A highway is not a panacea: The impact of a new highway on the local labour market in Slovakia *

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Abstract

In this paper we explore the effect of transport infrastructure on the local (municipality-level) labour markets. To this effect, we consider the impact of the *R1* highway in central Slovakia, which was put into use in two stages: in 2000 and 2011. We apply difference-in-differences and synthetic control method to explore whether municipalities located near the new highway benefited from its construction. To cope with endogeneity, we use the inconsequential unit approach by excluding major cities from the sample. Our results suggest that the municipalities located near the Trnava-Nitra segment opened in 2000 enjoyed substantially greater gains than those near the segment that connects Nitra and Banská Bystrica, opened in 2011. A possible explanation for these divergent patterns could be that the opening of the later segment occurred in the aftermath of the Great Recession.

Keywords: regional policy; infrastructure; regional development; unemployment; difference in differences; synthetic control method.

JEL Codes: H54, O18.

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Introduction

Regional disparities in Slovakia in terms of unemployment rate are relatively high: districts in western and north-western Slovakia exhibit low unemployment rates, in contrast to those in south-eastern and eastern Slovakia where unemployment remains persistently high. One possible explanation for this pattern is the better access of districts in the west of the country to the European road networks (Figure 1). According to the transport performance index measuring accessibility of regions in the EU, Bratislava and the surrounding area belong to the regions with an above average accessibility in the EU, while the rest of the country is among the least accessible areas (Dijkstra et al., 2020). Habrman and Žúdeľ (2017) note that this might have helped western and north-western Slovakia to attract sizable FDIs, notably the assembly facilities of companies such as Volkswagen, Stellantis, KIA and Samsung. By contrast, eastern Slovakia suffers from the lack of connection to the trans-Europe highway network combined with unfavorable geography: the centre of the country is mountainous, making road transport slow and vulnerable to bad weather conditions.[1]

Construction of highways can be an attractive policy measure for politicians. Consider a decision-maker who faces a choice between investment in a new highway or an education reform. While both alternatives have the potential to stimulate the economy, the benefit of the former is in its tangibility and visibility: it is easier for the population to be aware of a new highway than appreciate something as abstract as an education reform. In other words, construction of a highway also gives politicians the opportunity to take credit for large-scale high-visibility public investment projects and/or distribute patronage across regions. Furthermore, it raises public consumption and employment while the road is under construction, and it may lead to an increase in economic activity when the new road is open. Hence, assuming the public is unaware of the costs and benefits associated with different policy choices, the decision makers may be inclined to opt for the new highway to enhance their prospects of re-election.

The possible link between growth of economic activity and highway construction stimulates academic discussion on the topic. However, the existing literature is inconclusive, which might be attributed to three factors. Firstly, some analyses suffer from methodological shortcomings, such as not considering possible endogeneity stemming from selection bias, as a highway is usually constructed to connect more economically significant areas. Consequently, the ex-ante higher level of economic development may amplify the impact. Secondly, the capacity of a highway to generate economic activity may depend on certain enabling aspects, such as the mobility of production factors (Banerjee et al., 2020), level

[1] In 2021 the two largest cities located on the two sides of the country, Bratislava and Košice, were finally connected by a highway through Hungary, thus connecting the eastern Slovakia to the pan-European TEN-T network. As this still constitutes a diversion, and given that the highway connection through Slovakia remains incomplete, it does not significantly improve the accessibility of eastern and especially central Slovakia. See `https://tinyurl.com/5en9p5ra`.

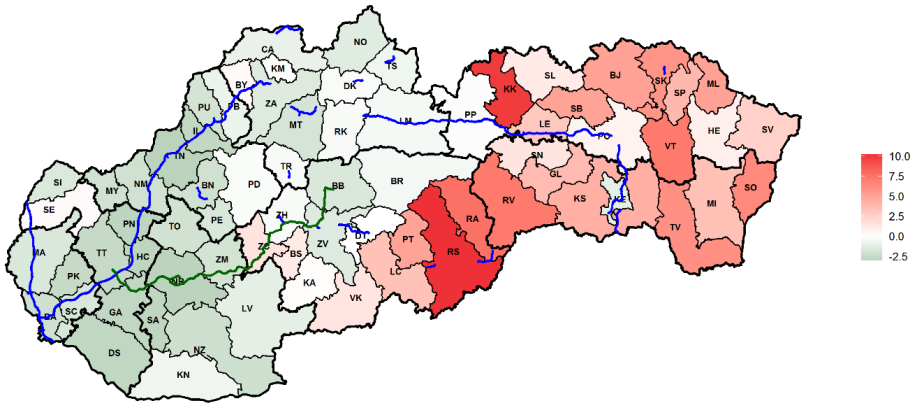

Figure 1: Highway network and the difference between district and national unemployment rates in 2019. Data source: CDB. Note: Green lines represent the R1 highway, while blue lines represent the other highways.

of human capital (Habrman and Žúdeľ, 2017) or quality of institutions (Crescenzi et al., 2016). Finally, as Crescenzi and Rodríguez-Pose (2012) point out, the impact of highways may display decreasing returns to scale. Therefore, not all highways (or not all segments of a given highway) need have the same impact on the local economies.

With this paper we would like to contribute to the ongoing discussion by analyzing the impact of highways on the local labour market in Slovakia. Similarly to Mikloš (2016) and Mikloš and Habrman (2018), we evaluate the impact of a new highway, R1, on unemployment. In contrast to the aforementioned studies, however, we analyze the impact of a new highway at the municipal level, which has several benefits.[2] Notably, it allows us to cope with the potential endogeneity by applying the inconsequential unit approach combined with difference-in-differences and synthetic counterfactual methods. Under the assumption that a highway is built to connect main cities as centers of economic activity, this method concentrates on the rural municipalities between such cities, as the selection of the rural areas that are near a highway can be considered largely random. Conducting the analysis on municipal level enables us also to differentiate between urban and rural municipalities. Furthermore, we have access to a longer time series at the municipal level, allowing us to examine the two stages in which the R1 highway was completed: the section between Trnava and Nitra in 2000 as well as the section Nitra to Banská Bystrica in 2011.

