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Abstract

We investigate the role of education in creating employment opportunities for persons with disabilities across the European Union. We use the European Union Statistics on Income and Living Conditions (EU-SILC) for 2011-2019. We find that educational attainment is a major factor determining the probability of employment among persons with disabilities. In particular, the employment effects of tertiary education are much larger among persons with disabilities than among non-disabled people: that is, having a disability is a greater disadvantage for less educated than for better educated people. We provide evidence that the endogeneity of educational attainment does not drive these findings. We also uncover substantial heterogeneity in the role of education between countries. In more developed countries, the employment status of persons with disabilities is generally less dependent on their educational attainment. Overall, we estimate that 20% of the disability employment gap in the 25-34 age group can be attributed to the gap in education between individuals with and without disabilities.

Keywords: Disability, Employment, Educational attainment, European Union

JEL: I26, I14, C21

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1. Introduction

Persons with disabilities are disadvantaged in the labour market. This disadvantage is reflected in the substantial difference between the employment rates of non-disabled people and persons with disabilities, which we refer to as the disability employment gap. In the European Union, the size of this gap is nearly 50 percentage points in the 30-49 age group.

Low educational attainment may be one of the reasons for the unfavourable labour market outcomes among persons with disabilities. In the EU, we observe a substantial gap in educational attainment based on disability status: on average, only 18% of persons with disabilities aged 25-34, compared with 39% of non-disabled people in the same age group, are tertiary educated. The size of this gap varies across the EU, from less than 15 percentage points in Slovenia, Italy, and Portugal to more than 30 percentage points in Lithuania and Belgium. Persons with disabilities face multiple barriers to participation in education (Druckman et al., 2021; Stodden et al., 2003; WHO, 2011). The negative impact of having a disability on educational attainment is strong even if mental retardation is controlled for as an independent factor (Loprest and Maag, 2007).

Numerous studies have confirmed that having more education results in a higher probability of employment (Mincer, 1991; Oreopoulos, 2006; Riddell and Song, 2011; Woessmann, 2016). However, the existing research on the employment effects of education among persons with disabilities is mainly descriptive (Bliksvær, 2018) or is based on case studies (Burker et al., 2004; Valtonen et al., 2006). These studies suggest that education has a strong, positive impact on employment among people with disabilities. There is also evidence of high wage returns to education among persons with disabilities in the US (Henderson et al., 2017; Hollenbeck and Kimmel, 2008) and in Nepal (Lamichhane and Sawada, 2013).

This paper aims to quantify the contribution of the disability education gap to the disability employment gap across the European Union. By doing so, we assess the potential benefits of increasing educational enrolment for persons with disabilities. The disability education gap is, to some extent, a policy-controlled variable. There are a number of measures that can be applied to increase the educational opportunities of persons with disabilities (Aron and Loprest, 2012; Cheatham and Elliott, 2013; Getzel, 2008).

Following Van Der Zwan and De Beer (2021), we use data from the European Union Statistics on Income and Living Conditions (EU-SILC) survey to analyse the employment of persons with disabilities in the European Union. The definition of disability we employ is based on self-reported limitations in daily activities for health reasons. This measure of disability is also used by the European Commission (2021) in its strategy for protecting the rights of persons with disabilities. We focus primarily on the 25-34 age group, among whom educational attainment can be realistically adjusted to health limitations. We also report the results for the working-age (25-64) population.

In assessing the causal effect of education on labour market outcomes, it should be taken into account that an individual's educational level is correlated with his/her unobserved ability. Without controlling for unobserved ability, the estimated effect of education can be upwardly biased. Although this bias is typically small (Gunderson and Oreopoulos, 2020), there is no evidence on the size of the bias among persons with disabilities. We use three steps to assess the potential size of the bias in our sample, and to minimise it. First, in line with the literature on the returns to education, we use family background variables to control for unobserved ability (Card, 1999). Second, we analyse the correlation of variables measuring general aptitude with educational attainment. We find that among persons with disabilities, these correlations are mostly similar to the correlations observed among non-disabled people. Third, we exclude persons who have not completed primary education from our analysis. Among persons with

disabilities, not completing primary education is a signal of having unobserved health conditions that may significantly impede labour market outcomes. However, our results are robust to the inclusion of this group.

We find that educational level attained is the main factor associated with the employment probability of persons with disabilities. Among persons with disabilities, those with upper secondary education have an employment probability that is 19 percentage points higher than that of those with primary education only. Having completed tertiary education further increases the employment chances of persons with disabilities by over 20 percentage points. Thus, the difference in the employment probability of tertiary educated and primary educated persons with disabilities is 39 percentage points.

The education effects among persons with disabilities differ from those among non-disabled people. While the effects of completing upper secondary education are similar, the effects of completing tertiary education on the employment probability of persons with disabilities are much larger. A possible explanation for this finding is that many persons with disabilities are primarily disadvantaged in performing manual tasks, while having tertiary education opens up employment opportunities that require higher cognitive skills. However, this mechanism has not been investigated in depth in the previous literature. A study that considers a similar mechanism is Krueger and Kruse (1995), who show the value of having computer skills for persons with disabilities. Furthermore, persons with disabilities may have higher reservation wages, and might thus be less interested in taking low-paying jobs. For some persons with disabilities, participation in the labour market may be costly due to various barriers, such as a lack of transportation or the high costs of workplace adjustments to meet their specific needs. The costs of overcoming these obstacles are more likely to be borne by workers who are better educated and better paid. In some institutional settings, employment may also be associated with the loss of a disability benefit, and thus with high marginal taxation, especially for workers without tertiary education.

We observe that the beneficial effects of tertiary education for persons with disabilities diminish with age. Among people in their late fifties, the employment effects of tertiary education become similar for people both with and without disabilities. Thus, the adverse labour market effects of health limitations are less related to educational attainment among older workers than they are among younger workers.

Our results indicate that the disability education gap accounts for 20% of the disability employment gap in the EU. We derive this observation from a counterfactual simulation in which 41% of persons with disabilities in the 25-34 age group upgraded their education. If this occurred, the disability education gap would be closed (except among persons who have not completed primary education), and the employment rate of persons with disabilities would likely increase from 34% to 43%. The results vary across countries, reflecting differences in the factors associated with the disability employment gap. Generally, in less developed EU countries, the employment chances of persons with disabilities are more dependent on their educational level.

In the next section, we introduce our data and present descriptive evidence on the disability education gap and its links with the disability employment gap. In Section 3, we discuss the endogeneity of education, and we outline our methodology. In Section 4, we report our econometric results, together with the results of the robustness analysis. In Section 5, we present the employment effects of closing the disability education gap. In Section 6, we conclude.

2. Data and descriptive evidence

2.1 Data

For our analysis, we use microdata from the European Union Statistics on Income and Living Conditions (EU-SILC). This dataset allows us to identify the disability status of respondents, and to consider a range of socio-economic variables. We include all 27 European Union member countries, and assign equal weights to each. The sample size is similar across countries, and is not directly linked to population size.

We consider two subsamples. The first consists of individuals aged 25 to 34. In this sample, educational attainment is endogenous with respect to disability and reverse causality is very limited, because most of the persons with disabilities in this sample made their educational choices at a time when they already had health limitations. Moreover, disabilities that start early in life are unlikely to be caused by long-term exposure to occupation-specific risks. Even for people who experienced the onset of disability in their early thirties, it is still feasible to adjust their educational attainment. The second sample consists of individuals aged 25-64. As the share of persons with disabilities in the population increases sharply with age (Figure 1), the majority of persons with disabilities in the second sample likely made their educational choices before they developed significant health limitations.

