University peers and career prospects: The impact of university ties on early labor market outcomes

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ABSTRACT

By using extensive Hungarian administrative data, this study aims to provide empirical evidence that former university ties strongly influence the labour market outcomes of individuals, even early in their careers. The estimates focus on the early career paths of graduates who obtained a master's degree between 2010 and 2017. As direct information on social contacts is not available in the dataset, we proxy university peers as students who started and finished the same university programmes (bachelor's or master's) in the same semester. Our results suggest that individuals are more likely to get hired by given firms if their former peers work there. The measured effects are considered significant and quite robust, even after controlling for the important sources of potential bias. Although we cannot present exact proof of the direct help of contacts, we provide suggestive evidence that seems to confirm the existence of such assistance. Our findings also revealed that the measured benefits are mainly attributable to connections from bachelor's studies. The effect of master's peers is mostly driven by the selection of individuals alongside prevalent study track-firm pathways. By comparing entries into new firms with and without peers, we also show that graduates with links have better labor market outcomes after hiring: they earn higher wages, obtain better and more prestigious positions, and stay longer at their new firm. The results draw attention to the importance of university peers in the labour market and contribute to the discussions about the determinants of early labour market success.

1. Introduction

In today's fiercely competitive labor market, attaining career success has become an uphill battle for newcomers. Securing stable employment, obtaining higher wages, or landing prestigious positions have evolved into daunting endeavors. On one hand, demand-side factors such as the diversification of the labor market, the increasing skill intensity of occupations, and the employers' heightened expectations for creativity and adaptability present formidable obstacles for aspiring professionals (Hensvik & Skans, 2023; James et al., 2013; Mann & Huddleston, 2017). Conversely, the expansion of higher education (HE) and the growing influx of skilled graduates contribute to intensified competition for entry-level positions, resulting in credential inflation and raising concerns among employers regarding the hiring of fresh graduates (Brynin, 2013; Tholen, 2017; Tholen et al., 2016).

Consequently, university graduates often face temporary mismatches with their education, underachievement, or frequent job changes during their early career paths (Johnson, 1978; Robert, 2014; Topel & Ward, 1992). Given these developments, gaining a comprehensive understanding of the factors that influence labor market success has become more critical than ever before. Thus, the current study aims to examine a specific factor that has the potential to significantly enhance labor market success: social connections.

Several studies have shown that social networks play an essential role in the labor market. Our acquaintances can provide us with useful information about job opportunities (Calvó-Armengol & Jackson, 2004, 2007) and they can enhance the creation of employer-employee matches through recommendations (Dustmann et al., 2016; Hensvik & Skans, 2016; Simon & Warner, 1992). As a result, the realized pairings can be of better quality than the ones resulting from formal job search methods,

and the characteristics of the acquired jobs are often more favorable (Brown et al., 2016; Loury, 2006). Such gains and, in general, the utilization of social ties might be particularly essential for university graduates. As they typically lack labor market experience to signal their skills and competence, informal intermediaries may play a crucial role in reducing the uncertainties faced by firms. Additionally, they can support career entrants who are less acquainted with the labor market by offering information about job opportunities. Professional connections established in work or higher education environments are likely to be the most valuable in this regard. Several studies have demonstrated that these types of contacts provide significant benefits in terms of employment and wages (Boza & Ilyés, 2020; Hensvik & Skans, 2014, 2016; Saygin et al., 2021). However, it remains a complex and intriguing question whether these types of ties can be effectively utilized or activated during the early stages of an individual's career, and whether they yield comparable labor market advantages as they do in later stages.

This study offers valuable insights into how university connections contribute to the early labor market success of master's graduates entering the labor market, utilizing linked administrative employer-employee data form Hungary. As direct information on university acquaintances is not available, we proxy university peers as individuals who have both started and completed their university programs (either at the bachelor's or master's level) during the same semester. Employing a state-of-the-art empirical approach, our research reveals that university peers have a positive effect on hiring prospects as well as labor market outcomes after hiring, including the level of wages, occupational status, prestige, and job stability. Furthermore, through additional analyses, we present compelling evidence supporting the causal interpretation of these observed differences as network effects.

When estimating the direct effect of former university peers on hiring outcomes, we follow a similar approach to previous studies that utilized administrative datasets to analyze employment prospects (Eliason et al., 2023; Kramarz & Skans, 2014; Saygin et al., 2021). By focusing on the unemployment periods of individuals following graduation and linking a set of employers to job seekers as potential employment options, we assess how the presence of university ties influences the probability of job seekers being hired by these companies. However, it is important to recognize that the reunion of former university acquaintances at the same firms may also stem from the systematic sorting of graduates into given firms or industries, thereby posing a significant challenge for identification. To effectively capture and disentangle potential selection effects from network-related effects, we utilize a rigorous fixed effects approach.

Our findings offer compelling evidence that former university ties serve as essential sources of job opportunities and informal help: their presence in given firms significantly improves the individuals' chances of being hired by those companies. These results remain robust even after accounting for the tendency of individuals from similar study programs to preferentially select the same firms after graduation. Our analysis further revealed that the observed benefits are primarily attributable to connections formed during bachelor's studies, whereas the effects of peers from master's programs mainly arise from individuals following the same established pathways between university master's programs and specific firms. On the one hand, these patterns may indicate a strong signaling effect of master's programs shared among former university peers, which may render additional assistance from such connections unnecessary. On one other hand, the findings may also suggest that excessive similarity in the educational and career paths of former university peers who pursued the same master's studies, particularly early in their careers, may limit their ability to provide valuable assistance and could lead to crowding-out effects. In contrast, a certain degree of dissimilarity in careers, commonly found among former bachelor's peers, may be associated with greater access to job information and improved economic prospects. To enhance the validity

of our findings, we also demonstrated that the hiring benefits are more significant when relationships are formed in higher contact intensity programs, such as full-time programs or programs with lower number of students per cohort.

In the second part of the analysis, we focus on job entries into firms and compare the employment characteristics of graduates who started with and without former university peers present. We show that individuals who start their new jobs at workplaces where their peers are employed tend to receive higher entry wages and occupy positions with greater prestige or higher status. Moreover, they have a higher chance of staying with their new employers for longer periods, suggesting that informal connections may contribute to the formation of better person-job matches. However, it is important to note that some of these advantages can be attributed mainly to the selection of linked graduates to firms that offer increased benefits to all career entrants. While the measured benefits may appear modest, they can provide crucial help for individuals entering the labor market. Given that early career paths can shape future labor market outcomes, the initially smaller advantages can result in substantial disparities in economic opportunities over time.

The paper extends upon the existing literature on graduate labor market entry and upon the research examining the influence of social ties on the labor market outcomes of career entrants. Additionally, it contributes significantly to the existing research on the role of education networks, which has predominantly focused on the importance of social ties formed at elite institutions, community colleges, or on the role of elite networks within universities. For instance, Kramarz & Thesmar (2013) showed that CEOs who graduated from prestigious colleges in France are more inclined to hire board members who share the same educational background, proxied by their joint university and civil service experiences. Likewise, Zimmerman (2019) observed similar patterns of hiring in managerial positions among graduates from the same degree cohorts at elite Chilean schools. In a related study, Michelman, Price, & Zimmerman (2022) examined the impact of the old-boys' network at Harvard University and found that membership in exclusive campus clubs led to substantial long-term socioeconomic benefits. Similarly, Marmaros & Sacerdote (2002) focused on the influence of ties from fraternity or sorority clubs at Dartmouth College and reinforced the notion that students often rely on club connections to secure job opportunities after graduating. In contrast to these studies predominantly focusing on elite settings, Zhu (2022) examined the role of connections formed in two-year community colleges using matched employer-employee data from the United States. By leveraging quasi-random variation in section enrollment within courses, the study demonstrated that having a peer employed at a particular firm increases the likelihood of students getting hired by the same firms. In a similar fashion, Fischer et al. (2021) utilized the random assignment of students to tutorial groups in a Business Economics program at Copenhagen Business School and provided further evidence that students benefit from their alumni network by gaining access to more stable and higher-paying jobs.

