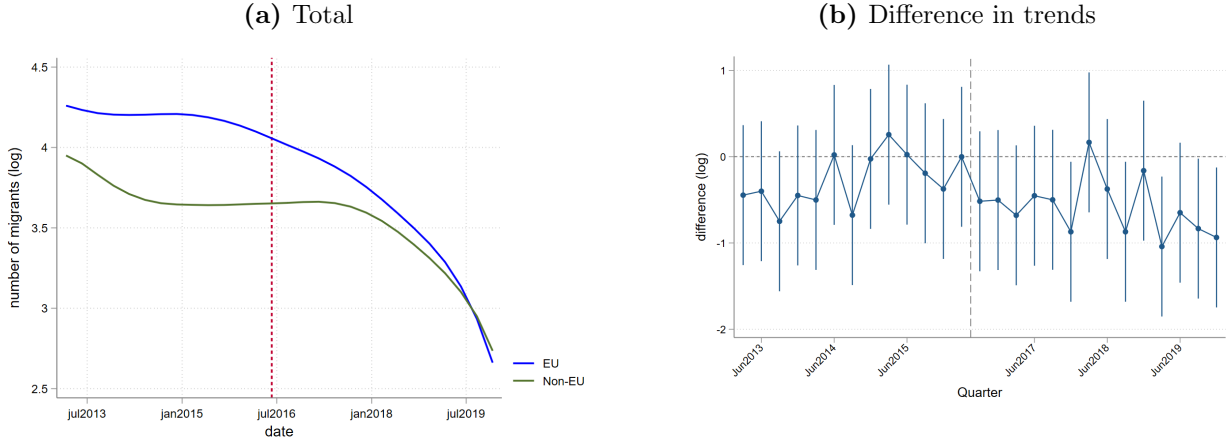
**Table 14:** Difference-in-difference estimates, work inflows to the UK, Alternative Control Group: Non-working non-EU, (UK LFS)

	(1)	(2)	(3)
	Total	EU14	EU_new
EU*post_ref	-0.346*** (0.098)	-0.384*** (0.134)	-0.333*** (0.117)
Origin region and quarter FE	Yes	Yes	Yes
<b>DiD effect</b>	-29%	-32%	-28%
Observations	392	308	364
R-squared	0.746	0.689	0.707

**Source:** Authors' calculations based quarterly UK LFS, Q1 2013 - Q1 2020. **Notes:** Inflows are for work migrants. Alternative Control Group: Non-working non-EU. Robust standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.001$ . Origin region is based on country of birth.

<sup>38</sup>Note that non-EU non- work are family migrants of non-EU, EU and UK born as well as study migrants.

**Figure 7:** Parallel trends of inflows (log) to the UK, alternative control group (UK LFS)



**Source:** Authors' calculations based on UK LFS data, Q1 2013 - Q1 2020. **Notes:** The red line indicates the quarter when the referendum took place. Graph (a) Trends in logs. Graph (b) show the estimated difference in the log of net migration from EU countries relative to non-EU countries, without conditioning on controls nor fixed effects. The baseline level is the quarter in which the Brexit referendum took place (June 2016, indicated with the dash line). 95% confidence interval for each difference is shown.

### 5.3 Counterfactual Scenarios

We also run two counterfactual scenarios for non-EU inflows to the UK to allow us to compare the extent, if any, of the additional positive spillover of non-EU worker migrants. (i) Scenario 1: we assume the same growth rate trajectory for non-EU work inflow to the UK in the post referendum period as was in the pre referendum period; i.e. in the absence of the referendum and if non-EU work inflows continued to grow at the same growth rates as before the referendum; (ii) Scenario 2: We assume no growth in non-EU work inflows relative to 2016 and use 2016 values for the non-EU inflows for the post referendum period. We then estimate the Difference in Differences and compare the actual estimates with the counterfactual scenarios. In Table 15 we present the raw statistics of the counterfactual values for non-EU inflows which show the magnitude of the difference between the counterfactual inflows, and the actual values. Table 16 shows the Difference in Differences estimates for the two counterfactual scenarios where in Scenario 1, EU work inflows would have fallen by 59% while in Scenario 2 work inflows would have dropped by 30%. The actual DiD effect is a drop of 34% suggesting that our estimates of the impact of the referendum on inflows does not seem to be overestimated; i.e. if non-EU work inflows were indirectly affected by the referendum resulting in higher non-EU work inflows (positive spillover), the actual DiD effect would have been much bigger than the DiD effects observed in Scenario 2.

**Table 15:** Descriptive statistics of UK migration inflows 2013-2019, (LTIM)

UK migration inflows from EU countries							
	Total		Before		After		Difference
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	mean	sd	mean	sd	mean	sd	(5-3)
Total	244.93	36.80	266.36	35.48	223.50	23.77	-42.86***
Work	135.39	31.69	148.21	25.38	122.57	32.98	-25.64**
Non-work	101.68	18.25	113.50	17.19	89.86	9.77	-23.64***
UK migration inflows from Non-EU countries							
	Total		Before		After		Difference
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	mean	sd	mean	sd	mean	sd	(5-3)
Total	294.64	41.65	270.36	19.56	318.93	44.16	48.57***
Work	86.32	17.90	73.64	14.05	99.00	11.02	25.36***
Non-work	205.18	26.50	195.29	8.09	215.07	34.38	19.79**
UK migration inflows from non-EU countries Counterfactual: Growth Rate as in 2013-2016							
	Total		Before		After		Difference
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	mean	sd	mean	sd	mean	sd	(5-3)
Total	303.71	42.31	270.36	19.56	337.07	30.63	66.71***
Work	127.90	79.61	73.64	14.05	182.15	81.40	108.5***
Non-work	209.83	20.34	195.29	8.09	224.37	18.40	29.09***
UK migration inflows from non-EU countries counterfactual: Inflows Fixed as in 2016							
	Total		Before		After		Difference
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	mean	sd	mean	sd	mean	sd	(5-3)
Total	279.68	16.56	270.36	19.56	289.00	0.00	18.64***
Work	81.82	12.82	73.64	14.05	90.00	0.00	16.36***
Non-work	196.14	5.68	195.29	8.09	197.00	0.00	1.714

**Source:** Authors' calculations based on quarterly ONS LTIM data, Q1 2013 - Q4 2019.

**Notes:** All statistics are expressed in thousands. Column 7 reports the results from a t-test of mean difference. \* p < 0.10, \*\* p < 0.05, \*\*\* p < 0.001. The sample of the test is based on 14 regions of origin classified by EU and non-EU and observed for 28 quarters.

**Table 16:** Counterfactual Scenarios: Difference-in-Differences estimates, Migration inflows to the UK, (LTIM)

	(1)	(2)	(3)
<b>A. Total inflows from EU and non-EU (log)</b>	All reasons	Work	Non-work
EU*post_ref	-0.258*** (0.0727)	-0.886*** (0.0979)	-0.137* (0.0724)
Origin region and quarter FE	Yes	Yes	Yes
<b>DiD effect</b>	- 22%	- 59%	-12%
Observations	392	392	392
R-squared	0.919	0.865	0.872
	(1)	(2)	(3)
<b>B. Total inflows from EU and non EU (log)</b>	All reasons	Work	Non-work
EU*post_ref	-0.0990 (0.0695)	-0.361*** (0.0760)	0.0336 (0.0849)
Origin region and quarter FE	Yes	Yes	Yes
<b>DiD effect</b>	- 9%	- 30%	3%
Observations	392	392	392
R-squared	0.938	0.949	0.901

**Source:** Authors' calculations based on quarterly LTIM data. **Notes:** Panel A: Based on counterfactual scenarios where non-EU inflows had the same growth rate in Post referendum period as in the pre-referendum. Panel B: Based on counterfactual scenarios where non-EU inflows stayed constant in Post referendum period as in 2016. Robust standard errors in parentheses. Non-work is study and family reasons for migration inflows. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.001$ . All statistics are expressed in thousands. Origin region is based on nationality.

## 5.4 Sensitivity Analysis

Another important check for the credibility of our methodology and findings is whether our pre-trends are parallel. Our identification relies on the mean outcomes of the control group, non-EU immigrants, evolving over time parallel to those of the treated group in the absence of any treatment; i.e. that the trends of EU immigrants and those of non-EU immigrants would have continued to hold between 2016-2019 in the absence of the Brexit referendum.

Recent advances in the literature highlight that one way to increase the credibility of the assumption of parallel trends is to require it to hold only conditional on covariates, see [Roth et al. \(2022\)](#) for an excellent review. However one can still worry if there remain unobserved time-varying confounding factors. Moreover, low power due to few observations as is our case for the EU destination analysis, might raise further concerns about the validity of the pre-trends. Nonetheless, as argued by [Roth et al. \(2022\)](#), there might still be something to be learnt even if the pre-trends assumption are violated in particular if the violation of parallel trends is small in magnitude. We follow [Rambachan and Roth \(2023\)](#) who have recently developed a methodology for robust inference and sensitivity analysis when parallel trends may be violated. They suggest two approaches based on the pre-trend of the estimated difference between treatment and control group. The first one (bounds on relative magnitude) estimates the magnitude of the post-treatment violation of parallel trends, relative to the observed maximum pre-treatment violation, which would make the estimated results inconsistent. The second one (smoothness restriction) estimates the magnitude of the deviation from a linear extrapolation of the pre-treatment differences in trends that would make the results inconsistent.

We revisit our analysis to establish the sensitivity of our conclusions to potential violations of the parallel trends assumption using both the approaches. In particular, we calculate the parameter  $M$  which would make our results inconsistent, i.e. the Break point, for both approaches. In Figure E.3 we focus on the UK work inflows, work outflows, and net flows based on LTIM data. In blue we show the 95% confidence interval of the treatment effect estimated in 2019, while in red we show the 95% confidence intervals when allowing for violations of the pre-period parallel trends, relative to the estimated pre-treatment coefficients, up to a parameter  $M$ .<sup>39</sup>

For the inflows the coefficient would remain significant up to  $M = 1$  with the bounds on relative magnitude approach (E.3a) and  $M = 0.20$  with the smoothness restriction approach (E.3b). This suggests that our estimated results would be significant if we allow for violations of parallel trends up to the maximum violation observed in the pre-period and if the deviation from the linear extrapolation of the estimated pre-trend is up to 0.2 percentage points, which is a third of the average change in slope observed in the pre-period.

For the outflows the coefficient would be significant if we allow the parameter  $M$  to be equal to 0.5 with the bounds on relative magnitude approach (E.3c) and 0.04 with the smoothness restriction approach (E.3d), suggesting that our results would no longer be significant if we allow the deviation from parallel trends to be equal to at least half of the maximum violation observed in the pre-period and the deviation from the linear extrapolation to be at least 0.04 points, which is roughly equal to the average change in slope in the pre-period.

For the net flows the parameters  $M$  are equal to 0.5 with the bounds on relative magnitude approach (E.3c) and 0.12 with the smoothness restriction approach (E.3d). In this case the results would be significant as long as the deviation from parallel trends is equal to at least half of the maximum violation observed in the pre-period and if the linear extrapolation deviates by up to 0.12 points, which is 4 times larger than the average change in slope in the pre-period.

To sum up, both approaches of the sensitivity analysis suggest that our results would remain significant and robust even if we allow for large deviations from the estimated pre-trends. This, and the fact that the event study graphs generally show non-significant coefficients in the pre-period, reassure us on the credibility of our results.

## 6 Heterogeneity Analysis and Robustness Checks

### 6.1 Heterogeneity Analysis

Another interesting aspect is the potential change in the characteristics of migrants after the referendum. Focusing on the inflows and using UK LFS, which provide individual socioeconomic characteristics, Figure 8 provides the estimated DiD effect by migrant characteristics.<sup>40</sup>

---

<sup>39</sup>When analysing smoothness restriction, when  $M$  is 0 the difference in trends between treated and control groups is linear. In Figure E.3 we report the confidence interval when  $M = 0$ , thus allowing for linear violations of parallel trends only, and the confidence interval for a value of  $M > 0$  until the estimated breakdown value at which our original coefficients would no longer be significant.

<sup>40</sup>See Tables F.12 and F.13 in The Appendix for the full coefficients.

After the referendum there was an overall drop in EU inflows by 27%. For almost all groups, the coefficients are negative and significant although the relative size differ slightly for the two EU groups (EU14 and EU new). For example, in terms of region of residence in the UK, although there has been a fall in the inflows, London has experienced the smallest drop (19%), though this was driven by a bigger drop for EU14 relative to EU new immigrants. Also, it is interesting to examine the impact of the referendum on sectors: Construction experienced the lowest decline (12%) in EU inflows while Hospitality had the largest drop (35%) in EU inflows fuelled by sharper decline in EU new inflows (39%) relative to EU14 (23%).

Another important dimension of the referendum is its role in the selectivity of migrants. Indeed, examining the Diff-in-Diff coefficients and effect for the high educated relative to the low-educated, Figure 8 suggests that the referendum had a much larger negative impact on the low-educated EU inflows (37%) compared to the high educated (17%) EU inflows.<sup>41</sup> This is also reflected if using skills to distinguish between high and the low skilled in Figure 8.<sup>42</sup> In other words, the findings suggest that the negative role of the referendum was more pronounced for low-skilled EU inflows relative to the high-skilled EU inflows, in particular low-skilled inflows from new EU states.<sup>43</sup>

Also, it is interesting to examine the role of the referendum on the characteristics of migrant stocks and not just on inflows. First, we use the UK LFS to compare the educational distribution of the labour force in the UK in Q2 of 2016 (quarter of the referendum) and Q4 of 2019 (our last quarter of analysis) in the Appendix, Table F.14. The share of EU high educated immigrants increased from 3.0% to 3.1%, while the share of EU low educated immigrants decreased from 4.4% to 4.3%. Although the share of non-EU high educated immigrants increased from 4.7% to 5.2%, while the share of non-EU low educated immigrants decreased from 5.0% to 4.9%, the share of high educated UK born also increased from 25.7% to 28.2% and the share of low educated UK born also decreased from 57.3% to 54.2%. Looking at high versus low skill (based on profession) show the same pattern. Also, when looking at the educational composition of EU migrants, there was 2% increase among high educated; i.e. EU immigrants in 2019 were slightly more educated than in 2016. However this increase is also seen for non-EU immigrants and for UK born workers. Hence, it is useful to go beyond the raw statistics and simple distribution as we do, and use the Diff-in-Diff to allow us to compare non-EU to EU immigrants while controlling for all confounding factors. Thus, we also estimate the role of the referendum and migrant stocks using Difference in Differences

---

<sup>41</sup>We also check the robustness of our definition of education using the UK LFS and employ an alternative definition of high and low-educated immigrants, based on the age when the individual left formal education (following Manacorda et al. (2012)) rather than on the qualification level where high educated refer to those who left formal education after the age of 20 years old. We also find negative impact of the referendum for both high and low-educated immigration to the UK when using this alternative definition of education.