[2]Mikloš and Habrman (2018) use descriptive data to show that there is a larger decline of probability of remaining unemployed among the inhabitants of municipalities located closer to the R1 highway segment connected to the highway network in 2011 than municipalities in the comparison groups.

Our results suggest that these two segments differ in terms of the impact they had on the labour markets in their vicinity. We find that the first section is associated with a reduction in the unemployment share in municipalities within 30 kilometers of the R1 by nearly two percentage points, independent of the method used. The results for the second section differ based on the method used. Using difference in differences, we find an increase of the unemployment share by nearly 2 percentage points. On the other hand, using the synthetic control method, we find that the unemployment rate declined by around 0.8 percentage points in the affected municipalities compared to their clones.

The reason for these contrasting results are likely to lie in the differences between the respective regions, which the two highway sections go through. With the completion of the first segment, western Slovakia was able to better leverage its closeness to the capital city of Bratislava and foreign markets, and became a more attractive destination for investments. On the other hand, the second segment of the highway is in more a mountainous area, making it a less attractive as an investment destination. Hence, this highway segment may have caused given rise to agglomeration effects: instead of attracting investments, it may have helped turn local residents into commuters working further away from their home municipality. The building of this segment also took place during the recovery from the Great Recession so that our results may be confounded by the aftermath of this crisis. Finally, the region has been impacted by institutional backsliding, with right-wing extremists presiding over the Banská Bystrica Region, resulting, for instance, in the cessation of the use of European Structural and Investment Funds. Under these unfavourable natural, economic and institutional conditions, the opening of a highway was not a sufficient stimulus to economic activity.

Literature review

Building transport infrastructure is often regarded as serving to enhance productivity and reduce regional disparities in an economy. This view is founded on the premise that better access to new markets fosters the exchange of goods and services and improves the allocation of physical and human capital. Regions lacking infrastructure may struggle to attract investment and cultivate a qualified labour force, or provide its citizens with a high standard of living. Banerjee et al. (2020) note that it was the economic impact of the massive railroad construction during the period of industrialization of Western Europe and North America that continues to place infrastructure investment to the forefront of the development discourse.

[3] We use the moment when the segments were completed and thus fully connected to the R1 network as points in time when the respective treatments started. We refer to this moment, interchangeably, as the completion, opening or the connection of a given section.

Studies examining the impact of public infrastructure investment have gained a particular momentum around three decades ago. Aschauer (1989) modified the Solow-Swan model of economic growth by distinguishing between public and private investment, with the assumption that both components influence production equally. [4] Subsequently, he demonstrated that public investment, most notably that directed into infrastructure, played a key role in boosting productivity in the United States in the post-war era.[5] This view is supported by the classical trade literature, which points out that transport infrastructure may reduce transport costs and thus facilitate expansion of trade routes, which in turn increases the profitability of firms and enables them to expand into new markets (Crescenzi and Rodríguez-Pose, 2012).

According to the New Economic Geography, however, the role of infrastructure development is rather ambiguous. Assume there are two regions, one more centrally-located and industrialized, and the second more peripheral and lagging behind in industrialization. Suppose that a highway is constructed to connect the two regions. The subsequent reduction of transportation costs exposes the firms in the periphery to increased competition from firms in the central region. Consequently, due to the assumption of increasing returns to scale linked to a higher number of firms and varieties in the center, the central firms will find it advantageous to expand to the market of the peripheral region (centrifugal forces). Yet, the prosperity enjoyed by the firms from the central region may stimulate the establishment of new firms, what could in turn lead to higher prices of production factors. Some firms might consequently choose to relocate to the periphery to take advantage of the lower costs of production (centripetal forces). It is not clear which of these two forces would prevail, making it possible to expect agglomeration as well as dispersion of economic activity resulting from new infrastructure projects (Puga, 2002; Redding and Turner, 2015).

The ambiguity in the scale and direction of the effects is also discernible from the results of empirical studies. In their meta-analysis of 776 results, Holmgren and Merkel (2017) find that the expected elasticity of investments in transport infrastructure with respect to economic output lies in the range of -0.06 to 0.52. They further find that the impact is positive mainly for construction and manufacturing sectors. Likewise, Redding and Turner (2015) observe in their extensive literature review that highways are effective in attracting new residents into their proximity. In contrast, they find that the effect is less clear when it comes to boosting economic activity in the nearby municipalities or regions.

There are numerous possible explanations for the ambiguity of the above-mentioned results. As Crescenzi and Rodríguez-Pose (2012) contemplate, the impact might become

[4] Holmgren and Merkel (2017) point to other methods of modeling infrastructure expenditure in the neoclassical model of economic growth, such as the production function or the investment rate. This, however, does not change the expectations of the positive impact on economic activity.

[5] Vanhoudt et al. (2000) warn that there may be reverse causality in this study, since richer and more productive economies allocate more funds to building and upgrading infrastructure.

negligible or even counterproductive after highway density surpasses a certain minimum threshold required to connect the region, due to the high costs of construction. In this context, Rodríguez-Pose et al. (2018) point to a massive infrastructure construction in Spain in the past 30 years, and show that the usage of these new roads remains very low. [6] Thus, Rodríguez-Pose et al. (2018) label road infrastructure as "white elephants", since politicians often prefer to make use of highway construction to send a signal to voters about the completion of a major project during their term of office than, say, an educational reform, which takes time until its effects become visible. As a result, something is built which looks nice in the eyes of the voters, but may actually be expensive and impractical.