Our paper differs from these studies, as we examine the role of all network connections that can develop within class settings in various types of universities and colleges offering graduate programs. Consequently, our analysis goes beyond evaluating the labor market impact of elite or specific university club ties and avoids solely focusing on a single higher education institution, elite institutions, or community colleges. The findings of our study yield more generalizable results applicable to the Bologna system, which is implemented across the European Union, as opposed to previous literature focusing mainly on evidence from the United States. The study by Eliason et al. (2023) is the closest one to ours in terms of data usage and approach. The authors utilized a similar style hiring analysis to investigate the impact of various types of social ties on labor market sorting using Swedish administrative data. According to their results, ties formed during primary, secondary, and tertiary

education may influence the job finding chances of individuals who experienced job loss due to closures. However, they did not primarily focus on early career workers or thoroughly investigate the impact of educational ties on the quality of newly acquired jobs.

In addition to addressing these gaps in knowledge, our study also explores whether ties from different levels of HE yields different advantages in the labor market. This question is particularly interesting due to the distinct characteristics and composition of ties from bachelor's and master's programs, which are likely to be associated with different forms of support for job seekers. While the former group exhibits more diversity in terms of the set of firms and occupations, and potentially has more work experience by the time their acquaintances complete their master's degrees, the latter group tends to be more concentrated within specific occupation cells and has less time to accumulate status and prestige in their workplaces.

The remainder of the paper is organized as follows. In Section 2, we begin by introducing the Hungarian higher educational system, which serves as a representative example of the systems commonly used in the European Union. Section 3 provides detailed information about the data and summary statistics. In Section 4, we discuss the empirical strategy and potential identification concerns. Section 5 presents the results, and finally, Section 6 concludes the paper.

2. Institutional background

Since 2005, the Hungarian higher education system has gradually adapted to the international standards set by the Bologna Process (Pusztai & Szabó, 2008). In general, the higher education system consists of three cycles; universities in Hungary are authorized to launch bachelor's (3–4 years), master's (1–2 years), and PhD programs (2+2 years) if the necessary requirements are satisfied. Besides, some study fields still follow a more extended, undivided one-tier study structure (5-6 years).[1] Nowadays, there are more than 60 higher education institutions in Hungary (Oktatashu, 2021). Budapest is the most concentrated centre of higher education, but we can find university centres in every region (Horváth, 2010). In the last decade, higher education enrolments amounted to approximately 90000 students per year (Felvi. hu, 2021) and in general, around 300000 students study yearly in HE (KSH, 2021c). In 2011 approximately 30% of the HE degree holders were under 35 years old (KSH, 2021b), and 14% of those under 35 had tertiary education as their highest level of education (KSH, 2021a).

The labor market prospects for young graduates are fairly good: between 2004 and 2018, around 80% of the bachelor's and master's degree holders were employed, and the average wage return for them was 130-160% and 200-250%, respectively, compared to those in primary education (Varga, 2020).[2] However, the jobs obtained are not always perfectly matched to the educational background of the career entrants: vertical and horizontal education-job mismatch is considerable in Hungary. In 2016, 54% of under 30 years old, master's degree holders were overqualified for their job – the same proportion for bachelor's graduates was 42% (Varga, 2020).

3. Data and definitions

The study uses a large Hungarian employer-employee administrative panel dataset from the Databank of the Centre for Economic and Regional Studies. The dataset integrates the administrative records of the Pension Directorate, the Tax Office, the Health Insurance Fund, the Office of Education, and the Public Employment Service on an individual level in anonymized form. It comprises monthly information on (among others) employment, health expenditures, and social transfers for a randomly selected 50% sample of the Hungarian population (Sebők, 2019). In addition, detailed education information is available starting from year 2009 onwards. For each person, we have information on all the study programs started, the active and passive semesters, and the date of completion of the programs. In terms of program characteristics, the name of the university and the program, the type of training (full-time or part-time), the language of instruction and the location of the training are also available.

By using the above information, unique master's and bachelor's programs at given universities are identified based on the combinations of the university faculty, the program name, the type of training (full-time or part-time), the language of instruction and the location of training. Besides, we also identified those programs, which give similar degrees irrespective of the educational institution, based on the name and level of the study programs. In the study, we will refer to the former as *institution–program* categories, while we will call the latter as *programs*.

Our sample covers those graduate students who have finished their master's degrees between 2010 and 2017. We do not include those who have just completed their bachelor's programs as they are likely to have continued their studies instead of entering the labor market. In addition, we have excluded from the analysis individuals with any missing master's program-related information.[3] As there is often a long time gap between the fulfilment of course requirements and the graduation date (e.g. due to the lack of required language exams), we considered the month of the completion of course units as the end of higher education studies (i.e. the date of obtaining the *absolutorium / pre-degree certificate*).

3.1. Identifying university peers and the proxy of informal help

Although our dataset comprises detailed information on the employment spells of a large number of individuals, it does not contain direct information on either job finding methods or personal networks. However, it offers alternative ways to overcome these shortcomings.

The available educational data makes it possible to find those individuals who attended the same university programs at the same time. Thus, we can identify university acquaintances who are likely to know each other due to their overlapping study periods. In our analysis, we identify former university peers as those individuals who *both* started and completed the same university programs (either bachelor's or master's) in the same semester. This fairly strict definition, which demands an exact match in the students' training period, will minimize the chance of falsely classifying individuals as acquaintances. However, in return, we might underestimate the actual number of university connections, as we do not consider those contacts who shifted semesters or the ones from neighboring cohorts. If contacts positively affect individual labor market outcomes (as theory would imply), such

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[1] Namely, medical (general medicine, pharmacy, dentistry) and veterinary studies, architecture, law, teacher training, and some specific programs related to arts, crafts and design.

[2] Although the unemployment rates of graduates are quite low, essential differences can be found by the educational level of the degree and by study fields. Master's graduates with pre-degree certificates have better chances of finding their first jobs and their job search duration is typically lower compared to those who finished their bachelor's studies. Also, labor market prospects appear to be most favorable for students in IT and education (Bartus & Róbert, 2019).

[3] Out of the total 196572 higher education spells, only 11 spells pertaining to 6 unique individuals had missing education-related information (including the start date of the program, date of completion of units, faculty, name of the program, type of training, the language of instruction, location of training and the field of training). These spells, affected by missing information, were neither included in the estimation sample nor used for the identification of contacts.

measurement error will lead to the underestimation of the effect of university peers.[4] The inferred number of university ties in our study aligns with previous research that utilizes administrative datasets and similar empirical strategies to estimate the influence of specific network segments on hiring and post-hiring outcomes (Boza & Ilyés, 2020; Glitz, 2017; Saygin et al., 2021). In our sample, the average number of university peers is approximately 67, while the average number of ties from master's and bachelor's programs is 18 and 90, respectively.[5]

Using the proposed definition and utilizing the dataset's unique individual and employer identifiers, we can track the workplaces of former university acquaintances, and find those cases, when former university peers reunite at the same firms after their graduation. For the hiring estimates, the covariate of interest will be a dummy indicating for each month of unemployment of job seekers if they have any former university peers (either from their bachelor's or master's studies) at firms that could potentially offer them relevant job opportunities. We will provide a detailed description of such firms in the next section. When focusing on post-hiring individual outcomes, the indicator of peers denotes those instances when the job seekers started their new job at a firm where any of their former university ties were already working. In both cases, we require contacts to work for at least six months at their firms beforehand to be considered potential sources of help.[6]

To ensure that the proxy variables reliably measure the effect of university peers, we had to exclude graduate students of specific programs within the fields of teaching, health, art, and religious activities. Such programs typically facilitate a clear transition to jobs in the public sector, where individuals (at the administrative level) are usually employed by umbrella institutions encompassing, for instance, all the educational or religious institutions. In such cases, the reunion of graduates at the same employers would not necessarily reflect the actual contribution of social ties but would occur due to technical (administrative) reasons. Therefore, we excluded such graduates.