Importantly, the individuals in the two samples tend to have different types of disabilities. Many of the health limitations of the people in the sample aged 25-64 can be attributed to cancer and heart disease. People aged 50-64 comprise 65% of this sample (Figure 2). Around 3% of the population aged 50-64 has been diagnosed with cancer in the previous five years[1]. By contrast, among the population aged 20-34, the share of cancer-affected people amounts to 0.3%. Similarly, about 0.8% of people aged 55-64 are affected by heart failure, compared to 0.04% of people aged 18-44 (Bosch et al., 2019).

Figure 1. Shares of persons with disabilities in the population by age groups (%), 2011-2019, EU-27 countries

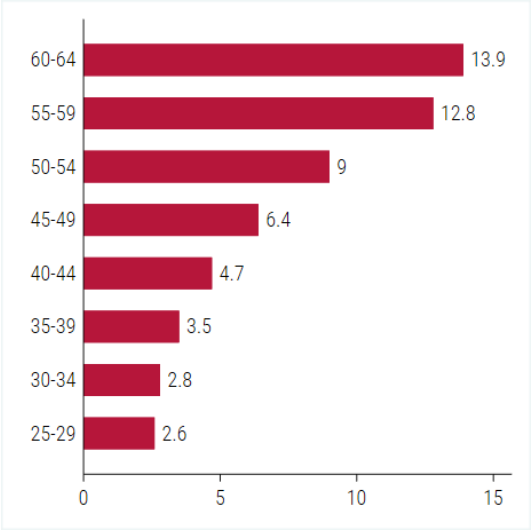
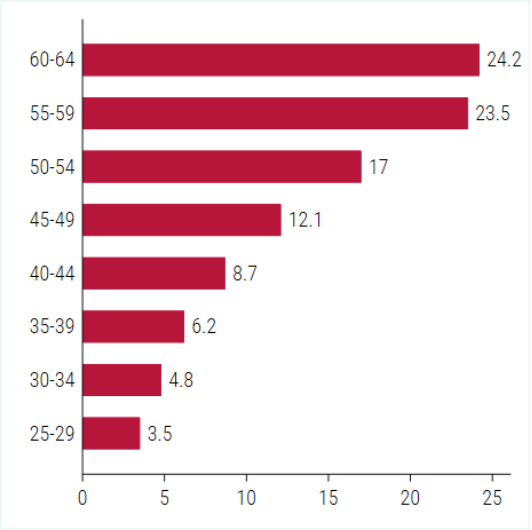


Figure 2. Shares of age groups in the population of persons with disabilities (%), 2011-2019, EU-27 countries



Source: own elaboration based on EU-SILC.

[1] Each year in the EU, 0.81% of people aged 50-64 are diagnosed with cancer, while the mortality rate is 0.27% (European Commission, 2022).

In the descriptive analysis, we include persons who have not completed primary education. Over 5% of persons with disabilities have not completed primary education, and this share is considerably higher than it is among non-disabled people (0.4%). For some people with disabilities, their health conditions made it impossible for them to complete even primary education. Among this group, we expect to find a strong correlation between unobserved ability and educational attainment. Therefore, we exclude persons without any formal education from the econometric analysis. However, as the results of the robustness analysis show, our findings do not depend on the exclusion of this group. Additionally, we exclude from both the descriptive and the econometric analysis people who continued their formal education, as for them, the impact of education on employment cannot be assessed.

We use three levels of education in the econometric analysis: primary education (primary and lower secondary education, ISCED levels 1-2), upper secondary education (upper secondary and post-secondary non-tertiary education, ISCED levels 3-4), and tertiary education (ISCED levels 5-8). In all EU countries, full-time compulsory education includes ISCED levels 1 and 2.

We pool data from the 2011-2019 period to obtain reasonably large samples of respondents with disabilities in each country. The average number of persons aged 25-34 per country is 16 thousand (the first subsample). In this sample, the number of persons with disabilities per country ranges from 125 (for Malta) to 922 (Poland). The number of persons aged 25-64 per country ranges from 49 thousand (for Ireland) to 231 thousand (Italy). In this second sample, the average number of persons with disabilities per country is 6.3 thousand, and is again lowest for Malta (1463 observations).

The EU-SILC respondents can report being i) strongly limited, ii) limited, or iii) not limited in daily activities because of health problems. To construct a proxy for disability, we select those individuals who report being limited in daily activities and receiving some disability benefits, or those individuals who report being strongly limited in their daily activities. Based on this definition, 2.7 per cent of respondents in the first sample and 7.1 per cent of respondents in the second sample have a disability status. As a robustness check, we also use two alternative disability definitions focusing on persons who report suffering from a longstanding health problem. Under the narrow definition, we only include those respondents who report having strong limitations in daily activities. When this definition is applied, persons with disabilities constitute 1.6% of the sample aged 25-34 and 4.2% of the sample aged 25-64. Under the broader definition, a person with disabilities is someone who reports being either limited or strongly limited in his/her daily activities. When this definition is applied, persons with disabilities constitute 6.3% of the sample aged 25-34 and 14.7% of the sample aged 25-64.

We construct the employment dummy variable based on the self-defined current economic status of the individuals in the EU-SILC data. Part- or full-time employees, self-employed people, and family workers are classified as employed. To control for the time-varying labour market situation, we use data on the unemployment rate compiled by Eurostat. We also take advantage of the information about each respondent's household situation when s/he was 14 years old. The data come from EU-SILC thematic modules conducted in 2011 and in 2019. Variables on the mother's education and the household financial situation are available for 80% of our first sample and for 74% of our second sample, as these questions are only posed to persons aged 25-59. For the Nordic countries, data are available for only 40% of the sample. We compare the characteristics of individuals with and without missing family background variables in Appendix A.

2.2 Descriptive evidence

In the sample aged 25-34, only 18% of those with disabilities attained tertiary education (Table 1), compared to 39% of those without disabilities. A similar gap is observed in the sample aged 25-64, among whom 31% of those without disabilities, compared to 14% of those with disabilities, are tertiary

educated. Moreover, there is a substantial difference in the shares of people with and without disabilities who have completed at least upper secondary education. This gap is largest in Lithuania and Romania (Figure 3). We also note that the tertiary education gap for people with disabilities varies substantially across countries (Figure 4), ranging from more than 30% in Lithuania and Belgium to less than 15% in Slovenia, Italy, and Portugal.

Table 1. Descriptive statistics by disability status

	Sample aged 25-34		Sample aged 25-64	
	Persons with disabilities	Persons without disabilities	Persons with disabilities	Persons without disabilities
Employment rate	35.7%	78.4%	26.9%	75.9%
Employment rate (primary education*)	18.8%	61.0%	16.9%	58.4%
Employment rate (upper secondary education)	40.0%	78.4%	28.9%	76.8%
Employment rate (tertiary education)	66.0%	85.3%	47.2%	86.3%
Pre-primary education	5.2%	0.4%	2.3%	0.5%
Primary education*	33.7%	14.8%	33.9%	20.1%
Upper secondary education	43.0%	45.4%	50.1%	48.0%
Tertiary education	18.2%	39.4%	13.7%	31.4%
Share of women	47.1%	49.6%	49.9%	50.5%
Mean age	30.1	29.8	51.4	44.7
Observations	11 185	417 759	175 381	2 314 889

** Throughout the paper, we include lower secondary education within the primary education category. Source: own elaboration based on EU-SILC.*

Figure 3. Difference in the shares of people with and without disabilities who completed at least upper secondary education, ages 25-34

