IMPACT EVALUATION OF THE GRADUATE PRACTICE INTERVENTION USING THE CART METHOD

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Abstract. The contribution for graduate practice is one of the measures of active labour market policy in Slovakia aimed at gaining first job experience and contacts for young school graduates. The main aim of the study is a counterfactual impact evaluation of this contribution on the employability of its participants. The evaluation is aimed at the period 2015–2017 and realised using the database of 12,953 treated eligible participants of Graduate practice and 83,907 non–treated controls. For the evaluation, propensity score matching was used, where the propensity scores were estimated by the method of Classification and Regression Trees. The results of the study show that treated individuals were employed on average three months longer and had an average salary of € 216.76 higher than non-treated during the 24–months impact period after the intervention.

Keywords: impact evaluation, graduate practice intervention, active labour market policy, counterfactual evaluation, unemployment.

JEL Classification: C5, E24, J08, J64.

Introduction

The current economic situation is causing negative experiences in the labour market, especially among young people. The Covid-19 pandemic has affected many sectors of the economy (Valaskova et al., 2021), also has caused an inflow of newly registered people (Svabova & Gabrikova, 2021). Job opportunities for young people have been significantly affected by the crisis caused by Covid-19. During the pandemic, the number of existing jobs was reduced, new jobs were not created, and employment support programs were used much less than in the pre-pandemic period, so young people often went straight to unemployment after graduating from school. This crisis has also affected the possibility of learning based on work or apprenticeships (OECD, 2021).

We can understand a group of young people as disadvantaged for several reasons. Young people have little or no experience with the labour market, often are without sufficient qualifications, education or professional experience, and can therefore be discriminated against when entering the labour market. Youth unemployment is not only a problem for young people but also a problem for individual countries as such. Youth unemployment has therefore become a major policy challenge for governments as well as employers (Grinevica & Rivza, 2018).

The aim of labour market policy (ALMP) is to focus on unemployment and thus increase employment (Rotar, 2018). This goal can be achieved through various labour market measures. Instruments or labour market measures are usually divided into active and passive (Zielinski, 2015). Active labour market policy measures help people get a job (Fossati et al., 2021), while passive labour market instruments are rather protective in nature and are designed to reduce the risk of a sudden drop in income (Zielinski, 2015).

Countries worldwide spend a lot of money on active labour market policies, but the problem is that even too much support for the unemployed from the state can lead to a loss of motivation to work. Therefore, determining the effectiveness of programs designed for the unemployed is very important (Rotar, 2021). The size of ALMP expenditures and their effectiveness should be monitored from a time, economic, integration, institutional and political point of view (Banociova & Martinkova, 2017). One of the main key tools for improving ALMP is their ongoing evaluation (Mueller et al., 2014). In recent years,

counterfactual impact evaluation methods have begun to be used to evaluate ALMP instruments. The aim of conducting an impact evaluation is to determine the effect of social or economic programs. This approach primarily measures the causal effect of the intervention, respectively program by an external entity, such as a national or local government, to a group of entities – people or companies for which is intervention, respectively program focused (Cerulli, 2015). The counterfactual approach to evaluation is based on the consideration of "what would have happened if the individual had not participated in the intervention program". Therefore, the impact assessment compares the individual's outcome in the labour market when he took part in the intervention and the counterfactual situation when he did not participate in the intervention. In reality, however, we can measure an individual's results in only one of these situations: either he participated in the intervention or did not. It is not possible to obtain data on both situations. Therefore, the counterfactual situation of non-participation in the intervention is for the participants (treated group) only hypothetical and is created by a comparison group of non-participants (non-treated group), who are as similar as possible to the participants in their individual characteristics and other contextual variables.