3.2. Estimation datasets

Separate estimation datasets are used to analyze hiring chances and post-hiring labor market outcomes. In both cases, we focus on the labor market histories of individuals (either their job search periods or employment spells) starting six months after the completion of their studies. Since many graduates enter the labor market simultaneously, the chance that two former peers get hired by the same company (just a few months apart) would be inherently higher than usual. By omitting this initial period, we can avoid introducing further bias, which may otherwise result in overestimating the impact of peers.

In our hiring estimations, we will focus on unemployment periods of individuals between 2011 and 2017, which were either followed by a job entry or not. Such periods cover months when individuals were already in the labor market (i.e. had finished their studies min. six months ago) but did not have a job. For each month of unemployment, we linked the individuals to a uniquely specified set of firms that could

provide them with employment opportunities. Thus, the observations of the hiring dataset will be individual-job search month-potential firm triads.[7] The pool of potential hiring firms is defined as the set of those workplaces that ever employed any students[8], who have completed the same *programs* as the job seekers prior to entering the labor market. Only those firms form part of the firm pool that existed in a given month and where the individuals have not previously worked before.[9] The average number of firm alternatives is 582 in the observation period.[10] Job search periods followed by re-entries to the individual's previous firms are excluded from the analysis to rule out the effects of firm-specific knowledge.

The analysis of the individuals' labor market outcomes after hiring (e.g. wages, prestige, tenure) focuses solely on job entries to new firms and is based on the first month of those employment spells that started between 2011 and 2017. Spells of military service, re-entries to former firms, cases of atypical forms of employment (such as self-employment, temporary and seasonal work) were excluded from the analysis. Also, we have removed spells where monthly wages were missing or (most likely) reflected administrative errors. Regarding the tenure estimates, we have applied a further restriction: to ensure a 2-years long follow-up period, we have chosen to focus only on those employment spells that began between 2011 and 2015.

The two estimation datasets are similar in their composition (see Table 1). Regarding the post-hiring estimation sample, we can observe differences between those who started their jobs with or without former university acquaintances. Linked individuals are, on average, younger, and the share of women is lower among them. At the same time, graduates from the study field of engineering and natural sciences are somewhat overrepresented in this group. The raw advantage of linked individuals can also be observed in log hourly wages and tenure.

4. Estimation strategy

4.1. Job-finding chances

To assess the direct impact of university connections on finding a job, we will examine whether the probability of establishing a given employer-employee match is higher when the individuals' former

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[4] If we underestimate the actual number of social contacts, we will consider a proportion of those with contacts as nonlinked individuals. In such a case, if we assume that connected individuals have better outcomes, then the average outcomes of individuals without links will eventually be better, and thus the difference between the connected and unconnected groups will be smaller. However, if we would have used a more inclusive peer definition, we would overestimate the number of peers. Then some nonlinked individuals with worse average outcomes would be considered as linked, and therefore the difference between the two groups will, again, be smaller.

[5] For more information see Online Appendix Table O1.

[6] In Table O2 in the Online Appendix, however, we present the results of our main estimations with the tenure requirements of min. 1 and min. 12 month as well.

[7] Online Appendix Table O3 provides an example for the format of the estimation dataset.

[8] Only persons employed in standard forms of employment were taken into account.

[9] Finding the optimal number of firms is a crucial empirical question since individual observations in our estimation sample are weighted by the number of firm alternatives. Consequently, it can affect both the baseline hiring probabilities in the sample and the effect of our control variables. By utilizing observed mobility in the data to infer information on relevant firms we ensure that we offer graduates relevant alternatives. However, there are some caveats to using this approach. On one hand, it is possible that a few suitable firms may be missing from the identified option pools due to graduates either being unable to secure positions there or our inability to observe graduates hired by these firms, given that our data represents only a 50% sample of the population. A potentially more significant concern could be the inclusion of an excessive number of alternatives, but since we are focusing on the relative effects of peers compared to the baseline probability in the sample, this may not cause a major issue.

[10] The detailed description of these companies can be found in Online Appendix Table O4. Compared to studies with similar empirical strategies, such as Eliason et al. (2023), Saygin et al. (2021), the used firm pool is slightly wider. However, as we will discuss in the estimation strategy section, the set of firm alternatives contributing to the identification of effects will be much lower and eventually of a similar magnitude to the indicated studies due to the employed fixed effects (see Table O7 in the Online Appendix).

Table 1
Characteristics of the estimation sub-samples.

	Hiring	Post-hiring outcomes		
		All	With peer	Without peer
Individual characteristics				
Gender				
Female	59.5%	59.6%	55.4%*	59.9%*
Male	40.5%	40.4%	44.6%*	40.1%*
Av. age	28.2	28.1	27.6*	28.2*
Field of study				
Agriculture	6.5%	6.3%	2.7%*	6.5%*
Humanities	21.9%	21.3%	20.8%	21.3%
Social Sciences	13.0%	13.0%	9.0%*	13.3%*
Informatics	2.3%	2.4%	3.4%	2.3%
Law	0.8%	0.8%	1.7%*	0.7%*
Public administration	3.5%	3.4%	8.6%*	3.1%*
Economics	26.8%	27.4%	19.8%*	27.9%*
Engineering	13.8%	14.1%	20.7%*	13.7%*
Sports science	1.3%	1.3%	0.7%	1.3%
Natural sciences	10.2%	10.0%	12.5%*	9.8%*
Have work experience	77.4%	77.9%	73.9%*	78.2%*
Characteristics of the new job				
Log hourly (entry) wage	7.0	7.05	7.3*	7.0*
Av. tenure	14.9	15.1	19.7*	14.8*
Occupation				
Manager	3.4%	3.9%	3.1%	3.9%
White-collar worker	93.3%	93.3%	96.3%*	93.1%*
Blue-collar worker	3.4%	2.8%	0.7%*	2.9%*
Number of individuals	8 284	7 988	584	7 551
Number of job search periods	10 513	–	–	–
Av. no. of firm alternatives	582.0	–	–	–
Number of job entries	10 130	9 983	590	9 393
Av. no. of job search months	8.1	8.0	9.6*	7.9*
Found job at a peer's firm (%)	5.8%	5.9%	–	–

Note: The hiring sample covers job entries between 2011 and 2017, preceded by at least a 1-month long unemployment period. The post-hiring sample comprises job entries between 2011 and 2017 when the employment form was not atypical. The statistics related to the new jobs are calculated based on the first month of the employment spells. Regarding the post-hiring sample, we measured differences between the job entries of individuals, with and without peers, by two-sided t-tests. *Statistically significant at 0.05 level.

university peers are employed at the same company. Doing so, the following linear probability model[11] is estimated:

$$Hiring_{i(du)jt} = \alpha + \beta_1 X_{it} + \beta_2 Z_{jt} + \gamma Peer_{ijt} + \mu_{du} + \delta_{dj} + \pi_t + \varepsilon_{ijt} \qquad (1)$$

where $Hiring_{i(du)jt}$ is an indicator variable showing if individual i who graduated with a master's degree d from university u was hired by firm j one month after the job search month t. We control for a set of individual characteristics (X_{it}) that may potentially affect hiring chances, including gender, age, region of residence, the number of bachelor's and master's programs completed, and work experience. Additionally, we incorporate fixed effects for the individuals' master's degrees (μ_{du}), control for the sector of the target firms (Z_{jt}) and include year dummies (π_t) to eliminate trend effects. Finally, to capture the effect of social ties on hiring, we have included an indicator variable in our model that proxies the presence of informal help. $Peer_{ijt}$, our covariate of interest, will

indicate if at least one university peer of i (either from master's or bachelor's) has been working at a given firm option j for a minimum of six months at job search month t.