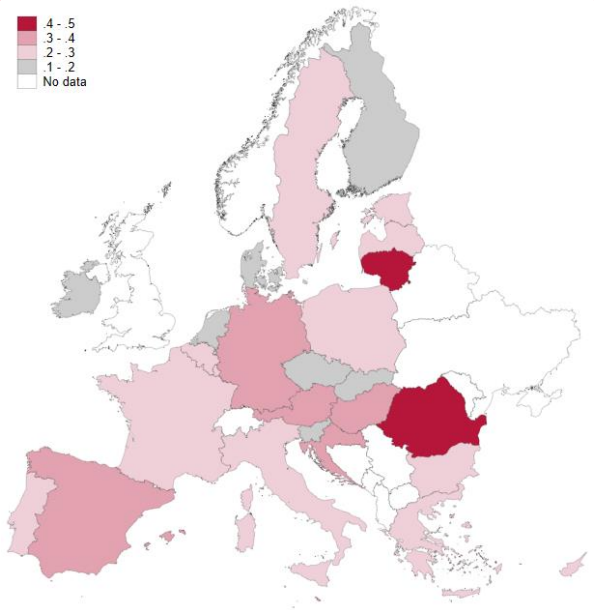
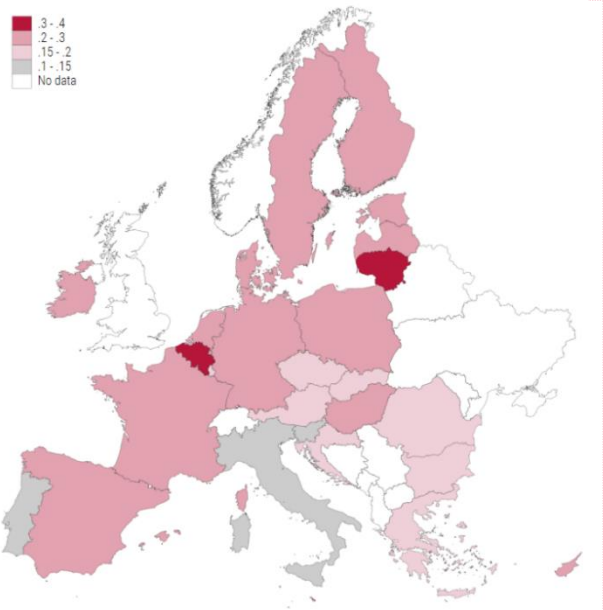


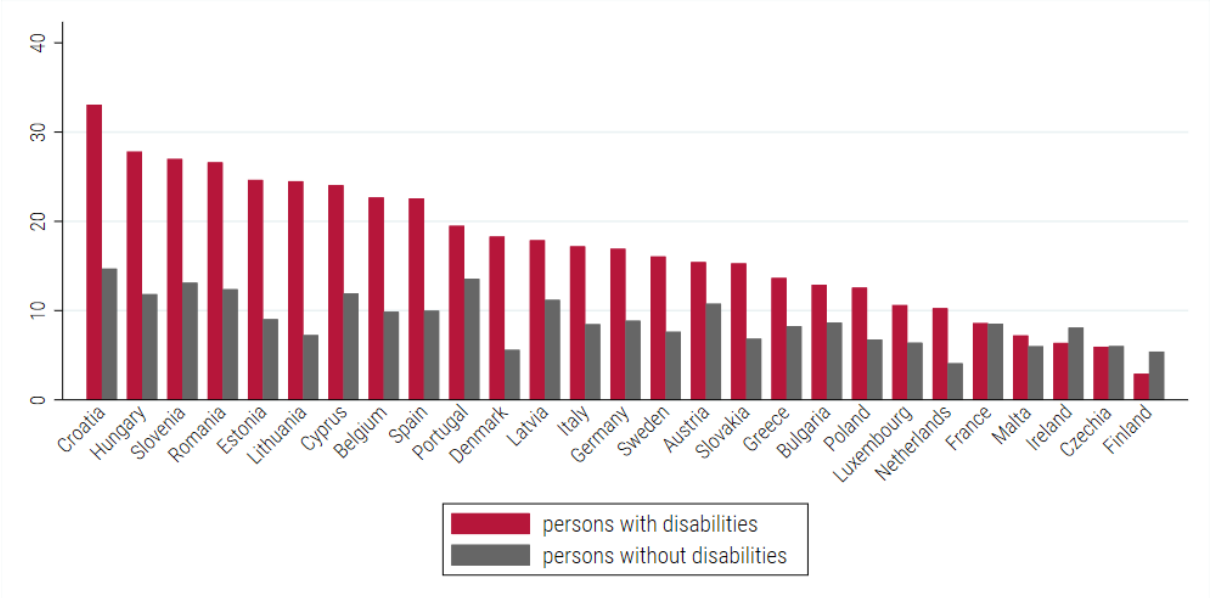
Figure 4. Difference in the shares of people with and without disabilities who completed tertiary education, ages 25-34



Source: own elaboration based on EU-SILC.

Persons with disabilities are more likely to grow up in financially underprivileged households, which may be one of the reasons why their educational attainment is lower. In most EU countries, people with disabilities are at least twice as likely as people without disabilities to assess their childhood material situation as poor (Figure 5). The share of persons who report having a very bad or a bad household financial situation is higher for respondents with disabilities in all but three EU countries (Figure 5), ranging from 2.9% in Finland to 33.1% in Croatia, compared to from 4.1% to 14.7% for respondents without disabilities.

Figure 5. Share of persons who report having a very bad or a bad household financial situation in childhood by country and by disability status, ages 25-34



Note: Assessment of the financial situation of the household when the respondent was around 14 years old; based on the 2011 and 2019 EU-SILC thematic modules.

The disability employment gap (i.e., the difference in the employment rates of people with and without disabilities) is larger among people with upper secondary education (38 percentage points) than it is among people with tertiary education (29 percentage points; Table 1). At the country level, the share of tertiary educated persons with disabilities is positively correlated with their employment rates (Figure 6). Furthermore, the smaller the differences in the shares of tertiary educated, the smaller the differences in the employment rates of persons without and with disabilities (Figure 7). Across the EU countries, the overall disability employment gap ranges from 26 percentage points (for Slovenia) to 62 percentage points (for Lithuania).

Figure 6. Employment rate and share of tertiary educated for persons with disabilities, ages 25-34

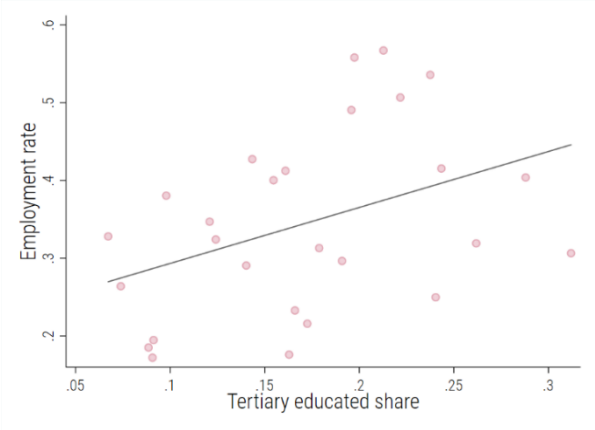
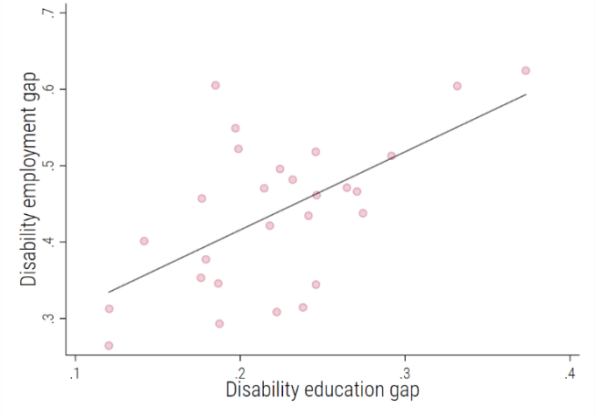


Figure 7. Differences in employment rates (employment gap) and in shares of tertiary educated (education gap) between persons with and without disabilities, ages 25-34



Source: own elaboration based on EU-SILC.