In the literature, we encounter studies that evaluate the effectiveness of various active policy instruments that target different population groups. For example, Costabella (2017) evaluated the effects of intensive training courses in Italy, which are primarily aimed at young high school graduates. The impact of the training on its participants is estimated by comparing it with a control group made up of individuals who did not attend the training. The analysis focused on the monthly employment rate and the number of weeks individuals spent during one year at work, these indicators were measured for four years from the beginning of the program. The results suggest that treated individuals were approximately 10 percent more likely to be employed, and these results are stable over time. Likewise, the time spent working in the treated group is about 10–15 percent higher than individuals who did not attend the training. The impact of vocational training on unemployment in Piedmont is being investigated by Donato et al. (2018), who also use the propensity score matching method in their study. Their results suggest that such programs have a greater impact on young people, the short-term unemployed and also those who have attended these courses for a longer period. The counterfactual evaluation of traineeships as one of the ALMP measures aimed at young people in Italy are a deeper analysis by Cappellini et al. (2019).

In the Romanian labour market conditions, Popescu and Roman (2018) also achieved a similar result of the impact of vocational education on employment as Costabella (2017), who used propensity score matching. They found that participation in the ALMP measure increased the chances of employment by 15%. The author also identified the groups in the population where the

program works best, especially women and people living in urban areas. In the study of Pirciog et al. (2015), the authors further evaluate the benefits of vocational education using the propensity score matching method in Romania. In Latvia, an analysis of the effectiveness of vocational training aimed at unemployed youth is carried out by Bratti et al. (2021).

The study of Caliendo and Schmidl (2016) examines active labour market policies in Europe, discussing the advantages and disadvantages of different active policies. They also provide a survey of recent evidence on the effectiveness of policies targeting young people living in Europe, focusing on a total of 37 evaluations carried out. They highlight the factors which, in their view, support or hinder the effectiveness of these measures in practice. Kluve et al. (2019) examine 113 impact assessments of ALMP programs targeted at young people worldwide. They have reached many conclusions, which are especially valuable for practitioners, as they provide them with an answer to the question of the important elements that contribute to the success of youth employment programs.

Hora and Sirovatka (2020) use counterfactual methods of evaluating the impacts of the apprenticeship program in the Czech Republic and are based on data provided by the Czech Labour Office. Their results suggest that this program is targeted at those groups of young people who are less disadvantaged in terms of their educational attainment and previous experience with unemployment. In terms of the outflow of the unemployed from the register, a weak impact can be observed for short- and medium-term unemployed and also for low and highly qualified youth. On the contrary, a stronger impact can be observed in medium-skilled youth and the long-term unemployed group.

In the conditions of Slovakia, Stefanik et al. (2020) deal with the impact evaluation of the contribution to Graduate practice. Participation in the intervention increases the chances of employment during the period after participation, but on the other hand, they found a negative impact of the intervention on the income of employed participants. Svabova et al. (2021) concluded that Graduate practice has a significant impact on the employability of young job seekers and their sustainability in employment.

Recently, especially in foreign literature, we have noticed a growing interest of authors in the use of data mining methods in the implementation of impact assessments. There is a presumption that artificial intelligence methods could create an even more accurate counterfactual situation using a better-estimated propensity score and a more accurate matching of individuals. However, in Slovakia, we have not identified this approach in any existing study. So here, we have identified the scientific gap that we want to fill with this study. At the same time, only a few impact evaluations of intervention programs in Slovakia have so far been realised, even though the Graduate Practice program belongs to those that are

more in the focus of the authors. The main goal of this study will be to quantify the impact of the intervention on the employment of its participants during the two–year impact period by using the data mining method of binomial trees to create a model of propensity score of participation in the intervention program Graduate Practice.

The paper is organised as follows. After a brief explanation of the conditions for the provision and operation of the Graduate practice intervention, which is dealt with in the section Institutional background, the following is a description of the methods and data used. The results of this study are then described, followed by a discussion and conclusion.

1. Institutional background

The contribution to Graduate practice in the conditions of the Slovak Republic is regulated by Section 51 of Act No. 5/2004 Coll. on Employment Services. The purpose of the contribution for the school graduate is to acquire such professional skills and practical experience with the employer that will correspond to their level of education (Act No. 5/2004 Coll.).