<sup>42</sup>See Table F.13 for the full set of coefficients. We distinguish immigrant inflows by high versus low skilled occupations as defined by the International Standard Classification of Occupations (ISCO). Categories 1 to 3 are classified as high-skilled, while all other categories are classified as low-skilled. For more information on the classification, see <https://ilostat.ilo.org/resources/concepts-and-definitions/classification-occupation/>.

<sup>43</sup>As a further robustness we run a triple difference where we compare high and low-educated inflows, and find that high educated EU inflows were less impacted compared to low educated EU inflows, Table F.19.



and UK LFS data.

Similar to what we did for the inflows, we build a repeated quarterly cross-sectional database from quarter 1 of 2013 to quarter 4 of 2019 and define the unit of analysis as the 14 regions of birth. However, to measure the quarterly stock of foreign-born, we include in our sample all respondents, with no restrictions on their interview’s wave and time of arrival, and each individual is counted in their interview’s quarter.<sup>44</sup> When we analyse the impact of the referendum on migrant stocks the DiD effect is positive and statistically significant, suggesting that the Brexit referendum had a positive effect on the stock of migrants from EU countries (Figure F.4), which is not surprising given that the size of EU inflow was much larger (despite its decline) than the size of the EU outflow. However, though EU migrant stock continued to increase post the referendum that increase was much smaller (only 25%) compared to before the referendum.<sup>45</sup> Interestingly, Figure F.4 also shows that the stock of EU high educated migrants increased by 1% more compared to the stock of EU low educated migrants, and when examining skills, this pattern is more pronounced as EU high skilled migrants increased by 4% more compared to the stock of EU low skilled migrants. Also, we examine the change in migrant stock (this would capture both inflows and outflows taking into account initial stocks).<sup>46</sup> Examining the change in stocks also mirrors the same patterns observed when focusing on the inflows - a bigger impact on the low educated - where the change in EU migrant stock is equivalent to 0.1% drop for the high educated and 0.5% drop for the low educated, Figure F.5. Thus, overall the referendum has resulted in a slight increase in the educational level of EU immigrant stock. Yet it is important to underscore that it is not surprising that the overall impact on the EU migrant stock is very small as the referendum affected more negatively EU inflows.

## 6.2 Robustness Checks

To check the robustness of our results on the impact of the Brexit referendum on migration in the UK, we run a number of alternative specifications and checks using different data sources, samples and definitions. All tests are presented in the Appendix and largely confirm the previous results of the baseline analysis.

(i) Data on National Insurance Registration: First, we validate our results on the inflows by replicating the same analysis using data on National Insurance number (NINo). The NINo is a register of foreigners who apply for a National Insurance Number and the date of application.<sup>47</sup> Appendix G describes the NINo data and displays the inflows based on that

---

<sup>44</sup>Since in this case we are using respondents in all the waves of the survey, for the baseline results on the stocks we use the individual weights provided in the survey. In Appendix F.2 we present how we calculate the stocks of migrants, the descriptive statistics of migrant stocks before and after the referendum and the results.

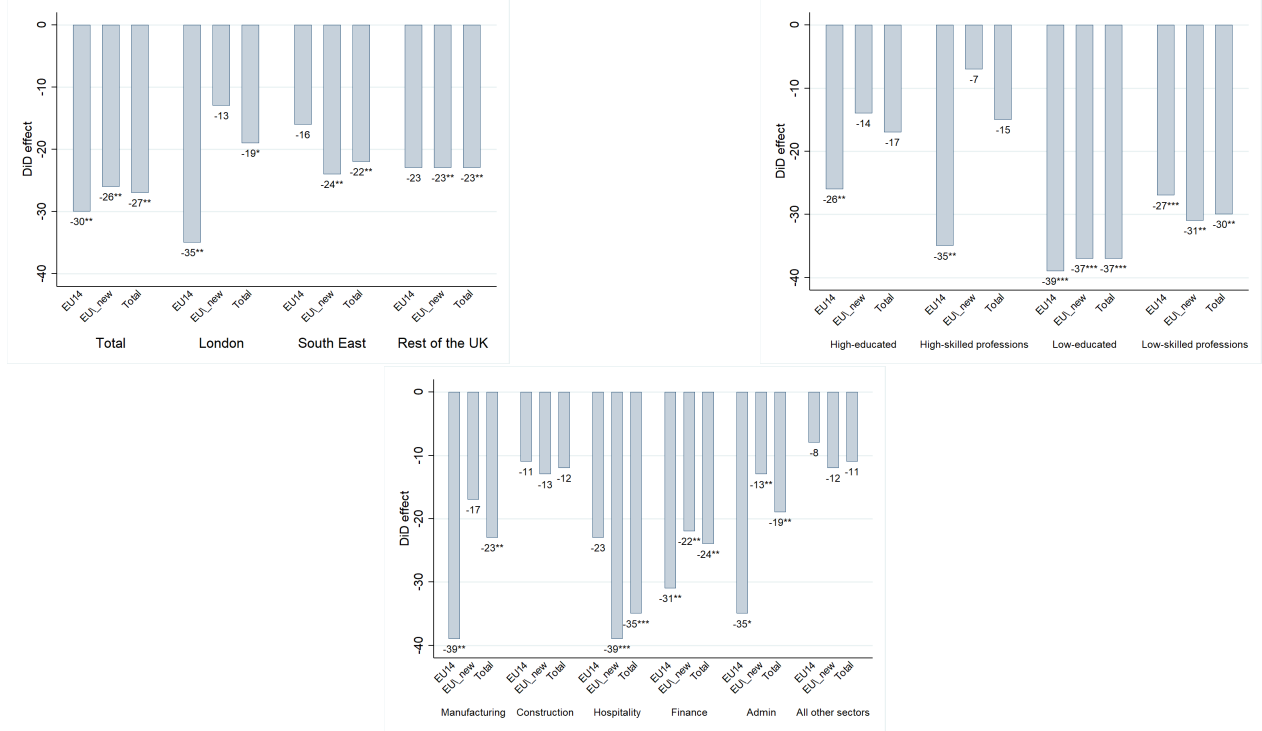
<sup>45</sup>Table F.16 in Appendix F.2 shows the results of a placebo test in the pre-referendum period. We define the same time span as for the inflows (April 2010 to March 2016) and set the pseudo-referendum on the 31st March 2013. The results show a positive and statistically significant coefficient, and the estimated DiD effect is 105%. This suggests that although the overall EU migrant stock continued to increase in the post referendum period, the increase was much smaller (about a quarter) than during the pre referendum period.

<sup>46</sup>See Appendix F.2 for details.

<sup>47</sup>Department for Work and Pensions (2020). National Insurance Number Registrations to Adult Overseas



**Figure 8:** Difference-in-Differences effects, Inflows to the UK (UK-LFS)



**Source:** Authors' calculations based on quarterly UK-LFS, Q1 2013 - Q1 2020. **Notes:** The bar show the estimated DiD effect associated to the  $\beta_1$  coefficient from Equation 1. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.001$ .

source of data as a further robustness check. We find results of similar magnitude suggesting a fall of about 28% in the immigration flows based on the NINO data post the referendum.

(ii) Excluding Other Europe: One limitation of the data, both LTIM and UK LFS, is that they provide only aggregate sub-region of origin and as a result EFTA countries (Switzerland, Norway, Iceland and Liechtenstein ) are included in the Other Europe group although this group of countries is part of the free movement agreement with the EU. It is worth noting though that inflows from those four countries are typically very small compared to the rest of countries in the Other Europe group. As a robustness and to deal with this limitation, we drop Other Europe from non-EU group, and re-estimate all our previous models. In Appendix H we replicate the estimation on total inflows, outflows, and net flows using LTIM data, and inflows using UK LFS. All our previous results hold.

(iii) Different Definitions and Sample: In Appendix I we replicate the analysis using the UK LFS by defining immigrants based on nationality, rather than country of birth. Again these checks confirm the robustness of our previous results, Table I.27.<sup>48</sup>

In the UK LFS we do not observe inflows from all sub-regions in all quarters. In the baseline results, we treated those as zeros to construct a balanced panel. So, we also check the robustness of our findings on the effects of the inflows using UK LFS when using the

Nationals Entering the UK. <https://stat-xplore.dwp.gov.uk/webapi/metadata/NINO/NINO.html>.

<sup>48</sup>LTIM data do not report data by nationality, hence we restrict this robustness to ones using UK LFS.

unbalanced panel. Table I.28 shows that our results still hold when using an unbalanced panel for the UK LFS inflows. We also conduct a further data (UK LFS) related check. Given the concerns about the UK LFS during the Covid-19 pandemic, in particular being only collected through telephone interviews, which might introduced underestimate in the number of non-UK born in particular, we exclude the inflows based on data we calculated using 2020 quarters, Table I.29. Again, we still find that our results are unchanged.

(iv) Was the inflow diverted to other EU countries? The results presented so far highlighted that the Brexit referendum has reduced immigration flows of EU immigrants to the UK and increased emigration of EU immigrants from the UK. Here we investigate whether the UK Brexit referendum and expecting Brexit increased the attractiveness of other EU countries as alternative destinations where freedom of movement was unaffected.<sup>49</sup> To analyse the impact of the UK referendum on EU countries we use yearly migration inflows to the EU based on the OECD International Migration Database between 2013-2019. We adopt a Difference-in-Differences strategy, where we include EU immigrants in the treatment group and non-EU (Other Europe) immigrants in the control group, but we exclude the UK as a possible destination. We use Other Europe as a control group, rather than the whole of non-EU, to exclude asylum seekers/refugees which are not a good comparison group for EU migrants. As the OECD data have dyadic information on the inflows, we are able exclude the EFTA countries from the Other Europe group. We also adopt a triple difference approach to estimate the relative difference between the UK and other EU destinations. Appendix J shows that the referendum did not have any significant impact on the relative attractiveness of other EU countries as possible destinations for EU immigrants.

Discussion: In summary, our estimates using different data sources and definitions support our previous results and show that after the UK referendum there was a significant impact on EU immigration. More precisely, comparing EU immigration flows to non-EU immigration flows, we find a decline of around 27% - 29% in EU inflows based on LTIM, UK LFS and NiNo data. Importantly, our results are not driven by any potential spillover effects affecting non-EU immigration to the UK. Also, outflows of EU immigrants has increased by over 100% overall, but particularly for EU immigrants from new member states. Net EU migration has decreased by 63% compared to non-EU net migration. Thus, after the UK Brexit referendum, there was a decline in UK migration even before the official UK withdrawal from the EU despite free movement continuing during that period (2016-2019). Of course, there are potentially various reasons behind the impact of the Brexit vote on migration. For example, a potential reason for lower immigration and higher emigration could be attitudes and public opinions. However, despite suggestions that public opinions were anti-immigration during the Brexit campaign, the evidence suggests that opinion polls shifted with the public becoming less concerned about immigration and more positive about its effects, see [Portes \(2022\)](#) for opinion poll patterns pre- and post- 2016. Also, at the same time, there were signs of slower employment growth prior to the referendum as some of the main EU sending countries were experiencing shortages of labour, and little evidence of lower employment rate post 2016 compared to before ([Portes, 2022](#)). Another potential reason behind the fall in UK immigration might be in response to the fall in GBP Sterling

---

<sup>49</sup>We exclude the UK as origin nationality.

due to macroeconomic uncertainty, post the Brexit vote, making the UK less attractive for potential migrants. However, the fall in value of Sterling was against both the US Dollar and the Euro, hence affecting all potential migrants and not just EU migrants. Nonetheless, it is important to note that we already control for all potential confounding factors in each time period (quarter) that are likely to affect both EU and non-EU migrants. Although one main contender behind the lower migration is the shock to expectations and the uncertainty regarding migration policy and immigrant rights that have discouraged further immigration and pushed many EU immigrants to leave the UK, there could be other potential reasons that are not captured by the quarter and origin fixed effects.

## 7 Conclusion

The outcome of the Brexit referendum in 2016 resulted in a huge shock to expectations about migration policy in the UK. The immediate period that followed were four years of uncertainty in immigration policies for potential and current EU migrants in the UK, when Brexit was expected but not well defined. This paper examines the impact of the Brexit referendum on UK migration flows and stocks while expecting Brexit.

We use a Difference-in-Differences strategy as the referendum represents an exogenous shock that directly affects EU immigration to the UK, allowing us to compare EU migrants to non-EU migrants before and after the UK referendum of June 2016. Our identification relies on comparing EU migrants to non-EU migrants in each quarter and controlling for all other confounding factors. The results show that after the referendum vote and whilst expecting Brexit, there was a decline in migration inflows from the EU, especially for work purpose. When examining the inflow by socioeconomic characteristics, we find that this decline was experienced by all groups. Both inflows from EU14 and new EU member States have fallen by around 29 percent of the average size of the pre-referendum inflow. This suggests that, contrary to some expectations that the Brexit referendum could have led to a surge in migration, as immigrants could have tried to establish legal residence in the UK before the freedom of movement was officially suspended, the referendum and the ensuing policy uncertainty related to their future rights discouraged EU immigrants to move to the UK. Moreover, our findings show that after the referendum vote there was an increase in the outflows of EU immigrants from the UK. Also, the results particularly hold for those migrants whose main motive for moving initially to the UK was for work, and the effect on the outflow was much higher for immigrants from new EU member States in the UK compared to those from EU14. Overall, the findings also show a decrease in net migration flows to the UK.