The mere construction of a new highway cannot be regarded as a panacea in itself. On the contrary, the impact of highways depends on several underlying economic factors. Crescenzi et al. (2016) point out that the investment in highway development has had favourable impact in the EU regions only in interaction with institutional quality. They justify this result by the fact that better institutions are associated with more efficient allocation of funds, so that such countries are less likely to build "white elephants". Given the high costs associated with major infrastructure projects, in addition to the risk of political abuse, highway construction is prone to collusion, corruption or delays in construction. Moreover, Banerjee et al. (2020) explain the weak impact of proximity to a highway in China by the low mobility of factors of production. Likewise, the quality of human capital is crucial. Habrman and Žúdeľ (2017) find that in Slovak districts with higher-quality human capital, the impact of highways and expressways on unemployment is more favourable. If, on the other hand, the region does not have an attractive workforce from an investor's point of view, the connection of this region to a highway will not work wonders. In this context, Duranton and Turner (2012, p. 16) emphasize that "No one would doubt that a completely isolated place will be poor, or that most rich places are well connected. But it does not follow from these observations that all well-connected places are rich or that improving connectivity necessarily brings development."

Additional explanations for the ambiguous impact of highway construction on economic performance may also be related to methodological caveats. Redding and Turner (2015) point out that the choice of the treatment group is non-random. As the choice of a particular route is likely to be influenced by the level of economic activity in the given region or by political factors, the possibility of endogeneity needs to be addressed. An instrumental variable is the traditional solution, and specifically in this case in the form of historical infrastructure (Duranton and Turner, 2012) or planned transport routes (Baum-Snow,

[6] For instance, Rodríguez-Pose et al. (2018) mention the toll Madrid-Toledo highway with a planned utilization of 25 thousand cars per year. However, the actual use after the opening was 2,800 cars per year in 2008, decreasing to only 881 cars per year in 2016. The new highway failed to attract cars from an existing parallel road, resulting in this very poor usage.

2007; Ciani et al., 2022).[7]

An alternative to instrumental variable is the so-called "inconsequential unit approach". This involves constraining the treatment group to contain only such regions that find themselves in it, to a certain extent, randomly. For example, Chandra and Thompson (2000) mention that highways are often built to connect two major cities, and the choice of these cities therefore is not random. Yet, the choice of rural areas through which the highway passes is largely subject to chance (and geography). Therefore, in their analysis, they exclude metropolitan areas and focus only on rural areas.

In addition to taking into account the problem of endogeneity, according to Redding and Turner (2015), a distinction needs to be made between growth and reorganization of economic activity. In particular, in addition to attracting new investment, the completed highway may shift economic activity from a region that lies further away from the new road to a region close to the new road. To deal with this problem, it is recommended to estimate the impact of the new highway on the observable differences in the region itself (reorganization), as well as to compare them with other regions in the country (growth). For instance, Ciani et al. (2022) find that even though a new highway in the Calabria region in Italy had a favourable effect on the municipalities in its proximity, it did not help Calabria to converge economically.

The R1 and the highway network in Slovakia

In this study, we aim to contribute to the discussion of the impact of highways on unemployment by focusing on the R1 highway through central Slovakia (Figure 2). The construction of a highway in central Slovakia was planned already during the 1970s when segments of the main roads in the region were rebuilt. However, the lack of an effective prioritization system for projects, and public procurement processes that encourage collusive behavior, resulted in a rather sluggish construction of highways in Slovakia (Kovalčík, 2017).[8]

In the case of the R1, it meant that the road segment between Trnava and Nitra was completed in 2000, while the section between Nitra and Banská Bystrica was fully opened in 2011. It was through the later opening in 2011 that the districts of Zlaté Moravce, Žarnovica, Žiar nad Hronom, Zvolen and Banská Bystrica as well as parts of the Nitra

[7] Though in the former case, it is important to describe the purpose of building the historical infrastructure. For instance, Donaldson (2018) and De Benedictis et al. (2018) in their analysis of British infrastructure in India and ancient Roman roads, respectively, stress that these infrastructure projects were primarily motivated by military expansion. If, on the other hand, the primary motivation would have been economic, the use of historical infrastructure data might not fully solve the "chicken-and-egg" problem, as the historical road connection might have reflected the economic development of cities at the time of construction and amplified their progress. The development boost since then might, in turn, have inspired more recent construction of infrastructure.

[8] A big turning point in the former problem was achieved in 2020 as the methodology for prioritisation of infrastructure investments was developed ÚHP, 2020.

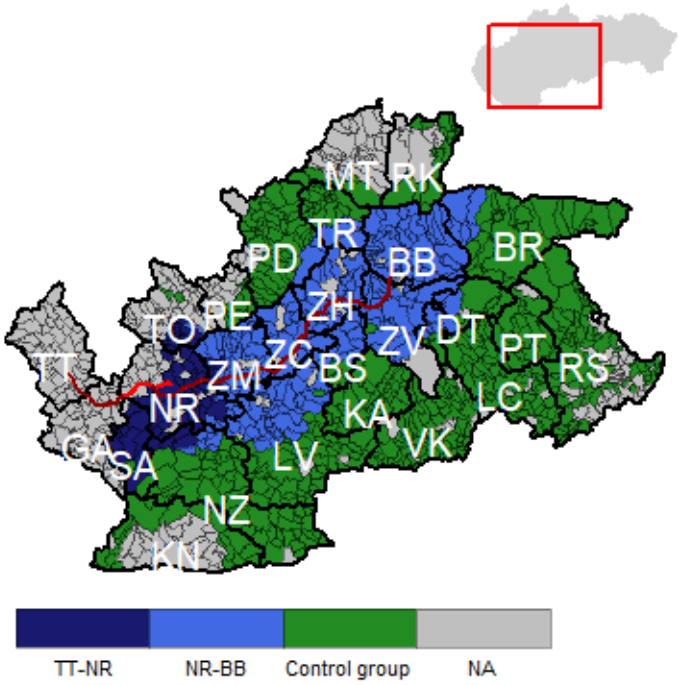

Figure 2: Composition of the treatment and control groups. Source: CDB and Open Street Map (processed by Michal Páleník). Note: the red and dark red lines represent the sections from Trnava (TT) to Nitra (NR) and from Nitra to Banská Bystrica (BB), respectively. The dark and light blue areas represent the two treatment groups, green is the control group and grey denotes the municipalities excluded from the sample (outliers as well as municipalities close to the D1 highway

district east of Nitra, were connected to the existing network of highways. At the same time, the R1 improved the accessibility of the Banská Štiavnica district and the northern part of the Levice district. In the future, the R1 should tie into highways that will connect Bratislava and Košice, the two largest cities in the country. In the north, it will be connected to the D1 highway near Martin, or Ružomberok, while in the south it will be connected to the R2 highway near Zvolen.

