Work permit regulations and migrants' labor market outcomes

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Abstract

This paper studies how the introduction of a novel residence permit for working purposes – the so-called Blue Card introduced in August 2012 – has affected entry-level wages of non-EU migrants in Germany. The Blue Card was targeted at non-EU university graduates with degrees received or recognized in Germany. It provided immediate residence to students with a working contract that pays above clearly-announced and regularly-updated wage thresholds. We leverage a difference-in-difference approach and unique data on national and international graduates in Germany between 2011-2014. We find that the introduction of the Blue Card increases entry-level wages of non-EU graduates relative to the control group by approximately 2 percent of the pre-treatment entry-level wages. We provide suggestive evidence that these results are not driven by more or better-quality non-EU graduates staying in Germany, but rather because the Blue Card wage threshold acts as a reference point.

JEL-Classification: J60, J61, J63

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1 Introduction

The economic integration of migrants is a challenge for destination countries. This has become particularly important for Western Europe as the share of foreign workforce has substantially increased in the past two decades. From 2000 to 2019, the foreign born population almost doubled in Austria and Belgium, increased from 10 to 13 percent in France and from 12 to 16 percent in Germany (OECD, 2021). Hence, many Western European countries have undertaken reforms to improve the legal conditions with which foreign workers could reside. Such reforms vary from the introduction of residence permits that tend to attract highly-qualified workforce (EU Blue Card, residence permits for self-employment) to reducing the time to naturalization and recognizing foreign occupational qualifications. The integration of migrants is often subject to public debate as their successful integration can be beneficial for the economy. It increases the fiscal contribution of the foreign workforce, improves their labor market performance and reduces their probability of becoming involved in criminal activities (Dustmann and Frattini, 2014; Mastrobuoni and Pinotti, 2015). Recent evidence has indeed shown that easing access to naturalization and allowing foreigners to practice the occupation in which they are qualified substantially improves migrants' labor market perspectives (Bratsberg et al., 2002; Gathmann and Keller, 2018; Govind, 2020; Brücker et al., 2021). Nevertheless, there has been scarce evidence on the causal impact of residence permits for working purposes, as a temporary residence, on the labor market outcomes of migrants, despite its importance for initial integration.

Against this background, we study how the introduction of a novel residence permit for working purposes – the so-called Blue Card introduced in August 2012 – has affected entry-level wages of non-EU migrants in Germany. The Blue Card is targeted at non-EU university graduates with degrees received or recognized in Germany. It provids immediate residence to students with a working contract that pays above clearly-announced and regularly-updated wage thresholds,[1] and extended the allowed search period for graduates from 12 to 18 months.

[1] The salary threshold for 2012 is €45,000 gross per year for occupations with no shortages in the labor market and €35,000 gross for those with a shortage. They are set such that immigrants contribute at least 75 and 52 percent of the annual earnings ceiling of the general pension scheme for the occupations without and with a shortage in the market, respectively. The Federal Ministry of the Interior announces the minimum

Importantly, the Blue Card was introduced on top of existing alternative ways of applying for residence permits for working purposes which remained unchanged.

We exploit the exogenous variation induced by the Blue Card's introduction in a difference-in-differences framework. We examine the change in entry-level wages between non-EU graduates who graduate right before and after the Blue Card's introduction with the change in entry-level wages of German and EU graduates who do not require a residence permit,[2] but who compete for similar jobs with similar skill sets given that they graduated from the same program in the same year. We base the analysis on unique survey data of both national and internationals graduates, covering their educational history and transition into the German labor market.

The Blue Card's introduction may have affected the wages of eligible non-EU graduates through three mechanisms. First, announced wage thresholds – set at two thirds of the social security payment ceiling – signal 'appropriate' wages in occupations to the eligible population. Depending on prior beliefs, the wage thresholds may thus act as a reference point for reservation wages. Second, the allowed search duration may lead to better job matches. Third, the reduced bureaucratic burden in receiving a residence permit may alter the selection of students who remain in Germany after graduation. Our data will enable discriminating between these channels to some degree. Further, in the longer run, the Blue Card may change the composition of international students, as a channel that is not examined in this short-run evaluation.

Our empirical findings show that the introduction of the Blue Card increased entry-level wages of non-EU graduates relative to the control group by approximately 2 percent of the pre-treatment entry-level wages. These results seems to be mostly driven by non-EU graduates in degrees other than STEM and medicine, which is also the group that is more incentivised to do so. This is the case because reaching the Blue Card salary threshold is

salaries in the Federal Gazette annually by December 31, for the following calendar year. Occupations with a shortage are considered those for which the demand succeeds the supply. Occupations with a shortage in the labor market are considered those in the field of Science, Technology, Engineering, Mathematics (STEM) and Medicine.

[2] EU graduates have the same legal rights as Germans to access the labor market as part of the labor mobility agreement among the EU member states.

harder for them in comparison with non-EU graduates in STEM and medicine.[3] Our results are in line with previous finding for knowledge migrants visas in Netherlands (OECD, 2016). Furthermore, we find no evidence for the Blue Card to affect non-EU graduates decision to remain in Germany. Provided that non-EU graduates cannot reside in Germany unless they have a working permit, we imply that the Blue Card did not affect the employment probability either. This is expected because non-EU graduates could reside in Germany with alternative residence permits for working purposes.[4]

We argue that these results are not driven by a *selection* effect, i.e. the Blue Card's introduction might have attracted a different sample of non-EU students, and potentially specifically those in fields that pay comparatively higher entry wages. Non-EU students have to decide about their bachelor/master/doctoral studies at least 4/3/6 years prior to graduation.[5] Hence, non-EU graduates would need to predict the introduction of the Blue Card at least three years in advance for them to self-select into treatment. Furthermore, we document that students do not postpone their studies to profit from the Blue Card eligibility.[6] Second, our results are not driven by a *compositional effect* given that we do not find any evidence of this reform affecting the decision to stay in Germany and the GPA of their last studies. Hence, the estimated effect on entry-level wages is not a result of more and/or better-quality graduates who decide to stay in Germany, who are more productive and thus earn more. Third, we can also rule out the notion that this impact is driven by non-EU graduates searching in occupations that pay at the level of the Blue Card salary threshold and not in occupations that match their qualification. Such a behavior could be more prevalent when non-EU graduates are willing to switch from non-shortage to shortage occupations because the threshold is easier to obtain. However, this is legally impossible since it is mandatory for

[3] Blue Card salary threshold is €3,700 gross per month for non-shortage occupations and €3,000 for shortage occupations. Non-EU graduates entering non-shortage occupations earn on average €2,200 whereas those entering shortage occupations earn €2,900 gross per month.

[4] In section 2 we will explain in detail the reasons why the Blue Card is a more attractive working permit than other types of working permits.

[5] For example, if we assume that bachelor students take three years to complete the degree and they need to apply one year in advance, non-EU students would have to predict the introduction of the Blue Card four years in advance for them to self-select into treatment.

[6] We find neither evidence for bunching in terms of graduation date after the Blue Card's introduction nor in the time when students started to search for a job in relation with their graduation date. See Figure A7 A8 and A9

the Federal Employment Agency to check whether the Blue Card applicant is acquiring a job in a shortage occupation that matches their qualifications.[7]

Next, we explore the mechanisms behind these findings. First, we examine whether the Blue Card salary threshold acts as a *reference point* to non-EU graduates during their job search. The availability of more information on what specific occupations pay in the labor market might change the salary goal for which non-EU graduates search. Prior to the introduction of the Blue Card, the salary reference point was formed through unofficial channels and might have varied for non-EU graduates. The Blue Card salary threshold establishes a common salary goal, thus updating the salary reference point. This means that the reservation wage is set to the level of the Blue Card salary threshold. Non-EU graduates would then search for a job that meets the level of the updated reservation wage. We provide suggestive evidence that non-EU graduates' entry-level wages assemble more around the Blue Card salary threshold after its introduction. Second, the extension of job search allowance from 12 to 18 months has not changed the job search duration of non-EU graduates. This means that the increase in entry-level wages is not a consequence of a longer search duration and thus increased opportunities for a better job match.

These results contribute to both the economic and policy debate. First, this paper is directly related to the literature studying the economic impact of residence permits for working purposes on targeted highly-educated migrants (Hunt, 2011). Most of the empirical evidence covers the context of the H-1B[8] visa in the US. For instance, Mayda et al. (2018) find that a reduction in H-1B quotas substantially reduced the hiring of new H-1B workers in for-profits firms and particularly those earning at the tails of the wage distribution. Focusing on international graduates, Amuedo-Dorantes and Furtado (2019) find that H-1B quota reduction prompted foreign-born graduates to settle for academia and even divert from their field of study whenever entering for-profit firms. Unlike previous studies, we exploit the context

[7] It is explicitly mentioned in §18b Abs.2 that immigrants entering shortage occupations have to prove to the Federal Employment Agency that their job matches their qualifications.

[8] H-1B visa is an employment type of visa offered in the United States to migrants with at least a bachelor degree in any of the STEM fields. The firm has to file a request for the H-1B visa granted to the migrant with the special qualifications. H-1B visas are then granted on a lottery basis under the yearly quota constraint. Unlike H-1B, there are no yearly quotas for the Blue Card.

of one of the Western European economies that has recently become a favorite destination for highly-qualified migrants and estimate the causal effect of the Blue Card on entry-level wages of non-EU graduates. Furthermore, we add to this literature by exploiting the unique features of a residence permit that can improve the labor market entrance of immigrants by not only signaling productivity but also informing about labor market pay-offs in a uniform way. To the best of our knowledge, this is the first paper to study the impact of the Blue Card on labor market outcomes of immigrants in the European Union.

Second, it contributes more broadly to the literature studying how the institutional settings affect the economic integration of migrants in the destination country. Gathmann and Keller (2018) and Govind (2020) show that policies that reduce the time to citizenship for migrants in the destination country substantially improve their employment prospects as well as their job stability. Brücker et al. (2021) show that formal recognition of occupational qualifications increase migrants' employment probability and hourly wages compared with those whose qualifications are not recognized. Such types of policies are very important for migrants' trajectories in the labor market given that they are often disadvantaged in comparison to natives (Chiswick and Miller, 2003; Dustmann et al., 2016; Card and Raphael, 2013). Hence, any institutional setting that can improve the entrance into the labor market of foreign labor is beneficial to both migrants and the destination country. We contribute to this literature by evaluating the impact of a residence permit for working purposes on the integration of migrants.

The intention behind the introduction of the Blue Card was to attract and retain skilled labor in EU to address labor market shortages, demographic aging and make the EU an equally attractive destination as the US, Australia and Canada. Given that we did not find any evidence of the Blue Card affecting the decision to stay, we conclude that the reform was not successful in retaining migrants who first entered Germany for study purposes. Instead, it operates via unintended channels and increases entry-level wages of non-EU migrants. In the present study, we do not consider the attraction, as we can only speak about the retention of those immigrants who first entered Germany for study purposes and subsequently decided to stay.

The remainder of the paper is organized as follows. Section 2 provides a detailed explanation of the institutional setting and the migration reform of August 1, 2012. Section 3 describes the data that we use, presents the empirical strategy and discusses the identifying assumptions. Section 4 follows with the main set of results, robustness checks and a discussion of the mechanisms. Finally, section 5 summarizes the findings and concludes.

2 Institutional Setting

During the early-2000s, the European Commission initiated a campaign for a common migration reform with respect to highly-qualified migration. On October 23, 2007, the EU Council Directive proposed the introduction of the Blue Card as an employment residence permit targeted at highly-qualified labor. The intention behind this reform was to attract high-skill labor and increase the retention to address skill shortages in the labor market and demographic challenges of the EU member states. Furthermore, there was political willingness to make Europe at least as attractive as the favorite migration destinations such as US, Australia and Canada (EPRS, 2015). The EU Blue Card Directive was adopted on May 25, 2009 and a deadline was set for all member states to transpose the Blue Card Directive into the respective national Residence Acts. In this paper, we are particularly interested in Germany because 80 percent of the Blue Cards issued each year come from Germany.

Table 1: Changes in the Residence Act affecting non-EU migrant graduates in Germany with respect to residence permits for employment purposes

	Before 01.08.2012	**After 01.08.2012**
Job search duration allowance	12 months	18 months
§16.4 AufenthG		
Blue Card Intro	-	Salary thresholds
§19a AufenthG		2012: €44,800 (€34,944)
		2013: €46,400 (€36,192)
		2014: €47,600 (€37,128)
		University degree
Self-employment	Invest €250K	Graduate in Germany
§21, §18, & §20 AufenthG	Create min. 5 jobs	
Empl. Residence	Graduate in Germany	Graduate in Germany
§18.4 AufenthG	Job match qualification	Job match qualification
	Avg. market salary	Avg. market salary
General conditions	Secure Livelihood	Secure Livelihood
§5 AufenthG		

Note: This table summarizes the specific changes in the Residence Act that affected the graduates after the introduction of the Blue Card as of August 1, 2012.
Source: Federal Ministry of Justice and Consumer Protection of Germany

The Blue Card was introduced at a time when Germany started to become an attractive destination for migrants. The introduction of the Blue Card was announced on June 1, 2012 and entered into force on August 1, 2012. Table 1 summarizes the changes in the Residence Act before and after the introduction of the Blue Card. Here, we only focus on those non-EU migrants who have graduated from university in Germany. Before August 1, 2012, the following regulations were in place for non-EU graduates. First, they could apply for a residence permit for job search purposes for up to 12 months after graduation. Second, they could apply for a residence permit for self-employment if their work was considered to be of superior economic importance, which was implied by investing €250,000 and creating at least five jobs. Third, they could obtain a residence permit for employment purposes as long as they had graduated in Germany, found a job that matches their qualifications and have a contract that pays up to the average value of a specific occupation. Fourth, the salary had to

secure their livelihood. Finally, the Federal Employment Agency had to check whether the job matches their qualification and if the salary that they earn does not cause wage dumping. The duration of the residence permit for employment purposes was limited to the duration of the working contract.

After August 1, 2012, the Residence Act was amended. First, the residence permit for job-search after graduation was prolonged to eighteen months. Second, non-EU graduates could more easily receive a residence permit for self-employment as they only needed to prove that their start-up was related to their studies. Third, a new residence permit for employment purposes was introduced, the so-called Blue Card. Fourth, the Federal Employment Agency did not have to give its approval for non-EU graduates who obtain a contract that pays above the Blue Card salary threshold for non-shortage occupations. Two of these amendments are mostly relevant for the target group in this study, namely the introduction of the Blue Card and the extension of the job search visa duration from twelve to eighteen months. More importantly, graduating students in Germany - both before and after the introduction of the Blue Card - could obtain a residence permit for employment purposes[9] as long as they could find a job matching their qualifications.