We also examine whether our findings are driven by the potential secondary (spillover) effects of the 2016 referendum due to the fall in EU migrant workers potentially leading to an increase in non-EU work migration; i.e. resulting in substitution of EU migrant workers with non-EU migrant workers. We do not find evidence that our findings are driven by this potential spillover. The results are robust to using different methodologies, data sources, and alternative control group. Our findings suggest that after the referendum there was a decline of almost a third in EU work inflows relative to non-EU inflows. To quantify the impact, as an example, by 2019, the impact of the referendum was almost 80 thousand less EU net

flow to the UK. Overall, our estimates suggest a substantial decline in migration flows even before Brexit took place.

An important implication of our results is that individuals vote with their feet and, even prior to the changes in EU migrants' right and freedom of movement, the UK has become less attractive to EU potential and current immigrants. It has to be seen whether post the UK exiting the EU, and the actual change in rules pertaining to EU migrants' freedom of movement and having the same immigration rules as non-EU migrants, those declining trends in net migration flows in the UK will persist.

## References

- Agersnap, O., Jensen, A., and Kleven, H. (2020). The welfare magnet hypothesis: Evidence from an immigrant welfare scheme in denmark. *American Economic Review: Insights*, 2(4):527–42.
- Angrist, J. D. and Pischke, J.-S. (2008). *Mostly harmless econometrics: An empiricist’s companion*. Princeton university press.
- Artuc, E. and Ozden, C. (2018). Transit migration: All roads lead to america. *The Economic Journal*, 128(612):F306–F334.
- Baker, S. R., Bloom, N., and Davis, S. J. (2016). Measuring Economic Policy Uncertainty\*. *The Quarterly Journal of Economics*, 131(4):1593–1636.
- Beine, M., Bertoli, S., and Fernández-Huertas Moraga, J. (2016). A practitioners’ guide to gravity models of international migration. *The World Economy*, 39(4):496–512.
- Beine, M., Bourgeon, P., and Bricongne, J.-C. (2019). Aggregate fluctuations and international migration. *The Scandinavian Journal of Economics*, 121(1):117–152.
- Belot, M. V. K. and Hatton, T. J. (2012). Immigrant selection in the OECD. *The Scandinavian Journal of Economics*, 114(4):1105–1128.
- Bertoli, S., Brücker, H., and Moraga, J. F.-H. (2016). The European crisis and migration to Germany: expectations and the diversion of migration flows. *Regional Science and Urban Economics*, 60:61–72.
- Bertoli, S. and Fernández-Huertas Moraga, J. (2015). The size of the cliff at the border. *Regional Science and Urban Economics*, 51:1–6.
- Bijwaard, G. E., Schluter, C., and Wahba, J. (2014). The impact of labour market dynamics on the return–migration of immigrants. *Review of Economics and Statistics*, 96:483–494.
- Bijwaard, G. E. and Wahba, J. (2014). Do high-income or low-income immigrants leave faster? *Journal of Development Economics*, 108:54–68.
- Bloom, N., Bunn, P., Chen, S., Mizen, P., Smietanka, P., and Thwaites, G. (2019). The impact of brexit on uk firms. *National Bureau of Economic Research Working Paper*, (26218).
- Bloom, N., Bunn, P., Chen, S., Mizen, P., Smietanka, P., Thwaites, G., and Young, G. (2018). Brexit and uncertainty: Insights from the decision maker panel. *Fiscal Studies*, 39(4):555–580.
- Borjas, G. J. and Bratsberg, B. (1996). Who leaves? The outmigration of the foreignborn. *Review of Economics and Statistics*, 78:165–176.
- Bratu, C., Dahlberg, M., Engdahl, M., and Nikolka, T. (2020). Spillover effects of stricter immigration policies. *Journal of Public Economics*, 190:104–239.

- Carr, J., Clifton-Sprigg, J., James, J., Huber, S. V., and Steinmayr, A. (2020). Love thy neighbour? brexit and hate crime. *IZA Discussion Paper*, 13902.
- Chassamboulli, A. and Peri, G. (2020). The economic effect of immigration policies: analyzing and simulating the U.S. case. *Journal of Economic Dynamics and Control*, 114:103898.
- Clemens, M., Lewis, E., and Postel, H. (2018). Immigration restrictions as active labor market policy: Evidence from the mexican bracero exclusion. *American Economic Review*, 108(6):1468–1487.
- Czaika, M. and De Haas, H. (2013). The effectiveness of immigration policies. *Population and Development Review*, 39(3):487–508.
- Dhingra, S., Machin, S., and Overman, H. (2017). Local economic effects of Brexit. *National Institute Economic Review*, 242(1):R24–R36.
- Dhingra, S. and Sampson, T. (2022). Expecting Brexit. *Centre for Economic Policy Research Working Paper*.
- Dustmann, C. and Frattini, T. (2014). The fiscal effects of immigration to the UK. *The Economic Journal*, 124(580):F593–F643.
- Dustmann, C., Frattini, T., and Preston, I. P. (2013). The effect of immigration along the distribution of wages. *Review of Economic Studies*, 80(1):145–173.
- Dustmann, C. and Görlach, J.-S. (2016). The economics of temporary migrations. *Journal of Economic Literature*, 54(1):98–136.
- Falkingham, J., Giulietti, C., Wahba, J., and Wang, C. (2021). The impact of Brexit on international students’ return intentions. *The Manchester School*, 89(2):139–171.
- Grogger, J. and Hanson, G. H. (2011). Income maximization and the selection and sorting of international migrants. *Journal of Development Economics*, 95(1):42–57.
- Hatton, T. J. (2005). Explaining trends in UK immigration. *Journal of Population Economics*, 18(4):719–740.
- Huber, M. and Steinmayr, A. (2021). A framework for separating individual-level treatment effects from spillover effects. *Journal of Business Economic Statistics*, 39(2):422–436.
- Kleven, H., Landais, C., Muñoz, M., and Stantcheva, S. (2020). Taxation and migration: Evidence and policy implications. *Journal of Economic Perspectives*, 34(2):119–42.
- Manacorda, M., Manning, A., and Wadsworth, J. (2012). The impact of immigration on the structure of wages: theory and evidence from Britain. *Journal of the European Economic Association*, 10(1):120–151.
- Mayda, A. M. (2010). International migration: A panel data analysis of the determinants of bilateral flows. *Journal of Population Economics*, 23(4):1249–1274.

- Migration Observatory (2017). Article 50: Shades of grey, or black and white? <https://migrationobservatory.ox.ac.resources/commentaries/article-50-shades-of-grey-or-black-and-white>.
- Migration Observatory (2019). EU migration to and from the UK. <https://migrationobservatory.ox.ac.resources/briefings/eu-migration-to-and-from-the-uk>.
- Migration Observatory (2020). Unsettled status 2020: Which EU citizens are at risk of failing to secure their rights after Brexit. <https://migrationobservatory.ox.ac.uk/resources/reports/unsettled-status-2020>.
- Nielsen, H. S., Smith, N., and Åželikaksoy, A. (2009). The effect of marriage on education of immigrants: Evidence from a policy reform restricting marriage migration. *The Scandinavian Journal of Economics*, 111(3):457–486.
- ONS (2021). Coronavirus and the impact on payroll employment: experimental analysis, ONS. <https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/articles/coronavirusandtheimpactonpayrollemployment/experimentalanalysis>.
- Ortega, F. and Peri, G. (2013). The effect of income and immigration policies on international migration. *Migration Studies*, 1(1):47–74.
- Portes, J. (2022). Immigration to the UK between the referendum and brexit. *Oxford Review of Economic Policy*, 38(1):82–96.
- Rambachan, A. and Roth, J. (2023). A more credible approach to parallel trends. *Review of Economic Studies*.
- Razin, A. and Wahba, J. (2015). Welfare magnet hypothesis, fiscal burden, and immigration skill selectivity. *The Scandinavian Journal of Economics*, 117(2):369–402.
- Roth, J., Sant’Anna, P., Bilinski, A., and Poe, J. (2022). What’s trending in difference-in-differences? a synthesis of the recent econometrics literature. *Unpublished manuscript, Harvard University*. [99].
- Vono de Vihena, D. and Bijak, J. (2021). Uncertainty in future migration flows: Where does it come from? *Population Policy Compact 29*, Berlin: Max Planck Society/Population Europe.
- Wadsworth, J., Dhingra, S., Ottaviano, G., and Van Reenen, J. (2016). Brexit and the impact of immigration on the UK. *CEP Brexit Analysis*, 5:34–53.

# 1 Appendix

## A Placebo tests

**Table A.1:** Placebo test, inflows to the UK by migration reason, (LTIM)

	(1)	(2)	(3)	(4)
<b>Total inflows from EU and non-EU (log)</b>	All reasons	Work	Family	Study
EU*post.shock	0.399*** (0.0730)	0.432*** (0.0808)	0.579*** (0.0840)	0.0501 (0.0731)
Origin region and quarter FE	Yes	Yes	Yes	Yes
<b>DiD effect</b>	49%	54%	78%	5%
Observations	336	336	336	336
R-squared	0.936	0.953	0.844	0.889
	(1)	(2)	(3)	(4)
<b>Inflows from EU14 and non EU (log)</b>	All reasons	Work	Family	Study
EU14*post.shock	0.292*** (0.0430)	0.341*** (0.0671)	0.523** (0.165)	0.122 (0.0925)
Origin region and quarter FE	Yes	Yes	Yes	Yes
<b>DiD effect</b>	33%	41%	69%	13%
Observations	264	264	264	264
R-squared	0.931	0.959	0.815	0.888
	(1)	(2)	(3)	(4)
<b>Inflows from EU new and non-EU (log)</b>	All reasons	Work	Family	Study
EU_new*post.shock	0.434*** (0.0929)	0.463*** (0.102)	0.597*** (0.0953)	0.0262 (0.0852)
Origin region and quarter FE	Yes	Yes	Yes	Yes
<b>DiD effect</b>	54%	59%	82%	3%
Observations	312	312	312	312
R-squared	0.924	0.941	0.849	0.878

**Source:** Authors' calculations based on quarterly LTIM estimations, Q2 2010 - Q1 2016. **Notes:** Robust Standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.001$ . Origin region is based on nationality.



**Table A.2:** Placebo test, outflows from the UK, (LTIM)

	(1)	(2)	(3)	(4)
<b>Total outflow from EU and non-EU (log)</b>	All reasons	Work	Family	Study
EU*shock	0.295 (0.184)	0.257 (0.200)	0.087 (0.139)	0.118 (0.185)
Origin region and quarter FE	Yes	Yes	Yes	Yes
<b>DiD effect</b>	34%	29%	9%	12%
Observations	154	154	154	186
R-squared	0.862	0.831	0.581	0.831
	(1)	(2)	(3)	(4)
<b>Outflows from EU14 and non EU (log)</b>	All reasons	Work	Family	Study
EU14*post_shock	0.233 (0.544)	0.284 (0.621)	0.256 (0.364)	-0.0840 (0.380)
Origin region and year FE	Yes	Yes	Yes	Yes
<b>DiD effect</b>	26%	33%	29%	-8%
Observations	145	145	145	145
R-squared	0.829	0.761	0.877	0.614
	(1)	(2)	(3)	(4)
<b>Outflows from EU new and non-EU (log)</b>	All reasons	Work	Family	Study
EU_new*post_shock	0.0829 (0.178)	0.208 (0.169)	-0.144 (0.254)	-0.0443 (0.133)
Origin region and year FE	Yes	Yes	Yes	Yes
<b>DiD effect</b>	8%	23%	- 15%	4%
Observations	171	171	171	171
R-squared	0.933	0.889	0.869	0.656

**Source:** Authors' calculations based on quarterly LTIM estimations, Q4 2012 - Q1 2016. **Notes:** Robust standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.001$ . Origin region is based on nationality.