For the purposes of this contribution, a school graduate is understood as a citizen under the age of 26 who completed ongoing daily professional preparation at the relevant level of education less than two years ago and has not had a regularly paid job since the end of professional preparation. The Graduate practice can be carried out based on concluded agreement on the Graduate practice between the Central Office of Labour, Social Affairs and Family (COLSAF) and jobseeker, who is a school graduate registered in the database of unemployed jobseekers of the COLSAF for at least one month (Central Office of Labor, Social Affairs and Family, 2022).

The Graduate practice is carried out for a minimum of three months and a maximum of six months, in the range of twenty hours per week. During the practice, the school graduate remains registered in the database of jobseekers. The participant will receive a confirmation of completing the Graduate practice from the employer after the end of the practice (Act No. 5/2004 Coll.).

The school graduate is obliged to perform a Graduate practice at the employer, who is agreed with the relevant labour, social affairs and family office, i.e., the work assigned to him by the employer. During the completion of the Graduate practice, the school graduate is paid a monthly contribution of 65% of the subsistence minimum provided to one adult person according to Act no. 601/2003 Coll. about the subsistence minimum. The amount of this contribution is therefore not fixed and changes over time depending on the amount of the subsistence minimum. For the period from 01.07.2021 to 30.06.2022, the subsistence minimum for one adult person is 218.06 €, which means that the contribution for Graduate practice is € 141.73. In the period covered by this study, the subsistence level ranged from € 198.09 to € 199.48, which means that the amount of the contribution to Graduate practice varied from € 128.75 to € 129.66. The contribution is paid to the participant by the relevant labour, social affairs and family office.

2. Methodology and data

In this study, we realised an impact evaluation of the Graduate practice intervention on the employability and sustainability of jobs of its participants.

Data on employment of individuals come from the Social Insurance Agency (SIA) database of the Slovak Republic (SR) and data on unemployment come from the database of jobseekers of the Central Office of Labour, Social Affairs and Family of the SR. After performing logical controls, eligibility controls and controls about the course of the intervention, we created a database for this study, which consisted of 83,907 non-treated and 12,953 treated individuals.

Treated individuals participated in the intervention in the period 1.10.2014–31.12.2015. These individuals were assigned an impact period corresponding to 2015–2017. This time limit was related to data availability.

All variables used in the study are listed in Table 1.

Table 1. Variables used in the study (source: own elaboration)

Variable name	Description
treated	identification of the individual's inclusion in a treated group or control group
school	the last graduated school of jobseeker
age	age at entry into the database of jobseekers
previous evidence	cumulative time of previous evidence in this database
profession	last profession of the jobseeker before the registration
duration of evidence	the number of days of the last registration in the database
gender	gender of the jobseeker
marital status	marital status of the jobseeker
education	degree of the highest achieved education
region	region of permanent residence
disadvantages	disadvantages of the jobseeker according to Act no. 5/2004 on employment services, § 8 Disadvantaged job seeker
driving licence	driving licence of individual categories

The composition of the sample in terms of gender is shown in Figure 1. We can notice that women predominate among the participants of the Graduate practice, and men predominate among the non-treated. From this, we conclude a higher interest in this intervention among women.

The composition of the sample in terms of highest education is shown in Figure 2. Here it is visible that the Presov and Kosice regions have the largest numbers of unemployed individuals, and this also applies to young
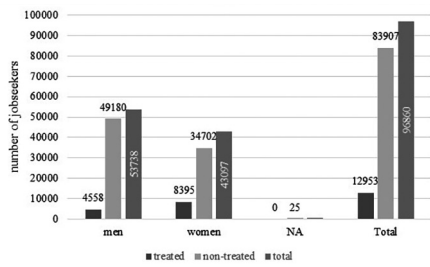
Figure 1. Composition of the groups in terms of gender
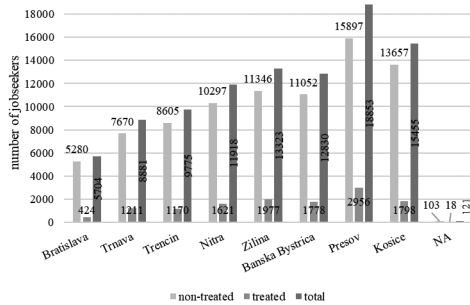(source: own elaboration)