The Blue Card is a residence permit for employment purposes targeted at highly-qualified labor. It is granted to applicants who have a university degree recognized by higher education institutions in Germany[10] and the applicant's annual salary exceeds a threshold of approximately €45,000. This wage threshold is lower (approximately €35,000) for occupations with labor market shortage, such as STEM and medicine-related types of occupations. These thresholds - specified by the Federal Employment Agency - are subject to change and have been increasing monotonically ever since. In Table 1, the thresholds up to 2014 are reported for both sets of occupations. These thresholds are published every December for the subsequent year by the Federal Employment Agency.

Compared with other residence permits for employment purposes in Germany, the Blue

[9] For instance, the following residence permits for employment purposes could be used: AufenthG §21.1, §18, §20.

[10] This covers two types of non-EU immigrants. The first group comprises those who obtained a university degree outside of Germany and that is recognized in Germany. The second group concerns non-EU immigrants who have obtained their university degree in Germany.

Card offers several comparative advantages (OECD and Union, 2016). First, it eases the procedures towards settlement permits, whereby a permanent residence permit can be claimed after only 30 months (and even 21 months in case B1 German language is proven) instead of 48 months with other type of residences for employment purposes. Second, Blue Card holders can freely access the EU labor market for employment purposes after only eighteen months. Third, it grants immediate residence to the family members of the Blue Card holder and access to the labor market. Finally, German citizenship can be claimed after six years instead of eight years. These comparative advantages are supposed to attract, retain and ease the integration of highly-educated migrants in the labor market in Germany.

Although the Blue Card is targeted at any non-EU individual who has a university degree recognized in Germany, in this paper we only focus on one strand of the affected non-EU immigrants, namely non-EU individuals who have graduated from public universities in Germany. Foreigners who enter in destination countries with a student visa hold particular interest, among others because they are found to have a large advantage over natives in terms of wages and patenting compared with other type of visas (such as family reunion ones, or as temporary visas holders) (Hunt, 2011; Gaule and Piacentini, 2013). Furthermore, these migrants are comparatively beneficial to the labor market for several reasons: (1) they are educated and trained according to the German labor market needs; (2) they are more accustomed to the society than migrants who are educated abroad and apply for a job in Germany from abroad; (3) compared with German students they come with lower educational costs;[11] and (4) as highly-educated labor, they contribute to the social security system with a higher rate than their low-educated counterparts (Dustmann and Frattini, 2014). Additionally, given that they are highly educated they are expected to boost productivity and innovation (Peri et al., 2015) and they are found in the literature to be in high demand due to skill biased technological change (David and Dorn, 2013; Goos et al., 2014). Finally, they are considered as a solution to labor market shortages and workforce aging.

Moreover, Germany is a relevant institutional setting in which to study how residence

[11] Foreign students have been educated in the country of origin at least until their high school (for those who come to Germany for bachelor studies) and at most their masters (for those who come for doctoral degrees). Hence, Germany has not been investing in their education as much as it invests in natives' education.

permits can help to improve the labor market entry of immigrants. It is leading the way in the number of Blue Cards issued among the EU member states with approximately 80 percent (BAMF, 2019). In Figure A2, the trend of Blue Cards issued over time in Germany is demonstrated. In 2012, there were only 2,584 Blue Card issued, in 2013 it went up to 11,290 and ever since it has rapidly increased up to 31,220 in 2019. These numbers cover the Blue Cards issued not only to the non-EU immigrants who graduated in Germany but also those who graduated abroad and found a job with which they can be entitled to the Blue Card in Germany. According to BAMF (2019), on average 44.1 percent of all issued Blue Cards have been a switch from a students residence permit or job search residence permit upon graduation in Germany. Furthermore, every year there are approximantely 30,000 non-EU graduates (RDC, 2019). This means that every year roughly one-third of non-EU graduates obtain the Blue Card after their studies, and that the Blue Card is a popular residence permit among non-EU graduates.

Finally, the Blue Card is also a unique type of residence permit for employment purposes. Unlike one of the most famous residence permits for employment purposes - the H-1B visa in the United States - the Blue Card is contingent on the "quality" of the immigrant and not subject to any yearly quota. This means that every university graduate who can be paid to the salary threshold can stay and work in Germany. No overall quantity constraint is binding, which makes it easier for the highly-educated to chose Germany as the country in which to stay and work. In the European context, the Blue Card is similar to the Red-White-Red Card in Austria and residence permits for knowledge migrants in the Netherlands. Both of these residence permit are also contingent to a salary threshold and aim to make it easy for highly-educated non-EU migrants to take up employment.

3 Data and Empirical Strategy

We describe in detail the data in section 3.1, before we further summarize the characteristics of the sample in section 3.2 and present our empirical strategy in section 3.3. Finally, we discuss the identifying assumption behind our empirical strategy in section 3.4.

3.1 Data

We make use of KOAB (Kooperationsprojekt Absolventenstudien) data, which are collected from a large-scale survey conducted by INCHER-Kassel (International Centre for Higher Education Research-Kassel) in cooperation with higher education institutions in Germany.[12] KOAB comprises a unique data set that covers information on education, the transition from university to work and labor market outcomes of graduating students from higher education institutions in Germany. This data covers representative information on German and migrant graduating students between 2011 and 2014 which includes a time frame before and after the introduction of the Blue Card. The graduates are surveyed one year up to one-and-a-half years after graduation. For instance, the 2011 wave comprises a sample of graduating students between 2010 and 2011 who were surveyed between October 2012 and February 2013. Approximately 60 universities and universities of applied sciences[13] from fourteen out of sixteen[14] German states have been participating in this project. The survey comprises a core and an optional set of questions. The core set of questions is asked by every participatory university and the optional ones are only conducted by those universities that were interested in obtaining more information. We only make use of the core set of questions to have consistently-asked questions across waves and universities. The response rate has been approximately 40 percent[15] among all graduating students whose address (either e-mail or residence address) could be identifiable (see Table A1 in the appendix for more details on the response rate).

Student characteristics. KOAB includes retrospective information on the educational trajectory of students graduating from higher education institutions in Germany. More specifically, there is information on the country in which the university entrance qualification is obtained, all the type of degrees and the respective subject of studies until the day of graduation, and whether the graduates will continue further education or enter the labor market.

[12] INCHER designed and handled the data collections, whereas the participating universities conducted the surveys via their Examination Offices. More information about KOAB data can be found at: http://141.51.193.156/en/koab.html

[13] See the list of universities: http://141.51.193.156/en/koab/universities.html

[14] Universities from the states of Saxony and Rhineland-Palatine are not part of this project

[15] INCHER-Kassel claims that the data are representative for different sub-groups such as migrants, but the response rates for these sub-groups are not made available.

Furthermore, questions about the way in which studies are financed and whether graduates have been working during their studies are also asked. Therefore, we have detailed information regarding the human capital accumulation of these graduates.

Labor market outcomes. For those graduates who enter the labor market, we have detailed information on the number of months that the graduate looked for a job, from which we can construct a proxy variable for the job search duration; the number of contacted employers during the job search period from which we can construct a proxy for the job search effort; and we know whether they found a job or not and the history of wages up to their tenth employer.[16] Wages are reported in categorical values, which are then recentered to the middle value of each bracket.[17] We refer to the wages of the first job obtained upon graduation as entry-level wages. We have this information irrespective of whether non-EU graduates end up working in the German labor market or abroad.

In case KOAB were not be fully representative with respect to the country of origin, demographics, subject of studies, type of degree and labor market outcomes, it would not be a concern for our identification strategy given that the survey design is conducted following the same strategy in every wave (INCHER, 2016). Nevertheless, to go one step further and check the representativeness of our sample, we make use of the Final Examination Register from the Research Data Centre of the Federal Statistical Office in Germany (RDC, 2019). It comprises individual-level information on the universe of graduating students from higher education institutions in Germany since 1990. More specifically, there is information on the country of origin, type of degree, subject of studies, university, state in which studies are completed, degree completion and final GPA.

Sample selection. We restrict the sample to students from Germany, EU and non-EU countries graduating from the range of universities participating in the KOAB project. Given that Croatia joined the European Union on July 1, 2013, we exclude all graduates with this citizenship. Moreover, graduates from Israel are also excluded due to specific agreements between Germany and Israel on immigration. In order to only consider those graduates who

[16] In most cases, information up to the third employer is given, which is reasonable given the 1.5 year timeframe.

[17] This is a standard procedure when using survey data information on wages.

experience the transition from university to work, we drop graduating students who continue further studies.[18] We further exclude those who chose to become self-employed given that the Blue Card is out of scope for them.[19] We also drop all those who graduated before the introduction of the Blue Card but found a job afterwards, as well as those who graduated after the reform but had a job before graduation to avoid potential endogeneity issues. Graduates aged between 20 and 40 years old are kept in the sample to also consider those who delayed their studies or pursued doctoral degrees. Finally, our sample includes German, EU and non-EU students who graduated between February 1, 2011 and May 1 2014.

3.2 Descriptives

The control group comprises German and EU graduates with a sample size of approximately 19,000 before the introduction of the Blue Card and 21,000 afterwards. By contrast, the sample of non-EU graduates amounts to 451 students before and 492 after. The majority of graduates from EU countries come from Poland, Greece, Italy, Bulgaria, Austria and Romania, whereas the group of non-EU graduates are mainly from China, Turkey, Russia, Ukraine, India and Mexico. This composition is also in line with the set of countries that have been attracted to Germany for studies abroad (see Hoffmeyer-Zlotnik and Grote (2019)). Figure A3 in the appendix describes in more detail the share of graduates in the control and treatment group in the KOAB data.

[18] The Blue Card might have incentivized non-EU students to continue further studies and invest in degrees that have better chances of paying at the Blue Card salary threshold. However, we do not believe that the Blue Card enters the decision-making for further studies to a considerable extent. We also support this empirically and check whether the reform shifted the decision-making for further studies. This is demonstarted in Figure in the Appendix.

[19] Apart from the introduction of the Blue Card, on August 1, 2012, it was also made easier for non-EU graduates to enter self-employment. The only conditions that mattered after August 1, 2012 were to initiate a business that holds economic importance and for the start-up to be related to the person's studies in Germany. There were no longer any monetary constraints in terms of the amount that had to be invested. Hence, after August 1st, 2012 more non-EU graduates could have been incentivized to enter self-employment. Unfortunately, we cannot investigate this reform given that we have only 78 non-EU graduates entering self-employment overall.

Table 2: Balance table: German and non-EU graduates' characteristics and labor market outcomes

	DiD		Before				After			
			EU+DE		Non-EU		EU+DE		Non-EU	
Outcome										
First Wage	133.22	(87.3)	2514.5	[1287.0]	2708.0	[1248.7]	2597.0	[1236.4]	2923.7	[1168.2]
Search Duration	0.17	(0.2)	2.5	[3.3]	3.5	[3.7]	3.0	[3.5]	4.2	[3.9]
Search Effort	-0.59	(1.1)	4.2	[6.2]	6.5	[10.5]	4.7	[6.6]	6.4	[9.8]
Stay Germany	-0.00	(0.0)	1.0	[0.2]	0.9	[0.4]	1.0	[0.2]	0.8	[0.4]
Demographics										
Female	0.00	(0.01)	0.47	[0.50]	0.42	[0.49]	0.49	[0.50]	0.43	[0.50]
Age	0.09	(0.19)	27.24	[2.84]	28.69	[3.33]	27.02	[2.82]	28.55	[3.18]
Type of Degree										
Bachelor	-0.16*	(0.07)	0.54	[0.50]	0.57	[0.50]	0.41	[0.49]	0.27	[0.44]
Diplom	0.08	(0.07)	0.19	[0.39]	0.13	[0.34]	0.13	[0.33]	0.15	[0.36]
Magister	0.01	(0.01)	0.05	[0.22]	0.04	[0.18]	0.01	[0.12]	0.01	[0.09]
Master	0.11	(0.07)	0.15	[0.35]	0.24	[0.43]	0.32	[0.47]	0.53	[0.50]
State Exam	-0.04	(0.03)	0.06	[0.24]	0.02	[0.13]	0.12	[0.33]	0.04	[0.19]
Doctoral	-0.00	(0.00)	0.01	[0.07]	0.00	[0.07]	0.01	[0.10]	0.01	[0.09]
Studies										
Last Degree GPA	0.04	(0.05)	1.95	[0.54]	2.13	[0.55]	1.95	[0.53]	2.17	[0.56]
Uni Type	-0.01	(0.04)	0.71	[0.45]	0.74	[0.44]	0.67	[0.47]	0.69	[0.46]
Lang & Cult	-0.05	(0.04)	0.20	[0.40]	0.15	[0.36]	0.18	[0.39]	0.09	[0.28]
Law Econ Social	0.05	(0.05)	0.30	[0.46]	0.26	[0.44]	0.30	[0.46]	0.31	[0.46]
Math Natural	0.02	(0.04)	0.16	[0.37]	0.18	[0.38]	0.16	[0.37]	0.20	[0.40]
Med Health	-0.01	(0.02)	0.10	[0.30]	0.04	[0.21]	0.11	[0.31]	0.04	[0.19]
Engineering	-0.02	(0.06)	0.24	[0.43]	0.37	[0.48]	0.25	[0.43]	0.36	[0.48]
Observations			18599		452		21393		493	

Note: The first two columns show the betas and standard errors from a difference-in-difference regression where the outcome variable is each one of the outcomes of interest and pre-determined variables. In this regression, the standard errors are clustered at the subject of study and type of degree level. Standard errors and the associated p-values are adjusted for multiway clustering following (Cameron et al., 2012). The following columns present the mean and standard deviations in parenthesis for each of the pre-determined variables using KOAB data before and after the introduction of the Blue Card for both the control and treatment group.

The control and treatment group seem to be comparable in terms of socio-demographics and the characteristics of their educational experience in Germany. Table 2 summarizes the pre-determined characteristics and the main outcomes of interest. The share of females is equal to males in the control group and slightly lower in the treatment group. The average age of graduates in both control and treatment group is 28 years old. The majority of graduates from both the control and treatment group have completed either a bachelor, diploma (four-years) or aaster degree. The number of bachelor graduates decreased after the introduction of the Blue Card, and significantly more so for the graduates in the treatment group. By contrast, the number of master graduates increased after the Blue Card's introduction, significantly more so for the graduates in the treatment group. Students in the treatment and control group graduated with an average GPA of 2[20] (both before and after the Blue Card).