**Table A.3:** Placebo test, inflows to the UK, (UK LFS)

<b>Total inflow from EU and non-EU (log)</b>	EU	EU14	EU new
EU*post_shock	0.283** (0.137)	0.420 (0.257)	0.237 (0.155)
Origin region and year FE	Yes	Yes	Yes
<b>DiD effect</b>	33%	52%	27%
Observations	368	299	345
R-squared	0.752	0.687	0.732

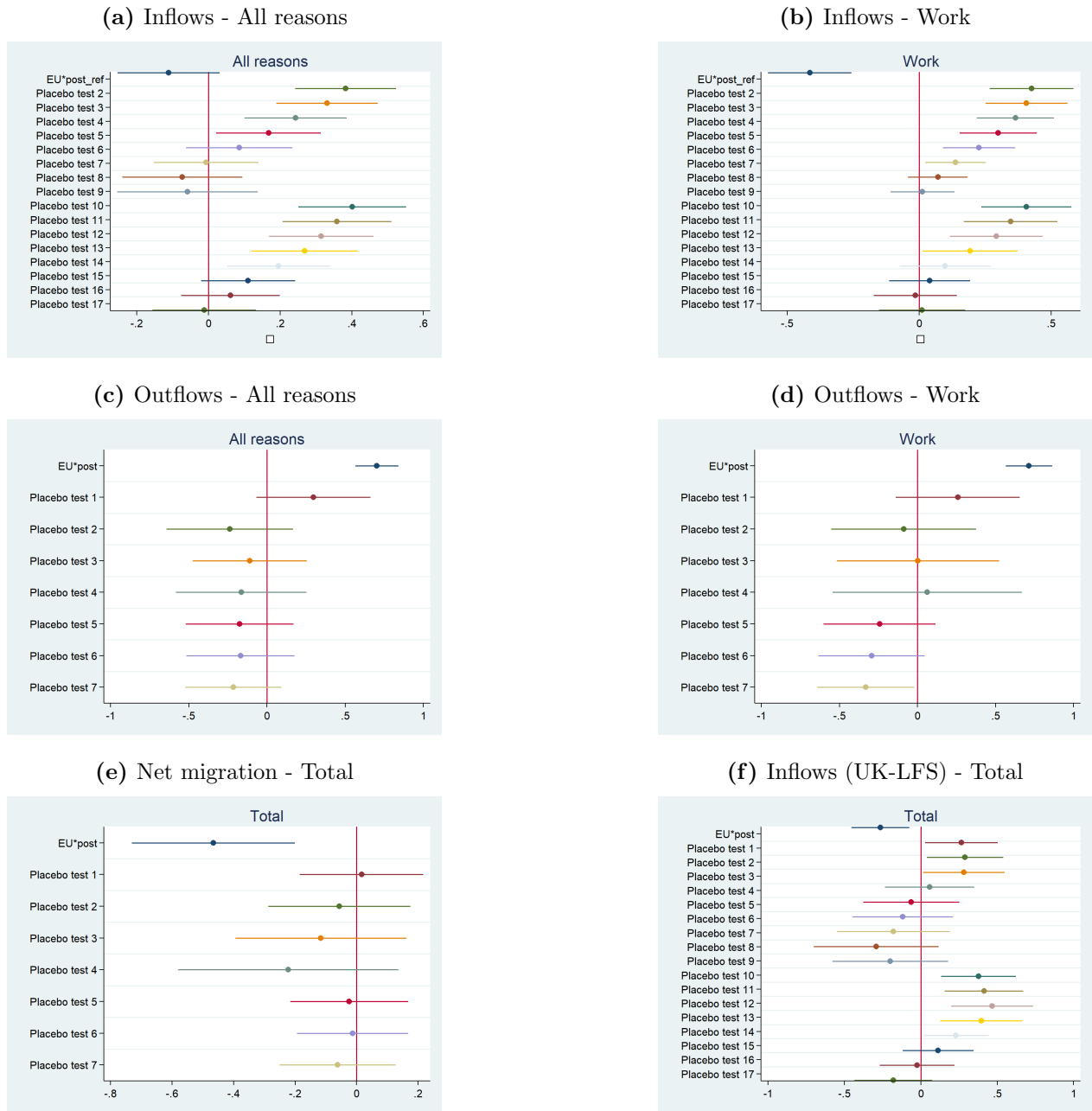
**Source:** Authors' calculations based on quarterly UK LFS estimations, Q2 2010 - Q1 2016. **Notes:** Robust Standard errors in parentheses. \*  $p < 0.10$ , \*\* $p < 0.05$ , \*\*\*  $p < 0.001$ . Origin region is based on country of birth.

**Table A.4:** Placebo test, net migration flows to the UK, (LTIM)

<b>Total inflow from EU and non EU (log)</b>	EU	EU14	EU new
EU*post_shock	0.0165 (0.1017)	0.119 (0.0908)	0.0306 (0.127)
Origin region and year FE	Yes	Yes	Yes
<b>DiD effect</b>	2%	13%	3%
Observations	154	132	143
R-squared	0.913	0.894	0.897

**Source:** Authors' calculations based on quarterly LTIM estimations, Q4 2012 - Q1 2016. **Notes:** Robust standard errors in parentheses. \*  $p < 0.10$ , \*\* $p < 0.05$ , \*\*\*  $p < 0.001$ . Origin region is based on nationality.

**Figure A.1: Placebo tests**



**Source:** Authors' calculations based on quarterly LTIM data, Q1 2013 - Q4 2019. **Notes:** The graphs show the estimated difference in the log of inflows from EU countries relative to non-EU countries, without conditioning on controls nor fixed effects. The baseline level is the quarter in which the Brexit referendum took place (June 2016, indicated with the dash line). 95% confidence interval for each difference is shown.

## B Inverse Hyperbolic Sine (IHS) transformation

**Table B.5:** Difference-in-Differences estimates, Migration inflows and outflows to the UK by migration reason, (LTIM), using IHS

	(1)	(2)	(3)	(4)
<b>Total inflows from EU and non EU (IHS)</b>	All reasons	Work	Family	Study
EU*post_ref	-0.0948 (0.0787)	-0.469*** (0.0924)	0.104 (0.0921)	0.135 (0.0988)
Origin region and quarter FE	Yes	Yes	Yes	Yes
Observations	392	392	392	392
R-squared	0.924	0.928	0.568	0.854
<b>Total outflows from EU and non EU (IHS)</b>	All reasons	Work	Family	Study
EU*post_ref	0.696*** (0.0668)	0.824*** (0.0914)	0.104 (0.0921)	0.135 (0.0988)
Origin region and quarter FE	Yes	Yes	Yes	Yes
Observations	392	392	392	392
R-squared	0.926	0.902	0.568	0.854

**Source:** Authors' calculations based on quarterly LTIM data. **Notes:** Robust standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.001$ . All statistics are expressed in thousands. Origin region is based on nationality.

**Table B.6:** Difference-in-difference estimates, Total net migration to the UK (LTIM), using IHS

	(1)	(2)	(3)
	EU total	EU14	EU_new
EU*post_ref	-1.518*** (0.309)	-0.506*** (0.115)	-1.856*** (0.402)
Origin region and quarter FE	Yes	Yes	Yes
Observations	392	308	364
R-squared	0.584	0.821	0.561

**Source:** Authors' calculations based on quarterly LTIM estimations data, January 2013 - December 2019. **Notes:** Robust standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.001$ . All statistics are expressed in thousands. Origin region is based on nationality.

**Table B.7:** Difference-in-difference estimates, Total migration inflows to the UK (UK-LFS), using IHS

	(1)	(2)	(3)
	EU total	EU14	EU_new
EU*post_ref	-0.278** (0.113)	-0.298** (0.114)	-0.271** (0.136)
Origin region and quarter FE	Yes	Yes	Yes
Observations	392	308	364
R-squared	0.786	0.709	0.761

**Source:** Authors' calculations based on quarterly quarterly UK LFS, Q1 2013 - Q1 2020. **Notes:** Robust standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.001$ . Origin region is based on country of birth.

## C Addressing Potential Spillover

### C.1 Event study

**Table C.8:** Difference-in-Differences estimates, Migration inflows to the UK, Event Study (Reference year 2016, LTIM)

	(1)	(2)	(3)	(4)
<b>Inflows from EU and non EU (log)</b>	All reasons	Work	Family	Study
EU	-0.811*** (0.115)	-0.364** (0.126)	-0.0749 (0.115)	-0.430*** (0.118)
EU×2013	-0.135 (0.145)	-0.123 (0.142)	0.0335 (0.149)	-0.112 (0.116)
EU×2014	-0.0176 (0.110)	0.0364 (0.0919)	-0.0997 (0.132)	-0.163 (0.124)
EU×2015	0.0432 (0.108)	-0.0156 (0.102)	-0.00420 (0.138)	-0.0186 (0.108)
EU×2017	0.0493 (0.116)	-0.392*** (0.112)	0.0593 (0.173)	-0.0215 (0.120)
EU×2018	-0.179 (0.126)	-0.503*** (0.127)	0.0357 (0.150)	0.0649 (0.157)
EU×2019	-0.379** (0.127)	-0.580*** (0.170)	0.153 (0.148)	-0.0678 (0.126)
Origin region, quarter, and year FE	Yes	Yes	Yes	Yes
Observations	392	392	392	392
R-squared	0.934	0.937	0.582	0.871
	(1)	(2)	(3)	(4)
<b>Inflows from EU_14 and non EU (log)</b>	All reasons	Work	Family	Study
EU14	2.449*** (0.0588)	3.296*** (0.0691)	1.382*** (0.160)	1.622*** (0.0950)
EU14×2013	-0.124** (0.0539)	0.115* (0.0589)	0.241 (0.176)	-0.172** (0.0836)
EU14×2014	-0.130** (0.0513)	0.0225 (0.0657)	-0.213 (0.185)	0.0510 (0.0872)
EU14×2015	-0.0452 (0.0438)	-0.0354 (0.0572)	-0.0313 (0.200)	-0.0708 (0.0962)
EU14×2017	-0.0706 (0.0580)	-0.217** (0.0848)	-0.338* (0.192)	0.190** (0.0852)
EU14×2018	-0.263*** (0.0510)	-0.573*** (0.0698)	-0.183 (0.196)	-0.141 (0.0958)
EU14×2019	-0.319*** (0.0518)	-0.613*** (0.0703)	0.0339 (0.216)	-0.129 (0.0989)
Origin region, quarter, and year FE	Yes	Yes	Yes	Yes
Observations	308	308	308	308
R-squared	0.956	0.944	0.611	0.895
	(1)	(2)	(3)	(4)
<b>Inflows from EU_new and non EU (log)</b>	All reasons	Work	Family	Study
EU_new	-0.827*** (0.129)	-0.351** (0.133)	-0.107 (0.133)	-0.428*** (0.125)
EU_new×2013	-0.139 (0.190)	-0.202 (0.180)	-0.0357 (0.167)	-0.0920 (0.141)
EU_new×2014	0.0200 (0.141)	0.0410 (0.113)	-0.0618 (0.153)	-0.235 (0.149)
EU_new×2015	0.0727 (0.140)	-0.00893 (0.127)	0.00484 (0.162)	-0.00123 (0.131)
EU_new×2017	0.0892 (0.149)	-0.450** (0.139)	0.192 (0.202)	-0.0949 (0.140)
EU_new×2018	-0.151 (0.165)	-0.480** (0.162)	0.108 (0.171)	0.133 (0.192)
EU_new×2019	-0.399** (0.164)	-0.569** (0.218)	0.193 (0.167)	-0.0475 (0.150)
Origin region, quarter, and year FE	Yes	Yes	Yes	Yes
Observations	364	364	364	364
R-squared	0.917	0.920	0.410	0.845

**Source:** Authors' calculations based on quarterly LTIM data. **Notes:** Robust standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.001$ . All statistics are expressed in thousands. Origin region is based on nationality.

## C.2 Excluding 2018 and 2019

**Table C.9:** Difference-in-Differences estimates, Migration inflows to the UK, (LTIM), Excluding 2018 and 2019

	(1)	(2)	(3)	(4)
<b>Total inflows from EU and non EU (log)</b>	All reasons	Work	Family	Study
EU*post_ref	0.00440 (0.0840)	-0.304*** (0.0717)	0.0386 (0.112)	0.130 (0.0901)
Origin region and quarter FE	Yes	Yes	Yes	Yes
<b>DiD effect</b>	0.4%	- 26%	3%	14%
Observations	196	196	196	196
R-squared	0.960	0.969	0.626	0.906
	(1)	(2)	(3)	(4)
<b>Inflows from EU14 and non EU (log)</b>	All reasons	Work	Family	Study
EU14*post_ref	0.0338 (0.0446)	-0.107 (0.0774)	-0.267* (0.139)	0.156** (0.0775)
Origin region and quarter FE	Yes	Yes	Yes	Yes
<b>DiD effect</b>	3%	-10%	-23%	17%
Observations	154	154	154	154
R-squared	0.973	0.962	0.679	0.919
	(1)	(2)	(3)	(4)
<b>Inflows from EU_new and non EU (log)</b>	All reasons	Work	Family	Study
EU_new*post_ref	-0.00540 (0.109)	-0.369*** (0.0854)	0.141 (0.132)	0.121 (0.109)
Origin region and quarter FE	Yes	Yes	Yes	Yes
<b>DiD effect</b>	-0.04%	- 31%	15%	13%
Observations	182	182	182	182
R-squared	0.949	0.962	0.519	0.883

**Source:** Authors' calculations based on quarterly LTIM data. **Notes:** Robust standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.001$ . All statistics are expressed in thousands. Origin region is based on nationality.

### C.3 Excluding 2019

**Table C.10:** Difference-in-Differences estimates, Migration inflows to the UK, (LTIM), Excluding 2019

	(1)	(2)	(3)	(4)
<b>Total inflows from EU and non EU (log)</b>	All reasons	Work	Family	Study
EU*post_ref	-0.0505 (0.0757)	-0.379*** (0.0750)	0.0657 (0.0862)	0.129 (0.0870)
Origin region and quarter FE	Yes	Yes	Yes	Yes
<b>DiD effect</b>	-5%	- 31%	7%	14%
Observations	308	308	308	308
R-squared	0.939	0.957	0.591	0.877
	(1)	(2)	(3)	(4)
<b>Inflows from EU14 and non EU (log)</b>	All reasons	Work	Family	Study
EU14*post_ref	-0.0433 (0.0500)	-0.323*** (0.0877)	-0.276** (0.111)	0.0633 (0.0744)
Origin region and quarter FE	Yes	Yes	Yes	Yes
<b>DiD effect</b>	-4%	-28%	-24%	6%
Observations	242	242	242	242
R-squared	0.956	0.956	0.628	0.904
	(1)	(2)	(3)	(4)
<b>Inflows from EU_new and non EU (log)</b>	All reasons	Work	Family	Study
EU_new*post_ref	-0.0528 (0.0982)	-0.397*** (0.0931)	0.180* (0.0971)	0.151 (0.107)
Origin region and quarter FE	Yes	Yes	Yes	Yes
<b>DiD effect</b>	-5%	- 33%	20%	16%
Observations	286	286	286	286
R-squared	0.922	0.946	0.446	0.850

**Source:** Authors' calculations based on quarterly LTIM data. **Notes:** Robust standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.001$ . All statistics are expressed in thousands. Origin region is based on nationality.