If we observe that the presence of contacts is associated with increased hiring chances at specific firms, it may provide indications for the presence of informal help – information transmission and referral. However, since the reunion of former university peers at certain firms may result from the systematic sorting of graduates into specific firms or industries, and driven by other alternative explanations, there is a possibility of overestimating the effect of peers. To account for the most severe sorting issues, particularly the tendency for individuals with similar unobserved characteristics to pursue similar educational and career paths and work at the same types of firms, we propose a fixed-effect approach. Specifically, we account for education track-firm pairs to capture the underlying probability of movement along given paths. By introducing various types of fixed effects into our model that capture these pathways with increasing precision, we progressively impose stricter criteria for identifying the effect of former university peers, aiming to get as close as possible to measuring causal effects.

In our first specification, we incorporate joint *program–firm* fixed effects (δ_{dj}), which allows us to compare only those individuals who have graduated from similar master's *programs*[12] and either have or lack connections at specific firms. Those firms, where no one or everyone has acquaintances, do not contribute to the identification of the former university peers' effect. γ in this specification captures whether the

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[11] It can be argued that the use of other statistical methods may be more appropriate to address this research question, such as fixed-effect logistic regressions or event history analysis. On the one hand, we chose to utilize fixed-effect linear probability models to ensure comparability with the wider literature (Eliason et al., 2023; Kramarz & Skans, 2014; Saygin et al., 2021) that rely on administrative data and address similar questions. However, to alleviate potential doubts regarding the used functional form, we reestimated our main models using fixed-effects logistic regressions, which yielded similar results. Additionally, we conducted Hausman-tests to ascertain that the use of fixed effects models is better suited for the data than random effect models. On the other hand, we opted for the current approach because it allows us to address several identification concerns that would not have been feasible with event history analysis.

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[12] E.g. individuals with a master's degree of the same name obtained from any universities, such as MA in Sociology.

probability of getting into a given firm is different for those with links than for others with similar qualifications without connections. While this specification can address a substantial portion of the selection issues, it cannot account for the possibility that given pathways between specific university programs and firms are inherently more probable due to some alternative explanations. Factors such as employer preferences for given university graduates, graduate preferences for particular firms, and agreements between companies and university program directorates can also induce systematic sorting patterns. Regional disparities in the size and diversity of local labor markets, along with the geographical proximity of individuals and universities to firms, may also contribute to a higher concentration of individuals with similar qualifications in particular companies.

To partially account for these mechanisms, specifically those related to geography, we will introduce two additional specifications in which we replace our previously employed *program–firm* fixed effects (δ_{dj}) with more restrictive alternatives. In the first specification, we include *program–university county–firm* fixed effects ($\delta_{dc(u)j}$, where $c(u)$ refers to the county of the university). While in the second one, we control for frequent pathways of individuals who finished the same type of programs and reside at the same counties during a given job search month ($\delta_{dc(i)j}$, where $c(i)$ refers to the county of the individuals' residence). Such specifications can take into consideration that individuals with similar qualification are more likely to find employment closer to their residence or their former universities.

The use of joint *institution–program–firm* fixed effects (δ_{duj}) could represent another, perhaps the best available option to account for all the mentioned confounders at once. In such a setting, we compare the hiring probabilities of individuals with or without peers at given firms who obtained the same master's degrees at the same universities before entering the labor market. This approach, however, inherently comes with some weaknesses. On the one hand, we are likely to underestimate the actual effect of peers as relationships may exist between subsequent cohorts in this specification. On the other hand, due to the applied fixed effects, the contribution of contacts from the most recently completed master's programs will only measure differences between cohorts since the set of connections (and thus the set of employed acquaintances) does not vary within year groups.[13] Other types of contacts, notably acquaintances from bachelor's or previous master's programs (if one has completed more than one), are less affected by this issue. As the individuals' bachelor's programs preceding their master's might vary, the number and distribution of ties gathered from bachelor's programs could be quite different among master's peers from the same university and same cohort.

While our strictest specification has the potential to eliminate most alternative explanations, it still cannot provide direct evidence on the help of social ties (i.e. prove the presence of actual information transmission or referral). To alleviate any remaining doubts regarding the right interpretation of effects, we present a set of heterogeneity and robustness checks to offer some additional supportive evidence.

After examining the overall effect of former university peers on hiring outcomes, we introduce an additional specification (Eq. (2)) to shed light on the heterogeneity of effects by the type ("origin") of relationships. We use separate indicators for marking the presence of bachelor's and master's ties (MA_{ijt} and BA_{ijt}, respectively). In the results section, we will present coefficients from models with all the previously

introduced fixed effects, where δ_{dj} is substituted with $\delta_{dc(u)j}$, $\delta_{dc(i)j}$ or δ_{duj}, respectively.

$$Hiring_{ijt} = \alpha + \beta_1 X_{it} + \beta_2 Z_{jt} + \beta_3 MA_{ijt} + \beta_4 BA_{ijt} + \mu_{du} + \boldsymbol{\delta_{dj}} + \pi_t + \varepsilon_{ijt} \quad (2)$$

4.2. Post-hire outcomes

To assess the impact of contacts on labor market outcomes after hiring, we compare the job entries of those individuals who started in firms with at least one former university contact and those who started without any. In doing so, the following general model is estimated:

$$Y_{ijt} = \alpha + \beta_1 X_{it} + \beta_2 Z_{jt} + \beta_3 V_{ijt} + \gamma Peer_{ijt} + \lambda_j + \pi_t + \varepsilon_{ijt} \quad (3)$$

where the dependent variable (Y_{ijt}) can take multiple measures. When estimating the effect of former university peers on entry wages $Y_{ijt} = \ln(w_{ijt})$, which denotes the log hourly wage of job seeker i at firm j at the first month of the employment spell (t). To test the effect of contacts on job quality, we use three different measures: $ISCO_{ijt}$ indicates the 1-digit occupation category of the individual's new job, $SIOPS_{ijt}$ captures the prestige score of the acquired job based on the Treiman prestige scale (Treiman, 1977) and $ISEI_{ijt}$ measures the status of the new job according to the ISEI index (Ganzeboom et al., 1992).[14] The latter measures can take up values between 0 and 100, where the higher values represent increased prestige and status, respectively. When estimating the university peers' effect on tenure $Y_{ijt} = \log\left(\frac{p_{ijk}}{1-p_{ijk}}\right)$, where p_{ijk} reflects the probability that individual i will spend at least k month(s) at firm j.