[20] The German educational grading scheme ranges from 1 to 5, whereby 1 is the best grade and 4 is the

After the introduction of the Blue Card, there are fewer graduates coming from universities, which doest not differ between the treatment and control group. The highest share of graduates in the control group have completed a degree in law, economics and social science, with slightly fewer in engineering and language and cultural studies. By contrast, the highest share of graduates in the treatment group hold a degree in engineering, followed by those holding a degree in law, economics and social sciences. However, these differences are not statistically significant.

Graduates in the control group earned on average €2,400 gross per month before the introduction of the Blue Card and €2,500 afterwards, whereas the non-EU graduates earned on average €2,600 gross per month before the Blue Card introduction and €2,900 thereafter. A potential explanation behind entry-level wages of graduates in the treatment group being higher than those in the control group is that non-EU graduates are restricted in terms of time and bureaucracy to find a job that matches their qualification. This makes them "forced" to have a better starting point than German and EU graduates who can afford to search longer and even start out with jobs that might not match their qualification. This is also reflected in the distribution of entry-level wages in Figure A4, where it can be noticed that the distribution of entry-levek wages for non-EU graduates is more shifted to the right compared with the graduates in the control group. The average salary threshold for the treatment group is not far from the Blue Card salary threshold required for shortage occupations which is exactly €2,900. However, the Blue Card salary threshold for the non-shortage occupations is €3,700, much higher than the average entry-level wage of both the control and treatment group. The threshold for shortage occupations pertains to the 40th percentile and the non-shortage ones to the 90 percentile of the entry-level wage distribution.

In terms of job search endeavor, treated graduates search longer but did not contact more employers on average. The amount of time searched for a job is truncated at eighteen months for both the control and treatment group given that the treatment group cannot search for longer than this period. Within the eighteen months of job search allowance, treated graduates search on average for one more month than the graduates in the control

lowest passing grade.

group. Graduates of both groups slightly increased the number of months for which they search for a job after the introduction of the Blue Card. Moreover, graduates in the control group have contacted two fewer employers on average than those in the treatment group. The number of contacted employers increased for the control group and only slightly decreased for the treatment group after the introduction of the Blue Card. However, these differences are not statistically significant.

Next, we compare the composition of our sample with the Final Examination Register for the time period between August 1, 2011 and August 1, 2013.[21] First, the composition of the EU and non-EU group in terms of citizenship is comparable to the universe of graduating students in Germany. Figure A3 compares these two data sources with respect to country of origin. In both data sets the highest share of graduates in the non-EU group come from China, Turkey, Russia, Ukraine and India. By contrast, EU graduates mostly come from Austria, Poland, Bulgaria, Italy, France and Greece. The composition of the EU and non-EU group seems comparable in terms of country of citizenship across the KOAB data and the universe of graduates around the same time. Second, we compare the distribution in our sample to the Final Examination Register data for the pre-determined variables. Although we cannot compare the data across the whole distribution we can at least compare the means. In Table A2 in the appendix it can be noticed that there are no differences in means with respect to gender, age and GPA of graduates' last studies. There are some differences with respect to the type of degree and subject of studies. Nevertheless, these differences do not seem to be substantial especially in terms of non-EU graduates.

3.3 Empirical Model

The intention of the Blue Card introduction was to increase the attractiveness and retention of high-skill labor and not create any distortion in the labor market. However, the Blue Card comes with features that could have affected the labor market outcomes of non-EU graduates. The Blue Card salary threshold might signal to non-EU immigrants to acquire jobs that pay to the threshold. Nevertheless, non-EU immigrants who already reside in the country and

[21] This is the period for which we have access to the Final Examination Register.

have a working contract that pays to the Blue Card wage threshold can be eligible to obtain the Blue Card, and thus might self-select into it. Faced with this endogeneity issue, we exploit a specific scenario dealing with the selection of non-EU migrants into the eligibility for obtaining the work permit. Namely, we compare entry-level wages of non-EU students with German and EU students who graduated after the introduction with those who graduated before. The introduction of the Blue Card is exogenous to the date of graduation, and those who graduated and found their first job before August 1, 2012 could not have profited from obtaining the Blue Card.

We study the impact of the Blue Card on non-EU graduates' labor market outcomes by exploiting the exogenous variation in the eligibility for obtaining the Blue Card. We estimate a difference-in-difference model where the treatment group comprises graduates from non-EU countries and the control group of graduates from Germany and EU member states. Given that non-EU students barely account for 2 to 3 percent of the whole stock of enrolled students in German higher education institutions, we do not expect them to induce general equilibrium effects. Difference-in-difference helps us to provide causal estimates as long as changes in labor market conditions between German+EU and non-EU graduates are the same. The empirical model to be estimated is as follows.

$$LogWage_{ict} = \beta_0 + \beta_1 NonEU_c + \beta_2 Post_{8/2012,t} + \beta_3 NonEU_c \times Post_{8/2012,t} + X_{ict}\alpha + \epsilon_{ict} \quad (1)$$

where $LogWage_{ict}$ denotes the wages of graduates from country c in month t. $NonEU_c$ is equal to 1 if the graduate pertains to the treatment group and 0 otherwise. $Post_{8/2012,t}$ is equal to 1 if the student graduated after August 1, 2012 and 0 otherwise. X_{ict} comprises all of the fixed effects necessary to control for any trends differentially affecting the control and treatment group. We include citizenship fixed effects to account for any trends differentially affecting graduates, and wages from different countries of origin. The type of degree is included because our timeframe overlaps with the implementation of the Bologna Reform in Germany. Upon signing the Bologna Declaration in 1999, Germany started to implement the Bologna structure of the higher education system as early as in 2002. Ever since, the number

of bachelor and masters courses has substantially increased and as a results the number of graduates with these degrees. We consider graduates between February 2011 and April 2014. These graduates would have been enrolled between 2008 and 2011 for either diploma (4-year), bachelor, master or magister degrees. Given that the implementation of the Bologna reform was not completed between 2009 and 2011, in our sample we will have graduates from both systems and naturally over time proportionally more graduates with either bachelor or master degrees. Hence, to partial out any differential pay-off from the type of degree, we include them as fixed effects. Moreover, subject of studies fixed effects are included to account for different pay-offs in different fields of studies. We also include seasonal quarter fixed effects to control for any cyclical trends that affect both the control and treatment group likewise. Finally, ϵ_{ict} is a zero mean error term. Standard errors are clustered at the type of degree and subject of studies to account for any within group serial correlation.

We further exploit the impact of such a reform in a more dynamic scenario by implementing an event study model. This will also help to establish that trends in cases between the treatment and control group behaved similarly before the introduction of the Blue Card. The event study model reads as follows:

$$LogWage_{icq} = \sum_{\tau=-5, \tau \neq 0}^{\tau=5} \gamma_\tau NonEU_{c,t-\tau} + Z_{icq}\theta + \varepsilon_{icq} \tag{2}$$

We restrict the window effect to a finite number of leads and lags following (Schmidheiny and Siegloch, 2019). More specifically, we limit the window effect to five quarters before and five quarters after the introduction of the Blue Card and create bins for the endpoints. The baseline period τ_0 is the first quarter of the introduction of the Blue Card. Provided that we do not observe many data points for each month of graduation, we estimate γ at the quarter level. $LogWage_{icq}$ represent the wages of student graduates from country c in quarter q. In Z_{icq}, a set of fixed effects are included such as the type of degree and graduation quarter interacted with the subject of studies dummies[22]. ε_{icq} is the error term.

[22] We will see in section 4 that these are the most impactful fixed effects

3.4 Identifying Assumptions

For the difference-in-difference strategy to identify the average causal effect the following three assumptions are necessary. First, under the *exogeneity assumption* we need the omitted variables not to be influenced by the treatment as well as the absence of self-selection into treatment. The second assumption is the stable unit treatment value assumption ($SUTVA$), under which it is important that the control and treatment group are independent, i.e. the entry-level wages of the two groups do not influence each other. Third is the *common trend assumption*, under which the entry-level wages of both the control and treatment group would have had the same trend in the absence of the Blue Card introduction. In what follows, we provide supportive evidence of these three assumptions.

Exogeneity. We rely on the exogenous variation that the introduction of the Blue Card generated regarding the eligibility of the non-EU graduates to obtain it. The announcement of the Blue Card's introduction was made on June 8, 2012 and entered into force on August 1, 2012. Hence, graduating students had only two months to change their behavior and self-select into treatment. Anticipatory behavior could be in the form of postponing the date of graduation beyond August 1, 2012. We present the results of two tests that provide counter evidence for potential anticipatory behavior. First, we look at whether students changed their timing of looking for a job. Figure A7 and A8 show that the introduction of the Blue Card did not affect the timing of the job search starting time for the non-EU graduating students compared to German and EU graduates. Furthermore, there is no evidence for a higher number of graduates after the introduction of the Blue Card (see Figure A9). This means that students did not prolong their studies in order to profit from the Blue Card's introduction. Second, we employ a donut estimator following Barreca et al. (2011) where we exclude those students who graduated three months before and three months after the introduction of the Blue Card. We will see in section 4.4 that the point estimates do not change (see Table A4 in the appendix).

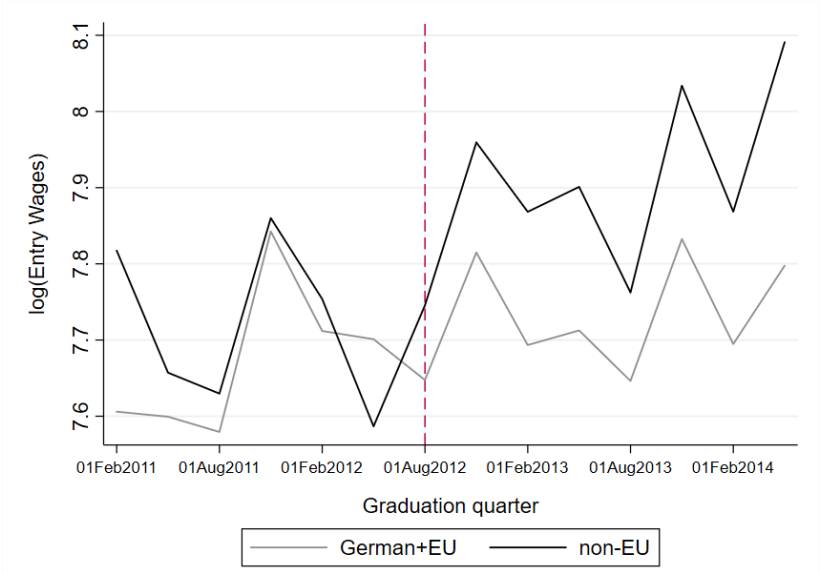
Balancing tests. Provided that we cannot explicitly check whether any omitted variable is correlated to the introduction of the Blue Card, we examine whether there are any jumps in

observables as a result of the reform. Hence, we conduct balancing tests to indirectly check whether any of the pre-determined characteristics is a potential confounder as supportive evidence towards the first assumption. Table 2 presents these balancing tests as well as summary statistics of the pre-determined characteristics before and after the introduction of the Blue Card, separately by control and treatment group. There are no differences in terms of gender and age across the treatment and control group both before and after the introduction of the Blue Card. We only find mild evidence for compositional differences in terms of the bachelor type of degree. Provided that non-EU graduates decide about their bachelor/master studies at least three/two years before they graduate, the chances of taking a decision about the type of degree depending on the Blue Card are almost non-existent, first because there are other ways of remaining in Germany for employment purposes, and second because non-EU graduates might have not even heard of the Blue Card before coming to Germany for studies. Hence, we believe that there is no selection bias emerging from the type of degree. Nevertheless, we tend to be conservative and to deal with this type of imbalances in observed characteristics, we control for the type of degree and the subject of studies. We will see in Table 3 that the impact of the Blue Card on entry-level wages does not change.

SUTVA. Provided that non-EU graduates pertain to approximately only 2 to 3 percent (see Figure A1) of the total number of graduates in Germany per year, we believe that there is insufficient competition induced in the market such that the outcome of this group (treatment group) interacts with the control group and thus violates the SUTVA assumption. However, one concern could be that non-EU graduates are larger in numbers in sectors where there is a shortage. In Table A2 are displayed the share of enrolled students (the RDC columns) for the control and treatment group in each of the subject of studies.[23] It can be noticed that the share of enrolled students in each one of the fields is not substantially different between the control and treatment group. This speaks against increased competition across these two groups in specific sectors.

[23] RDC covers the whole universe of enrolled students in higher education institutions in Germany.

Figure 1: Log(entry-level wages) trend



Note: The graph plots log(entry-level wages) for each quarter of graduation for the control and treated group. The Blue Card salary threshold for graduates entering shortage occupations falls at log(entry-level wages)=7.29 and 8.22 for the non-shortage ones.

Common trend assumption. Finally, the main identification assumption is that the outcome of both the control and treatment group would have followed the same trend in the absence of the treatment. Figure 1 shows the trend of entry wages of the control and treatment group graduating six quarters before and seven quarters after the introduction of the Blue Card. It can be noticed that before the introduction of the Blue Card the trend of entry wages for the treatment group is parallel to the control one. The spike of the first quarter before the reform is driven by a small number of graduating students in that quarter in the treated group.

The fact that entry-level wages of non-EU graduates are above those of German and EU graduates comes because the lower tail of the distribution for the control group has more mass than that of non-EU graduates. The distribution of entry-level wages for both the control and treatment group is demonstrated in Figures A4 and A5 in the Appendix. This makes sense because both German and EU graduates do not have pressure neither in terms of time to look for a job, nor in finding an occupation that matches their qualifications. They can thus be more flexible in their job search endeavour. In the quarters subsequent to

the Blue Card's introduction, the mean log entry wages of non-EU graduates have increased well above those of the EU and German graduates. To further support the parallel trend assumption, in Figure 2 we present event study estimates. The approximately zero effect and statistically insignificant effect in the pre period provides further supportive evidence for the parallel trend assumption.

Furthermore, we check on the parallel trend assumption for the split sample by graduates entering shortage and non-shortage occupations. In Figure A6, it can be noticed that the parallel trend assumption also holds for the split sample. In both cases, the entry-level wages of the treated group surpass those of the control group after the introduction of the Blue Card. However, graduates in the treated group entering shortage occupations cross the Blue Card salary threshold in the after period, whereas those entering non-shortage occupations do not cross the salary threshold, reflecting the firm side also operating, i.e. the market does not pay non-shortage occupations to the level of the Blue Card.

Finally, to further support the identification strategy, we conduct several robustness checks. We estimate donut difference-in-difference regressions, re-estimate the results with only Germans as a control group and only EU graduates as a control group, and form a placebo treatment group where we consider EU graduates as the affected group and German graduates as the control. These are presented in section 4.4.