## D Alternative control

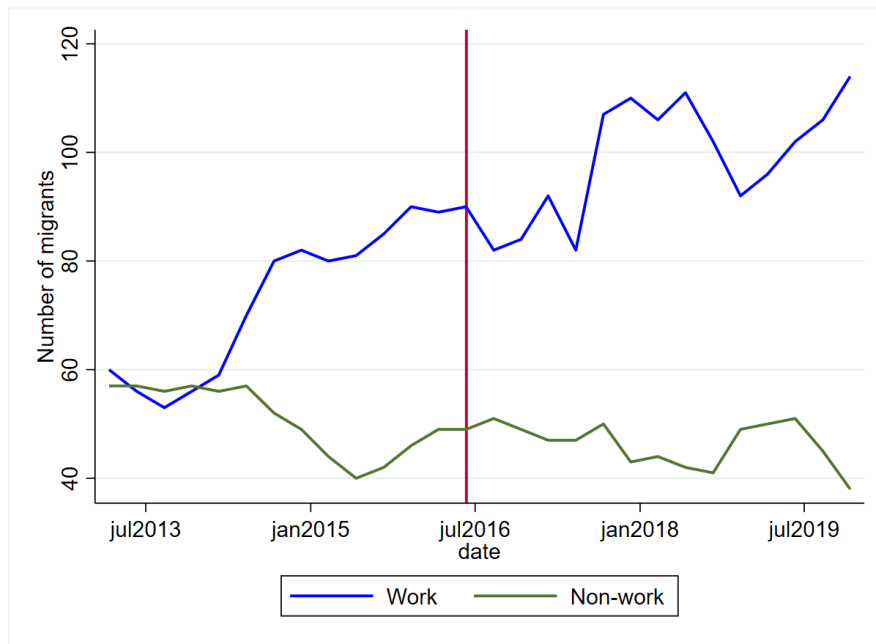
### D.1 Dependent variable: Total inflows, Control group: non-working non-EU, UK LFS

**Table D.11:** Difference-in-difference estimates, Total inflows to the UK, Based on UK LFS, Alternative Control Group

	(1)	(2)	(3)
	EU total	EU14	EU_new
EU*post_ref	-0.308** (0.103)	-0.337** (0.111)	-0.299** (0.124)
Origin region and quarter FE	Yes	Yes	Yes
<b>DiD effect</b>	-26%	-29%	-26%
Observations	392	308	364
R-squared	0.782	0.728	0.734

**Source:** Authors' calculations based on quarterly UK LFS, Q1 2013 - Q1 2020. **Notes:** Control group is non-EU non-working inflow. Robust standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.001$ . Origin region is based on country of birth.

**Figure D.2:** Trend of non-EU work and non-work (Alternative Control Group) inflows to the UK, (LTIM)



**Source:** Authors' calculations based on LTIM data, Q1 2013 - Q4 2019. **Notes:** Statistics are the sum (in thousands) of non-EU in migrants in each quarter. The red line indicates the quarter when the referendum took place. Trend in non-EU non-work (alternative control group) and non-EU work inflows.



**E Sensitivity analysis**

**F Heterogeneity**

**F.1 Heterogeneity: Inflows**

**Table F.12:** Difference-in-Differences estimates, Inflows to the UK by group, Heterogeneity analysis (UK LFS)

Total Inflow from EU and Non-EU (log)										
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	
Total	High.educated	Low.educated	Women	Men	Young	Older	London	South-East	Rest of the UK	
EU*post_ref	-0.311** (0.107)	-0.469*** (0.105)	-0.312** (0.106)	-0.353** (0.108)	-0.329** (0.110)	-0.257** (0.109)	-0.214* (0.110)	-0.255** (0.116)	-0.266** (0.117)	
Origin region and quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
DiD effect	- 27%	- 37%	- 27%	- 30%	- 28%	- 23%	- 19%	- 22%	- 23%	
Observations	392	392	392	392	392	392	392	392	392	
R-squared	0.749	0.717	0.692	0.678	0.715	0.516	0.594	0.470	0.696	
Total Inflow from EU14 and Non-EU (log)										
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	
Total	High.educated	Low.educated	Women	Men	Young	Older	London	South-East	Rest of the UK	
EU14*post_ref	-0.359** (0.116)	-0.496*** (0.141)	-0.330** (0.146)	-0.426** (0.162)	-0.347** (0.121)	-0.417* (0.214)	-0.423** (0.207)	-0.176 (0.203)	-0.260 (0.214)	
Origin region and quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
DiD effect	- 30%	- 39%	- 28%	- 35%	- 29%	- 34%	- 35%	- 16%	- 23%	
Observations	308	308	308	308	308	308	308	308	308	
R-squared	0.725	0.617	0.651	0.636	0.672	0.471	0.563	0.447	0.612	
Total Inflow from EU new and Non-EU (log)										
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	
Total	High.educated	Low.educated	Women	Men	Young	Older	London	South-East	Rest of the UK	
EU_new*post_ref	-0.295** (0.128)	-0.460*** (0.123)	-0.306** (0.123)	-0.329** (0.127)	-0.323** (0.131)	-0.204* (0.118)	-0.144 (0.124)	-0.281** (0.130)	-0.268** (0.135)	
Origin region and quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
DiD effect	- 26%	- 14%	- 26%	- 28%	- 28%	- 19%	- 13%	- 24%	- 23%	
Observations	364	364	364	364	364	364	364	364	364	
R-squared	0.701	0.568	0.642	0.612	0.662	0.443	0.504	0.438	0.662 -	

**Source:** Authors' calculations based on quarterly UK-LFS, Q1 2013 - Q1 2020. **Notes:** Robust standard errors in parentheses. \*  $p < 0.10$ , \*\* $p < 0.05$ , \*\*\*  $p < 0.001$ . Origin region is based on country of birth.

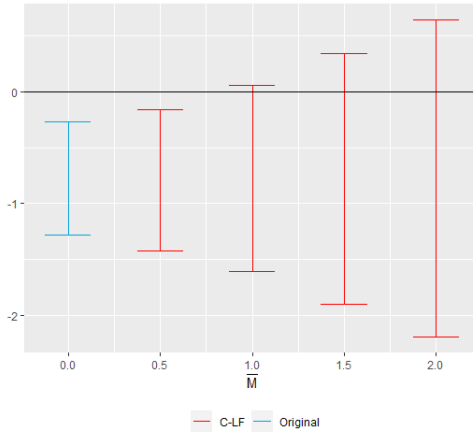
**Table F.13:** Difference-in-Differences estimates, Inflows to the UK by profession skills and sector of occupation, (UK LFS)

Total Inflow from EU and Non-EU (log)								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	High skilled professions	Low skilled professions	Manufacturing	Construction	Hospitality	Finance	Admin	All other sectors
EU*post_ref	-0.160 (0.105)	-0.363*** (0.102)	-0.263** (0.108)	-0.133 (0.0832)	-0.440*** (0.109)	-0.278** (0.101)	-0.214** (0.105)	-0.121 (0.103)
Origin region and quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
DiD effect	- 15%	- 30%	- 23%	- 12%	- 35%	- 24%	- 19%	- 11%
Observations	392	392	392	392	392	392	392	392
R-squared	0.655	0.743	0.524	0.362	0.595	0.507	0.414	0.540
Total Inflow from EU14 and Non-EU (log)								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	High skilled professions	Low skilled professions	Manufacturing	Construction	Hospitality	Finance	Admin	All other sectors
EU14*post_ref	-0.428** (0.173)	-0.317** (0.152)	-0.503** (0.218)	-0.119 (0.175)	-0.265 (0.202)	-0.378** (0.168)	-0.430* (0.225)	-0.0899 (0.209)
Origin region and quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
DiD effect	- 35%	- 27%	- 39%	- 11%	- 23%	- 31%	- 35%	- 8%
Observations	308	308	308	308	308	308	308	308
R-squared	0.667	0.597	0.325	0.189	0.497	0.548	0.438	0.530
Total Inflow from EU new and Non-EU (log)								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	High skilled professions	Low skilled professions	Manufacturing	Construction	Hospitality	Finance	Admin	All other sectors
EU_new*post_ref	-0.0710 (0.113)	-0.378** (0.118)	-0.183 (0.118)	-0.137 (0.0903)	-0.498*** (0.121)	-0.245** (0.115)	-0.142 (0.111)	-0.131 (0.111)
Origin region and quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
DiD effect	- 7%	- 31%	- 17%	- 13%	- 39%	- 22%	- 13%	- 12%
Observations	364	364	364	364	364	364	364	364
R-squared	0.574	0.719	0.551	0.399	0.560	0.398	0.316	0.510

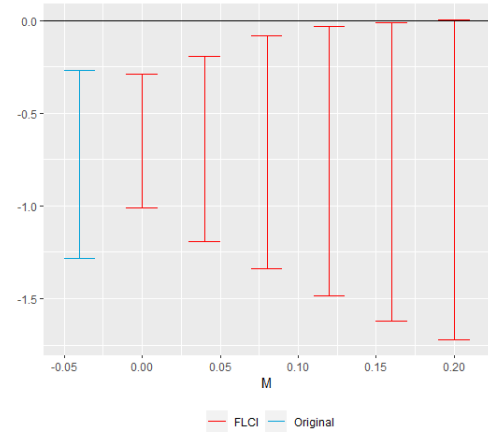
**Source:** Authors' calculations based on quarterly UK-LFS, Q1 2013 - Q1 2020. **Notes:** Robust standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.001$ . Origin region is based on country of birth.

**Figure E.3:** Parallel trends sensitivity analysis, UK migration - breakdown points for 2019 average treatment coefficients

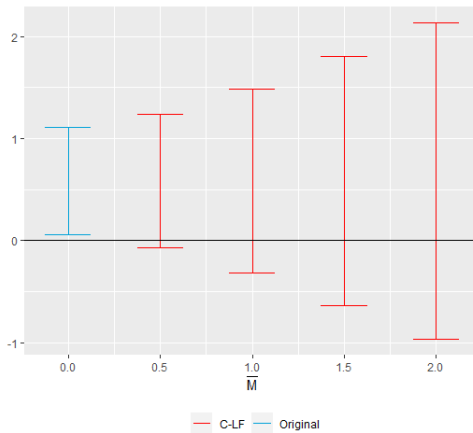
**(a)** Work inflows to the UK, based on LTIM  
Bounds on relative magnitude



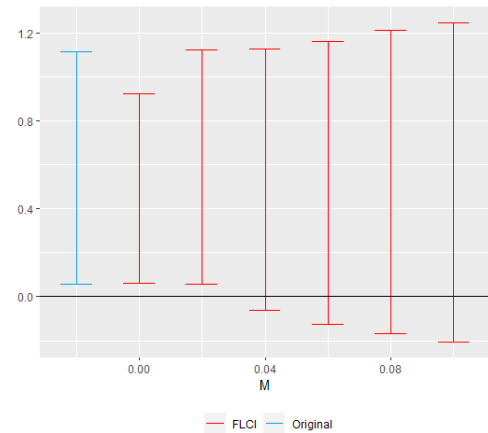
**(b)** Work inflows to the UK, based on LTIM  
Smoothness restriction



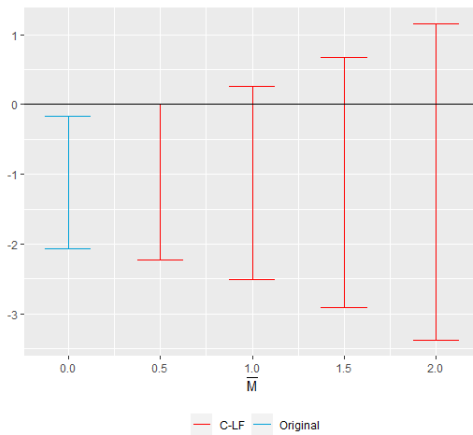
**(c)** Work outflows to the UK, based on LTIM  
Bounds on relative magnitude



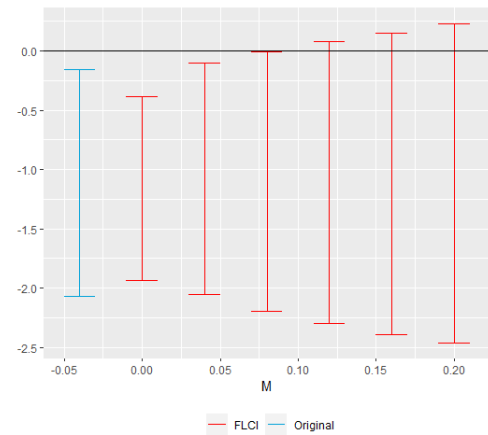
**(d)** Work outflows from the UK, based on LTIM  
Smoothness restriction



**(e)** Net migration from the UK, based on LTIM  
Bounds on relative magnitude



**(f)** Net migration to the UK, based on LTIM  
Smoothness restriction



## F.2 Heterogeneity: Stocks and Changes in Stocks

**Table F.14:** Labour force distribution in 2016 and 2019 (UK LFS)

	Distribution by educational level				Distribution by Skills			
	High educated		Low educated		High skilled		Low skilled	
	2016	2019	2016	2019	2016	2019	2016	2019
	Share in LF				Share in LF			
<b>Non-EU</b>	4,7%	5,2%	5,0%	4,9%	4,7%	5,2%	4,9%	4,9%
<b>EU</b>	3,0%	3,1%	4,4%	4,3%	2,7%	3,0%	4,7%	4,5%
<b>UK</b>	25,7%	28,2%	57,3%	54,2%	37,6%	39,6%	45,4%	42,8%
<b>Total</b>	33,3%	36,6%	66,7%	63,4%	45,0%	47,8%	55,0%	52,2%
	Share in total education group				Share in total skill group			
<b>Non-EU</b>	14,0%	14,3%	7,4%	7,8%	10,5%	11,0%	8,9%	9,4%
<b>EU</b>	8,9%	8,6%	6,6%	6,8%	6,0%	6,2%	8,5%	8,6%
<b>UK</b>	77,1%	77,1%	85,9%	85,4%	83,5%	82,9%	82,6%	82,0%
<b>Total</b>	100,0%	100%	100%	100%	100,0%	100,0%	100,0%	100,0%
	Share among origin group				Share among origin group			
<b>Non-EU</b>	48,4%	51,5%	51,6%	48,5%	49,3%	51,6%	50,7%	48,4%
<b>EU</b>	40,3%	42,1%	59,7%	57,9%	36,3%	39,7%	63,7%	60,3%
<b>UK</b>	31,0%	34,2%	69,0%	65,8%	45,3%	48,1%	54,7%	51,9%

**Source:** Authors' calculations based on quarterly UK-LFS, Q2 2016 and Q4 2019. High skilled is ISCO categories 1 to 3, while all other categories are classified as low skilled. Origin region is based on country of birth.