Previous studies which have analyzed the impact of highway construction on the Slovak labour market have been inconclusive. Habrman and Žúdeľ (2017) find that the presence of a highway within 30 kilometers of a district capital reduces unemployment in that district. Other analyses implemented a quasi-experimental approach by looking at the effect of a newly constructed highway. Mičúch et al. (2015) observe that the unemployment rate decreased in districts with a new highway segment 9 months after its construction. At the same time, however, unemployment increased in the neighboring districts. Baláž et al. (2018) conclude that construction of new highway segments after 2000 led to an increase in wages and the number of firms, but had an insignificant impact on unemployment. Likewise, Mikloš (2016) obtains an insignificant result for the second segment of R1 between Nitra and Banská Bystrica on district-level unemployment. For the construction of

the same highway segment of R1, Mikloš and Habrman (2018) find that the impact was significant mainly for districts that are either centers of economic activity in the region or contain successful industrial parks.[9]

By conducting the analysis at the municipal level, we want to assess whether a newly-established connection to a highway changes the economic structure of districts. Specifically, we are interested in examining whether the inhabitants of the municipalities near the R1 highway in Slovakia were able to gain a better foothold in the labour market thanks to new job opportunities, in comparison with the inhabitants of municipalities further away from the new highway. We take advantage of two milestones, the completion of the Trnava-Nitra and Nitra-Banská Bystrica segments in 2000 and 2011, respectively.

Data

To evaluate the impact of a new highway on the local labour market in its proximity, we define the treatment group as municipalities located within 30 kilometers from the nearest highway exit. [10] Using the most direct path here could be inaccurate, as there could be a forest or other natural barrier separating a municipality and the highway. To circumvent this, Páleník (2021) used data from open street maps to calculate the distance from the exits of the R1 highway to the municipalities located in central Slovakia by the means of auxiliary roads.[11] We divide the treatment group into two parts: municipalities close to the exits of the Trnava-Nitra section (TT-NR) and municipalities close to the exits of the Nitra-Banská Bystrica (NR-BB) section. The control group consists of municipalities from the surrounding districts; however, we removed the municipalities located within 30 kilometers from the D1 highway that was constructed earlier in the northern part of central Slovakia, as such municipalities were already well-connected to a highway network. Figure 2 shows the composition of the control and treatment groups.

As the outcome variable, we look at the unemployment at the municipal level. As the unemployment rate is not reported for individual municipalities, We first obtain the data on the number of unemployed persons at the municipal level for the years 1996 - 2022 from the Statistical Office of the Slovak Republic. We utilize this to construct the municipal unemployment share as the ratio of the number of unemployed persons in a municipality to the number of inhabitants in productive age (15-64) in the given municipality.[12] To avoid including outliers, we discarded the lowest and the highest five percent of the distribution

[9] However, they do not provide a definition of a *successful industrial park*.

[10] We have also used other distance thresholds from the R1 for robustness checks: 15 km, 20 km, 40 km. The results are similar and are reported in the annex in Table 5.

[11] We are grateful to Michal Pálenik for sharing this information with us.

[12] We define this as the unemployment share to distinguish this from the unemployment rate, which is defined as the ratio of unemployed persons to the number of persons in the labor force. The Statistical Office of the Slovak Republic provides information on the number of people in productive age in a municipality, but not the number of person in the labor force. Therefore, we use the unemployment share as a proxy for the unemployment rate on municipal level.

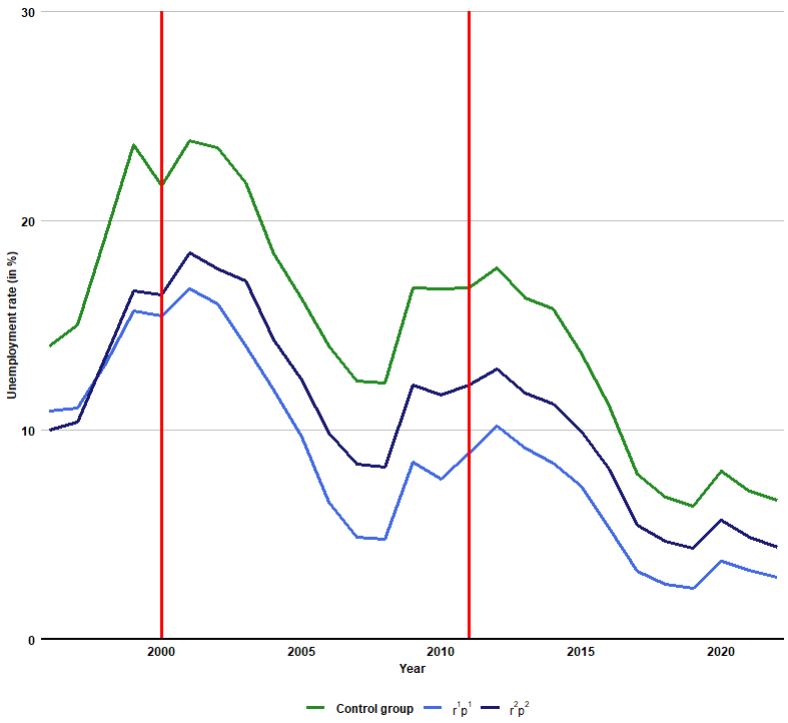

Figure 3: Development of unemployment share in the control group and two treatment groups. Data source: SO SR. Note: The dark blue and blue lines represent the two treatment groups (r^1p^1 denotes the TT-NR segment, while r^2p^2 the NR-BB segment), the control group is in green. The red vertical line indicates the connection of individual sections to the highway network.

of the average of this indicator over the entire period under review.