4 Results

First, we present our main results on the impact of the introduction of the Blue Card on entry-level wages and the decision to stay for the non-EU graduates in sections 4.1 and 4.2, respectively. We further dig into the potential explanatory mechanisms behind the main results in section 4.3. Next, we test for the sensitivity of our results implementing a donut estimator, different control groups and placebo treatment in section 4.4.

4.1 Entry-Level Wages

We first examine the impact of the introduction of the Blue Card on entry-level wages for the non-EU graduates in Germany. We start by estimating a simple difference-in-difference equation with OLS . Table 3 presents various specification of equation 1 where we sequentially control for the subject of study, type of degree, citizenship, quarter of graduation, university type (university or university of applied sciences) and university fixed effects. The non-EU group dummy is absorbed by the citizenship fixed effects in the last three specifications.

Table 3: Difference-in-difference estimates of entry-level wages

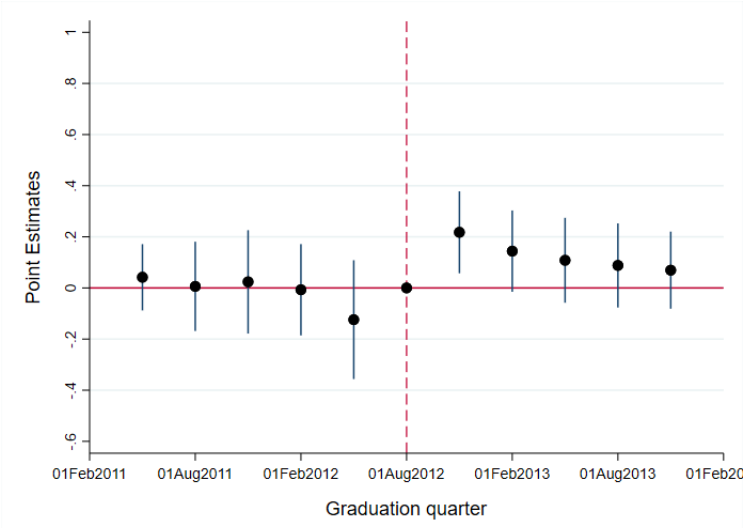
	I	II	III	IV	V	VI	VII
Post	0.060	0.073	0.062	0.031	0.031	0.029	0.022
	(0.043)	(0.045)	(0.042)	(0.048)	(0.048)	(0.060)	(0.070)
Non-EU	0.094**	0.029	0.021	0.022			
	(0.031)	(0.034)	(0.033)	(0.033)			
Post#Non-EU	0.077*	0.074*	0.065***	0.035**	0.022**	0.023**	0.019*
	(0.032)	(0.028)	(0.014)	(0.011)	(0.005)	(0.008)	(0.007)
Age		0.036**	0.038**	0.031**	0.031**	0.031**	0.030**
		(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.010)
Female		-0.269**	-0.164***	-0.166***	-0.165***	-0.166***	-0.166***
		(0.085)	(0.032)	(0.034)	(0.034)	(0.034)	(0.034)
GPA		-0.009	-0.090**	-0.046**	-0.046**	-0.046**	-0.048**
		(0.051)	(0.022)	(0.013)	(0.013)	(0.013)	(0.012)
Mean dep. var.	2565	2565	2565	2565	2565	2565	2565
Subject FE	No	No	Yes	Yes	Yes	Yes	Yes
Degree FE	No	No	No	Yes	Yes	Yes	Yes
Citizenship FE	No	No	No	No	Yes	Yes	Yes
Quarter FE	No	No	No	No	No	Yes	Yes
University Type FE	No	No	No	No	No	No	Yes
Observations	41020	41020	41020	41020	41020	41020	41020

Note: The outcome variable is the logarithm of the gross entry-level wage. The non-EU group dummy in columns V to VII is absorbed by the citizenship fixed effects. Here, the control group comprises both German and EU graduates. Standard errors, reported in parenthesis, are clustered at the subject of study and type of degree level. Standard errors and the associated p-values are adjusted for multiway clustering following Cameron et al. (2012). * p<0.1, ** p<0.05, ***p<0.01

We find that the introduction of the Blue Card increased the entry-level wages of non-EU graduates by approximately 7.7 percent, ceteris paribus. Adding controls such as age, female,

GPA of graduates' last studies reduces the impact to 7.4 percent. Sequentially controlling for the subject of study, type of degree and citizenship reduces the impact to 2 percent. This means that the introduction of the Blue Card increased the entry-level wage of non-EU graduates in Germany by 2 percent relative to the control group in the pre period. Making the control and treatment group more comparable by including the quarter of graduation and type of university does not influence the size of the coefficient of interest. The consistency of the estimate in the latter specifications tells for unobserved variation to not matter anymore. In addition, female obtain lower entry-level wages than males. As expected, higher ability students - as reflected in our case with the GPA of last studies - is associated with higher entry-level wages. Notice that in the German education system, grades vary from 1 to 5 and 1 is the best grade, hence explaining the negative correlation of the GPA of last studies.

Figure 2: Event study on the impact of the Blue Card introduction on entry-level wages



Note: This graph plots the point estimates and the corresponding 90% confidence interval of the event study model. The event study model estimates a regression of log entry wages on the relative time to the introduction of the Blue Card after controlling for the type of degree and the interaction between the subject of studies and quarter of graduation. Robust standard errors.

Next, we look at the impact of the Blue Card from a dynamic perspective and estimate event studies. Figure 2 displays estimated coefficients of the event study model presented in equation 2. Provided that the sample of observed non-EU graduates for each quarter is rather small,[24] we only control for the most influential fixed effects such as the type of

[24] It ranges between 40 and 100 observations per graduation quarter

degree, subject of studies and quarter of graduation. The results indicate a slight increase in entry-level wages in the first two quarters. In particular, non-EU graduates entering the labor market during the first quarter after the reform seem to have profited the most, with an average increase of 20 percent. Provided that the number of observations in each quarter differs (and more so at the end points of the event study), we should not expect that the average effect of all point estimates in the after period minus the pre period results exactly at the level of the point estimate of the difference-in-difference estimates, i.e. 2 percent. To derive the difference-in-difference point estimates starting from the event study we need to take a weighted average (which depends on the number of observations) and not a simple average. Point estimates slightly reduce in magnitude for the following quarter and are no longer statistically significant. However, we need to keep in mind that these estimates might be underpowered given the small variation and small number of observations in the treatment group in each quarter.

These results are not driven by the drop in the entry wages in the treatment group one quarter prior to the introduction of the Blue Card. To prove this we also report results on the donut difference-in-difference estimator in Table A4 and donut event study A11 where we drop two months before and two months after the introduction of the Blue Card. It can be noticed that the results remain intact with the decline in entry-level wages of the treatment group one quarter before. Moreover, we find no evidence for these results to be driven by a potential declining patter in the wages of the graduates from EU member states (part of the control group). Table A7 shows that when considering the German graduates as the control group and EU graduates as the treatment group, there is no specific pattern of the EU graduates to be affect by the introduction of the Blue Card.

Next we look at the heterogeneities across graduates entering fields with or without a labor market shortage given that the Blue Card salary thresholds are different for these two categories. Occupations with labor market shortages in Germany are considered STEM fields and medicine. In 2012, the Blue Card salary threshold was €35,000 (€2,900 per month) gross, and €45,000 (€3,700 per month) gross for fields with and without a labor market shortage, respectively. In the upper part of Table A3 in the Appendix, the estimates of equation 1

are presented for graduates in fields such as social sciences, law, economics and language and culture studies.[25] In the lower part of Table A3, the estimates are provided for graduates in STEM and medicine fields. In both cases, we have controlled for the pre-determined characteristics and the most influential fixed effects such as the type of degree, subject of study and quarter of graduation.

The results seem to be mainly driven by non-EU graduates in degrees other than STEM and medicine fields. More specifically, the entry-level wages of these graduates have increased by approximately 5 percent due to the introduction of Blue Card. The impact on entry-level wages on STEM and medicine graduates amounts to 2 percent. Due to the splitting of the sample, we encounter power issues. Nevertheless, the evidence suggests that the Blue Card salary threshold more strongly incentivizes those graduates who would have earned below the threshold on average. This is exactly the case for, non-EU graduates entering non-shortage occupations who earn on average €2,200 per month, well below the €3,700 of the Blue Card salary. By contrast, non-EU graduates in fields with a shortage earn on average €2,909, which is right at the Blue Card salary threshold. Hence, graduates in non-shortage fields are more incentivized to reach this threshold, which might justify the larger impact.

4.2 Decision to Stay in Germany

To further back up the causal identification, we discuss whether these findings are driven by a **compositional effect**. With composition effects, we mean that the increase in entry-level wages could be driven by either a higher proportion or better quality of non-EU graduates deciding to stay in Germany. Hence, we first look at whether the introduction of the Blue Card changed non-EU graduates' decision to stay in Germany. Table 4 presents the results of a difference-in-difference set-up where the outcome variable is the decision to stay in Germany or not. Providing the same regression specifications as in the case of entry-level wages, we do not find any evidence suggesting that the introduction of the Blue Card has an impact on non-EU graduates decision to stay in Germany. While underpowered, the upper bound of

[25] In order to obtain the Blue Card, or any alternative employment residence permit, non-EU graduates have to find a job that matches their qualification. Hence, even if we do not have information on the occupation of the graduates, we can infer it from the subject of studies.

the confidence interval is very close to zero, making a large positive effect unlikely.[26]

Table 4: Difference-in-difference estimates - Decision to stay in Germany

	I	II	III	IV	V	VI	VII
Post	0.014*	0.012*	0.012*	0.010	0.009	0.013*	0.011*
	(0.006)	(0.004)	(0.005)	(0.005)	(0.005)	(0.005)	(0.004)
Non-EU	-0.068***	-0.078***	-0.079***	-0.078***			
	(0.014)	(0.015)	(0.014)	(0.014)			
Post#Non-EU	-0.041*	-0.039	-0.039	-0.040	-0.017	-0.017	-0.017
	(0.017)	(0.023)	(0.022)	(0.022)	(0.018)	(0.018)	(0.017)
Age		0.004**	0.004**	0.004**	0.004**	0.004**	0.003**
		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Female		0.003	0.005	0.005	0.005	0.005	0.004
		(0.005)	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)
GPA		0.016**	0.018**	0.017***	0.018***	0.018***	0.018***
		(0.005)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)
Subject	No	No	Yes	Yes	Yes	Yes	Yes
Degree	No	No	No	Yes	Yes	Yes	Yes
Citizenship	No	No	No	No	Yes	Yes	Yes
Quarter	No	No	No	No	No	Yes	Yes
University Type	No	No	No	No	No	No	Yes
Observations	82986	82986	82986	82986	82986	82986	82986

Note: The outcome variable is the dummy indicating whether the graduate stayed in Germany or not. The non-EU group dummy is absorbed by the citizenship fixed effects. Standard errors, reported in parenthesis, are clustered at the study of subject and type of degree level. Standard errors and the associated p-values are adjusted for multiway clustering following Cameron et al. (2012). * p<0.1, ** p<0.05, ***p<0.01

This is not a surprising result because both before and after the introduction of the Blue Card, non-EU graduates could stay in Germany with other residence permits for employment purposes. For instance, an alternative employment residence permit, not as attractive as the Blue Card, is the one targeted to university graduates that have found a job that matches their qualifications (§18 of the Residence Act). Consequently, the possibility of residing in Germany once an employment contract was realized is not threatened in the case that the contract does not pay to the Blue Card salary threshold. Therefore, we can conclude that

[26] We also look at the impact of the Blue Card on the decision to stay for the split sample by graduates entering occupations with or without a shortage. These results are presented in Table A8 in the Appendix. Although the results are underpowered, we can rule out a large positive effect on the decision to stay even for the split sample.

there is not much scope for the Blue Card to change the retention probability of immigrant graduates in Germany.

Furthermore, it could also be the case that on aggregate the Blue Card did not change graduates' decision to stay but that better quality graduates stayed. We could speak of better quality students staying in case there was a positive selection of non-EU graduates from high-paying degrees and with a higher GPA. We rule out this being the case by showing in Table 2 that there are no compositional differences in terms of the type of degree and subject of studies. Overall, we can rule out the notion that the effect is driven by compositional changes.

The results on the decision to stay can also be interpreted as results on employment probability. Non-EU graduates cannot reside in Germany unless they hold a residence permit for work purposes or family reunion. All of the non-EU graduates who decided to stay in Germany also have a job in Germany. This tells us that obtaining a residence permit for family reunion is not the most significant margin, at least not in the short run (which is also the time frame that we are studying here), and not for the highly-educated ones. Therefore, we can also conclude that the introduction of the Blue Card did not affect the employment probability of non-EU graduates in Germany.

4.3 Mechanisms

In this section, we dig into potential mechanisms behind the positive wage effects. The introduction of the Blue Card was also associated with an increase in the number of months of job search duration after graduation. Hence, it is necessary to check whether the increase in entry-level wages is actually due to more time to search for a job or due to the Blue Card. For this reason, we exploit next whether there were changes in the job-search endeavor of non-EU graduates.

Job Search Duration and Effort. We proxy search duration with the self-reported number of months looked for a job and search effort with the number of contacted employers per months of job search. We estimate equation 1 for different specifications of job search duration and effort. In both cases, we drop from our sample those graduates who found a job before the reform but graduated after, and vice-versa.

Table 5 presents results on the potential impact of the reform (the introduction of the Blue Card and the extension of job search time allowance) in job search duration and effort. Columns 1 and 2 focus on the impact of the Blue Card on job search duration within eighteen and twelve months, respectively. We have first truncated the sample at 18 months of job search because non-EU graduates are forced to return to their country of origin in case they cannot find a job within eighteen months after the introduction of the Blue Card. We further truncate the sample to a maximum of twelve months of job search duration to rule out that the effect found in entry-level wages is not because they had more time to search for a job. Moreover, only twelve non-EU graduates searched for a job for more than twelve months after the introduction of the Blue Card. In all specifications the logarithm of job search duration and effort is taken. This also forces considering only those graduates who searched for at least one month.