In this sub-section we analyse the impact of the referendum on the migrant stocks in the UK using the UK LFS. However, first in Table F.14 we use the UK LFS to compare the educational distribution of the labour force in the UK in Q2 of 2016 (the quarter of the referendum) and Q4 of 2019 (our last quarter of analysis).

Then, similar to what we did for the inflows using UK LFS, we build a repeated quarterly cross-sectional database from Quarter 1 2013 to Quarter 4 2019 and define the unit of analysis as the 14 regions of birth. However, to measure the quarterly stock of foreign-born, we include in our sample all respondents, with no restrictions on their interview's wave and time of arrival, and each individual is counted in their interview's quarter. Since in this case we are using respondents in all the waves of the survey, for the baseline results on the stocks we use the individual weights provided in the survey.

Delving more into the characteristics of the migrant stock, Table F.17 shows the average immigrant stocks before and after distinguished by education, age and gender using the UK LFS. We can notice that, differently from the inflows, the stocks of immigrants from EU countries has increased between the pre and post-referendum period. The difference is statistically significant for the total, high-educated, younger cohort, women, and men stocks. Similarly the stock of non-EU immigrants has increased, and the difference is significant for most of the migrant groups based on demographics.

We then analyse the impact of the referendum on immigrants stocks in the UK. Figure shows that the DiD effects are all positive and significant. The relative average increase in stock is around 25%. New EU member States stock shows a positive and significant coefficient in all columns, with a relative effect ranging between 27% and 44%. On the other hand, the effects are not strong for the stock of immigrants from EU14. In other words, this suggests that there has been no significant increase in the stock of EU14, but a significant one for the stock of immigrant from new EU member States in the UK. When we run a placebo test and set the pseudo-shock in March 2013, the results in Table F.16 show a positive and statistically significant coefficient in all columns, suggesting an ongoing increasing trend that pre-dates the referendum, and suggests that in the absence of the referendum both EU and non-EU migrants stocks would have continued their upward trend. Thus, overall EU migrant stock increased post the referendum but that increase was much smaller to the increase witnessed until the referendum.

It is important to note that the effects of the referendum on migrant stocks are consistent with our earlier results on inflows, outflows and net migration. Using the figures on net migration from Table 4 and Table F.17 though those are from different sources and the purpose here is just illustrative. If before the referendum, EU migrant stock was 2.7 million and EU net migration was 182 thousands, but after the referendum, EU migrant stock was 2.97 million and EU net migration was 56 thousands, EU migrant stocks continued to increase but at a lower rate as net migration was positive but smaller than before. Hence, our results here provide further evidence on the robustness of our results.

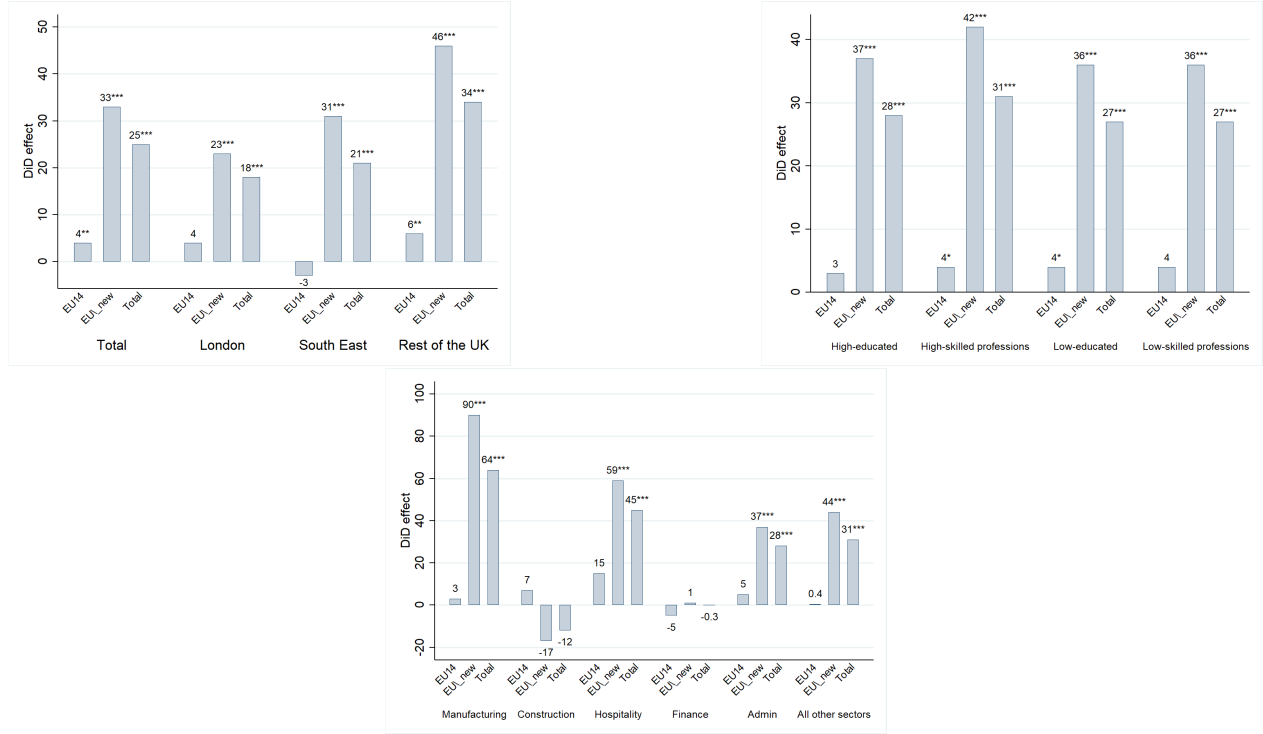
As a further robustness, we re-estimate the change in stock which would capture the effect of inflows and outflows. We present the descriptive statistics by group and individual characteristics. Indeed, these estimates are consistent with our previous results discussed in Section 6.

**Table F.15:** Descriptive statistics of migrant stocks in the UK, 2013-2019 (weighted), UK LFS

	Total		Before		After		Difference
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	mean	sd	mean	sd	mean	sd	(5-3)
<b>Total</b>							
EU	2729.5	306.8	2489.4	262.3	2969.6	51.0	480.1***
Non-EU	4695.2	171.9	4543.3	85.1	4847.2	66.2	303.9***
<b>High-educated</b>							
EU	969.4	152.9	846.8	119.3	1092.0	44.4	245.2***
Non-EU	1932.0	155.2	1790.8	61.9	2073.3	56.8	282.5***
<b>Low-educated</b>							
EU	1760.1	162.1	1642.6	144.8	1877.5	62.6	234.9***
Non-EU	2763.2	60.5	2752.5	50.6	2773.9	69.3	21.5
<b>London</b>							
EU	839.68	68.76	861.79	57.13	817.57	74.19	-44.21*
Non-EU	2119.71	231.66	2283.50	75.43	1955.93	219.07	-327.6***
<b>South East</b>							
EU	667.50	28.12	660.57	31.39	674.43	23.53	13.86
Non-EU	2119.71	231.66	2283.50	75.43	1955.93	219.07	-55.50***
<b>Rest of the UK</b>							
EU	2013.86	179.06	1881.79	162.61	2145.93	175.05	264.1***
Non-EU	2779.68	85.25	2816.57	89.77	2742.79	64.06	-73.79**
<b>High-skilled profession</b>							
EU	962.96	98.57	885.64	79.22	1040.29	32.05	154.6***
Non-EU	1877.14	45.66	1868.57	53.44	1885.71	36.28	17.14
<b>Low skilled profession</b>							
EU	1767.36	148.26	1678.21	150.06	1856.50	77.56	178.3***
Non-EU	2032.18	104.67	2084.64	68.68	1979.71	110.04	-104.9***
<b>Manufacturing</b>							
EU	407.32	47.26	388.64	47.59	426.00	40.28	37.36**
Non-EU	276.96	21.88	288.79	20.81	265.14	16.14	-23.64***
<b>Construction</b>							
EU	211.07	23.68	198.93	20.63	223.21	20.53	24.29***
Non-EU	145.39	8.50	147.36	5.96	143.43	10.30	-3.929
<b>Hospitality</b>							
EU	594.11	62.99	544.29	46.48	643.93	27.11	99.64***
Non-EU	792.93	58.95	821.79	41.65	764.07	60.73	-57.71***
<b>Finance</b>							
EU	458.93	38.97	432.57	34.75	485.29	21.20	52.71***
Non-EU	702.36	30.06	686.50	25.82	718.21	25.85	31.71***
<b>Admin</b>							
EU	576.39	43.32	555.14	40.28	597.64	36.08	42.50***
Non-EU	1241.14	38.94	1263.14	37.02	1219.14	27.14	-44***
<b>Rest of sectors</b>							
EU	471.50	49.59	434.29	43.03	508.71	16.53	74.43***
Non-EU	739.11	41.09	730.64	37.96	747.57	43.72	16.93

**Source:** Authors' calculations based on quarterly UK LFS, January 2013 - December 2019. **Notes:** All statistics are expressed in thousands. Column 4 reports a t-test of mean difference. \*p < 0.10, \*\*p < 0.05, \*\*\*p < 0.001. The sample of the test is based on 14 sub-region grouped by EU and Non-EU and observed for 28 quarters.

**Figure F.4:** Difference-in-Differences effects, Migrant stock in the UK (UK LFS)



**Source:** Authors' calculations based on quarterly UK-LFS, Q1 2013 - Q4 2019. **Notes:** The bar show the estimated DiD effect associated to the  $\beta_1$  coefficient from Equation 1. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.001$ .

**Table F.16:** Placebo test, migrant stocks in the UK, (UK LFS, weighted)

Migrant stock (log)	EU + non-EU	EU14 + non-EU	EU new + non-EU
EU*post_shock	0.721*** (0.184)	0.385** (0.152)	0.833*** (0.203)
Origin region and quarter FE	Yes	Yes	Yes
<b>DiD effect</b>	105%	47%	130%
Observations	336	264	312
R-squared	0.681	0.875	0.675

**Source:** Authors' calculations based on quarterly UK LFS estimations, Q2 2010 - Q1 2016. **Notes:** Robust standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.001$ . Origin region is based on country of birth.

**Table F.17:** Descriptive statistics of difference in migrant stocks in the UK, 2013-2019 weighted, in thousands, (UK LFS)

	Total		Before		After		Difference
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	mean	sd	mean	sd	mean	sd	(5-3)
<b>Total</b>							
EU	30.80	65.06	32.87	76.84	30.46	64.79	-2.409
Non-EU	13.77	74.97	-13.33	74.87	18.29	75.62	31.62
<b>High-educated</b>							
EU	15.75	32.23	5.16	17.59	17.52	34.00	12.36
Non-EU	15.37	44.32	-7.77	31.46	19.23	45.47	27.00
<b>Low-educated</b>							
EU	15.05	49.70	27.70	71.47	12.94	46.91	-14.77
Non-EU	-1.60	63.75	-5.56	50.85	-0.94	66.56	4.614
<b>&lt; 40 years old</b>							
EU	15.49	54.05	21.23	71.23	14.53	52.54	-6.695
Non-EU	-5.45	52.96	-29.44	31.90	-1.45	55.16	27.99
<b>&gt; 39 years old</b>							
EU	15.31	24.69	11.64	26.07	15.92	24.98	4.286
Non-EU	19.22	39.07	16.11	68.48	19.74	34.32	3.628
<b>Women</b>							
EU	17.13	38.73	24.47	40.84	15.91	39.14	-8.562
Non-EU	7.92	51.75	-14.51	64.51	11.66	49.99	26.17
<b>Men</b>							
EU	13.67	36.00	8.39	36.20	14.54	36.67	6.152
Non-EU	5.85	35.90	1.18	15.08	6.63	38.46	5.448
<b>London</b>							
EU	9.39	38.69	28.83	36.98	6.15	38.76	-22.69
Non-EU	-1.46	41.99	-28.33	23.99	3.02	42.99	31.35
<b>South East</b>							
EU	6.71	19.21	7.01	34.07	6.66	16.79	-0.344
Non-EU	5.89	28.08	6.21	12.94	5.84	30.06	-0.368
<b>Rest of the UK</b>							
EU	14.70	38.72	-2.97	26.89	17.65	40.03	20.62
Non-EU	9.33	36.79	8.79	46.92	9.42	36.08	0.636

**Source:** Authors' calculations based on quarterly UK LFS, January 2013 - December 2019.

**Notes:** All statistics are expressed in thousands. Column 4 reports a t-test of mean difference. \*p < 0.10, \*\*p < 0.05, \*\*\*p < 0.001. The sample of the test is based on 14 sub-region grouped by EU and Non-EU and observed for 28 quarters.