Unfortunately, we face data limitations in terms of possible covariates. For the difference-in-differences approach (which we explain in more detail below), we are restricted to population density, average age of the population and the migration balance. For the microsynth synthetic counterfactual method, we benefit from the fact that we can find suitable clones for the treatment groups using more detailed data from the pre-treatment 1991 census. Hence, we obtain information on the ratio of persons with elementary schooling as their highest attained educational level, the ratio of persons employed in the manufacturing sector and the ratio of persons belonging to the Roma minority.

One of the characteristics that differs across the municipalities is their altitude. While the municipalities located in the proximity of the R1 section from Trnava to Nitra are located in lower altitudes, the section of R1 from Nitra to Banská Bystrica is in more hilly areas. The higher altitude of some municipalities might amplify their distance from the highway and result in a lower impact. Hence, we also include data on the altitudes of the municipalities. All data is obtained from the Statistical Office of the Slovak Republic.

In Figure 3, we can observe the development of the unemployment share in the control group and the two treatment groups. Both treatment groups have a significantly lower

unemployment share than the rest of the sample. The differences between the individual groups remain approximately the same throughout the period. The exception is the development observed in the first section between Trnava and Nitra following the opening of the R1, where the rate of unemployment has significantly reduced in the municipalities in its vicinity.

Difference in Differences Analysis

We first analyze the impact of the R1 highway using difference in differences in the following form:

$$u_{it} = \beta_0 + \delta_1 r^1_{it} + \delta_2 r^2_{it} + \delta_3 p^1_{it} + \delta_4 p^2_{it} + \delta_5 r^1_{it} * p^1_{it} + \delta_6 r^2_{it} * p^2_{it} + \sum_{j=1}^{3} \beta_{ijt} x_{ijt} + \alpha_i + \tau_t + \varepsilon_{ijt} \quad (1)$$

where u_{it} represents the unemployment share for a given municipality i in year t. The two treatment groups (r^1_{it}, r^2_{it}) and treatment periods correspond to the two phases in which the highway was completed (p^1_{it}, p^2_{it}) along with the interactions denoting the impact of the highway on the municipalities in its proximity. Moreover, x_{ijt} denotes socio-economic control variables (population density, average age of population and migration balance). The last variables represent the individual and fixed time effects (a_i and τ_t) and the residuals (ε_{it}). We are particularly interested in the coefficients δ_5 and δ_6, as they measure the difference between the control and treatment groups in the period following the opening of the individual sections.

In addition, we are interested in the overall impact of the distance from the highway on the unemployment share. Therefore, we also estimate the following model:

$$\begin{aligned} u_{it} = {} & \beta_0 + \delta_1 r^1_{it} + \delta_2 r^2_{it} + \delta_3 p^1_{it} + \delta_4 p^2_{it} + \delta_5 r^1_{it} * p^1_{it} * d_{it} + \delta_6 r^2_{it} * p^2_{it} * d_{it} \\ & + \sum_{j=1}^{3} \beta_{ijt} x_{ijt} + \alpha_i + \tau_t + \varepsilon_{ijt} \end{aligned} \quad (2)$$

where we define the distance (d_{it}) for the year 1999 as the distance from Trnava, in the years 2000 to 2010 as the shortest distance from the municipality to the nearest exit of the highway section Trnava - Nitra and in the years 2011 to 2022 as the shortest distance from the municipality to the nearest exit to the R1. The distance variable thus measures the shortest distance from each municipality to the nearest R1 exit, taking into account the staggered completion of the two highway segments.

The difference in difference estimations in Table 1 reveal that the opening of the two segments of the R1 highway had different effects on the nearby municipalities. The first

Table 1: Impact of highway construction on rural and urban municipalities.

	(1) u_{it}	(2) u_{it}	(3) u_{it}	(4) u_{it}	(5) u_{it}	(6) u_{it}
Constant	13.30***	6.507**	6.060**	6.751***	3.657	27.02**
	(0.186)	(2.545)	(2.951)	(2.556)	(2.710)	(10.35)
$r^1_{it} * p^1_{it}$	-1.687***	-1.826***	-1.744***		-2.153***	-0.498
	(0.416)	(0.419)	(0.440)		(0.446)	(0.766)
$r^2_{it} * p^2_{it}$	1.831***	1.777***		1.978***	1.768***	0.882
	(0.318)	(0.315)		(0.326)	(0.326)	(0.801)
Total number observations	20 763	20 763	14 931	19 143	19 710	1 053
Number of municipalities	769	769	553	709	730	39
Number of treated municipalities	276	276	60	216	260	16
Sample of municipalities	All	All	Excluding r^2	Excluding r^1	Rural	Urban
Individual fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Socioeconomic controls	No	Yes	Yes	Yes	Yes	Yes
R^2	0.620	0.622	0.621	0.616	0.622	0.798
Adj.R^2	0.620	0.621	0.620	0.616	0.621	0.792
F	238.1	216.2	172.7	200.2	207.4	163.9

Note: The dependent variable is the unemployment share in a municipality. Robust standard errors in parentheses. $r^1_{it} * p^1_{it}$ and $r^2_{it} * p^2_{it}$ denote the TT-NR and NR-BB sections, respectively. $r^1_{it} * p^1_{it}$ is omitted from the last two models due to lack of observations in those quintiles of altitude. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

segment from Trnava to Nitra reduced unemployment in the municipalities near the R1 by 1.7 to 2.2 percentage points compared to more distant municipalities. On the other hand, unemployment in municipalities near the later-constructed section running between Nitra and Banská Bystrica increased after the completion of the section. This difference could be linked to the distance from the capital city of Bratislava and the related connection to the pan-European highway network: the municipalities near the Trnava - Nitra were relatively close to Bratislava and therefore stood to benefit more from having a highway connection than the more distant municipalities near the Nitra - Banská Bystrica segment. It is also possible that the municipalities near the first section had certain predispositions (for example, being more developed in terms of industrialization and human capital), which were amplified by the new highway section. Moreover, at the time of the construction of the section between Trnava and Nitra, a new Stellantis (known as Peugeot-Citroën until 2021) manufacturing plant was located in the region, which could have had favorable effects in the region.