Figure 2. Composition of the groups in terms of education
(source: own elaboration)

unemployed. In these two regions, there was also the highest interest in participating in the analysed intervention among all regions of Slovakia.

To measure the effect of the Graduate Practice intervention, we used the propensity score matching method. This method uses a statistical comparison group, which is created on the basis of the probability of participation in interventions, using observable characteristics of population units.

To estimate the propensity score of each individual, we used the Classification and Regression Trees (CART) method. CART is a kind of Decision Tree that can provide a probability of treatment (Westreich et al., 2010). All variables listed in Table 1 were used to predict an individual's propensity score, representing an individual probability of participating in Graduate practice. This propensity score was predicted using the Classification and Regression Trees (CART) method.

When creating the tree, we used the division of the sample into training and testing parts in a ratio of 80:20. The tree was pruned for brevity. Using the generated tree, we estimated the value of the propensity score for each treated and non-treated individual. These values were then used to match treated individuals with non-treated to create a counterfactual situation. Different approaches can be used to match treated individuals with non-treated individuals based on the propensity score, such as:
– nearest-neighbour matching,
– calliper and radius matching,
– kernel matching,
– stratification and interval matching,
– local linear matching (Khandker et al., 2009).

In this study, matching was performed with replacement by radius matching with a maximum allowed difference in propensity scores between the matched individuals at 0.0004. Matching with replacement means that one non-treated individual can be used repeatedly as a suitable match for more treated individuals.

By matching, we received samples of treated and non-treated jobseekers who were as similar as possible in terms of the probability of their participation in the intervention. The groups thus created were used to assess the impact of the intervention. This impact was quantified using the outcome variables listed in Table 2. The average treatment effect (ATE) is then calculated as the average of the differences in results between the group of treated and non-treated individuals (Khandker et al., 2009).

Table 2. Outcome variables used in the study (source: own elaboration)

Outcome variable	Description
wage	the average monthly wage during the 24-month impact period
part_time_employed	number of days of registration in SIA as part-time employed
full_time_employed	number of days of registration in SIA as full-time employed
employed	number of days of registration in SIA as self-employed and full-time employed

These variables measured the employment process during the 24-month impact period of every individual, which began after the end of participation in the intervention. We assumed that if an individual is not registered in the Social Insurance Agency (SIA) database (s) he is again unemployed. Using the values of these outcome variables, we want to find out whether participation in the Graduate practice had a significant impact on the employment of its participants compared to those jobseekers, who were also eligible, but decided not to participate. By comparing the mean values of the outcome variables in the treated and non-treated groups, we obtain a quantification of the impact of the intervention, together with a test of its statistical significance.

All calculations were performed in the IBM SPSS Statistics environment, version 26. A significance level of 0.05 was used in the hypothesis tests.

3. Results

To evaluate the impact of the intervention Graduate practice on the employability and sustainability of jobs of its participants, we carried out a counterfactual impact evaluation. The first step, after the preparation of the samples of treated individuals and their control counterparts, was the creation of the Classification and Regression Tree, which classify the individuals into one of the groups (treated or non-treated) using the values

of the independent variables and predicted a value of propensity score for every individual. We do not list the complete CART tree due to its complexity. However, its structure determines the branching according to the values of selected variables. The first variable used in the tree structure was the variable *age shifted* (individual's age shifted to the start date of the intervention) with a cut-off value of 20.675 years. Furthermore, the variables *degree of education* (full secondary vocational education, second-degree university education, full secondary general education and secondary vocational education), *previous evidence* (cut-off value 135.5 days), *disadvantages* (long-term unemployed, school-leaver) and individual's *age* upon entering the database (cut-off value 19.5 years) were used in the tree structure. All these variables determine the tree according to which it is possible to predict the classification of an individual into a group of participants of the Graduate practice or control group with some probability level.