3. Empirical strategy

We seek to analyse to what extent the disability gap in employment can be attributed to the disability gap in education. We outline our strategy in three steps. First, we investigate whether the educational attainment of persons with disabilities is correlated with their general aptitude, as measured by observed variables. This strategy enables us to assess the risk of overestimating the employment effects of education due to the correlation between the educational level and unobserved abilities. Then, we present our main econometric specification, which estimates the employment effects of education. Lastly, we explain our approach to quantifying the potential effects of closing the disability education gap on employment in the European Union.

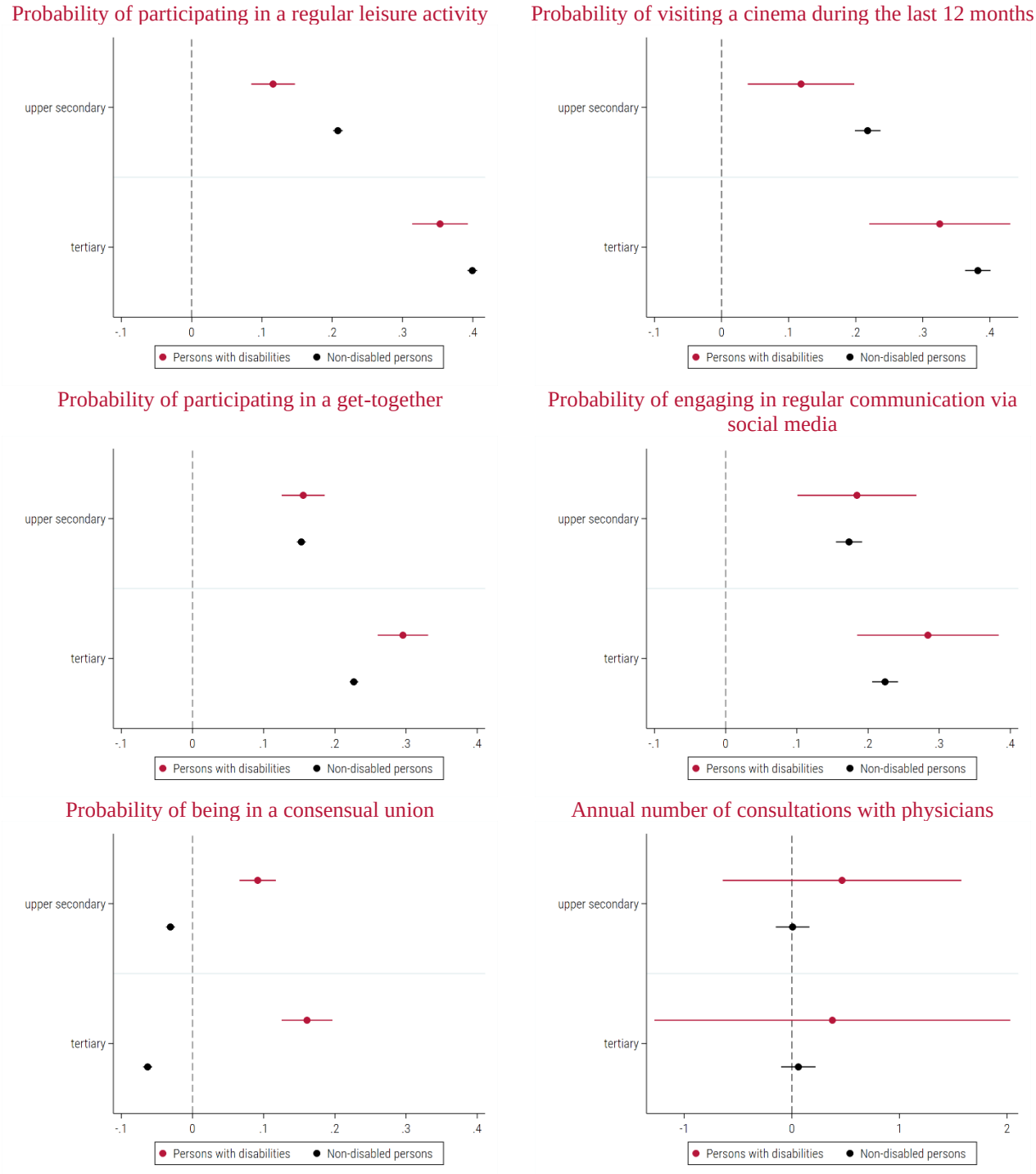
3.1 Education and unobserved ability

Educational attainment is correlated with the unobserved ability of individuals. Therefore, the relationship between education and labour market outcomes may not reflect the true causal effects of education on employment, as it may also capture the effects of unobserved abilities. However, studies that are able to circumvent the endogeneity problem have found that the bias related to unobserved ability is small (Gunderson and Oreopoulos, 2020). Does this reassuring finding also hold for persons with disabilities? Obviously, there are no ideal ways to detect the unobserved ability of these individuals. In our approach, we draw on various measures of general aptitude, which should also reflect social abilities.

We analyse six variables measuring individual recreational activities, social relations, union formation, and health. Our focus here is on the sample of young people (aged 25-34), as educational decisions are primarily made by young people. We regress the general aptitude variables on the dummy variables denoting upper secondary and tertiary education, with primary and lower secondary education serving as a reference value. We control for the interaction of gender and country, and we use the linear and the quadratic terms of age. This exercise is done separately for persons with and without disabilities.

We thus verify whether the relationship between our measures of general aptitude and educational attainment is similar among persons with and without disabilities. A stronger correlation among persons with disabilities would indicate that the endogeneity of education is of more concern among this group than it is among non-disabled people.

Figure 8. Proxies for general aptitude by educational attainment



Note: In these charts, we show the OLS estimations of the relationship between educational level and six proxies for general aptitude. Primary and lower secondary education is used as a reference level. Error bars represent 95% confidence intervals. We additionally control for age and the interaction of country and gender fixed effects. All regressions use data for respondents aged 25-34. The second and the fourth panel use data from the 2015 EU-SILC thematic module, and the sixth panel uses data from the 2017 thematic module. The remaining panels use the EU-SILC data for the years 2011–2019.

The probability of participating in leisure activities and of maintaining social relations is positively correlated with the level of education among people both with and without disabilities (Figure 8). Moreover, the coefficients pertaining to particular levels of education are generally similar among people both with and without disabilities. The probability of participating in regular leisure activities and of visiting the cinema is less related to the level of education among persons with disabilities than it is among non-disabled people. The opposite is the case for the probability of participating in a get-together.

The probability of being in a consensual union (including marriage) is positively related to the level of education among persons with disabilities and is negatively related to the level of education among non-disabled persons. On the one hand, this finding suggests that the factors influencing the probability of forming a union differ between people with and without disabilities. On the other hand, we observe that persons with disabilities who completed primary education only are significantly less likely to be in a consensual union than those with upper secondary education (by 9.2 percentage points) and those with tertiary education (by 16.1 percentage points). It therefore appears that among persons with disabilities, the educational level may be correlated with some unobserved characteristics that also influence union formation. We take this into account in our econometric analysis by controlling for being in a consensual union in one of the specifications. We find no evidence that primary educated persons with disabilities have more health problems, as proxied by the annual number of consultations with physicians, than better educated persons with disabilities.

The above analysis confirms that educational level is correlated with various measures of general aptitude. However, the correlations found among persons with disabilities are similar to those observed among non-disabled people, which supports our estimation strategy. The only exception is the probability of forming a union, which we will directly control for in the econometric analysis. Overall, we do not expect that the correlation of unobserved ability with educational attainment should be of more concern in the sample of persons with disabilities.