**Table F.18:** Descriptive statistics of difference in migrant stocks in the UK by skill and sector of occupation, weighted, in thousands (UK LFS)

	Total		Before referendum		After referendum		Difference
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	mean	sd	mean	sd	mean	sd	(5-3)
<b>High-skilled profession</b>							
EU	14.19	24.12	6.21	9.86	15.53	25.64	9.318
Non-EU	14.45	34.67	-3.46	33.26	17.43	34.67	20.89
<b>Low skilled profession</b>							
EU	16.54	47.17	24.62	47.78	15.19	47.97	-9.427
Non-EU	6.83	31.85	12.45	19.89	5.90	33.65	-6.559
<b>Manufactury</b>							
EU	3.14	16.14	4.73	14.56	2.88	16.66	-1.851
Non-EU	1.93	12.85	5.98	9.55	1.26	13.37	-4.721
<b>Construction</b>							
EU	2.16	13.57	5.55	11.35	1.60	14.03	-3.952
Non-EU	1.35	10.07	3.75	1.75	0.95	10.84	-2.791
<b>Hospitality</b>							
EU	8.25	19.56	10.92	15.76	7.81	20.38	-3.112
Non-EU	0.85	23.19	2.10	22.59	0.64	23.76	-1.454
<b>Finance</b>							
EU	5.13	17.60	2.60	15.98	5.56	18.13	2.953
Non-EU	5.61	19.31	-2.53	23.51	6.96	18.77	9.495
<b>Admin</b>							
EU	6.18	19.50	6.38	11.54	6.15	20.71	-0.227
Non-EU	6.65	22.23	-1.68	23.29	8.04	22.25	9.716
<b>Rest of sectors</b>							
EU	6.29	19.10	1.87	16.50	7.03	19.72	5.156
Non-EU	5.47	22.66	2.43	19.71	5.98	23.46	3.549

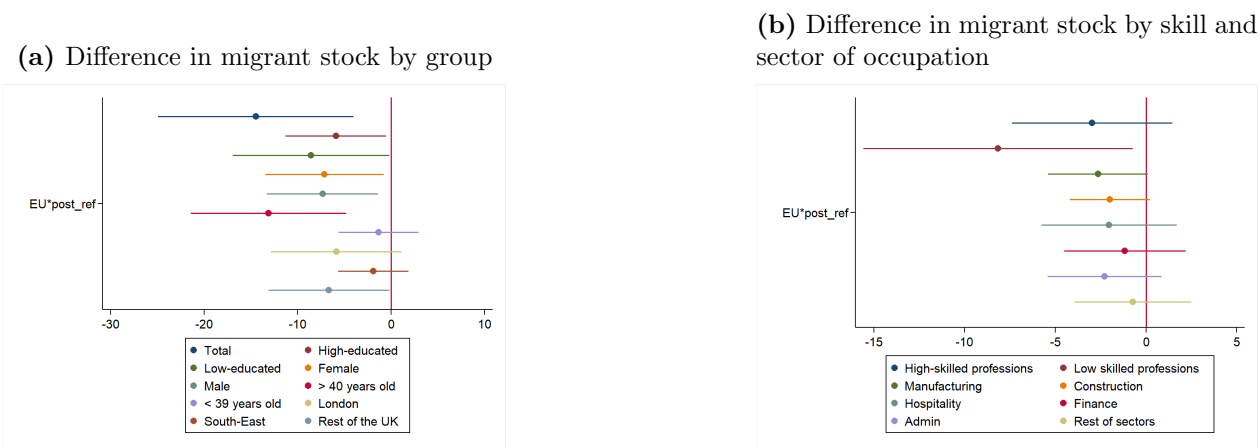
**Source:** Authors' calculations based on quarterly UK LFS, Q1 2013 - Q1 2020. **Notes:** Column 7 reports the results of a t-test of mean difference. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.001$ . The sample of the test is based on 14 region grouped by EU and Non-EU and observed for 28 quarters.

**Table F.19:** Triple diff-in-diff estimation, Inflows to the UK by educational level, (UK LFS)

	(1)	(2)	(3)
	Total	EU14	EU new
High.ed	0.0276 (0.0440)	0.164*** (0.0448)	0.0205 (0.0457)
EU*post_ref	0.0137 (0.101)	-0.252** (0.0969)	0.121 (0.119)
EU*post_ref*high.ed	-0.490*** (0.110)	-0.0626 (0.123)	-0.670*** (0.131)
Origin region and quarter FE	Yes	Yes	Yes
Observations	784	616	728
R-squared	0.596	0.570	0.547

**Source:** Authors' calculations based on quarterly UK-LFS, Q1 2013 - Q1 2020. **Notes:** Robust standard errors in parentheses. \*  $p < 0.10$ , \*\* $p < 0.05$ , \*\*\*  $p < 0.001$ . Origin region is based on country of birth.

**Figure F.5:** Difference-in-Differences estimates, Difference in migrant stock in the UK (UK LFS)



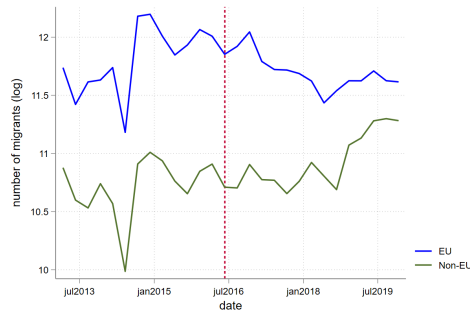
**Source:** Authors' calculations based on quarterly UK-LFS, Q1 2013 - Q4 2019. **Notes:** The graphs show the estimated  $\beta_1$  coefficient from Equation 1. 90% confidence interval for each coefficient is shown.

## G Data on National Insurance Registrations

In this section we compare the results obtained from the LTIM data with the ONS National Insurance number (NINo) data for adult overseas nationals. The two data sources are not directly comparable, as the NINo data only register foreigners who apply for a National Insurance Number and the date of application may differ from the arrival date. Also, NINo registrations are likely to include short-term migrants, while the LTIM statistics are especially targeted to estimate long-term migration inflows. Nonetheless, NINo registrations is a useful source of comparison for our findings. Similarly to the LTIM, data are available quarterly and we can define the same time span going from Q1 2013 to Q4 2019, for a total of 28 points in time (14 before and 14 after the referendum). The quarterly version of the data does not report the country of citizenship, but it is possible to distinguish 14 regions, as for the LTIM data.

Figure G.6 provide evidence of the pre-trend. Table G.20 reports basic descriptive statistics on the inflow, distinguishing between EU and non-EU region of citizenship, and between the period before and after the referendum. The difference is negative and significant for EU countries, and positive and significant for non-EU countries, suggesting an inverse trend for the two groups. Table G.21 presents the results from the Difference-in-Differences estimation, which confirm the findings on the LTIM data.

**Figure G.6:** Parallel trends of inflows (log) to the UK, (NINo registrations data)



**Source:** Authors' calculations based on quarterly NINo registration data, Q1 2013 - Q4 2019 **Notes:** All statistics are expressed in logs. The red line indicates the quarter when the referendum took place.

**Table G.20:** Descriptive statistics of UK migration inflows, 2013-2019, (NINo registrations data).

	Total		Before		After		Difference
	mean	sd	mean	sd	mean	sd	
Inflow (EU)	130.66	30.80	140.38	37.15	120.95	19.66	-19.43*
Inflow (non-EU)	51.91	13.32	46.36	10.01	57.47	14.21	11.11**

**Source:** Authors' calculations based on quarterly NINo registrations data, Q1 2013 - Q4 2019 **Notes:** all statistics are expressed in thousands. The last column reports the results from a t-test of mean difference.\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.001$ . The sample is based on 14 regions of origin grouped by EU and non-EU and observed for 28 quarters.

**Table G.21:** Difference-in-Differences estimates, Total Inflow to the UK, (NINo registrations data)

	(1)	(2)	(3)
	EU total	EU14	EU new
EU*post_ref	-0.196*** (0.0535)	-0.290*** (0.0466)	-0.165** (0.0612)
Origin region and quarter FE	Yes	Yes	Yes
<b>DiD effect</b>	-28%	-25%	-15%
Observations	392	308	364
R-squared	0.952	0.982	0.936

**Source:** Authors' calculations based on quarterly NINo registrations data, Q1 2013 - Q4 2019. **Notes:** Robust standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.001$ . Origin region is based on nationality.

## H Excluding Other Europe

**Table H.22:** Descriptive statistics of inflows, outflows and net flows 2013-2019, (LTIM), Excluding Other Europe

UK migration inflows from EU countries							
	Total		Before		After		Difference
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	mean	sd	mean	sd	mean	sd	(5-3)
Total	244.93	36.80	266.36	35.48	223.50	23.77	-42.86***
Work	135.39	31.69	148.21	25.38	122.57	32.98	-25.64**
Family	19.07	4.88	19.00	4.67	19.14	5.26	0.143
Study	40.11	7.97	38.36	6.34	41.86	9.22	3.500
UK migration inflows from Non-EU countries							
	Total		Before		After		Difference
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	mean	sd	mean	sd	mean	sd	(5-3)
Total	278.79	41.15	255.14	19.40	302.43	44.01	47.29***
Work	81.86	16.74	70.21	13.38	93.50	10.55	23.29***
Family	43.57	6.14	43.86	5.25	43.29	7.12	-0.571
Study	122.89	22.65	117.07	7.75	128.71	30.54	11.64
UK migration outflows of EU migrants							
	Total		Before		After		Difference
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	mean	sd	mean	sd	mean	sd	(5-3)
Total	109.46	28.03	84.07	5.31	134.86	14.66	50.79***
Work	62.79	21.12	44.07	5.58	81.50	11.89	37.43***
Family	4.36	1.37	4.43	1.60	4.29	1.14	-0.143
Study	17.82	2.20	17.21	1.93	18.43	2.34	1.214
UK migration outflows of Non-EU migrants							
	Total		Before		After		Difference
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	mean	sd	mean	sd	mean	sd	(5-3)
Total	86.71	8.01	91.43	6.85	82.00	6.21	-9.429***
Work	21.96	2.41	22.79	2.29	21.14	2.32	-1.643*
Family	4.61	2.60	4.79	1.63	4.43	3.37	-0.357
Study	41.29	4.18	43.64	3.71	38.93	3.25	-4.714***
UK net migration from EU countries							
	Total		Before		After		Difference
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	mean	sd	mean	sd	mean	sd	(5-3)
Total	119.29	91.29	182.29	31.40	56.29	88.17	-126***
UK net migration from Non-EU countries							
	Total		Before		After		Difference
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	mean	sd	mean	sd	mean	sd	(5-3)
Total	192.07	46.84	163.71	24.81	220.43	47.00	56.71***

**Source:** Authors' calculations based on quarterly ONS LTIM data, Q1 2013 - Q4 2019. **Notes:** Excluding Other Europe from non-EU. All statistics are expressed in thousands. Column 7 reports the results from a t-test of mean difference. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.001$ . The sample of the test is based on 14 regions of origin classified by EU and Non-EU and observed for 28 quarters.

**Table H.23:** Difference-in-Differences estimates, Migration inflows to the UK, (LTIM)

	(1)	(2)	(3)	(4)
<b>Total inflows from EU and non EU (log)</b>	All reasons	Work	Family	Study
EU*post_ref	-0.113 (0.0735)	-0.402*** (0.0817)	0.114 (0.0721)	0.117 (0.0759)
Origin region and quarter FE	Yes	Yes	Yes	Yes
<b>DiD effect</b>	-11%	- 33%	17%	14%
Observations	364	364	364	364
R-squared	0.929	0.935	0.621	0.877
	(1)	(2)	(3)	(4)
<b>Inflows from EU14 and non EU (log)</b>	All reasons	Work	Family	Study
EU14*post_ref	-0.0890* (0.0483)	-0.410*** (0.0794)	-0.174 (0.114)	0.0530 (0.0655)
Origin region and quarter FE	Yes	Yes	Yes	Yes
<b>DiD effect</b>	- 8%	- 34%	23%	11%
Observations	280	280	280	280
R-squared	0.954	0.943	0.815	0.925
	(1)	(2)	(3)	(4)
<b>Inflows from EU_new and non EU (log)</b>	All reasons	Work	Family	Study
EU_new*post_ref	-0.121 (0.0954)	-0.400*** (0.103)	0.210** (0.0792)	0.139 (0.0920)
Origin region and quarter FE	Yes	Yes	Yes	Yes
<b>DiD effect</b>	- 11%	- 33%	16%	15%
Observations	336	336	336	336
R-squared	0.911	0.918	0.463	0.851

**Source:** Authors' calculations based on quarterly LTIM data. **Notes:** Robust standard errors in parentheses. \*  $p < 0.10$ , \*\* $p < 0.05$ , \*\*\*  $p < 0.001$ . All statistics are expressed in thousands. Origin region is based on nationality.

**Table H.24:** Difference-in-Differences estimates, Outflows from the UK by group, (LTIM), Excluding Other Europe

	(1)	(2)	(3)	(4)
<b>Total outflows (log)</b>	All reasons	Work	Family	Study
EU*post_ref	0.716*** (0.0710)	0.741*** (0.0772)	0.114 (0.0721)	0.117 (0.0759)
Origin region and quarter FE	Yes	Yes	Yes	Yes
<b>DiD effect</b>	104%	109%	12%	12%
Observations	362	364	364	364
R-squared	0.935	0.916	0.621	0.877
	(1)	(2)	(3)	(4)
<b>EU14 (log)</b>	All reasons	Work	Family	Study
EU14*post_ref	0.364*** (0.0675)	0.521*** (0.0830)	-0.174 (0.114)	0.0530 (0.0655)
Origin region and quarter FE	Yes	Yes	Yes	Yes
<b>DiD effect</b>	44%	68%	-16%	5%
Observations	280	280	280	280
R-squared	0.937	0.914	0.655	0.901
	(1)	(2)	(3)	(4)
<b>EU new</b>	All reasons	Work	Family	Study
EU_new*post_ref	0.834*** (0.0848)	0.814*** (0.0931)	0.210** (0.0792)	0.139 (0.0920)
Origin region and quarter FE	Yes	Yes	Yes	Yes
<b>DiD effect</b>	130%	126%	23%	15%
Observations	336	336	336	336
R-squared	0.918	0.885	0.463	0.851

**Source:** Authors' calculations based on quarterly LTIM data, Q1 2013 - Q4 2019. **Notes:** Robust standard errors in parentheses. \*  $p < 0.10$ , \*\* $p < 0.05$ , \*\*\*  $p < 0.001$ . Origin region is based on nationality.

**Table H.25:** Difference-in-difference estimates, Total net migration to the UK, Based on LTIM, Excluding Other Europe

	(1)	(2)	(3)
	Total	EU14	EU new
EU*post_ref	-1.018*** (0.183)	-0.508*** (0.118)	-1.188*** (0.237)
Origin region and quarter FE	Yes	Yes	Yes
<b>DiD effect</b>	-64%	-40%	-70%
Observations	364	280	336
R-squared	0.711	0.838	0.681

**Source:** Authors' calculations based on quarterly LTIM estimations data, January 2013 - December 2019. **Notes:** Robust standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.001$ . All statistics are expressed in thousands. Origin region is based on nationality.