We model the introduced outcomes as linear functions of observable individual characteristics (X_{it}), firm-specific features (Z_{jt}), observable characteristics of the employer-employee pairings (V_{ijt}) such as occupation, firm fixed effects (λ_j) and trend effects (π_t). The indicator of university peers ($Peer_{ijt}$), marks if individual i had any university contacts at firm j at time t, who started working there at least 6 months prior to time t.

5. Results

5.1. The effect of former university peers on hiring

We start by estimating the model described in Eq. (1) on a specific dataset comprising individual-job search month-target firm triads as observations. In addition to controlling for observable characteristics, our model accounts for *program–firm* fixed effects. According to the results, the individuals' chance of getting into given firms is significantly higher if they have any former university acquaintance there – even if we limit the comparisons to only those with similar type of master's degrees. The parameter of interest (presented in the first column of Table 2) is 0.0007, which can be considered a meaningful increase compared to the baseline job-finding probability in the sample (0.0002).[15]

However, since this specification cannot account for frequent labor flows between specific university programs and firms, and potentially capture the influence of other mechanisms, the obtained effects are likely to be only upper estimates of the impact of former university peers. The measured effects may still reflect the presence of agreements

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[13] Therefore, in these cases, we will essentially measure whether particular employer-employee matches are more likely to realize if individuals have connections there, compared to matches where only peers from different cohorts are employed. Consequently, the specification will allow us to exclude the effect of signaling at least for MA ties. Namely, that employers rely on the reputation associated with certain university degrees when making hiring decisions, leading to former peers reuniting at the same companies – even without the actual contribution of former peers.

[14] The SIOPS index is a common prestige metric, constructed by averaging and rescaling national prestige scores from local prestige surveys of 60 countries that rank occupation titles. The ISEI index ranks occupations by the average level of education and average earnings of job holders based on comparably coded data from 16 countries. The Hungarian 4-digit occupation categories (FEOR-08) were converted into ISCO-08, then the ISEI and SIPOS measures were merged by using the conversion toolkit of Ganzeboom & Treiman, 2001.

[15] The baseline hiring probability is estimated as the mean of predicted hiring probabilities to given firms assuming the lack of any contacts at the given firms.

Table 2
Effect of former university peers on hiring.

	(1) Program–Firm FE	(2) Program–University County–Firm FE	(3) Program–Individual County–Firm FE	(4) Institution–Program–Firm FE
Former university peers	0.000670***	0.000332***	0.000538***	0.000178*
	(0.000076)	(0.000075)	(0.000080)	(0.000081)
Constant	0.000155**	0.000135*	0.000014	0.000126*
	(0.000055)	(0.000057)	(0.000076)	(0.000060)
Institution–Program FE	Yes	Yes	Yes	No
Additional FE	δ_{dj}	$\delta_{dc(u)j}$	$\delta_{dc(i)j}$	δ_{duj}
R^2	0.00437	0.0100	0.0354	0.0163
Baseline hiring probability	0.000213	0.000216	0.000212	0.000217
Observations	46 263 778	46 262 304	46 229 210	46 256 215
Program	195	195	195	195
Institution–Program	767	760	762	748
Program–Firm	38 884	38 876	38 876	38 875
Program–Uni. County–Firm	172 174	170 700	171 773	170 660
Program–Ind. County–Firm	614 710	614 350	594 226	613 857
Institution–Program–Firm	362 182	360 708	361 143	354 619
Individuals	8 282	8 275	8186	8 263

Note: The models are estimated according to Eq. (1). The indicator of peers denotes whether a job seeker had at least one former university peer (from any study levels) with a minimum six-month-long employment spell at a given target firm at a given job search month. Additional controls include gender, categorized no. of spells before (0, 1, 2, 3 or more), year dummies, the industry of the potential firms, the no. of bachelor's and master's programs finished and age. Except for the latter two, all covariates are dummies. Specifications (1-2) also include region dummies. Standard errors are in parentheses and clustered at individual and institution–program levels. *Statistically significant at 0.05 level; **at 0.01 level; ***at 0.001 level.

between given firms and programs and firm preferences for the graduates of specific university master's (due to their matching skills and knowledge). Besides, geographical determinants might also contribute to the repeated hiring of given graduates and, thus, the reunion of former university peers.

We introduced two slightly modified versions of the previous model (columns (2) and (3)), which can partially account for the mechanisms discussed above. In the second specification, we included *program–institution county–firm* fixed effects ($\delta_{dc(u)j}$), while in the third specification, we let *program–firm* paths to vary by the counties of the individuals' residence ($\delta_{dc(i)j}$). Thus, when identifying the effect of former university peers, in the former case, we compare the chances of graduates getting into given firms who finished similar *programs* in the same counties, either with or without any contacts there.[16] Similarly, in the latter model, we narrow down the comparisons to individuals who finished the same programs and resided in the same counties during their job search.

Regardless of the chosen specification, the magnitude of the coefficients decreases in both cases, confirming that geographical factors play a prominent role in explaining the selection of individuals to given firms. However, the inclusion of the university's county appeared to exert a stronger influence on the employment decisions of individuals, possibly due to the tendency of graduates to relocate closer to their universities without updating their primary address during their study period. To account for the influence of geographical proximity to firms in a more precise manner, we have created two alternative supplementary specifications. One, in which we account for the distance between the municipalities of individuals and firms.[17] As well as another,

where we narrowed down the set of potential target firms to those within commuting distance (see Online Appendix Table O5-O6). These specifications yielded similar results to those presented in the main tables. Even after controlling for distance and limiting the target firm pool, we still observe significant hiring advantages associated with the presence of former university peers.

Finally, in our last specification, by using *institution–program–firm* fixed effects (δ_{duj}), we aim to account for all the aforementioned confounding factors at once. After controlling for such pathways, the effect of peers, although being substantially reduced, remains significant.[18] On the one hand, this indicates that there are indeed pre-established, prevalent pathways between specific university master's programs and firms, which can be considered significant drivers of the observed effects. On the other hand, the finding that a considerable part of the measured effect cannot be attributed to such selection patterns provides suggestive evidence for the beneficial role of peers on hiring. However, we cannot completely rule out the possibility of a higher rate of chance encounters at specific firms. Additionally, the presented specifications do not offer direct evidence for the actual contribution of former university peers (for example, whether they pass on information about job opportunities or make recommendations to help their acquaintances find jobs). In the upcoming part of the analysis, in addition to examining the heterogeneity of results by the origin of relationships, we present some additional robustness tests that may provide further evidence for the interpretation of the observed effects as network effects.

5.2. Heterogeneity and robustness

Next, we proceed by investigating if there are differences in the

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[16] Although it seems a tough restriction, we found examples of two identical types of *programs* operating in the same counties in all regions of Hungary. In general, 93 programs and 497 *institution–program* combinations are utilized for identifying the effects.

[17] Unfortunately, the dataset lacks direct information regarding the exact location of firms. However, we can approximate their location by finding the municipality where the majority of their employees work. By applying this strategy and using the haversine formula, we have calculated the distance between the centroids of the municipalities associated with the location of individuals and the available firm options.

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[18] When estimating the impact of peers with different kind of fixed effects, concerns may arise regarding the similarity of the identification sub-samples contributing to the parameter of interest. In Online Appendix Table O7 we show that these samples are quite similar in composition. In Online Appendix Table O8 and O9 we also present the estimated effects on the identification samples of the different fixed effects. As narrower samples are used, the size of the parameter is reduced to some extent, but remains significant and of similar magnitude.

Table 3
Heterogeneity of effects by the level of programs from which relationships originate.