Both effects are weaker in magnitude in cities compared to rural areas and even become insignificant for urban municipalities. The reasons can be twofold. From a statistical point of view, the rural municipalities constitute a substantially larger part of our sample and therefore capture stronger effects. From an economic point of view, Redding and Sturm (2008) point out that larger municipalities are more robust to local exogenous shocks that impact trade barriers and improvements in transportation infrastructure as they may have it easier to specialize and access other markets.

Table 2: Impact of highway construction on municipalities at different altitudes.

	(1) [107;156] u_{it}	(2) [156;198] u_{it}	(3) [198;288] u_{it}	(4) [288;453] u_{it}	(5) [453;972] u_{it}
Constant	9.312*	16.31***	12.21***	-5.337	2.714
	(5.137)	(5.883)	(4.492)	(5.821)	(5.502)
$r_{it}^1 * p_{it}^1$	0.237	-0.709	-3.711**		
	(0.768)	(0.622)	(1.859)		
$r_{it}^2 * p_{it}^2$	1.191	0.139	0.531	1.445**	2.466***
	(0.933)	(0.798)	(0.557)	(0.665)	(0.630)
Total number of observations	4 212	4 104	4 131	4 131	4 185
Number of municipalities	156	152	153	153	155
Number of treated municipalities	43	69	37	66	61
Sample of municipalities	All	All	All	All	All
Individual fixed effects	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes
Socioeconomic controls	Yes	Yes	Yes	Yes	Yes
R^2	0.749	0.661	0.644	0.529	0.571
Adj.R^2	0.747	0.658	0.641	0.526	0.567
F	90.41	76.13	74.91	52.11	53.26

Note: The dependent variable is the unemployment share in a municipality. Robust standard errors in parentheses. $r_{it}^1 * p_{it}^1$ and $r_{it}^2 * p_{it}^2$ denote the TT-NR and NR-BB sections, respectively. $r_{it}^1 * p_{it}^1$ is omitted from the last two models due to lack of observations in those quintiles of altitude. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Furthermore, the impact of the new sections of the R1 varies with altitude (Table 2). In the lower altitudes, we observe insignificant results. For the Trnava-Nitra section, this impact becomes significantly favorable (meaning lower level of unemployment) in the third altitude quintile. Furthermore, we see a positive and a statistically significant impact on the unemployment level in municipalities near Nitra-Banská Bystrica section, mainly in the higher altitudes.

The heterogeneity in the impact across these altitude quintiles may be caused by a positive correlation with the distance from the highway.[13] This would mean that the municipalities located in higher altitudes also tend to be further away from the highway and the higher elevation may intensify the impact of the distance from the highway. The increase in unemployment in higher-lying municipalities could also occur due to the migration of the population to lower-lying municipalities, which may have a more attractive labour market.

Table 3 shows the results of the impact of highway construction on municipalities, taking into account their distance from the highway. Following the opening of the first, Trnava-Nitra section in 2000, we observe a decrease in unemployment by approximately 0.08 percentage points for each additional kilometer of distance within the radius of 30 km from the nearest R1 exit. Therefore, for the municipality located 20 km from the newly opened section of the highway, the unemployment share should fall by 1.6 percentage points. On the other hand, after the opening of the second, Nitra-Banská Bystrica highway section,

[13]The correlation is around 0.44 for the municipalities in the two treatment groups

Table 3: Impact of highway construction on municipalities in interaction with distance.

	(1) u_{it}	(2) u_{it}	(3) u_{it}	(4) u_{it}	(5) u_{it}	(6) u_{it}
Constant	13.30***	6.058**	6.181**	6.080**	3.337	25.72**
	(0.187)	(2.563)	(2.920)	(2.607)	(2.770)	(10.24)
$r_{it}^1 * p_{it}^1 * d_{it}$	-0.0780***	-0.0830***	-0.0799***		-0.0820***	-0.0471**
	(0.0187)	(0.0188)	(0.0195)		(0.0193)	(0.0205)
$r_{it}^2 * p_{it}^2 * d_{it}$	0.0573***	0.0573***		0.0626***	0.0613***	0.0248
	(0.0199)	(0.0198)		(0.0202)	(0.0204)	(0.0429)
Total number of observations	20 763	20 763	14 931	19 143	19 710	1 053
Number of municipalities	769	769	553	709	730	39
Number of treated municipalities	276	276	60	216	260	16
Sample of municipalities	All	All	All	All	Rural	Urban
Individual fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Socioeconomic controls	No	Yes	Yes	Yes	Yes	Yes
R^2	0.618	0.619	0.621	0.613	0.620	0.796
Adj.R^2	0.617	0.619	0.620	0.613	0.619	0.790
F	234.6	213.0	170.5	198.5	204.6	137.3

Note: The dependent variable is the unemployment share in a municipality. Robust standard errors in parentheses. $r_{it}^1 * p_{it}^1 * d_{it}$ and $r_{it}^2 * p_{it}^2 * d_{it}$ denote the TT-NR and NR-BB sections, respectively, both in interaction with the distance from the newly constructed highway. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

the unemployment share in the surrounding municipalities increases by 0.06 percentage point for each kilometer of distance. The municipalities further away from this segment of the highway are located in higher altitudes, rendering their accessibility still difficult. The robust difference in results between the two segments of the R1 may be consistent with the findings of extant literature, which suggests that the impact of highway construction on economic outcomes depends on other enabling factors, such as human capital.[14]

Synthetic Control Method

Previous literature finds that the effect a highway has on economic development can depend on certain factors or pre-conditions. One of such factors observed in the Slovak context is the level of human capital, which, according to Habrman and Žúdeľ (2017) facilitates the positive impact of a highway on the local economy. However, detailed demographic data at the municipal level is only available from censuses that are conducted every ten years. Therefore, we implement the microsynth synthetic control method developed by Robbins and Davenport (2021) to match the treated municipalities with the untreated ones using the data from the pre-treatment census in 1991. Specifically, we are able to obtain on municipal level the ratio of persons with elementary schooling as their highest attained educational level, the ratio of persons employed in the manufacturing

[14] We have also examined the impact of highway construction on population change, to capture the potential impact of the highway on migration. However, these results did not exhibit statistical significance. These results are available upon request.

sector and the ratio of persons belonging to the Roma minority. In addition, we include the data on the altitude of a municipality for the matching procedure.