**Table H.26:** Difference-in-difference estimates, Inflows to the UK, Excluding Other Europe (UK LFS)

	(1)	(2)	(3)
	Total	EU14	EU new
EU*post_ref	-0.250** (0.0974)	-0.278** (0.0947)	-0.240** (0.117)
Origin region and quarter FE	Yes	Yes	Yes
<b>DiD effect</b>	-28%	-32%	-27%
Observations	364	280	336
R-squared	0.763	0.704	0.717

**Source:** Authors' calculations based on quarterly UK LFS, Q1 2013 - Q1 2020. **Notes:** The mean for non-EU (excluding other Europe) before the referendum was 60.61 std dev 38.25; and after the referendum the mean was 66.36 and std dev was 24.06. The difference was between before and after the referendum was 5.75 but not significant. Standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.001$ . All statistics are expressed in thousands. Origin region is based on nationality.

## I Different definitions and samples

**Table I.27:** Difference-in-Differences estimates, Inflows to the UK, immigrants defined by nationality (UK LFS)

	(1) Total	(2) High educated	(3) Low educated	(4) EU14	(5) EU new
EU*post_ref	-0.279** (0.103)	-0.176 (0.111)	-0.326** (0.105)	-0.321** (0.113)	-0.265** (0.123)
Origin & quarter FE	Yes	Yes	Yes	Yes	Yes
<b>DiD effect</b>	-24%	-16%	-28%	-27%	-23%
Observations	392	392	392	308	364
R-squared	0.771	0.655	0.728	0.710	0.725

**Source:** Authors' calculations based on quarterly UK LFS, Q1 2013 - Q1 2020. **Notes:** Robust standard errors in parentheses. \*  $p < 0.10$ , \*\* $p < 0.05$ , \*\*\*  $p < 0.001$ . Origin region is based on nationality at the time of the survey.

**Table I.28:** Difference-in-Differences estimates, Inflows to the UK by group, unbalanced panel, (UK LFS)

	Inflows to the UK (log)						
	(1) Total	(2) High educated	(3) Low educated	(4) Women	(5) Men	(6) Young	(7) Older
EU*post_ref	-0.474*** (0.116)	-0.385** (0.124)	-0.573*** (0.118)	-0.362** (0.114)	-0.474*** (0.105)	-0.532*** (0.117)	-0.233* (0.126)
Origin region FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	357	330	273	328	306	345	217
R-squared	0.654	0.566	0.679	0.607	0.652	0.632	0.408

**Source:** Authors' calculations based on UK-LFS, Q1 2013 - Q1 2020. **Notes:** Robust standard errors in parentheses. \*  $p < 0.10$ , \*\* $p < 0.05$ , \*\*\*  $p < 0.001$ . Origin region is based on country of birth.

**Table I.29:** Difference-in-Differences estimates, Total inflows, excluding 2020 (UK LFS)

	(1) Total	(2) EU14	(3) EU new
EU*post_ref	-0.236** (0.102)	-0.319* (0.180)	-0.208* (0.116)
Origin region FE	Yes	Yes	Yes
Quarter FE	Yes	Yes	Yes
<b>DiD effect</b>	-21%	-27%	-19%
Observations	392	308	364
R-squared	0.798	0.743	0.773

**Source:** Authors' calculations based on quarterly UK LFS, Q1 2013 - Q4 2019. **Notes:** Standard errors in parentheses. \*  $p < 0.10$ , \*\* $p < 0.05$ , \*\*\*  $p < 0.001$ . Origin region is based on country of birth.



## J Was the inflow diverted to other EU countries?

In this sub-section we investigate whether the Brexit referendum increased the relative attractiveness of the rest of EU countries, where freedom of movement did not suffer any threat for EU potential immigrants. We use the OECD International Migration Database, which provides information on the yearly migration inflows to OECD countries by immigrants' nationality. We examine annual migration to EU27 countries excluding to the UK between 2013-2019.<sup>50</sup> Immigrants with British nationality are excluded from the sample. The time span of our analysis goes from 2013 to 2019, and we exclude the year 2016. We compare EU to non-EU (Other Europe), migration inflows before and after 2016.<sup>51</sup>

In Table J.30 we provide some basic descriptive statistics. In the upper panel we consider only the UK as possible destination, while in the lower panel we consider the rest of EU countries. Consistently with our previous analysis, the difference for the EU inflows to the UK between the pre and post-referendum period is negative.<sup>52</sup> We also find a negative sign for the inflow of non-EU(Other Europe) immigrants. Concerning the rest of the EU countries, we find a positive difference for the inflows of EU immigrants, and a positive difference for Other Europe immigrants. In both cases the difference is not statistically significant. From this first descriptive evidence we do not find any significant change in the post-referendum period in terms of the attractiveness of EU countries as destinations for EU migrants.

**Table J.30:** Descriptive statistics, Immigration to EU versus the UK, (OECD)

Destination: UK							
	Total		Before		After		Difference
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	mean	sd	mean	sd	mean	sd	(5-3)
EU	200.98	30.99	218.67	28.18	183.29	25.84	-35.38
non-EU(Other Europe)	6.33	1.63	6.67	2.52	6.00	0.00	-0.667
Destination: EU countries							
	Total		Before		After		Difference
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	mean	sd	mean	sd	mean	sd	(5-3)
EU	1369.94	57.82	1350.09	82.48	1389.79	19.32	39.71
non-EU(Other Europe)	428.20	99.28	358.08	75.33	498.32	64.93	140.2

**Source:** Authors' calculations based on OECD data on migration inflows by nationality, 2013 - 2019 excluding 2016. **Notes:** All statistics are expressed in thousands. UK is excluded as country of origin/nationality. In the second panel we only consider EU countries as possible destinations. No data are available for Bulgaria, Cyprus, Croatia, Ireland, Lithuania, Malta, and Romania. The last column reports a t-test of mean difference. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.001$ . The sample is based on 3 regions grouped by EU and non-EU and observed for 6 years.

We adopt a Difference-in-Differences strategy where we include EU immigrants in the treatment group and non-EU (Other Europe) immigrants in the control group. We focus only on Other Europe as the EU has experienced a huge surge in asylum seekers and refugees since 2015 which would make non-EU a problematic control group. We exclude the UK both as a possible destination and as possible nationality. In Figure J.7 we display the inflows trend for EU and non-EU (Other Europe) immigrants over time to the EU. The pre-referendum trend looks parallel which reassures us that the assumption of parallel trends can plausibly hold between EU and Other Europe immigrants to the EU.

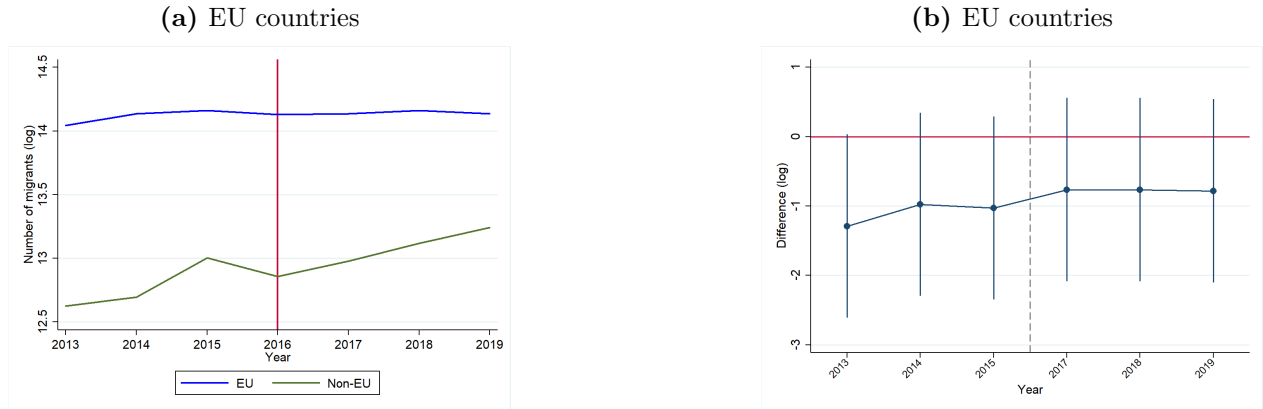
Table J.31 presents the results of the Difference-in-Differences estimates. In Columns 1, 2, and 3 we add respectively year, nationality, and destination fixed effects, in Columns 4 and 5 we add lagged log GDP per capita and then lagged unemployment. The magnitude of the coefficient of the double difference is robust to the inclusion of the different fixed effect and controls, and is never statistically significant. Overall, this suggests that there was no significant change in the inflows of EU immigrants to the rest of EU countries. Also, we use a triple difference approach to estimate the relative difference between the UK and other EU destinations. Table J.32 shows the results of the triple difference estimation. The coefficients of the DiD are not significant in any of the specifications, confirming the results of Table J.31. Also the coefficient of the triple differences is never significant, suggesting that the referendum did not have a significant impact on the relative attractiveness of other EU countries as possible destinations for EU immigrants.

<sup>50</sup>OECD.Stat (2020). Immigration by sex and broad group of country of birth. <https://stats.oecd.org/>. The time span varies depending on the country. Data are not available for Bulgaria, Cyprus, Croatia, Ireland, Lithuania, Malta, and Romania.

<sup>51</sup>EFTA countries are excluded from the analysis.

<sup>52</sup>It is important to note that the inflow data for the UK compiled by the OECD are annual, so is not exactly comparable to the ONS LTIM data on inflows to the UK.

**Figure J.7:** Parallel trends of migration inflows (log) to the EU 2013-2019, (OECD)



**Source:** Authors' calculations based on OECD data on migration inflows by nationality, years 2013-2019 excluding 2016.

**Notes:** Non-EU here refers to Other Europe. UK is excluded as origin/nationality. Both figures consider only EU countries (excl. the UK) as possible destinations. No data are available for Bulgaria, Cyprus, Croatia, Ireland, Lithuania, Malta, and Romania. The red line indicates the year when the referendum took place.

To check the robustness of these results, we also replicated our analysis using data on immigration flows by country of destination and country of birth available from Eurostat.<sup>53</sup> We use data on immigration flows by country of destination and country of birth as well as country of nationality.<sup>54</sup> The results are also consistent with the analysis on the OECD data, suggesting that there was no spillover effect on other EU countries. As a further robustness, we use data from the European Labour Force Survey (EU LFS), which is the largest harmonised household survey in Europe and has detailed information on the main respondents' socioeconomic characteristics, including country of birth and nationality.<sup>55</sup> We use the EU LFS (2014-2018) to analyse stocks at the time of the survey. Results do not show any impact of the referendum on the stocks of EU immigrants in EU countries as destinations, regardless of individuals' socioeconomic characteristics.<sup>56</sup>

<sup>53</sup>Eurostat (2020b). Immigration by gender and broad group of country of birth. <https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=migrimm4ctblang=en>.

<sup>54</sup>These were based on 2014-2018 due to data limitation.

<sup>55</sup>Eurostat (2020a). Annual European Labour Force Survey, reference years: 2013-2019.

<sup>56</sup>Both robustness analysis using Eurostat data and EULFS data are not reported for brevity but are available from the authors.

**Table J.31:** Difference-in-Differences estimates, Migration inflows to EU countries, (OECD)

	Total migration inflows to EU countries (log)				
	(1)	(2)	(3)	(4)	(5)
EU*post_ref	-0.396 (0.433)	-0.396 (0.418)	-0.396 (0.284)	-0.396 (0.276)	-0.396 (0.276)
GDP (log)				10.97*** (2.556)	10.35*** (2.893)
Unemployment					-0.0231 (0.0547)
Year FE	Yes	Yes	Yes	Yes	Yes
Origin region FE	No	Yes	Yes	Yes	Yes
Destination country FE	No	No	Yes	Yes	Yes
Observations	570	570	570	570	570
R-squared	0.0476	0.234	0.764	0.772	0.772

**Source:** Authors' calculations based on OECD data on migration inflows by nationality, years 2013-2019 excluding 2016. **Notes:** Robust standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.001$ . Control group is non-EU. The UK is excluded as possible origin/nationality. In this table we only consider EU countries (excl. the UK) as possible destinations. No data are available for Bulgaria, Cyprus, Croatia, Ireland, Lithuania, Malta, and Romania. Unemployment and real GDP per capita are lagged on one year. Origin region is based on nationality.

**Table J.32:** Triple Difference-in-Differences, Migration inflows to EU countries versus the UK, (OECD)

	Total migration inflows (Log)				
	(1)	(2)	(3)	(4)	(5)
UK	1.865*** (0.468)	1.865*** (0.356)	-0.213 (0.368)	2.973*** (0.382)	1.780** (0.597)
EU*post_ref	-0.406 (0.425)	-0.406 (0.409)	-0.406 (0.284)	-0.409 (0.396)	-0.419 (0.276)
UK*EU*post_ref	-0.625 (1.275)	-0.625 (0.962)	-0.625 (0.963)	-0.576 (0.954)	-0.368 (0.944)
GDP (log)				2.173*** (0.333)	11.59*** (2.942)
Unemployment					-0.0161 (0.0541)
Year FE	Yes	Yes	Yes	Yes	Yes
Origin region FE	No	Yes	Yes	Yes	Yes
Destination country FE	No	No	Yes	Yes	Yes
Observations	600	600	600	600	600
R-squared	0.057	0.256	0.747	0.426	0.756

**Source:** Authors' calculations based on OECD data on migration inflows by nationality, years 2013-2019 excluding 2016. **Notes:** Robust standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.001$ . Control group is non-EU(Other Europe). The UK is excluded as possible origin/nationality. In this table we consider EU countries versus the UK as possible destinations. No data are available for Bulgaria, Cyprus, Croatia, Ireland, Lithuania, Malta, and Romania. Unemployment and real GDP per capita are lagged of one year. Origin region is based on nationality.