	(1) Program–Firm FE	(2) Program–University County–Firm FE	(3) Program–Individual County–Firm FE	(4) Institution–Program–Firm FE
Bachelor's tie	0.000857***	0.000518***	0.000693***	0.000446***
	(0.000103)	(0.000102)	(0.000107)	(0.000106)
Master's tie	0.000489***	0.000185*	0.000439***	-0.000037
	(0.000091)	(0.000089)	(0.000100)	(0.000098)
Constant	0.000158**	0.000137*	0.000016	0.000128*
	(0.000055)	(0.000057)	(0.000076)	(0.000060)
Institution–Program FE	Yes	Yes	Yes	No
Additional FE	δ_{dj}	$\delta_{dc(u)j}$	$\delta_{dc(i)j}$	δ_{duj}
R^2	0.00438	0.0100	0.0354	0.0163
Baseline hiring probability	0.000213	0.000215	0.000211	0.000216
Observations	46 263 778	46 262 304	46 229 210	46 256 215
Program	195	195	195	195
Institution–Program	767	760	762	748
Program–Firm	38 884	38 876	38 867	38 875
Program–Uni. County–Firm	172 174	170 700	171 773	170 660
Program–Ind. County–Firm	614 710	614 350	594 226	613 857
Institution–Program–Firm	362 182	360 708	361 143	354 619
Individuals	8 284	8 275	8 186	8 263

Note: The models are estimated according to Eq. (2). Separate indicators are introduced for the presence of bachelor's and master's ties with at least six months of employment, in each job search month for each target company. For other controls, see Table 2. Standard errors are in parentheses and clustered at individual and institution–program levels. *Statistically significant at 0.05 level; **at 0.01 level; ***at 0.001 level.

obtained hiring benefits depending on whether social ties were formed at the bachelor's or the master's levels. Drawing on theories related to network diversity (Burt, 1992, 2004; Granovetter, 1973, 1983) and to the role of the status and influence of social ties (Lin, 1999, 2001), it seems reasonable to expect differences in both the magnitude of effects and the primary channels of help for these two groups. Ties from bachelor's programs are more likely to encompass a diverse range of individuals with heterogeneous occupations and career paths, making them more effective in transmitting non-redundant information on job opportunities. On the other hand, ties from master's programs tend to be more homogeneous in terms of career orientation and excel in providing insider information and career support, primary through recommendation. Thus, we can anticipate beneficial effects from both types of connections, albeit through different channels. However, the labor market position of the ties can influence these effects. While many bachelor's ties may have achieved better integration and reputation over time when their former peers completed their master's degrees, contacts from master's may lack bargaining power as they enter the labor market at roughly the same time. This may reduce the potential benefits that master's peers can offer. To provide empirical insights into the topic, we introduced an additional specification (outlined in Eq. (2)), where we control for the presence of bachelor's and master's ties separately.

According to the first specification of Table 3, which includes *program–firm* fixed effects, connections from both study levels have a significant impact on hiring probabilities. However, the effect size of bachelor's ties is nearly twice as large as that of master's ties. As we progressively impose more rigorous criteria to identifying these effects (columns (2) through (4)), the influence of both types of contacts decreases in magnitude. However, while the effect of contacts from bachelor's programs remains significant even in the final and most demanding specification, the effect of master's ties becomes zero.

The finding that bachelor's ties are the main drivers of the previously observed effects is consistent with our expectations that the diverse nature of bachelor's ties may associate with a higher volume of (better quality) information on vacancies across a broader range of firms. This interpretation is further reinforced by our supplementary analysis. In those cases where job seekers successfully secured employment at firms where they had connections, we investigated the similarity between the positions of the acquaintances using the average occupational-

relatedness measure proposed by Hidalgo et al. (2007). These calculations revealed an essential disparity between the positions of the individuals and their bachelor's ties, underscoring the more diverse nature of this particular segment of contacts.[19]

Conversely, the lack of effects by master's ties may suggest that due to their limited bargaining power, they may be less valuable or capable of providing help. However, another possible explanation could be that master's degrees themselves may act as stronger indicators of an individual's skills and qualities, thereby making additional assistance from peers less necessary.

To support the interpretation of the results as network effects, we conduct two additional robustness checks. Both tests involve examining the heterogeneity of the results by program characteristics, which can influence the intensity of contact and the likelihood of forming relationships. Hence, the magnitude of the observed hiring benefits by contacts. We slightly modified the previously used contact variables and introduced separate indicators for ties originating from programs of different training types (full-time and part-time studies) or different sizes (e.g., small and large). If former university peers directly contribute to individuals' hiring prospects, we would anticipate more pronounced effects for contacts from programs characterized by higher contact intensity.

In Table 4, we report the effect of those contacts from small and large bachelor's and master's programs separately (under and over 50 or 25 students, respectively). Consistent with our expectations, the findings reveal more significant effects for peers from smaller programs. Our other robustness check also yielded positive results, indicating that the measured effects are more than three times larger for individuals who were studying full-time and had more frequent interactions with their former peers (see Table 5).

5.3. Wage outcomes and job quality

In the second part of the analysis, we take a step forward and test whether those individuals who were hired by the firms of their former

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[19] The average relatedness score for bachelor's ties is 0.70, whereas it is 0.77 for master's ties.

Table 4

Heterogeneity of effects by program size.

	(1) Program–Firm FE	(2) Program–University County–Firm FE	(3) Program–Individual County–Firm FE	(4) Institution–Program–Firm FE
Bachelor's tie (size<=50)	0.001860***	0.001261***	0.001472***	0.001203***
	(0.000319)	(0.000313)	(0.000330)	(0.000332)
Bachelor's tie (size>50)	0.000646***	0.000366**	0.000528***	0.000296*
	(0.000104)	(0.000111)	(0.000113)	(0.000115)
Master's tie (size<=25)	0.000769***	0.000288	0.000679***	-0.000055
	(0.000142)	(0.000148)	(0.000159)	(0.000162)
Master's tie (size>25)	0.000230*	0.000088	0.000226*	-0.000020
	(0.000090)	(0.000093)	(0.000109)	(0.000103)
Constant	0.000155**	0.000136*	0.000014	0.000129*
	(0.000054)	(0.000056)	(0.000076)	(0.000060)
Institution–Program FE	Yes	Yes	Yes	No
Additional FE	δ_{dj}	$\delta_{dc(u)j}$	$\delta_{dc(i)j}$	δ_{duj}
R^2	0.00438	0.0100	0.0354	0.0163
Baseline hiring probability	0.000213	0.000215	0.000211	0.000216
Observations	46 263 778	46 262 304	46 229 210	46 256 215
Program	195	195	195	195
Institution–Program	767	760	762	748
Program–Firm	38 884	38 876	38 867	38 875
Program–Uni. County–Firm	172 174	170 700	171 773	170 660
Program–Ind. County–Firm	614 710	614 350	594 226	613 857
Institution–Program–Firm	362 182	360 708	361 143	354 619
Individuals	8 282	8 275	8 186	8 263

Note: The models are estimated according to the slightly modified version of Eq. (2). We introduce separate indicators for those bachelor's and master's ties that originated from either small or large programs (the threshold is 50 students for bachelor's degrees and 25 for master's). For additional controls, see Table 2. Standard errors are in parentheses and clustered at individual and institution–program levels. *Statistically significant at 0.05 level; **at 0.01 level; ***at 0.001 level.

Table 5

Heterogeneity of effects by the form of study.