Formally, microsynth divides the sample J into the control group (J_0) and the treatment group ($J - J_0$) and calculates the relative change $\hat{\Delta}$ during the treatment period $t = [T_0 + 1; T]$ in percentage terms as:

$$\hat{\Delta} = 100 * \frac{\sum_{t=T_0+1}^{T} (\sum_{j=J_0+1}^{J} u_{tj} - \sum_{j=1}^{J_0} w_j * u_{tj})}{\sum_{t=T_0+1}^{T} \sum_{j=1}^{J_0} w_j * u_{tj}} \tag{3}$$

where the numerator compares the variable of interest (unemployment share) in the treatment group in the post-treatment period to the one of a weighted clone of the control group observations ($w_j * u_{tj}$), divided by the weighted clone of the control group observations. Differently put, the resulting coefficient shows the change in the treatment group compared to a clone that approximates the development of the treatment group if it were not treated. The weights (w_j) used to clone the counterfactual of the treatment group are determined so that the synthetic control matches the treatment units across the l covariates ($\sum_{j=1}^{J_0} w_j * R_{lj} = \sum_{j=J_0+1}^{J} R_{lj}$) as well as the outcome variable in the pre-treatment period ($\sum_{j=1}^{J_0} w_j * u_{tj} = \sum_{j=J_0+1}^{J} u_{tj}$). Lastly, the sum of weights is equal to the number of observations in the treatment group ($\sum_{j=1}^{J_0} w_j = J - J_0$).

The composition of the treatment and control groups is the same as in the case of the difference-in-differences method described in the previous section.[15] That is, the treatment groups are composed of municipalities located within 30 kilometers of the exits from the respective segment (Trnava-Nitra or Nitra-Banská Bystrica), which are not close to any other already existing highway or whose unemployment share is not an outlier. In a similar manner, the control group is composed of municipalities located further away from the R1 highway while at the same time not being close to any other highway, and whose unemployment share is not considered an outlier. Thus, the difference between our two approaches is in the weights allocated to municipalities in the control group. In the difference-in-differences approach, each control-group municipality has the same weight. With the synthetic control method, the weights are determined analytically to ensure that each treated municipality and its synthetic clone are as similar as possible in the pre-treatment period. The list of municipalities with non-zero weights from the control group, along with their respective weights, are listed in the Appendix (Table 7 and Table 8). These municipalities are deemed most similar to the treatment group based on the selected covariates.

Even after controlling for human capital and the economic structure of the municipalities, the municipalities located near the first section (Trnava-Nitra) again benefited more from the opening of the new highway than the latter section (Nitra-Banská Bystrica).

[15] See Figure 2.

Table 4: Overall effects of the synthetic counterfactual.

	(1) u_{it}	(2) u_{it}
$r^1 * p^1$	-24.5%*** [-26.0% - 23.0%]	
$r^2 * p^2$		-4.2%*** [-6.3% - 2.1%]
Number of municipalities	527	673
Number of treated municipalities	57	203
Number of counterfactual municipalities	133	233
Sample of municipalities	Excluding r^2	Excluding r^1

Note: The dependent variable is the unemployment share in a municipality. $r^1_{it} * p^1_{it} * d_{it}$ and $r^2_{it} * p^2_{it} * d_{it}$ denote the TT-NR and NR-BB sections, respectively. Confidence interval in parentheses. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Treated and untreated denote the number of municipalities in the treatment group and control group, respectively. Number of municipalities used for the construction of the synthetic counterfactual is in the brackets.

Table 4 shows the overall impact of the connection of both sections to the highway network. Connecting the Trnava-Nitra section to the highway network led to a decline of unemployment by around 25% in the nearby rural municipalities. In contrast, the decline in unemployment was significantly lower in the Nitra-Banská Bystrica segment, at around 4%.

One possible explanation is that it takes more time for the economic benefits to materialize in the surrounding region. In Figure 4 we can observe the development of the unemployment shares in the two treatment groups and their clones. Notice that while for the first section the benefits of improved infrastructure started relatively soon following the opening, for the second section the difference between the treated group and its clone in unemployment remained insignificant during most of the period, turning slightly in favor of the municipalities located near the new highway section only in the most recent years.

An explanation could be that there are two specific adverse events which could have delayed the highway's impact. First, the opening of the second segment (Nitra-Banská Bystrica) came shortly after the Great Recession. We can see that the unemployment share of the treatment group and its clone increased in a similar manner during and following the crisis. The potential for attracting FDI in the recovery period was naturally lower. Hence, while the new highway segment could have stimulated new FDI in its surroundings, this positive effect would have been diminished by the aftermath of the Great Recession.

Second, in 2013, Marián Kotleba, the leader of a far-right fascist political party in Slovakia, was elected to the position of governor of the self-governing Region of Banská Bystrica, where a significant portion of the municipalities in the vicinity of the second highway segment are located. Kotleba's rule in Banská Bystrica Region was filled with nepotism

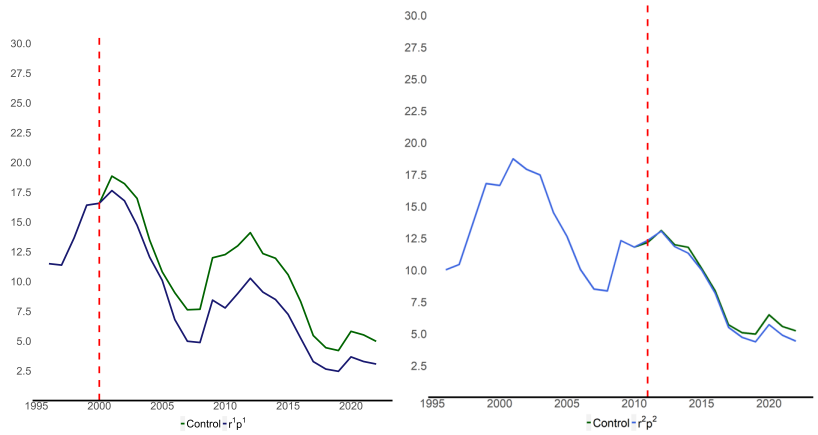

Figure 4: Development of unemployment share in the treatment groups and their counterfactuals. Data source: SO SR. Note: The dark blue and blue lines represent the two treatment groups (r^1p^1 denotes the TT-NR segment, while r^2p^2 the NR-BB segment), their counterfactual in green and red vertical lines indicate the connection of individual sections to the highway network.

and kulturkampf (stopping projects that did not support his cultural views) that eventually lead to the Region becoming ineligible for EU funds.[16] Such institutional degradation at the local level could have additionally prevented the favorable development near the Nitra-Banská Bystrica segment following the R1 completion.