Table 5: Difference-in-difference estimates for search duration and effort - Donut estimator

	log(Duration)≤18m	log(Duration)≤12m	log(Effort)≤18m	log(Effort)≤12m
Post	0.162*	0.147**	0.315**	0.290**
	(0.060)	(0.053)	(0.111)	(0.104)
Non-EU	0.236***	0.214***	0.382***	0.358***
	(0.044)	(0.036)	(0.041)	(0.053)
Post#Non-EU	0.037	0.054*	0.074***	0.104**
	(0.033)	(0.021)	(0.015)	(0.023)
Mean dep. var.	3.27	3.08	3.83	3.83
Observations	31222	30578	31128	30485
Subject	Yes	Yes	Yes	Yes
Degree	Yes	Yes	Yes	Yes
Quarter	Yes	Yes	Yes	Yes

Note: This table presents the results of a difference-in-difference regression where the outcome variable is the logarithm of job-search duration in months and logarithm of the number of contacted employers. In the first column, the job search duration is truncated at eighteen months to make the job search behavior of German and EU graduates comparable to that of non-EU graduates. In the second column, the job search duration is truncated at twelve months, which pertains to the job search duration prior to the introduction of the Blue Card. Search effort is also truncated the same way as search duration to have comparable and meaningful estimates. It is controlled for the most influential fixed effects such as type of degree, subject of studies and quarter of graduation. Standard errors are clustered at the degree type and subject of study level and reported in parenthesis. * p<0.1, ** p<0.05, ***p<0.01

The results presented in first two columns of Table 5 show that whenever graduates were

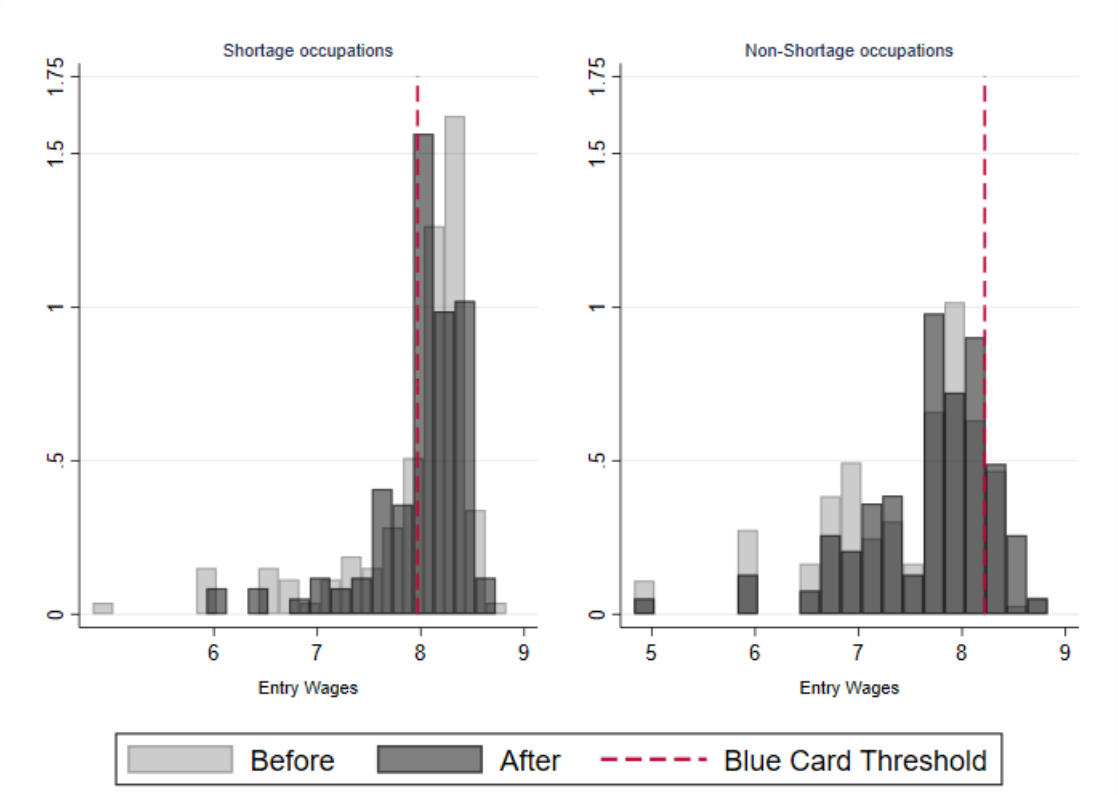
searching for a job for up to eighteen months, the duration was not significantly affected by the reform. This means that the effect of the reform on entry-level wages was not operating via the increase in job search duration but rather through the introduction of the Blue Card. An additional piece of evidence further speaking to this argument is the fact that only twelve non-EU graduates have searched for longer than twelve months during the whole period after August 1, 2012. The fact that the results are not driven by the extension of the time allowance for job search, means that our results cannot be driven by any changes in bargaining power. Longer job search duration in the case of highly-educated migrants could be associated with higher bargaining power, although this is not the case here.

Reference Point. The Blue Card salary threshold might have been operating as a reference point for non-EU graduates. Before the introduction of the Blue Card the reference point was likely at the level of the average salary that a certain occupation could pay. This information might be asymmetric to non-EU graduates as it can be collected from either native peers/network or online information. After the introduction of the Blue Card, the new reference point is the Blue Card salary threshold, whereby this information is the same for all non-EU graduates. The intuition behind the Blue Card acting as a reference point is that non-EU graduates' decision to accept a job offer now also depends on how the offer compares to the Blue Card salary threshold. In other words, it can be perceived as the new salary goal to be achieved.

For the Blue Card salary threshold to operate as a reference point, it is necessary that the non-EU graduates earning at the lower end of the wage distribution experience an increase in entry wages and non-EU graduates earning at the higher end of the wage distribution experience a decrease in entry wages. This means that non-EU graduates earning at the lower end of the wage distribution increase their reservation wage to the level of the Blue Card wage threshold. Subsequently, they induce more effort and search longer (naturally within the restricted timeframe of twelve/eighteen months) such that their entry-level wages meet the level of the reservation wage. We test this hypothesis by looking at whether wages gathered more to the level of the Blue Card salary threshold and whether any changes in search duration and effort were realized among the non-EU graduates.

First, we look at the distribution of entry-level wages for non-EU graduates before and after the introduction of the Blue Card presented in Figure 3. We need to split the sample for the graduates entering occupations with and without a shortage in the labor market given the different Blue Card salary thresholds for these two groups. Non-EU graduates in both groups of occupations assemble more around the Blue Card salary threshold in the after period. Non-EU graduates in shortage occupations compared to those in non-shortage ones cross the threshold more often. This is in line with our expectation, given that the threshold is more easily reachable for this group.

Figure 3: Distribution of entry wages for non-EU graduates before and after the introduction of the Blue Card

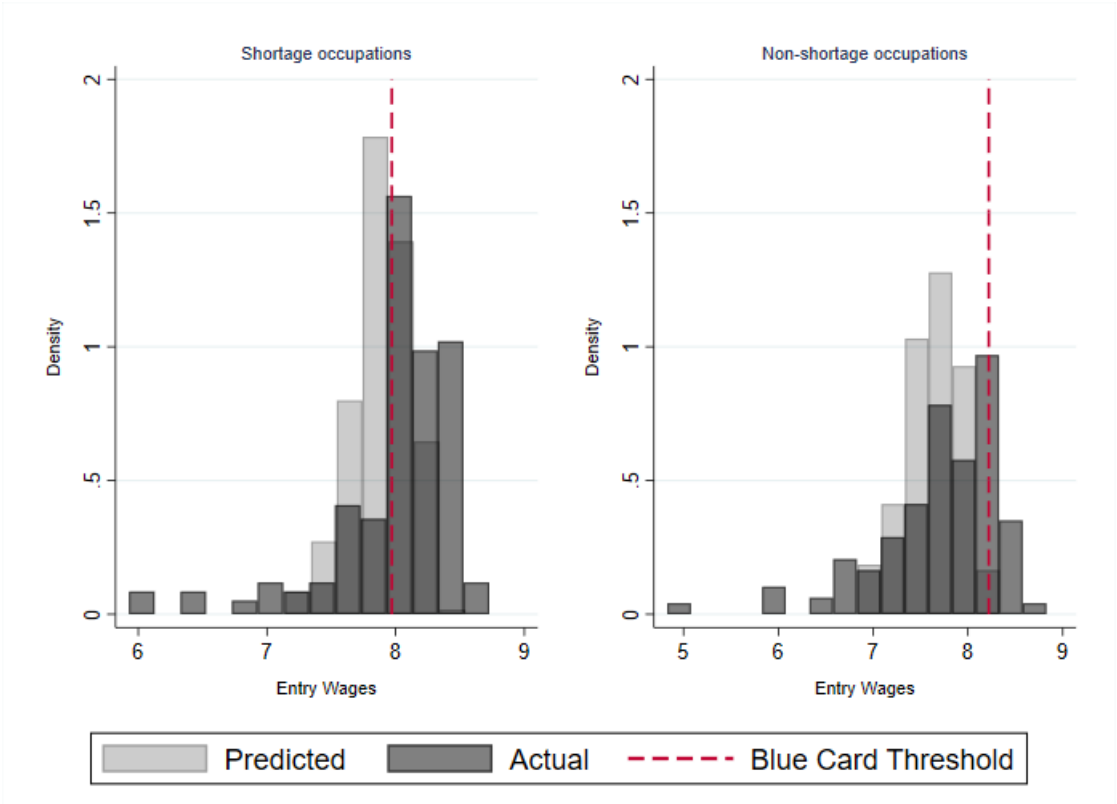


Note: These graphs show the distribution of entry level wages for non-EU graduates before and after the introduction of the Blue Card. The vertical dashed line corresponds to the level of the Blue Card salary threshold. For non-EU graduates in fields with shortages, the threshold is €2900 (ln(2900)=7.97), whereas for those in fields with no shortages the threshold is €3700 (ln(3700)=8.22).

More importantly, non-EU graduates in shortage occupation earning below the threshold prior to the Blue Card experienced a slight increase in their entry-level wages in the after

period. However, this proceeds in the opposite direction for those who earned above the threshold prior to the Blue Card. We can thus observe the gravity of the reference point from both sides of the entry-level distribution, i.e. the Blue Card acting as a reference point. We believe that on the left-hand side supply side forces dominate, which push for the wages to increase, whereas on the right-hand side we think that demand side forces push the entry-level wages down to the threshold. Due to data restrictions, here we are unable to distinguish between these two forces. This is not as much the case for non-EU graduates in non-shortage occupations, because the threshold for this group is more difficult to reach. Hence, we can only observe the effect of the reference point from the left-hand side of the entry-level wages distribution.

Figure 4: Distribution of actual and predicted entry wages for non-EU graduates *after* the introduction of the Blue Card



Note: These graphs show the distribution of actual and predicted entry wages for non-EU graduates after the introduction of the Blue Card. The prediction of entry-level wages is made using information on age, gender, GPA, study of subject, type of degree, citizenship and type of university for the control group during the whole period and treatment group only from the pre-period. The vertical dashed line corresponds to the level of the Blue Card salary threshold. For non-EU graduates in fields with shortages, the threshold is €2900 (ln(2900)=7.97), whereas for those in fields with no shortages the threshold is €3700 (ln(3700)=8.22).

Second, we come up with counterfactual wages to check whether actual wages gathered more around the Blue Card salary threshold than they would have in the absence of this reform. For this purpose, we predict entry-level wages for the non-EU graduates in the absence of the treatment. We use information[27] from the pre period for the both control and treatment group and only the control group in the after period. Next, we compare the distribution of predicted log entry-level wages[28] with the actual log entry- level wages. These are displayed in Figure 4 for the split sample by the fields with a shortage in the labor market or not.

The left panel of Figure 4 shows that actual wages of non-EU graduates entering shortage occupations have assembled more above the salary threshold when compared to the predicted ones. Hence, in the presence of the Blue Card, entry-level wages have assembled more to a level above the Blue Card salary threshold. In the right panel of Figure 4, we consider graduates entering non-shortage occupations. Their actual entry-level wages also assemble more around the threshold than the predicted entry-level wages. Although, they crossed the threshold less often. This is an expected result given that it is more difficult for graduates in social sciences to be paid at the level of the Blue Card salary threshold. The market pays on average well below €3,700 per month, the necessary salary to obtain the Blue Card. As a robustness check, we have also used Lasso to predict the counterfactual entry-level wages and then compare them with the actual ones. We present these results in Figure A10 in the Appendix. The distribution of predicted wages is not qualitatively different from those using OLS.

Residence permit salary thresholds are not a new phenomenon in the migration literature. In the past decade, many EU member states offer residence permits that target highly-educated migrants and whose only condition is a salary threshold (OECD and Union, 2016). Two such cases are the residence permit to knowledge migrants in the Netherlands and Red-White-red Card in Austria. For the case of Netherlands, there is evidence that the existence

[27] We regress log(entry-level wages) on demographic controls, study of subject, type of degree, citizenship, type of university and quarter of graduation using data for both the control and treatment group in the pre period and only the control group in the post-period. We then predict the entry-level wages only for the treated group in the after period.

[28] We preserve the same functional form of the entry-level wages, i.e. the logs, as in our main specification.

of such thresholds increases wages of non-EU migrants and more so for the ones that are further away from the threshold (OECD, 2016).

Finally, in Table 5 we explore the effect of the reform on job search duration and effort. In the second column, where we restrict to only those graduates who looked for a job between one and twelve months, we found that job search duration significantly increased. This means that within the time limit of twelve months, non-EU graduates tend to search slightly longer to reach the level of the Blue Card salary threshold. Moreover, the non-EU graduates contact significantly more employers. Overall, non-EU graduates searched for a job longer, albeit within the twelve-month limit and devoting more effort into searching. The change in search behavior further supports the idea of the Blue Card salary threshold acting as a reference point.

4.4 Robustness Tests

Donut Estimator. To deal with any self-selection into treatment we run a donut estimator by excluding graduates who completed their degree one quarter before and one quarter after the introduction of the Blue Card. These results are summarized in Table A4 in the appendix. The findings are in line with our main results. If anything, the impact is even larger in this case, namely, the introduction of the Blue Card seems to have increased entry-level wages of non-EU graduates on average by approximately 3 to 4 percent. This could also be interpreted as further evidence for the main results not being driven by graduates changing their month of graduation due to the Blue Card. In orther words, we do not find evidence speaking to any anticipatory behavior. Furthermore, we also present event studies for the donut estimator in Figure A11. Similarly to the event study in Figure 2, we find the same trend of effect before and after the introduction of the Blue Card. However, the effect is not statistically significant and seems to dissipate over time.