	(1) Program–Firm FE	(2) Program–University County–Firm FE	(3) Program–Individual County–Firm FE	(4) Institution–Program–Firm FE
Full-time study	0.000857***	0.000447***	0.000694***	0.000275**
	(0.000096)	(0.000096)	(0.000098)	(0.000100)
Part-time study	0.000251**	0.000061	0.000181	-0.000076
	(0.000090)	(0.000088)	(0.000096)	(0.000100)
Constant	0.000157**	0.000136*	0.000015	0.000127*
	(0.000055)	(0.000056)	(0.000076)	(0.000060)
Institution–Program FE	Yes	Yes	Yes	No
Additional FE	δ_{dj}	$\delta_{dc(u)j}$	$\delta_{dc(i)j}$	δ_{duj}
R^2	0.00438	0.0100	0.0354	0.0163
Baseline hiring probability	0.000219	0.000216	0.000212	0.000217
Observations	46 263 778	46 262 304	46 229 210	46 256 215
Program	195	195	195	195
Institution–Program	767	760	762	748
Program–Firm	38 884	38 876	38 867	38 875
Program–Uni. County–Firm	172 174	170 700	171 773	170 660
Program–Ind. County–Firm	614 710	614 350	594 226	613 857
Institution–Program–Firm	362 182	360 708	361 143	354 619
Individuals	8 282	8 275	8 186	8 263

Note: The models are estimated according to the slightly modified version of Eq. (1). The indicator of peers is interacted with the form of study (full-time or part-time); for additional controls, see Table 2. Standard errors are in parentheses and clustered at individual and institution–program levels. *Statistically significant at 0.05 level; **at 0.01 level; ***at 0.001 level.

university peers acquired higher wages and better-quality jobs compared to other graduates.[20] We estimate the general model described by Eq. (3) on a subsample comprising the first month of the graduates' employment spells. The indicator of peers marks those instances when the job seekers were hired by firms where their former university ties had already been working for six months.

We start by estimating an OLS regression to examine the effect of university peers on monetary outcomes, with the dependent variable being the logarithm of individuals' hourly wages in the first month of their employment spells (see Table 6). Based on the first specification without any fixed effects, there is a notable and significant wage advantage of 16% for individuals who started their jobs at firms where their peers were employed. However, this gain might capture some

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[20] The raw differences in job quality and wages suggest the benefits of individuals with links: their wages are slightly higher, while their tenure is longer (see Table 1). Compared to those without links, a higher share of these individuals starts in white-collar positions, while a lower number of them as managers.

Table 6

The effect of former university peers on entry wages.

	(1) No FE	(2) Program FE	(3) Institution–Program FE	(4) Firm FE
Former university peer	0.1639***	0.1151***	0.1199***	0.0140
	(0.0203)	(0.0219)	(0.0210)	(0.0194)
Constant	6.3790***	6.5393***	6.5169***	6.9941***
	(0.1319)	(0.1270)	(0.1245)	(0.1670)
Job entries	9 968	9 862	9 949	6 190
Job entries with peers	590	590	589	562
No. of firms	4 905	4 895	4 855	1 127
R^2	0.283	0.342	0.288	0.656

Note: The models are estimated according to Eq. (3). The dependent variable is the hourly log wage of the individual in the month of their job entry. The indicator of peers denotes whether the job seekers had any former university peers at their new firms with a minimum six-month tenure. Additional controls include gender, region of residence, the field of study of the latest master's program, the industry of the new firm and the 2-digit occupation category of the new job, year dummies, quadratic age and work experience. Except for the latter two, all covariates are dummies. In the specifications (2-3), we have applied program and institution–program fixed effects, while in the specification (4), we used firm fixed effects. Standard errors are in parentheses and clustered at individual and institution–program levels. *Statistically significant at 0.05 level; **at 0.01 level; ***at 0.001 level.

unintended bias if students with a given type of training systematically earn more in the market, while also having a higher chance of getting into the same firms. Such discrepancies might occur both on the level of *programs* and at the level of specific universities' master's programs.

To account for these issues, we introduce two model specifications that incorporate either *program* or *institution–program* fixed effects. In these specifications, the effect of former university peers will capture the average wage difference between graduates who started their jobs with or without peers and completed either similar types of programs or the exact same university programs. As column (2) and (3) suggest, the parameter of interest is decreasing as we restrict the comparisons to individuals who are more alike in terms of their education. When applying *institution–program* fixed effects, the wage gain reduces to 12%, which is still quite considerable.

Such wage gain, however, might result from various mechanisms. Apart from referrals, former university ties could influence the sorting of their high-productivity peers into specific firms or facilitate the selection of their acquaintances to companies offering higher premiums, by providing valuable information about job opportunities. To shed some light on the underlying mechanisms, we re-estimated our model with firm fixed effects, which can capture the unobserved, time-invariant characteristics of the receiving firms, such as their average level of wage premium. Doing so, we compare job entries to the same firms with and without peers. Only the firms that hired at least two individuals during the observation period will contribute to the identification of effects. After including fixed effects, the formerly positive, non-negligible effect essentially disappears. This implies that the measured wage gains are only by-products of a selection mechanism: university contacts seem to promote the hiring of individuals to firms where fresh graduates (and probably all workers) typically earn more. Furthermore, these firms are even better within their respective industries, as positive wage effects were observed in all specifications even after accounting for sector dummies.

The estimated wage gain, irrespective of the mechanism in play, could be an essential help for those who are early in their careers, and it may also create additional advantages in the long run. The same holds for the quality of the newly acquired positions: better entry positions might jumpstart the graduates' careers and lead to more successful career tracks. To investigate the role of former university peers on job-related outcomes, we have introduced three measures as dependent variables, which aim to capture different aspects of job quality. We measure the position of individuals on the occupational ladder with 1-digit occupation codes (which can take up values between 1-9), while we capture the prestige and status of the acquired jobs by the SIOPS (Treiman, 1977) and the ISEI (Ganzeboom et al., 1992) scores, both taking values between 0 and 100. We estimated two specifications for each outcome variable, with and without firm fixed effects, and have

presented the results in Table 7.

The presence of peers has a noticeable impact on all the measures of job quality presented. Job seekers with connections more typically landed positions with, on average, lower occupational codes (i.e. jobs that are higher up in the occupational ladder).[21] In addition, former university peers also affect the prestige and status of the new jobs: positions acquired though peers have, on the average, 1.22 points higher SIOPS and 2.84 higher ISEI scores. The effect size is meaningful in both cases: the parameters represent a 2.3% and 4.5% improvement, respectively, compared to the average scores in the estimation sample. When we limited the identification of the former university peers' effect to comparisons within specific workplaces, using firm fixed effects, all parameters decreased in magnitude, yet remained statistically significant. This suggests that the position-related advantages experienced by individuals with connections are partly driven by firm selection – similarly to wage gains –, but not entirely.

In our last set of estimates, we investigated whether those individuals with peers have longer expected tenure. We estimated multiple logistic regressions, where the dependent variables marked if the employment spell of the individuals reached a minimum length of 3, 6, 12, 18 or 24 months, respectively. The findings presented in Table 8 indicate that having university peers at given firms significantly enhances the likelihood of a more stable employment spell. Specifically, individuals with connections have approximately 1.6 times higher odds of having a minimum employment spell duration of one year or two years. However, when considering shorter employment spells and applying lower minimum tenure requirements, the observed effects disappear. This finding is consistent with the ideas of job shopping models (Johnson, 1978; Topel & Ward, 1992) that propose the frequent job switches of individuals at the beginning of their careers. The weak and insignificant effects in columns (1) and (2) may signal that university ties cannot mitigate all the uncertainties associated with given individual-organizational matches or career perspectives.