3.2 Estimation strategy

Our aim is to estimate the average partial effects of educational attainment on the probability of employment. Given the non-linear nature of the process determining individual employment, we use a probit model; and, in a robustness analysis, we also report the results from a logistic model. Formally, we estimate the following regression:

$$y_i = \alpha_0 + \beta_L \cdot edu_{L,i} + \beta_{L,D} \cdot edu_{L,i} \cdot D_i + \gamma \cdot D_i + \varphi \cdot controls_i + \epsilon_i \qquad (1)$$

Where y_i is the dummy variable denoting employment of individual i; $edu_{L,i}$ is a vector of dummy variables representing completion of a given level of education, with L being either upper secondary or tertiary education (primary and lower secondary education are jointly used as a reference value); D_i is a dummy variable that stands for persons with disabilities; and the vector $controls_i$ contains age in linear and quadratic terms, the unemployment rate in linear and quadratic terms, and country-gender fixed effects.

We employ two methods to assess whether the effect of education on employment is overestimated due to a positive correlation between the educational level and unobserved ability. First, in an additional specification, we include information on mother's education and the household financial situation when the respondent was 14 years old (both interacted with the disability status). Adding the family background variables may reduce the biases in the measured returns to education (Card, 1999). In our data, the family background variables are available for two years (2011 and 2019). To assess the extent of the potential bias arising from not controlling for unobserved ability, we compare the results of the

specification including family background against the baseline specification, estimated on the subsample for whom data on family background are available.

Second, we use a dummy variable for being in a consensual union, interacted with the disability status and gender. As reported in section 3.1, primary educated persons with disabilities are significantly less likely to be in a consensual union than their peers with upper secondary and tertiary education. By adding these control variables, we estimate the employment effects of education within groups of similar unobserved characteristics. However, being in a consensual union is expected to be a collider that is influenced by educational attainment and employment status. Hence, this econometric specification aims to assess the potential size of the bias, rather than to estimate the true causal effects of education.

It may be noted that among prime-aged and older people, disability is much more likely to be endogenous to educational and employment choices. For example, people who perform cognitive tasks face a lower risk of becoming disabled than people who have manual jobs. However, this does not undermine our empirical strategy. We assess the employment effects of educational attainment within the sample of persons with disabilities. The sum of coefficients β_L and $\beta_{L,D}$ indicates an expected increase in the probability of employment that would come with completing educational level L for a person with a disability.

3.3 Counterfactual analysis

The final goal of our analysis is to quantify the potential employment effects of closing the education gap between persons with and without disabilities. To answer the question of how much of the differences in the employment rates of persons without and with disabilities can be attributed to the difference in their educational attainment, we conduct the subsequent exercise separately for each country.

First, we re-run the probit model to obtain country-specific employment effects of tertiary and upper secondary education for persons with disabilities. Second, we determine how many primary and secondary educated persons with disabilities would have to upgrade their educational attainment to close the education gap between them and persons without disabilities. For persons who have not completed primary education, we do not assume a change in the level of education. Third, we calculate the potential employment gains among persons with disabilities. We multiply the number of people with counterfactual educational levels by the country-specific average marginal effects pertaining to upper secondary and tertiary education. This allows us to report the share of the disability employment gap that can be attributed to the disability education gap.

4. Results

4.1 Econometric results

Educational attainment is a major predictor of the probability of employment for persons both with and without disabilities (Table 2). Our baseline estimation (column 1) indicates that completing upper secondary education is associated with a probability of employment that is 15.8 percentage points higher than completing primary or lower secondary education only. For persons with disabilities, the effect of having upper secondary education amounts to 18.7 percentage points (the sum of 15.8 percentage points and 2.9 percentage points). Completing tertiary education further increases the probability of employment by 8.6 percentage points (20.6 percentage points for persons with disabilities).

The employment effect of having tertiary education is much larger for persons with disabilities than it is for non-disabled people. Various mechanisms can explain this finding. First, having tertiary education may enable persons with disabilities to work in occupations in which they are less disadvantaged. While people with physical impairments and medical disabilities typically have difficulties in performing

certain manual tasks required in low- and medium-skilled jobs, they may not be disadvantaged in performing cognitive tasks (Krueger and Kruse, 1995). However, to work in occupations that require high cognitive skill levels, an individual usually needs to complete tertiary education. It is also possible that the signalling role of tertiary education is especially important among persons with disabilities, as it can reduce discrimination by employers. Second, the reservation wage for persons with disabilities may be high due to additional costs, such as the inconveniences of commuting and the availability of disability benefits. Thus, labour force participation may be higher among tertiary educated persons who are able to earn higher wages.

The subsequent regressions indicate that the bias related to unobserved ability is rather small. In column 2, we re-estimate the baseline regression on the sample for whom the family background variables are available. The change in the estimates reflects the non-random nature of the missing variables (around half of the respondents were not asked the family background questions in some countries). Nevertheless, the inclusion of family background controls has a minor impact on the coefficients of interest (the difference between columns 2 and 3). When we control for being in a consensual union (column 4), the employment effect of tertiary education for persons with disabilities is only three percentage points lower than it is in column 1[2]. Moreover, in this specification, there is no difference in the effect of upper secondary education for persons with and without disabilities. Importantly, the results reported in column 4 may even underestimate the true causal effect of education. The risk of a downward bias arises because being in a consensual union can be influenced by both employment status and educational level.

Table 2. Estimated effect of educational attainment on the probability of employment, individuals aged 25-34.

	(1)	(2)	(3)	(4)
Tertiary education	0.086***	0.079***	0.072***	0.084***
	(0.002)	(0.004)	(0.005)	(0.002)
Tertiary education × Disability	0.120***	0.161***	0.164***	0.092***
	(0.014)	(0.029)	(0.030)	(0.013)
Upper secondary education	0.158***	0.146***	0.135***	0.159***
	(0.002)	(0.005)	(0.005)	(0.002)
Upper secondary education × Disability	0.029*	-0.020	-0.011	0.005
	(0.011)	(0.025)	(0.025)	(0.011)
Family background controls?	No	No	Yes	No
Consensual union controls?	No	No	No	Yes
Persons with disabilities	10 417	1 882	1 882	10 393
All observations	426 499	73 444	73 444	425 968

*Note: In this table, we report the average marginal effects from a probit model with an employment dummy as the dependent variable. The regression for column 1 uses all available data for the years 2011–2019. Full estimation results for this regression are reported in Appendix B. Column 2 shows results from estimations based on observations with non-missing data on the family background variables: mother's education and the financial situation of the household when the respondent was around 14 years old. In the regression for column 3, we control for these family background variables interacted with the disability status. In the regression for column 4, we use all data for the years 2011-2019 and control for the consensual union dummy variable interacted with the disability status and gender. In all regressions, we control for the disability status, the country-gender fixed effects, age in linear and quadratic terms, and the unemployment rate in linear and quadratic terms. Robust standard errors in parentheses. * p < .05 ** p < .01 *** p < .001.*

[2] Limiting the sample based on the availability of the consensual union variable does not change the coefficients reported in column 1 for either the sample aged 25-34 or the sample aged 25-64.

In the sample aged 25-64, the relationship between the educational attainment and the employment status of persons with disabilities is weaker than it is in the sample aged 25-34. Still, the employment probability gap between people with upper secondary education and people with primary education is 12.4 percentage points for non-disabled people and is 9.8 percentage points for persons with disability. The gains in the probability of employment related to tertiary education are 9.5 percentage points for non-disabled people and 13.7 percentage points for persons with disabilities.

It is important to note that among persons with disabilities, the effect of tertiary education decreases with age (Figure 9). For people with disabilities in their fifties, the employment effects of having tertiary education become slightly smaller than they are among non-disabled people.