Different Control Groups. In addition, we also test whether our results are robust to different specifications of the control group. We first consider the control group composed only of German gratuates. The results are presented in Table A5. The point estimates remain very close to our main results in terms of both magnitude and statistical significance. This

robustness is rather straighforward given that the majority of the control group in the main results comprises German graduates. In Table A6, we also show the results with the control group being only EU graduates. It can be argued that EU graduates would potentially be a better control group than both German and EU graduates. This could be the case because both EU and non-EU graduates experience similar barriers to the labor market and an international experience in Germany. Hence, we also provide robustness with the control group comprising only out of EU national graduates. We find that the Blue Card influences an increase in non-EU graduates' entry-level wages on average by 4 to 6 percent. These point estimates further support our main set of results. We also complement these estimates with event study graphs, presented in Figure A12. In both cases, the main results found from the event study are confirmed once again. A short lived effect can be detected in both versions of the control group, only German graduates or only EU graduates.

Placebo Treatment Group. To test for a placebo effect, we consider the EU graduates as the treated group and Germans as the control group. We present these results in Table A7. For comparison reasons we preserve the same variety of specifications as in our main results. We do not find evidence of the Blue Card having affected EU graduates. In our preferred specification in column V, this effect is almost zero.

5 Discussion and Conclusion

In this paper, we analyze how a novel residence permit, that informs immigrants on what the market pays for a highly-qualified immigrant affects immigrants' labor market outcomes. This innovative residence permit – called the Blue Card – was introduced for the first time on August 1, 2012. The only condition to obtain it was to gain a working contract that pays to a specific salary threshold signaling high quality. For our analysis, we exploit a novel data set that covers both natives and international graduates from German public universities between 2011 and 2014. We focus on non-EU nationals graduating from German universities and exploit the exogenous variation in the eligibility of obtaining the Blue Card. All of the non-EU graduates who found a job before the introduction of the Blue Card could not

profit from it, at least for their entry-level wages. We thus employ a difference-in-difference technique and event studies to identify the effect of the introduction of the Blue Card on the initial integration of non-EU graduates in the German labor market.

We find that the introduction of the Blue Card increased entry-level wages of non-EU graduates from German universities by approximately 2 percent. These results are neither driven by better-quality non-EU graduates entering the German labor market (*selection effect*) nor by more high-quality non-EU graduates deciding to stay in Germany (*composition effect*). Instead, we provide suggestive evidence that the Blue Card salary threshold is acting as a reference point for the non-EU graduates. Due to the Blue Card, the targeted group now receives uniform information on what the labor market pays for occupations in STEM and non-STEM fields, thus setting up a reference point for what their wage should be. Prior to the Blue Card, such information was very heterogeneously accessible via peers and/or information gathered online. Furthermore, the increase in entry-level wages does not seem to be driven by either having more time on disposition to look for a job that matches their qualification. Instead, we find that non-EU graduates contact more employers, i.e. put more effort into searching, within the twelve months after graduation. They might also become more selective and probably even more efficient in their application process, reflecting channels that we are unable to test in this paper due to data restrictions.

Moreover, the intentions behind the introduction of the Blue Card – i.e. to attract more skilled labor and increase the retention rate – were not realized in the labor market. In this study, we do not look at the extent to which the Blue Card attracted new skilled labor in Germany and cannot thus provide any implication. However, we can speak about its impact on the retention of those immigrants who first entered for study purposes and further decided to stay in Germany. We find that the Blue Card did not help in retaining highly-educated immigrants who first entered with a student visa. By contrast, it operates via unintended channels and increased entry-level wages.

To conclude, the Blue Card has helped the initial economic integration of highly-educated migrants, at least those who first entered in Germany with a student visa. This could reduce the potential for wage downgrading and set up a path for a better perspective in the labor

market. Further research is needed to understand the impact of the Blue Card on the overall targeted population of highly-educated migrants and natives in Germany.

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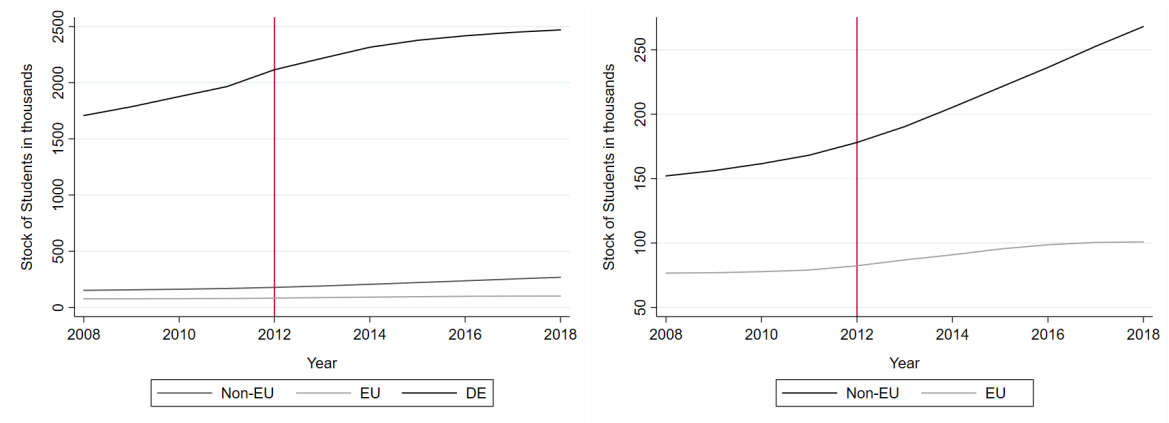
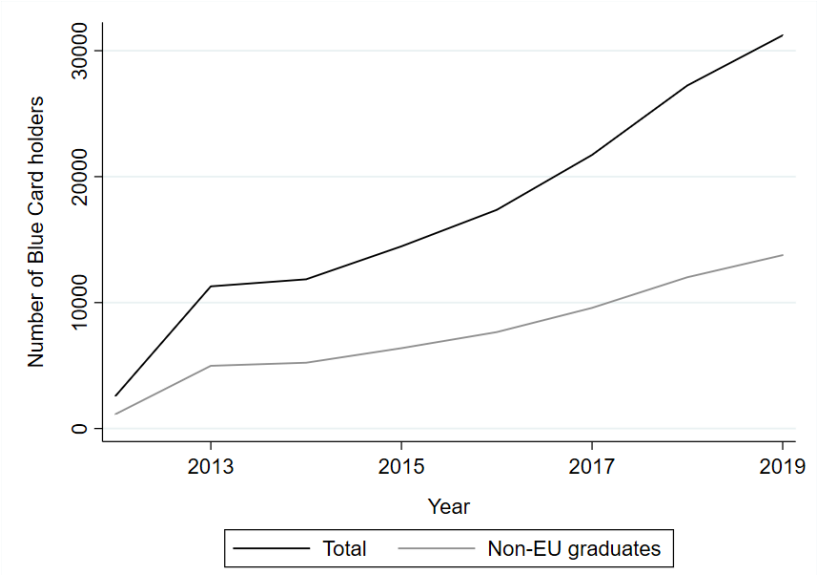
Appendix

Figure A1: Stock of EU, non-EU and German students enrolled at German universities during 2008-2018



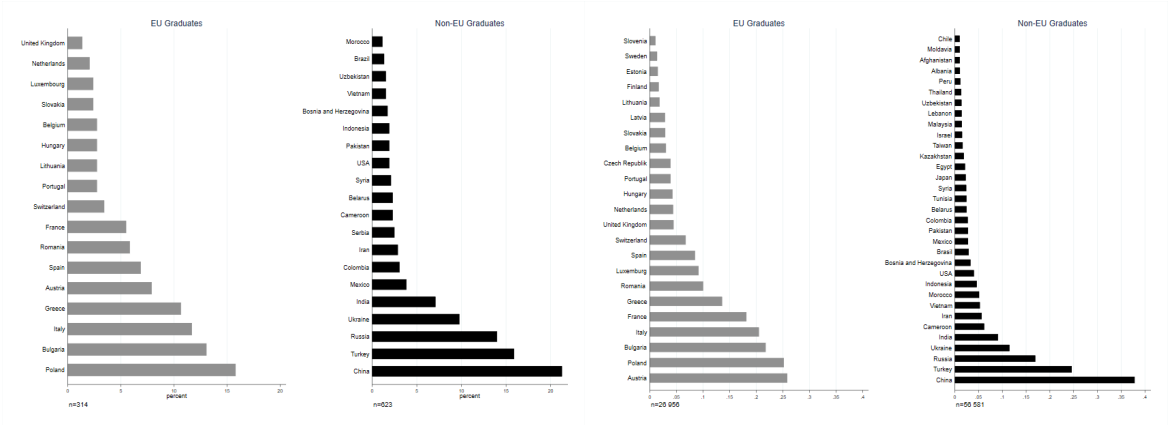
Note: This graph presents the trend of the stock of students enrolled at higher education institution in Germany during 2008 and 2018. This is presented separately for students with a citizenship from any EU member states, non-EU and Germany. Source: Federal Statistical Office of Germany

Figure A2: Number of Blue Card issued in Germany from 2012 until 2019



Note: This graph shows the trend of the number of the Blue Cards issued in Germany. The number of non-EU graduates who become Blue Card holders is calculated as a 44.1 percent of the total number of issued Blue Cards in Germany, following the number provided by BAMF (2019). Source: BAMF (2019)

Figure A3: Composition of control and treatment group by citizenship with KOAB and Final Examination Register data



Note: This figure compares the share of graduates by country of origin using KOAB and Final Examination Register data. A timeframe between August 1st, 2011 and August 1st, 2013 is used, given that we have access to the Final Examination Register data only for this period. The upper panel presents the share of graduates by country of origin in both EU and non-EU group of graduates. The lower panel shows the same graph using Final Examination Register data.

Table A1: Statistics on surveys carried out for the collection of KOAB data in the waves between 2011 and 2014

	2011	2012	2013	2014
Timing of Survey	Oct12-Feb13	Oct13-Feb14	Oct14-Feb15	Oct15-Feb16
No. of participating Universities	72	65	65	60
Graduatees Surveyed	141 000	119 000	131 000	138 188
Graduatees Answered	61 000	50 000	48 900	45 743
Response Rate	45 %	44 %	40 %	35 %

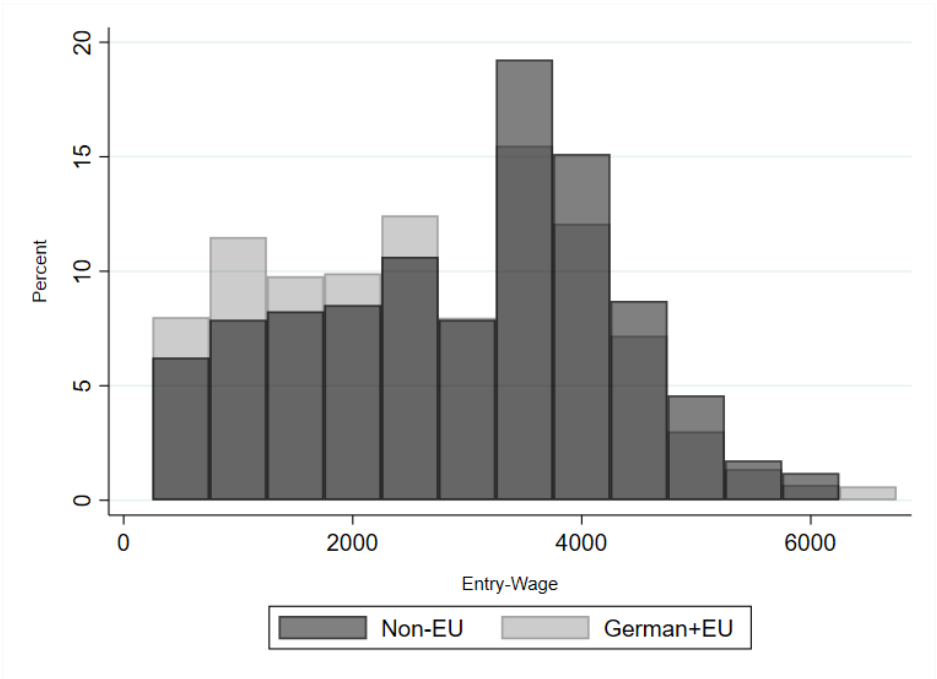
Source: INCHER (2016) and Alesi et al. (2011) Note: This table presents information on the important statistics regarding the way in which the data was collected.

Table A2: Comparison between KOAB and Final Examination Register data in terms of predetermined variables

	DE		EU		Non-EU	
	RDC	KOAB	RDC	KOAB	RDC	KOAB
Demographics						
Female	0.499	0.475	0.540	0.579	0.476	0.410
Age	27.11	27.19	28.22	27.99	28.69	28.72
Type of Degree						
GPA	2.053	1.942	2.095	2.053	2.207	2.110
Bachelor	0.560	0.417	0.411	0.394	0.362	0.312
Diplom	0.135	0.177	0,171	0.150	0.148	0.169
Magister	0.023	0.021	0.053	0.042	0.028	0.024
Master	0.206	0.231	0.284	0.272	0.384	0.402
Stateexam	0.055	0.115	0.046	0.071	0.029	0.037
Doctoral	0.018	0.039	0.034	0.071	0.051	0.055
Subject of studies						
Lang, Culture	0.224	0.174	0.261	0.248	0.164	0.100
Law, Econ, Social	0.329	0.297	0.348	0.315	0.278	0.276
Math, Natural	0.196	0.168	0.166	0.143	0.212	0.223
Medicine, Health	0.062	0.105	0.052	0.054	0.037	0.043
Engineerings	0.190	0.256	0.173	0.239	0.308	0.358

Note: This table presents a comparison of the means of the pre-determined variables between KOAB and the Final Examination Register data during the time frame between August 1, 2011 until August 1, 2014. These means are presented separately for the German, EU and non-EU graduates, both before and after the introduction of the Blue Card.

Figure A4: Distribution of entry-level wages for the treatment and control group



Note: This graph shows distribution of entry-level wages for the control and treatment group.