As in our previous analysis, we re-estimated our specifications by incorporating firm fixed effects (see Online Appendix Table O11). Similar to the wage regressions conducted earlier, the previously observed effects disappeared, indicating that the positive advantages attributed to university peers in terms of job stability are partially driven by firm selection. Individuals with social connections are more likely to enter firms where all career entrants tend to have longer tenures.

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[21] We re-estimated our model by using an ordinal logit regression, which is more suited to the measurement level of the dependent variable. The results, presented in Online Appendix Table O10, suggest that the measured positive effect is mostly driven by the higher chance of linked individuals to acquire jobs in the top occupational categories (encompassing managers and professionals).

Table 7

The effect of former university peers on job quality.

	(1)	(2)	(3)	(4)	(5)	(6)
	1-digit occupation		SIOPS		ISEI	
	No FE	Firm FE	No FE	Firm FE	No FE	Firm FE
Former university peer	−0.1826***	−0.0891*	1.2283**	0.7946*	2.8462***	1.2517*
	(0.0380)	(0.0383)	(0.4007)	(0.4048)	(0.5756)	(0.5823)
Constant	2.8572***	2.8264***	54.0559***	51.1999***	62.5018***	64.0293***
	(0.2665)	(0.1592)	(1.6547)	(1.1214)	(2.6481)	(1.6749)
Job entries	9 983	6 201	9 891	6 121	9 891	6 121
Job entries with peers	590	562	582	554	582	554
No. of firms	4 912	1 130	4 894	1 124	4 894	1 124
R^2	0.110	0.497	0.216	0.617	0.199	0.601

Note: Based on Eq. (3), linear regression models were estimated with three different dependent variables: the 1-digit occupation category of the new jobs, the prestige and the status of the positions (based on the measures of SIOPS and ISEI). The indicator of peers denotes whether the job seekers had any former university peers at their new firms with a minimum of six-month tenure. Additional controls include gender, age, region of residence, the field of study of the latest master's program, the industry of the new firm, and year dummies. Except for work experience and age, all covariates are dummies. In specifications (2), (4) and (6), we used firm fixed effects. Standard errors are in parentheses and clustered at individual and institution–program levels. *Statistically significant at 0.05 level; **at 0.01 level; ***at 0.001 level.

Table 8

Tenure at the new firms.

	(1) Min. 3 months	(2) Min. 6 months	(3) Min. 12 months	(4) Min. 18 months	(5) Min. 24 months
University peer	1.0245	1.3601*	1.6590***	1.5613***	1.7605***
	(0.2061)	(0.2134)	(0.2186)	(0.1880)	(0.2110)
Constant	0.0028***	0.0033***	0.0006***	0.0004***	0.0003***
	(0.0044)	(0.0044)	(0.0006)	(0.0004)	(0.0003)
Job entries	5 618	5 645	5 656	5 654	5 654
Job entries with peers	341	343	343	343	343
No. of firms	3 034	3 044	3 049	3 047	3 047
Pseudo-R^2	0.0960	0.0880	0.0983	0.0935	0.0890

Note: The models are estimated according to Eq. (3). The dependent variables denote whether the individuals spent at least 3, 6, 12, 18 or 24 months at their new company (specifications (1)-(5), respectively). The indicator of peers denotes whether the job seekers had any former university peers at their new firms with minimum six-month tenure. Additional controls include gender, age, region of residence, the field of study of the latest master's program, the industry of the new firm, and year dummies. Except for work experience and age, all covariates are dummies. The coefficients of the logistic regressions are presented in an exponentiated form. Robust standard errors are in parentheses. *Statistically significant at 0.05 level; **at 0.01 level; ***at 0.001 level.

However, it is important to note that the reduced sample size resulting from within-firm comparisons and the additional time constraints may also contribute to the absence of significance effects.

6. Discussion

In this study, we aimed to broaden our understanding of a specific group of contacts, namely former university ties, in the labor market and investigate whether such acquaintances contribute to the success of master's graduates when entering the labor market. Using a large administrative panel dataset from Hungary and proxying former university peers with shared training periods at the same university programs, our estimations aimed to uncover the role of such relationships on the chances of finding a job and the quality of the jobs acquired.

Our findings suggest that university graduates are more likely to start at those firms where their former peers work. However, a considerable part of the observed effects is attributable to the selection of individuals along existing pathways between university master's programs and firms. Such paths may reflect company preferences, agreements between programs and firms (providing mentoring or training for given types of graduates), or even the regional characteristics of employment opportunities. Our results demonstrate that even after accounting for such sorting patterns, individuals are still more likely to end up working at their former peers' firms, providing suggestive evidence for the presence of informal help. Our further robustness tests also supported this interpretation of the results.

When investigating the heterogeneity of results by the type of ties, we show that the beneficial effect of peers on job-finding is mostly driven by the positive contribution of bachelor's ties, while we did not observe significant effects for master's contacts. These patterns are in line with the implications of some network and contact effect theories. Bachelor's ties, unlike peers from master's programs, typically encompass a larger number of students and offer more options for specialization, resulting in varied professions, occupations, industries, and career paths among these graduates. Such diversity of connections can lead to increased information benefits and better access to more job vacancies (Barbulescu, 2015). In contrast, master's ties are more focused within specific job fields, which are likely to limit their ability to provide diverse job information. Yet, this concentration makes them more effective in conveying insider information about specific jobs and job fields, sharing job tips, and providing career support (Kunda et al., 2002). However, the labor market position of individuals and the timing of their labor market integration necessarily influence the presence and magnitude of potential benefits. As master's graduates typically enter the labor market at roughly the same time it may reduce their opportunities to provide valuable support to one another in the early phase of their career due to their limited time for establishing influence, status, and bargaining power within their respective workplaces. Furthermore, the simultaneous labor market entry of graduates may lead to parallel job searches, which can intensify competition and potentially result in crowding-out effects.

When focusing on post-hiring outcomes, we found that the newly acquired jobs of those who started at their peers' workplace are better in many respects. For instance, they are characterized by higher wages, higher status and greater prestige. Additionally, we demonstrated that the benefits related to wages and job stability are primarily attributable

to the fact that former peers promote the selection of their acquaintances to firms where all career entrants earn more or stay longer. However, in terms of positional advantages, even after restricting the analysis to within-firm comparisons, we observe an advantage for those with links over those without.

The measured gains can be considered essential benefits for career entrants. Finding the right career track and acquiring suitable employment have always been a challenge for graduate students. Especially nowadays, when the demand-side labor market expectations increase toward graduates and change quickly. Informal ties, especially professionally relevant ones, can speed up the labor market integration of graduates and, by helping them acquire better quality employment, can jumpstart their careers. Moreover, the help of contacts can even contribute to significant benefits in the long run, as early labor market situations might affect later outcomes.

Aside from the presented benefits, university ties may have a crucial role in shortening the job-shopping period of graduates and speeding up their labor market integration. As they can provide useful insights about profile-fitting jobs and potential firms, they might increase the chance of individuals to acquire employment options that fit the best for their interests and skills. Therefore, relying on professional ties might even moderate the creation of horizontal and vertical education-job mismatches. The investigation of this topic, however, requires additional research as our results provide only intuitive clues to the presence of such benefits.

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CRediT authorship contribution statement

Virág Ilyés: Conceptualization, Methodology, Formal analysis, Supervision, Writing – original draft, Writing – review & editing. **Anna Sebők:** Conceptualization, Writing – original draft.

Data availability

Due to the size and sensitivity of the data, access to it is provided exclusively for academic purposes, on a case-by-case basis by the Databank of the Centre for Economic and Regional Studies, Hungarian Academy of Sciences. Access can be initiated at adatkeres@krtk.hu.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.econedurev.2023.102456.

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