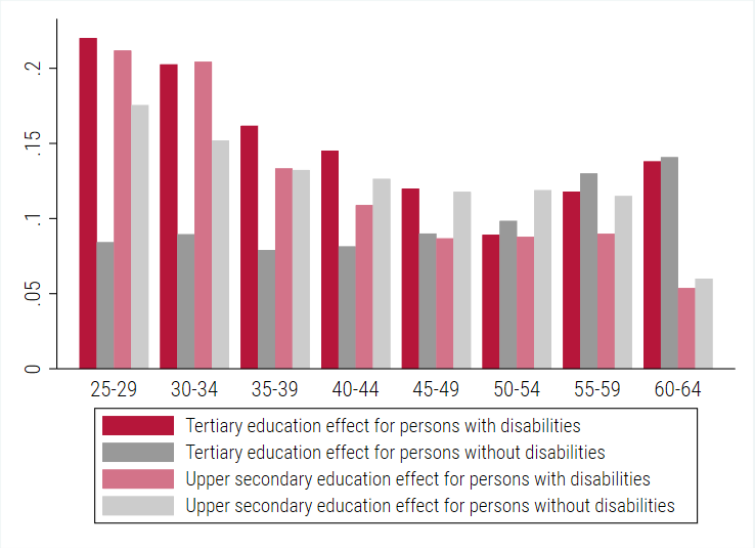
Controlling for family background and being in a consensual union has a negligible impact on the results in the older sample. Endogeneity of education is of less concern here than it is in the early-onset disability sample because the educational choices of the individuals in this sample were mostly made before the onset of their health limitations.

Table 3. Estimated effect of educational attainment on the probability of employment, individuals aged 25-64

	(1)	(2)	(3)	(4)
Tertiary education	0.095***	0.087***	0.083***	0.093***
	(0.001)	(0.002)	(0.002)	(0.001)
Tertiary education × Disability	0.042***	0.059***	0.058***	0.036***
	(0.004)	(0.009)	(0.009)	(0.004)
Upper secondary education	0.124***	0.126***	0.118***	0.122***
	(0.001)	(0.002)	(0.002)	(0.001)
Upper secondary education × Disability	-0.026***	-0.032***	-0.023**	-0.032***
	(0.003)	(0.007)	(0.007)	(0.003)
Family background controls?	No	No	Yes	No
Consensual union controls?	No	No	No	Yes
Persons with disabilities	170 569	25 564	25 564	170 341
All observations	2 472 924	387 586	387 586	2 470 871

*Note: In this table, we report the average marginal effects from a probit model with an employment dummy as the dependent variable. The regression for column 1 uses all available data for years 2011–2019. Full estimation results for this regression are reported in Appendix B. Column 2 shows the results from estimations based on observations with non-missing data on the family background variables: mother's education and the financial situation of the household when the respondent was around 14 years old. In the regression for column 3, we control for these family background variables interacted with the disability status. In the regression for column 4, we use all data for the years 2011-2019, and control for the consensual union dummy variable interacted with the disability status and gender. In all regressions, we control for the disability status, the country-gender fixed effects, age in linear and quadratic terms, and the unemployment rate in linear and quadratic terms. Robust standard errors in parentheses. * p < .05 ** p < .01 *** p < .001.*

Figure 9. The effects of education on employment probability by age group



Note: In this figure, we report the average marginal effects from a probit model of being employed estimated separately for eight age groups. For each regression, we report four bars representing the marginal effects for employment probability of completing upper secondary or tertiary education, separately for persons with and without disabilities. We control for the country-gender fixed effects, the disability status, age in linear and quadratic terms, and the unemployment rate in linear and quadratic terms.

4.2 Robustness analysis

We conduct a number of robustness checks to verify whether our findings depend on methodological choices. The regressions in columns 2 and 3 (Tables 4 and 5) use alternative definitions of disability, described in section 2.1. When the narrow definition of disability is applied (column 2), the effect of tertiary education is reduced by 2.4 percentage points; that is, by 12% of the baseline estimate. When the broad definition of disability is used, the effect of tertiary education on the employment probability of persons with disabilities is 3.9 percentage points lower than in the baseline estimate. When alternative definitions of disability are applied to the sample aged 25-64 (Table 5), the employment effect of tertiary education is only around 3% lower than in the baseline estimate.

In column 4, we report results from the baseline specification estimated on the samples that include people without primary education. The interpretation of the coefficients pertaining to upper secondary education changes, as now the reference value includes not only primary and lower secondary education, but also no education. However, the change in the coefficient values is small. In column 5, we use a logit model and the same variables as in the baseline equation. It turns out that the selection of a non-linear function is of little importance. For the sample aged 25-34, the logit specification yields marginally lower effects of tertiary and upper secondary education: i.e., 0.5 percentage points and 0.2 percentage points lower, respectively.

Overall, we confirm that the gap in the educational attainment of people with and without disabilities is an essential factor in their employment probability. In particular, we find that tertiary education plays a more important role in the employment probability of persons with disabilities than of non-disabled people. These findings are robust to changes in the specification and to the use of alternative definitions of disability.

Table 4. Effects of educational attainment on the probability of employment: robustness analysis, sample aged 25-34

	(1)	(2)	(3)	(4)	(5)
Tertiary education	0.086***	0.090***	0.083***	0.086***	0.088***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Tertiary education × Disability	0.120***	0.092***	0.084***	0.120***	0.113***
	(0.014)	(0.018)	(0.008)	(0.014)	(0.013)
Upper secondary education	0.158***	0.162***	0.157***	0.163***	0.154***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
Upper secondary education × Disability	0.029*	0.026	0.038***	0.043***	0.031**
	(0.011)	(0.014)	(0.008)	(0.011)	(0.011)
Persons with disabilities	10 417	6 530	24 757	11 185	10 417
All observations	426 499	426 499	426 499	428 931	426 499

*Note: In this table, we report the average marginal effects from a probit model with an employment dummy as the dependent variable (columns 1-4) and from a logistic model (column 5) with an employment dummy as the dependent variable. Column 1 repeats the baseline results from column 1 of Table 2. In the regression for columns 2 and 3, we use alternative definitions of disability. In the regression for column 4, we include people who have not completed primary education. Column 5 shows estimates of the average marginal effects from a logistic model. Robust standard errors in parentheses. * p < .05 ** p < .01 *** p < .001.*

Table 5. Effects of educational attainment on the probability of employment: robustness analysis, sample aged 25-64

	(1)	(2)	(3)	(4)	(5)
Tertiary education	0.095***	0.103***	0.094***	0.095***	0.099***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Tertiary education × Disability	0.042***	0.029***	0.039***	0.042***	0.035***
	(0.004)	(0.005)	(0.003)	(0.004)	(0.004)
Upper secondary education	0.124***	0.129***	0.126***	0.128***	0.120***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Upper secondary education × Disability	-0.026***	-0.042***	-0.016***	-0.020***	-0.017***
	(0.003)	(0.004)	(0.002)	(0.003)	(0.003)
Persons with disabilities	170 569	102 795	364 269	175 377	170 569
Observations	2 472 924	2 472 924	2 472 924	2 490 245	2 472 924

*Note: In this table, we report the average marginal effects from a probit model with an employment dummy as the dependent variable (columns 1-4) and from a logistic model (column 5) with an employment dummy as the dependent variable. Column 1 repeats the baseline results from column 1 of Table 3. In the regression for columns 2 and 3, we use alternative definitions of disability. In the regression for column 4, we include people who have not completed primary education. Column 5 shows estimates of the average marginal effects from a logistic model. Robust standard errors in parentheses. * p < .05 ** p < .01 *** p < .001.*

4.3 Heterogeneity of results between countries

We have run the baseline analysis separately for each European country in our sample. We find that in all EU countries, educational attainment is a major factor in the probability of employment among persons with disabilities (Table 6). In the sample aged 25-34, the difference in the employment probability of tertiary educated and primary educated persons with disabilities ranges from 22 percentage points in the Netherlands to 76 percentage points in Romania. Furthermore, we show that in all countries except Ireland, the employment effect of tertiary education is larger among persons with disabilities than among non-disabled people. In 12 out of 26 countries, this difference is statistically significant. Although the relationship between the educational level and employment is generally found to be less strong in the sample aged 25-64, the results indicate that tertiary education still plays a particularly large role in the employment probability of persons with disabilities in this sample. In 17 countries, the employment effects of tertiary education are shown to be significantly larger among persons with disabilities than among non-disabled people.