The value of the risk estimate of our created model is 0.07, which means that the created model predicts the participation in the intervention (variable *intervention*) correctly in 93% of cases and incorrectly in 7%. This fact can also be verified in Table 3.

Table 3. Classification table of the created CART model (source: own elaboration)

Observed	Predicted		
	Non-treated	Treated	Percent Correct
Non-treated	83,420	487	99.4 %
Treated	6,301	6,652	51.4 %
Overall Percentage	92.6 %	7.4 %	93.0 %

The classification table shows the total percentage for the correct classification by the created model, which in this case is 93%. Therefore, we can say that the created model has a good classification ability because up to 93% of cases are correctly classified. As we can see in

the Classification table, the created model predicts the group of non-treated individuals better, where 99.4% of non-treated individuals are correctly predicted, whereas 51.4% of treated individuals are correctly predicted. Using the created CART model, we estimated the propensity score of each individual, and subsequently, the estimated propensity scores are used for matching the individuals from both groups. We used radius matching with the selected tolerance level of 0.0004 and matching with replacement, where one non-treated individual could serve as a matched counterpart for more treated individuals.

Matching resulted in the matched groups of treated and non-treated that are so similar in their propensity score and thus their characteristics that every change in the values of their outcome variables can be attributed to the participation in the Graduate practice intervention. To compare the means of outcome variables for matched groups, we used a t-test. Table 4 shows the results of the testing.

The result of Levene's test for equality of variances determines the use of the t-test with the assumption of equal or not equal variances. If the p-value (column Sig.) is larger than 0.05, we use the first line of the table – *Equal variances assumed*. If the p-value of Leven's test is lower than 0.05, we use the second row of results – *Equal variances not assumed*. All the p-values of Levene's test in Table 4 are all lower than 0.05, so the t-tests with equal variance not assumed are used for all outcome variables. The p-values of these t-tests show statistically significant differences in means of all means of outcome variables (wage, employed, part-time, and full-time employed) between the treated and non-treated groups. The differences in means between the treated and non-treated show that treated individuals had an average wage of € 216.76 higher than non-treated individuals during their impact. Moreover, treated individuals were employed (as a full-time employee or self-employed person) on average 97.28 days longer than non-treated individuals during their impact period. Treated individuals were part-time employed on average 15.79 days more than non-treated

Table 4. Independent Samples t-test (source: own elaboration)

Variable / Test	Levene's Test for Equality of Variances		t-test for Equality of Means				
	F	Sig.	type of t-test	t	df	Sig. (2-tailed)	Mean Difference
wage	36,245.2	< 0.05	Equal variances assumed	−98.4	27,486	< 0.05	−216.76
			Equal variances not assumed	−98.4	13,743	< 0.05	−216.76
employed	51,642.6	< 0.05	Equal variances assumed	−104.6	27,486	< 0.05	−97.28
			Equal variances not assumed	−104.6	13,743	< 0.05	−97.28
part time employed	8,199.1	< 0.05	Equal variances assumed	−45.6	27,486	< 0.05	−15.79
			Equal variances not assumed	−45.6	13,743	< 0.05	−15.79
full time employed	38,227.1	< 0.05	Equal variances assumed	−85.4	27,486	< 0.05	−76.21
			Equal variances not assumed	−85.4	13,743	< 0.05	−76.21

ones. The full-time employment was for the treated individuals on average 76.21 days longer than non-treated individuals.