Figure A5: Boxplots on entry-level wages by treatment group before and after the introduction of the Blue Card

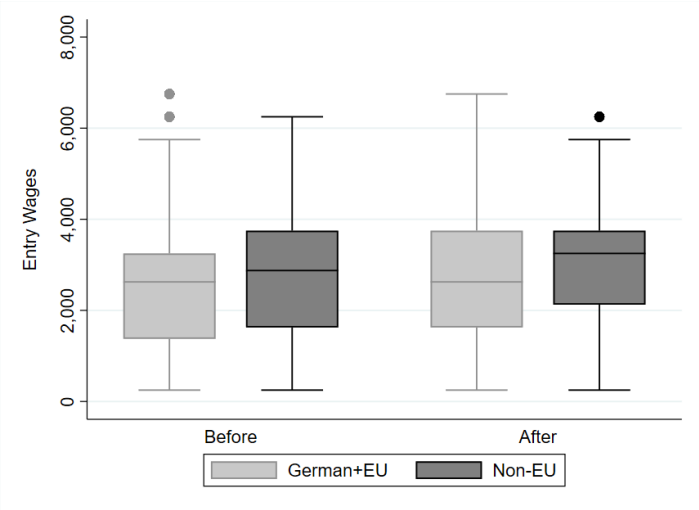
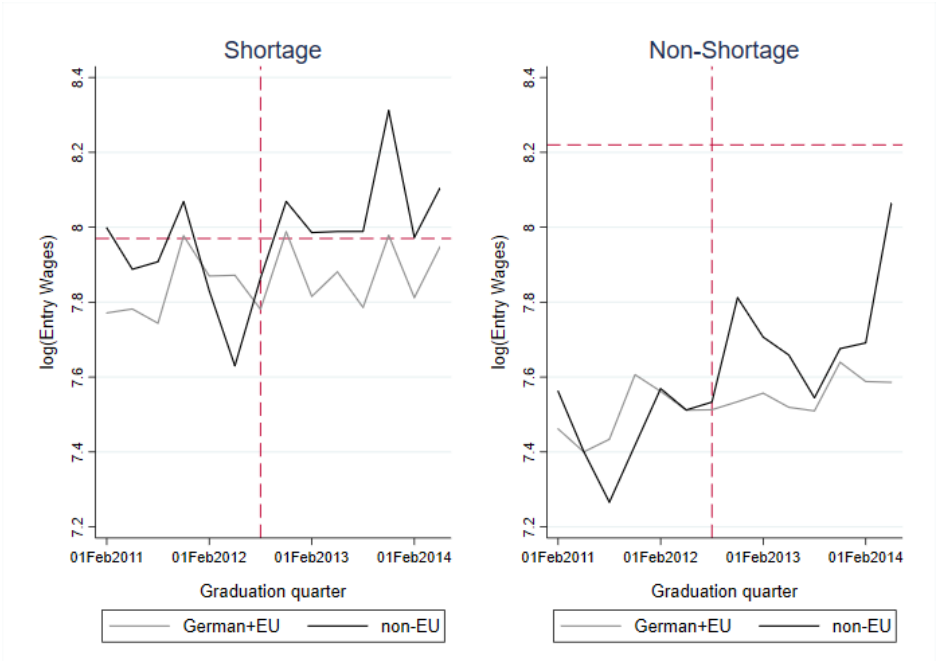
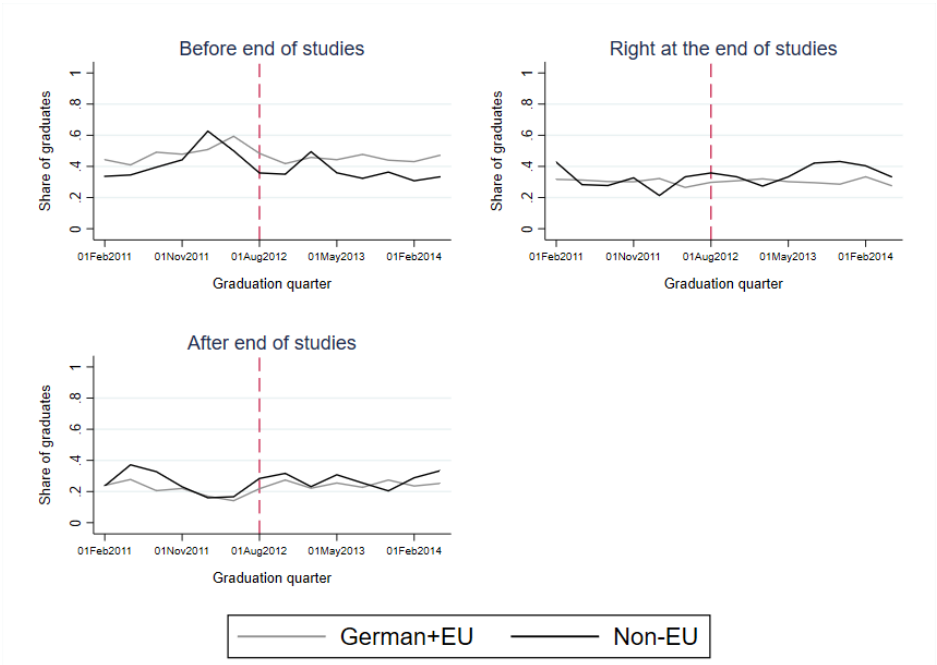


Figure A6: Log(entry-level wages) trend by graduates entering shortage and non-shortage occupations



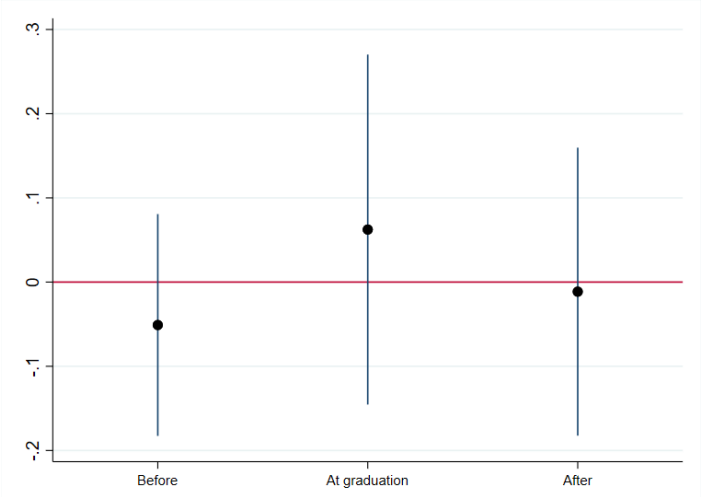
Note: The graph plots log(entry-level wages) for each quarter of graduation for the control and treated group. Horizontal lines represent the Blue Card salary thresholds.

Figure A7: Trend of the time graduates started their job-search endeavour



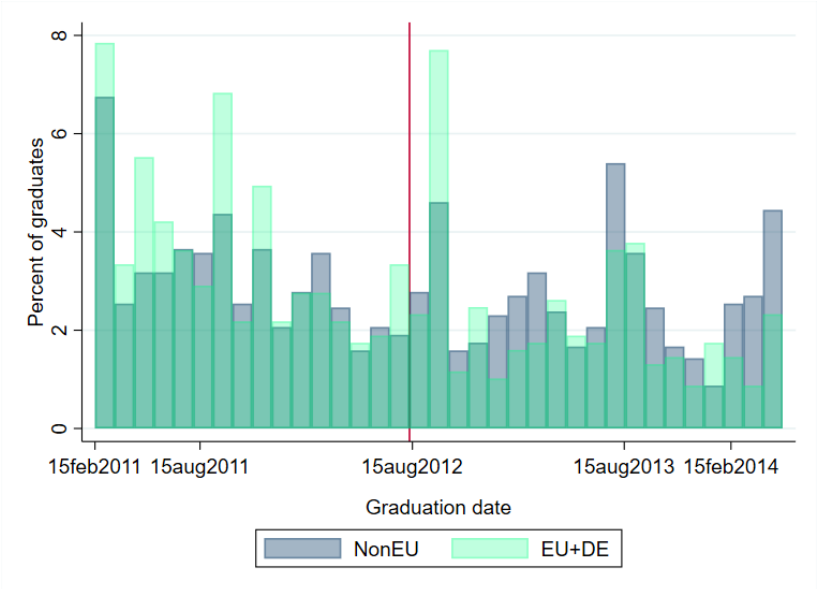
Note: This graph shows the trend of the share of graduating students that started looking for a job before the end of the studies, right at the end of the studies and after the end of the studies. These are presented separately for the control and treatment group.

Figure A8: Differences in job search starting time due to Blue Card's introduction



Note: This graph shows whether there are statistically significant differences in the time non-EU graduates start to look for a job. Here are plotted the coefficients from a difference-in-difference regression with outcomes being 1) a dummy variable equal to one if the student started looking for a job before graduation 2) a dummy variable equal to one if the student started looking for a job right at graduation and 3) a dummy variable equal to one if the student started looking for a job after graduation.

Figure A9: Distribution of graduation date for the control and treatment group



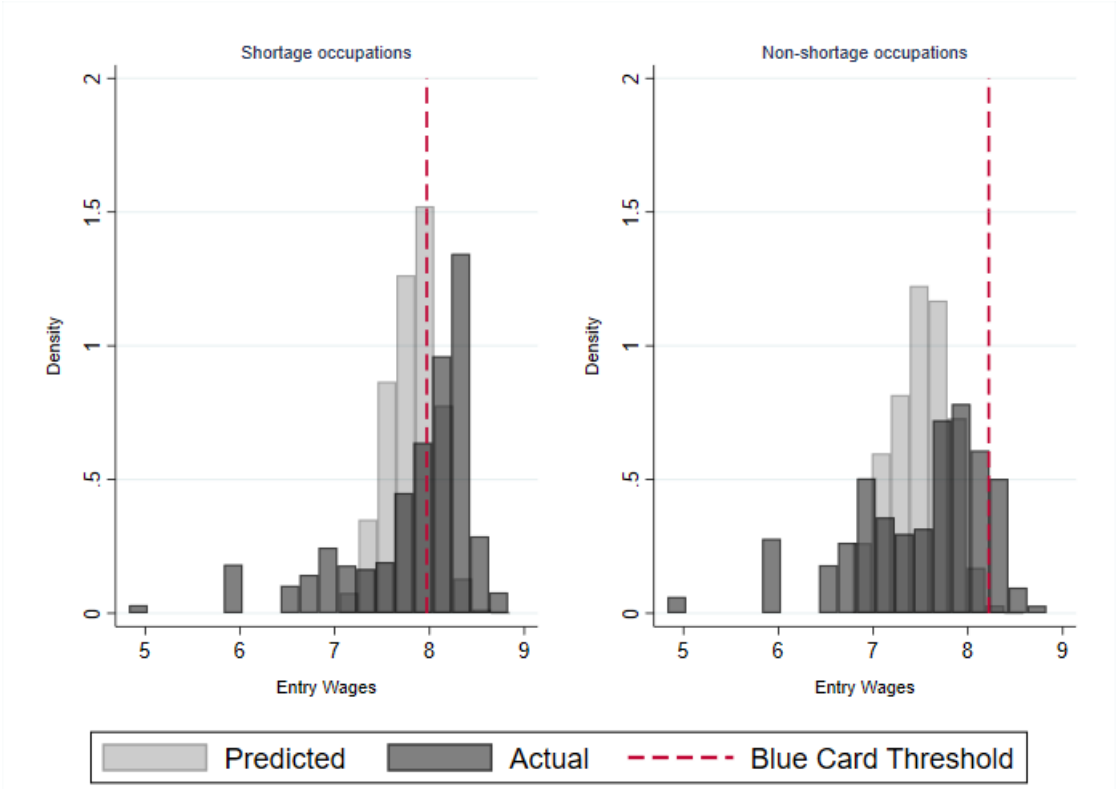
Note: This graph shows the distribution of the date of graduation before and after the introduction of the Blue Card and separately for the control and treatment group.

Table A3: Difference-in-difference estimates of entry-level wage split in terms of degrees in shortage or non-shortage occupations

	I	II	III	IV	V
Non-Shortage Occup.					
Post	0.069	0.081	0.070	0.064	0.084
	(0.060)	(0.068)	(0.066)	(0.073)	(0.108)
Non-EU	0.008	-0.026	-0.039	-0.048	-0.047
	(0.037)	(0.031)	(0.016)	(0.019)	(0.022)
Post#Non-EU	0.140	0.130	0.088	0.055	0.051
	(0.029)	(0.075)	(0.049)	(0.035)	(0.036)
Mean dep. var.	2200	2200	2200	2200	2200
Observations	19894	19894	19894	19894	19894
Shortage Occup.					
Post	0.043**	0.056	0.054	0.006	-0.018
	(0.008)	(0.033)	(0.036)	(0.038)	(0.026)
Non-EU	0.103	0.038	0.055	0.055	0.054
	(0.057)	(0.028)	(0.053)	(0.060)	(0.062)
Post#Non-EU	0.042	0.035	0.051	0.015	0.020
	(0.031)	(0.038)	(0.034)	(0.039)	(0.033)
Mean dep. var.	2909	2909	2909	2909	2909
Observations	21126	21126	21126	21126	21126
Predetermined vars.	No	Yes	Yes	Yes	Yes
Subject	No	No	Yes	Yes	Yes
Degree	No	No	No	Yes	Yes
Quarter	No	No	No	No	Yes

Note: The outcome variable is the logarithm of the gross entry-level wage. In the set of pre-determined variables controls such as gender, age and GPA of last studies are included. Graduates from subjects other than STEM and medicine fields are expected to fill position in occupations for which there is not any labor market shortage, whereas graduates in STEM and medicine would fill occupations that have a shortages in the labor market. The non-EU group dummy is absorbed by the citizenship fixed effects. For non-EU graduates in fields with shortages, the threshold is €2900, whereas for those in fields with no shortages the threshold is €3700. Standard errors are clustered at the type of degree level and reported in parenthesis. * p<0.1, ** p<0.05, ***p<0.01

Figure A10: Distribution of actual and Lasso predicted entry-level wages for non-EU graduates after the introduction of the Blue Card



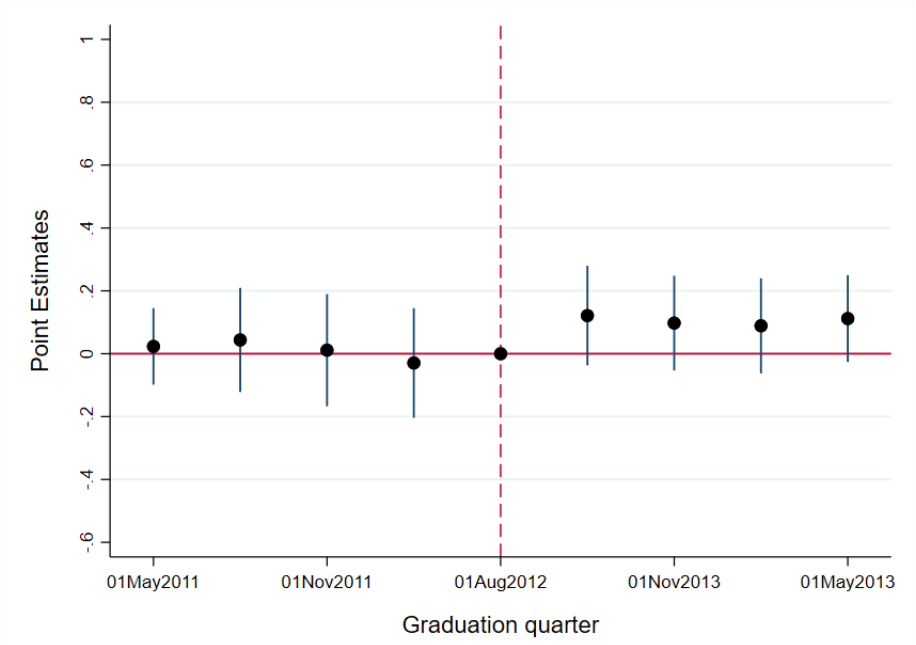
Note: These graphs show the distribution of actual and predicted entry-level wages for non-EU graduates after the introduction of the Blue Card. The prediction of entry-level wages is made using information on age, gender, GPA, study of subject, type of degree, citizenship and type of university for the control group during the whole period and treatment group only from the pre-period. The vertical dashed line corresponds to the level of the Blue Card salary threshold. For non-EU graduates in fields with shortages, the threshold is €2900 (ln(2900)=7.97), whereas for the ones in fields with no shortages the threshold is €3700 (ln(3700)=8.22).