We also find that the employment effects of education are negatively correlated with GDP per capita (Figure 10). These effects are typically larger in Central and Eastern European countries, and are smaller in Western European countries. However, the employment rate of tertiary educated persons with disabilities is slightly positively correlated with economic development (Figure 11). Taken together, these observations imply that in less developed countries, persons with disabilities are more disadvantaged, and that being better educated enables them to significantly improve their labour market outcomes.

Figure 10. The employment effects of upper secondary and tertiary education for persons with disabilities aged 25-34 vs GDP per capita

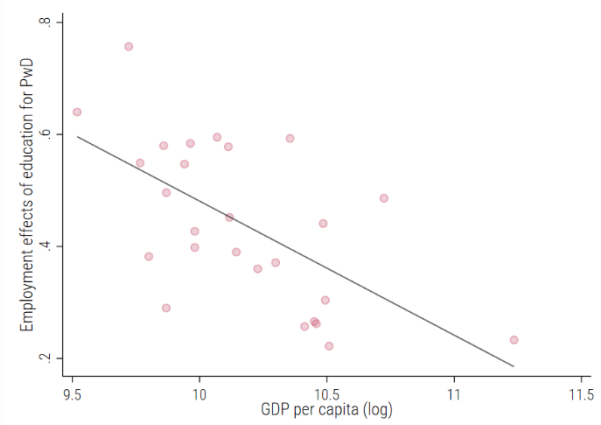
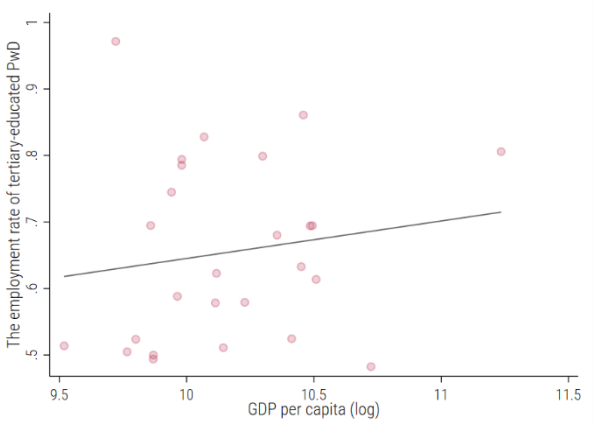


Figure 11. The employment rate of tertiary educated persons with disabilities aged 25-34 vs GDP per capita



Note: In Figure 10, we report the sum of the employment effects of upper secondary and tertiary education for persons with disabilities obtained from a probit model estimated separately for each country. The results for Malta are not available due to a very low number of observations of tertiary educated persons with disabilities. On the horizontal axis of both Figure 10 and Figure 11, we show the average log of GDP (in purchasing power standards) per capita for the years 2011-2019.

Table 6. Estimation results by countries

	Sample 25-34				Sample 25-64			
	Tertiary education	Tertiary education × Disability	Upper secondary education	Upper secondary education × Disability	Tertiary education	Tertiary education × Disability	Upper secondary education	Upper secondary education × Disability
Austria	0.078***	0.113	0.179***	-0.066	0.052***	0.047**	0.132***	-0.077***
Belgium	0.118***	0.049	0.147***	-0.057	0.101***	0.026	0.123***	-0.033*
Bulgaria	0.100***	0.148	0.264***	0.128	0.108***	0.034	0.211***	-0.025
Croatia	0.076***	0.124	0.298***	0.051	0.175***	0.026	0.185***	-0.112***
Cyprus	0.092***	0.163**	0.075***	0.122	0.083***	0.077***	0.081***	0.011
Czechia	0.040***	0.167**	0.237***	0.134	0.047***	0.060**	0.204***	-0.059***
Denmark	0.075***	0.119	0.212***	0.035	0.052***	0.018	0.115***	0.019
Estonia	0.076***	0.159***	0.096***	0.096*	0.067***	0.048***	0.104***	0.023
Finland	0.117***	0.200**	0.175***	0.101	0.086***	0.097***	0.103***	0.035*
France	0.117***	0.051	0.159***	0.044	0.100***	0.000	0.089***	-0.011
Germany	0.053***	0.123*	0.226***	-0.136***	0.056***	0.035***	0.143***	-0.097***
Greece	0.094***	0.223**	0.091***	0.088	0.146***	0.077***	0.016***	0.032
Hungary	0.084***	0.039	0.236***	-0.069	0.081***	0.060**	0.167***	-0.087***
Ireland	0.160***	-0.09	0.219***	0.197*	0.121***	-0.013	0.138***	0.042
Italy	0.032***	0.151	0.149***	0.028	0.115***	0.060**	0.156***	-0.007
Latvia	0.118***	0.037	0.110***	0.117*	0.122***	0.033*	0.119***	0.043*
Lithuania	0.180***	0.096	0.154***	0.154*	0.158***	0.007	0.177***	0.047
Luxemb.	0.043***	0.160*	0.087***	-0.057	0.049***	0.093***	0.036***	0.052**
Malta	0.072***	n/a	0.173***	n/a	0.120***	-0.017	0.171***	0.026
Netherlands	0.068***	0.032	0.084***	0.038	0.074***	-0.012	0.081***	-0.007
Poland	0.142***	0.170***	0.159***	0.109**	0.147***	0.088***	0.119***	0.015
Portugal	0.024*	0.166*	0.072***	0.136**	0.066***	0.086**	0.082***	0.046*
Romania	0.103***	0.697***	0.139***	-0.182*	0.140***	0.115**	0.087***	-0.175***
Slovakia	0.047***	0.176***	0.340***	-0.016	0.068***	0.147***	0.261***	-0.120***
Slovenia	0.048***	0.198*	0.150***	0.199**	0.118***	0.076***	0.111***	-0.038*
Spain	0.115***	0.031	0.109***	0.135	0.117***	-0.080**	0.118***	0.027
Sweden	0.032***	0.102	0.121***	0.007	0.047***	0.036*	0.096***	-0.041**

*Note: In this table, we report the average marginal effects from a probit model with an employment dummy as the dependent variable. Each row represents a separate regression for an individual country. The results for Malta (sample aged 25-34) are not available due to a very low number of observations of tertiary educated persons with disabilities. We control for the disability status, gender, age in linear and quadratic terms, and the unemployment rate in linear and quadratic terms. * $p < .05$ ** $p < .01$ *** $p < .001$.*

5. Economic implications of closing the disability education gap

This section assesses one aspect of the economic consequences of the disability education gap observed in the EU. We estimate the employment benefits of a hypothetical increase in the educational attainment of people with disabilities to the level observed among non-disabled people. The main results at the country level are reported in Table 7.