4. Discussion

In this study, we focused on assessing the impact of Graduate practice intervention on the employment of young school-leavers. A similar issue was addressed by the authors in the study by Stefanik et al. (2020). The authors examined the impact of Graduate practice by the instrumental variable method, using the travelling time to the nearest COLSAF office as the instrument and propensity score nearest neighbour and kernel matching of individuals. In the study, the authors found a positive impact of the intervention on the participants' employment from the 30th month after the end of participation. The authors also found a positive medium-term impact during the economic crisis, but only in the public sector and a negative impact on the income of the participants. The positive impact of the intervention on employment during the years 2016–2017 was demonstrated in the study by Svabova and Kramarova (2021), but this did not prove statistically significant. However, the authors found a significant positive impact on the wages of the treated participants. Similar results were shown by the study by Svabova et al. (2019), where the positive impact of the intervention on employment was demonstrated during 2014 and 2015. In a study by Stefanik et al. (2014), the authors analysed several active labour market policy measures in Slovakia, where Graduate practice proved to be one of the most effective. The positive effects of the Graduate practice are also indicated by studies by Borik et al. (2015) and Harvan (2011).

It can be said that the positive impact of this intervention is shown in several studies, which is evaluated using different methods and also in different periods. This intervention certainly has a positive impact on its participants, and, in this study, we evaluated the impact on their employment and also on their wages. In the further direction of this study, we want to update the results using new data from the period up to 2020. It will also be interesting to monitor the impact of the pandemic on the use of LMP measures in Slovakia.

Conclusions

This article focused on evaluating the impact of the Graduate practice intervention provided in the Slovak Republic to school graduates to gain professional skills and practical experience directly with the employer. This allowance can be received in Slovakia by a young graduate of a school up to the age of 26 who is also registered as a job seeker at the Office of Labour, Social Affairs and Family.

As part of the evaluation, we worked with the database of jobseekers of the Central Office of Labour, Social Affairs and Family of the Slovak Republic, from which we obtained data on unemployment and with the database of the Social Insurance Agency (SIA) of the Slovak Republic, from which we obtained data on the employment of individuals. Thus, in this study, we worked with a database that consisted of 83,907 non-treated and 12,953 treated individuals. In examining the impacts, we monitored the impact period during the years 2015– 2017.

Although the period under review is 2015–2017, the results of this study can be considered relevant. This is mainly due to the fact that there have been no significant changes in legislation since the period under review to nowadays, specifically in Act 5/2004 Coll. on Employment Services, which regulates the conditions for providing this contribution. There were also no other significant changes in the Slovak environment or the labour market. We, therefore, consider the results obtained in this study to be relevant at present.

We used counterfactual impact evaluation methods to evaluate the impact of the intervention on the employability and sustainability of jobs of its participants. Specifically, we used the propensity score matching method, the Classification and Regression Tree, to estimate the propensity score values for the participant and non-participants of the measure. The created CART model has a good classification ability because it correctly predicted participation in the intervention for up to 93% of cases. Subsequently, we matched treated individuals with non-treated ones using the radius matching technique. For evaluating the statistical significance of the differences in the observed outcome variables for these two groups, we performed a t-test. Based on the results of this testing, we can say that all outcome variables (wage, employed, part-time employed, full time employed) are significantly different in means between the treated and non-treated groups.

We found that treated individuals were employed on average 97.28 days longer than non-treated individuals during the impact period. That means the participation in the Graduate practice results in more than three months longer employment of treated individuals compared to the non-participants of the intervention. For full-time employment, it was 76.61 days longer for the treated than the non-treated. The intervention also affected the amount of their wages, treated individuals had an average of € 216.76 higher wages than non-treated individuals. Based on the results, we can say that the intervention Graduate practice has a positive impact on the employability of jobs of its participants and also on their wages.

In addition, this intervention has undeniable benefits for young people, but it is not measurable. It helps them gain their first work experience, work contacts with potential employers, work habits. This is one of the reasons why young people use it. However, as has been shown in the numbers of people treated, it is constantly necessary to rationalise the conditions under which it operates in order to have the desired effect of reducing the youth unemployment rate.

Disclosure statement

The authors declare no competing financial, professional, or personal interests from other parties.

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