Table A4: Difference-in-difference estimates of entry-level wage - Donut estimator

	I	II	III	IV	V	VI	VII
Post	0.072	0.081	0.068	0.037	0.036	0.028	0.021
	(0.046)	(0.049)	(0.047)	(0.054)	(0.054)	(0.061)	(0.070)
Non-EU	0.101**	0.036	0.028	0.029			
	(0.028)	(0.032)	(0.031)	(0.031)			
Post#Non-EU	0.077**	0.076*	0.073**	0.044*	0.031**	0.033**	0.030*
	(0.024)	(0.031)	(0.020)	(0.017)	(0.010)	(0.011)	(0.012)
Age		0.036**	0.037**	0.031**	0.031**	0.031**	0.030**
		(0.009)	(0.008)	(0.009)	(0.009)	(0.009)	(0.009)
Female		-0.268**	-0.164***	-0.166***	-0.166***	-0.166***	-0.166***
		(0.086)	(0.032)	(0.034)	(0.035)	(0.035)	(0.034)
GPA		-0.012**	-0.094**	-0.054**	-0.054**	-0.053**	-0.056**
		(0.054)	(0.024)	(0.012)	(0.012)	(0.013)	(0.011)
Mean dep. var.	2573	2573	2573	2573	2573	2573	2573
Subject FE	No	No	Yes	Yes	Yes	Yes	Yes
Degree FE	No	No	No	Yes	Yes	Yes	Yes
Citizenship FE	No	No	No	No	Yes	Yes	Yes
Quarter FE	No	No	No	No	No	Yes	Yes
University Type FE	No	No	No	No	No	No	Yes
Observations	35957	35957	35957	35957	35957	35957	35957

Note: The outcome variable is the logarithm of the gross entry-level wage. The Non-EU group dummy is absorbed by the citizenship fixed effects. The first two months before and after the introduction of the Blue Card are dropped from the sample to obtain the donut estimator. Additionally dropping three months before and three months after does not change the results. Standard errors, reported in parenthesis, are clustered at the subject of study and type of degree level. Standard errors and the associated p-values are adjusted for multi-way clustering following Cameron et al. (2012). * p<0.1, ** p<0.05, ***p<0.01

Figure A11: Donut event study graph



Note: This graph plots the point estimates and the corresponding 90% confidence interval of the event study model. The event study model estimates a regression of log entry wages on the relative time to the introduction of the Blue Card after controlling for the type of degree and the interaction between the subject of studies and quarter of graduation. Robust standard errors.

Table A5: Difference-in-difference estimates of entry-level wages - German control group

	I	II	III	IV	V	VI	VII
Post	0.060	0.073	0.062	0.031	0.031	0.030	0.023
	(0.043)	(0.045)	(0.042)	(0.048)	(0.048)	(0.060)	(0.070)
Non-EU	0.093**	0.028	0.020	0.022			
	(0.031)	(0.034)	(0.034)	(0.033)			
Post#Non-EU	0.078*	0.074*	0.065**	0.036**	0.022**	0.023*	0.018*
	(0.033)	(0.028)	(0.015)	(0.011)	(0.006)	(0.008)	(0.007)
Age		0.036**	0.038**	0.031**	0.031**	0.031**	0.030**
		(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.010)
Female		-0.268**	-0.162***	-0.165***	-0.164***	-0.164***	-0.164***
		(0.086)	(0.032)	(0.034)	(0.034)	(0.034)	(0.034)
GPA		-0.008**	-0.089**	-0.045**	-0.045**	-0.045**	-0.048**
		(0.051)	(0.022)	(0.013)	(0.013)	(0.013)	(0.012)
Mean dep. var.	2566	2566	2566	2566	2566	2566	2566
Subject FE	No	No	Yes	Yes	Yes	Yes	Yes
Degree FE	No	No	No	Yes	Yes	Yes	Yes
Citizenship FE	No	No	No	No	Yes	Yes	Yes
Quarter FE	No	No	No	No	No	Yes	Yes
University Type FE	No	No	No	No	No	No	Yes
Observations	40533	40533	40533	40533	40533	40533	40533

Note: The outcome variable is the logarithm of the gross entry-level wage. In the last three specifications, the non-EU group dummy is absorbed by the citizenship fixed effects. Standard errors are clustered at the subject of study and type of degree level and reported in parenthesis. Standard errors and the associated p-values are adjusted for multi-way clustering following Cameron et al. (2012). * p<0.1, ** p<0.05, ***p<0.01

Table A6: Difference-in-difference estimates of entry-level wages - EU control group

	I	II	III	IV	V	VI	VII
Post	0.081	0.061	0.067	0.035	0.015	0.047	0.041
	(0.093)	(0.089)	(0.070)	(0.085)	(0.087)	(0.113)	(0.114)
Non-EU	0.142**	0.084	0.055**	0.058**			
	(0.041)	(0.051)	(0.019)	(0.016)			
Post#Non-EU	0.057	0.086*	0.060**	0.031	0.042	0.036	0.037
	(0.034)	(0.037)	(0.017)	(0.021)	(0.022)	(0.019)	(0.019)
Age		0.016	0.022	0.017	0.019	0.019	0.018
		(0.015)	(0.012)	(0.012)	(0.013)	(0.014)	(0.014)
Female		-0.283***	-0.170***	-0.164***	-0.147**	-0.147**	-0.144**
		(0.040)	(0.019)	(0.018)	(0.040)	(0.039)	(0.039)
GPA		-0.046	-0.108	-0.070	-0.064	-0.063	-0.062
		(0.072)	(0.025)	(0.007)	(0.018)	(0.018)	(0.019)
Mean dep. var.	2704	2704	2704	2704	2704	2704	2704
Subject FE	No	No	Yes	Yes	Yes	Yes	Yes
Degree FE	No	No	No	Yes	Yes	Yes	Yes
Citizenship FE	No	No	No	No	Yes	Yes	Yes
Quarter FE	No	No	No	No	No	Yes	Yes
University Type FE	No	No	No	No	No	No	Yes
Observations	1422	1422	1422	1422	1422	1422	1422

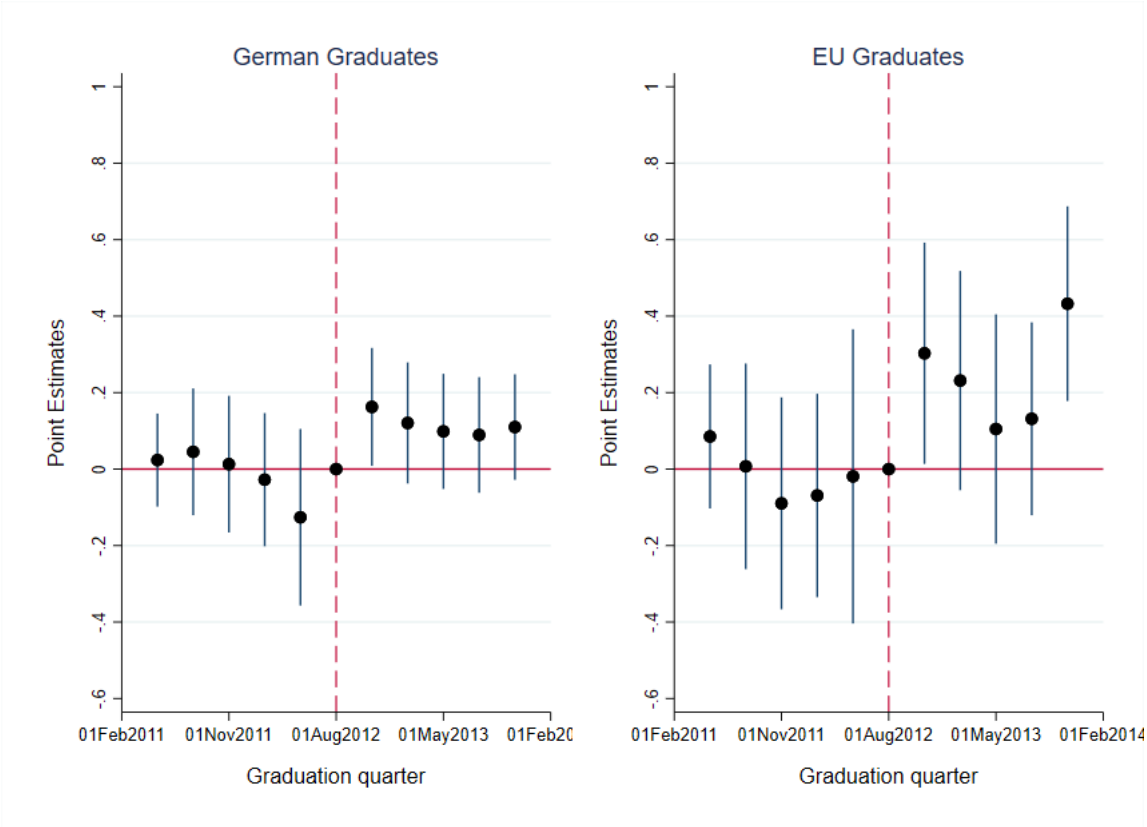
Note: The outcome variable is the logarithm of the gross entry-level wage. In the last three specifications, the non-EU group dummy is absorbed by the citizenship fixed effects. Standard errors are clustered at the subject of study and type of degree level and reported in parenthesis. Standard errors and the associated p-values are adjusted for multi-way clustering following Cameron et al. (2012). * p<0.1, ** p<0.05, ***p<0.01

Table A7: Placebo difference-in-difference estimates of entry-level wages - EU treated group and Germans control group

	I	II	III	IV	V	VI	VII
Post	0.060	0.073	0.062	0.031	0.031	0.028	0.021
	(0.043)	(0.044)	(0.043)	(0.048)	(0.048)	(0.059)	(0.070)
EU	-0.050*	-0.044	-0.023	-0.023			
	(0.023)	(0.028)	(0.038)	(0.035)			
Post#EU	0.021	-0.017	0.013	0.018	-0.001	-0.002	-0.008
	(0.068)	(0.065)	(0.055)	(0.060)	(0.055)	(0.058)	(0.056)
Age		0.037**	0.039**	0.032**	0.032**	0.031**	0.030**
		(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.010)
Female		-0.268**	-0.163***	-0.166***	-0.166***	-0.166***	-0.166***
		(0.085)	(0.032)	(0.034)	(0.034)	(0.034)	(0.033)
GPA		-0.008**	-0.089**	-0.046**	-0.046**	-0.046**	-0.049**
		(0.051)	(0.022)	(0.013)	(0.013)	(0.014)	(0.013)
Mean dep. var.	2559	2559	2559	2559	2559	2559	2559
Subject FE	No	No	Yes	Yes	Yes	Yes	Yes
Degree FE	No	No	No	Yes	Yes	Yes	Yes
Citizenship FE	No	No	No	No	Yes	Yes	Yes
Quarter FE	No	No	No	No	No	Yes	Yes
University Type FE	No	No	No	No	No	No	Yes
Observations	40085	40085	40085	40085	40085	40085	40085

Note: The outcome variable is the logarithm of the gross entry-level wage. In the last three specifications, the non-EU group dummy is absorbed by the citizenship fixed effects. Standard errors are clustered at the subject of study and type of degree level and reported in parenthesis. Standard errors and the associated p-values are adjusted for multi-way clustering following Cameron et al. (2012). * p<0.1, ** p<0.05, ***p<0.01

Figure A12: Event study graph for German and EU graduates as a control group separately



Note: This graph plots the point estimates and the corresponding 90% confidence interval of the event study model. The event study model estimates a regression of log entry wages on the relative time to the introduction of the Blue Card after controlling for the type of degree and the interaction between the subject of studies and quarter of graduation. Robust standard errors.

Table A8: Difference-in-difference estimates - Decision to stay in Germany

	I	II	III	IV	V
Non-Shortage Occup.					
Post	0.020	0.018	0.019	0.016	0.025
	(0.005)	(0.004)	(0.004)	(0.005)	(0.006)
Non-EU	-0.083	-0.098	-0.098	-0.095	-0.095
	(0.016)	(0.019)	(0.020)	(0.022)	(0.022)
Post#Non-EU	-0.021	-0.018	-0.018	-0.019	-0.020
	(0.021)	(0.023)	(0.022)	(0.024)	(0.023)
Mean dep. var.	0.95	0.95	0.95	0.95	0.95
Observations	40365	40365	40365	40365	40365
Shortage Occup.					
Post	0.007	0.005	0.005	0.005	0.006
	(0.006)	(0.004)	(0.004)	(0.005)	(0.003)
Non-EU	-0.058**	-0.065**	-0.066**	-0.066**	-0.066**
	(0.008)	(0.011)	(0.011)	(0.010)	(0.010)
Post#Non-EU	-0.053*	-0.051*	-0.052*	-0.051	-0.051*
	(0.016)	(0.017)	(0.016)	(0.018)	(0.017)
Mean dep. var.	0.96	0.96	0.96	0.96	0.96
Observations	42621	42621	42621	42621	42621
Predetermined vars.	No	Yes	Yes	Yes	Yes
Subject	No	No	Yes	Yes	Yes
Degree	No	No	No	Yes	Yes
Quarter	No	No	No	No	Yes

Note: The outcome variable is the dummy indicating whether the graduate stayed in Germany or not. Standard errors are clustered at the type of degree level and subject of study and reported in parenthesis. * p<0.1, ** p<0.05, ***p<0.01