Table 7. Summary of the counterfactual simulation by countries

	Sample aged 25-34			Sample aged 25-64		
	Share of PwD upgrading the edu. level	Increase in the empl. rate of PwD, perc. points	Reduction in the disab. empl. gap, %	Share of PwD upgrading the edu. level	Increase in the empl. rate of PwD, perc. points	Reduction in the disab. empl. gap, %
Austria	47%	6.7	19.3%	32%	2.4	4.8%
Belgium	45%	6.1	10.1%	45%	4.9	8.5%
Bulgaria	27%	8.6	15.6%	28%	4.6	8.9%
Croatia	46%	13.4	25.7%	27%	3.6	6.8%
Cyprus	42%	9.6	20.6%	43%	5.5	11.9%
Czechia	31%	8.6	18.8%	27%	3.4	6.5%
Denmark	40%	8.8	20.8%	31%	3.2	5.3%
Estonia	38%	8.3	26.8%	30%	3.6	8.6%
Finland	45%	13.3	28.8%	36%	6.0	11.6%
France	35%	6.4	20.5%	38%	3.4	8.9%
Germany	55%	7.0	16.1%	33%	2.3	4.1%
Greece	33%	8.1	22.9%	38%	4.5	11.8%
Hungary	49%	7.2	14.6%	37%	4.0	7.0%
Ireland	46%	9.9	22.6%	55%	8.0	14.9%
Italy	30%	5.3	17.0%	34%	5.4	14.2%
Latvia	46%	9.0	19.1%	26%	4.1	9.7%
Lithuania	64%	18.8	30.1%	33%	6.0	11.1%
Luxemb.	38%	4.3	14.8%	42%	4.8	11.4%
Malta	53%	12.0	23.1%	36%	6.6	13.9%
Netherlands	36%	3.9	8.2%	30%	2.0	3.4%
Poland	47%	13.8	27.0%	30%	6.0	11.2%
Portugal	27%	5.4	13.4%	32%	4.5	10.0%
Romania	36%	8.7	14.4%	25%	2.4	3.7%
Slovakia	31%	8.3	22.1%	24%	4.5	9.4%
Slovenia	25%	7.5	28.2%	33%	4.5	12.2%
Spain	37%	7.5	15.6%	39%	3.8	7.4%
Sweden	48%	6.3	18.2%	39%	2.7	5.4%

Note: In this table, we report the estimated reduction in the disability employment gap if the disability education gap were closed. We use coefficients pertaining to tertiary and upper secondary education for persons with disabilities obtained from a probit model of being employed estimated separately for each country. We control for gender, disability status, age in linear and quadratic terms, and the unemployment rate in linear and quadratic terms. Source: own elaboration based on the EU-SILC data.

To close the education gap, the average share of persons with disabilities who would have to upgrade their educational level is 41% (on average in the EU), with the share in each country ranging from 25% in Slovenia to 64% in Lithuania. Importantly, we assume that the disability education gap would be closed only among persons who have completed at least primary education. In such a case, the employment rate for persons with disabilities aged 25-34 would increase, on average, from 34.5% to 43.1%. This would imply an average reduction in the disability employment gap of 19.8% among persons aged 25-34[3].

The employment effects of closing the disability education gap are heterogeneous across countries. In six countries, the disability education gap accounts for less than 15% of the disability employment gap. This is the case in Belgium, the Netherlands, Portugal, Romania, Hungary, and Luxembourg. At the other end of distribution, the education gap accounts for more than 25% of the employment gap in the following six countries: Lithuania, Finland, Slovenia, Poland, Estonia, and Croatia. In line with the findings presented in section 4.3, we again see that the largest effects of closing the education gap could be achieved in the less developed EU countries.

For the sample aged 25-64, the employment rate for persons with disabilities in the EU would increase from 26.4% to 30.7% if the disability education gap were closed. This would translate to a 9.0% reduction in the disability employment gap. The country-specific reductions in the employment gap are positively correlated with the reductions observed in the sample aged 25-34.

6. Summary and conclusions

In this paper, we quantified the employment effects of education among persons with disabilities across the EU. We found that the employment probability gains from having tertiary education are much larger among persons with disabilities than they are among non-disabled people. If persons with disabilities who have completed at least primary education had the same probability of completing upper secondary and tertiary education as non-disabled people, the disability employment gap among people aged 25-34 could be 20% lower.

There are several factors that contribute to the differences in the educational attainment of people with and without disabilities. Persons with disabilities face multiple barriers to participation in education, including financial, organisational, and attitudinal challenges, and often need special assistance to be able to complete their education. However, investing in the education of persons with disabilities can bring tangible socio-economic benefits, as it will help to close the disability employment gap. Higher levels of employment among people with disabilities will increase their levels of income and overall wellbeing, which will, in turn, lead to higher budgetary inflows and lower social transfers.

However, we have also shown that in many EU countries, the benefits of closing the disability education gap would still be limited. More action is needed to address the other reasons for the disability employment gap. Non-formal education, especially digital skills training, may significantly improve the labour market outcomes of persons with disabilities. Public employment services must reorient some of their support services to target unemployed people with disabilities, who often need a different support mix. For example, public awareness campaigns aimed at preventing discrimination by employers should be implemented. In some countries, a large share of the disability employment gap may be explained by architectural and transportation barriers or inadequate health services. These issues should be tackled in national strategies aimed at increasing the employment rates of people with disabilities.

[3] For the EU as a whole (using the population weights for countries), the employment rate of persons with disabilities aged 25-34 would increase from 35.7% to 44.4%, and the disability employment gap would be reduced by 20.2%.

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Appendices

Appendix A. Descriptive statistics for persons with missing family background variables

The family background variables are unavailable for 19.6% of the sample aged 25-34 and for 26.3% of the sample aged 25-64. In both samples, the respondents with missing family background variables have, on average, lower educational attainment. In the sample aged 25-64, respondents with missing family background variables are, on average, significantly older and less likely to be employed.

Table A1. Descriptive statistics for missing and non-missing family background variables (mother's education and the financial situation of the household when the respondent was about 14 years old), 2011-2019

	Sample aged 25-34		Sample aged 25-64	
	Non-missing family background variables	Missing family background variables	Non-missing family background variables	Missing family background variables
Female	49.7%	48.2%	50.5%	49.9%
Age (mean)	30.2	28.5	43.3	51.0
Persons with disabilities	2.9%	1.9%	6.8%	7.8%
Upper secondary education	44.8%	49.8%	48.3%	48.2%
Tertiary education	39.0%	35.0%	31.0%	27.0%
Employment rate	78.7%	77.0%	77.2%	60.4%
Observations	76 388	18 617	407 048	145 030

Appendix B. Full estimation results of the baseline specification

Table B1. Estimation results

	Sample 25-34	Sample 25-64
Tertiary education	0.086***	0.095***
	(0.002)	(0.001)
Tertiary education × Disability	0.120***	0.042***
	(0.014)	(0.004)
Upper secondary education	0.158***	0.124***
	(0.002)	(0.001)
Upper secondary education × Disability	0.029*	-0.026***
	(0.011)	(0.003)
Disability	-0.410***	-0.376***
	(0.011)	(0.003)
Age	0.032***	0.059***
	(0.007)	(0.000)
Age^2	-0.000***	-0.001***
	(0.000)	(0.000)
Unemployment rate	-0.011***	-0.015***
	(0.001)	(0.000)
(Unemployment rate)^2	0.000***	0.000***
	(0.000)	(0.000)
Persons with disabilities	10 417	170 569
All observations	426 499	2 472 924

*In this table, we report the average marginal effects from a probit model with an employment dummy as the dependent variable. The regressions use all available data for the years 2011–2019. The regression for column 1 uses the sample aged 25-34, while the regression for column 2 is estimated on the sample aged 25-64. Besides the covariates reported in the table, we also control for country-gender fixed effects. Robust standard errors in parentheses. * p < .05 ** p < .01 *** p < .001.*

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