Yet another source of the difference might be the economic structure of the regions. In the precious section where we used difference-in-differences, we argued that one explanation for the divergent results between the two highway sections may lie in cross-regional differences in human capital and economic structure. However, when we match the treated municipalities to the ones in the control group based on these covariates, we find that the contrasting impact persists. Furthermore, we argued that the large-scale investment decision by Stellantis might have augmented the positive impact of the first section of the highway. Hence, we also include here the ratio of persons employed in manufacturing as a covariate. Our covariates, however, stem from the last census conducted before the opening of the highway in 1991. Since then, many Slovak municipalities struggled to sustain their non-competitive industries in the transition period. In this sense, a timely opening of the first highway section might have alleviated the struggle for nearby municipalities, boosting their attractiveness for FDI. While the opening of the Nitra-Banská Bystrica segment might have bolstered migration from the municipalities located in the proximity of this segment to western Slovakia or other EU countries.

The different impacts between the two highway sections may also be explained by potentially differing motivations behind building them in the first place. The first segment seems to have been motivated by better connecting an already dynamic region to the center of economic activity domestically and internationally. Conversely, the primary impulse for

[16]See `https://tinyurl.com/bdfjez7v`, `https://tinyurl.com/22msztf9`, `https://tinyurl.com/2rm2nubk` for stories from this period.

building the second sections was to help complete the highway connection between the two largest cities in the country: Bratislava and Košice. As these two cities still remain without a (domestic) highway connection, the full impact of the second segment has not yet materialized.

Conclusions

Previous studies have found that the impact of highways on economic activity is ambiguous, and conditioned by a number of factors, such as institutional quality and human capital. Furthermore, declining economies of scale are anticipated to come into play after a certain minimum threshold of highways is reached in a region. Additionally, it proves challenging to correctly measure the effect, as highways tend to be constructed to connect economically prosperous areas, thus constituting a reverse causality problem.

With our analysis, we contribute to the ongoing debate by analyzing the impact of a new highway connected to an existing road network. Specifically, we assess the impact of the opening of the R1 highway on the unemployment share in the region of central Slovakia by applying difference-in-differences and synthetic counterfactual methods. The R1 highway was connected in two parts: the Trnava-Nitra section in 2000 and the Nitra-Banská Bystrica section in 2011.

Our results suggest that while the municipalities around the Trnava-Nitra section experienced a decrease in the unemployment share, the effect for the municipalities near the Nitra-Banská Bystrica section is inconclusive and dependent on the method applied. When using the difference-in-differences approach, we find an increase in unemployment share following the opening of the second highway segment. In contrast, the results of the microsynth synthetic counterfactual method point to a decrease in the unemployment rate, which falls far short of the improvement in unemployment following the opening of the first segment.

The difference in the impact between the two sections of the R1 on the unemployment share may be justified by the fact that the highway does not reduce unemployment in and of itself. The connection of the first section coincided with a new manufacturing plant having been opened in the region. The new plant is likely to have helped boost the local economy – while at the same time its opening was likely to have been partially motivated by the prospect of improved road infrastructure in the region. In contrast, the second Nitra-Banská Bystrica section may have caused an outflow of the local labour force instead of an inflow of companies and increase in economic activity. Another factor that may have played a role is the importance of physical geography: the municipalities near the Nitra-Banská Bystrica segment are located in higher altitudes, which reduces the potential gains from better road connectedness. Moreover, the opening of the second segment took place during the recovery from the Great Recession and was followed by the election of

an anti-system far-right politician to the post of governor of the Banská Bystrica region. Indeed, according our synthetic counterfactual results, the unemployment share in the municipalities in the proximity of the Nitra-Banská Bystrica section started to fall more notably than its counterfactual only around the end of his governorship.

Our results thus imply that highway construction needs to be accompanied by supporting regional policies and reforms. Under such conditions, connecting less developed regions to the existing highway network can help reduce unemployment. However, if faced with institutional backsliding and adverse geographical conditions, constructing a new highway cannot be expected to deliver positive economic impacts in and of itself.

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Table 5: Robustness checks with different distance thresholds for treatment.

	(1) u_{it} 15 km	(2) u_{it} 20 km	(3) u_{it} 40 km
Constant	4.761*	4.800*	4.386***
	(2.730)	(2.708)	(2.683)
$r^1_{it} * p^1_{it}$	-3.101**	-3.292***	-2.517***
	(1.208)	(0.552)	(0.356)
$r^2_{it} * p^2_{it}$	1.847***	2.060***	2.144***
	(0.331)	(0.305)	(0.311)
Total number of observations	19710	19710	19710
Number of municipalities	730	730	730
Number of treated municipalities	154	214	448
Sample of municipalities	Rural	Rural	Rural
Individual fixed effects	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes
Socioeconomic controls	Yes	Yes	Yes
R^2	0.620	0.622	0.625
Adj. R^2	0.619	0.620	0.624
F	206.28	209.44	211.49

Note: The dependent variable is the unemployment share in a municipality. Robust standard errors in parentheses. $r^1_{it} * p^1_{it} * d_{it}$ and $r^2_{it} * p^2_{it} * d_{it}$ denote the TT-NR and NR-BB sections, respectively, both in interaction with the distance from the newly constructed highway. The columns show varying treatment groups: a municipality is treated if it is located within 15, 20 or 40 kilometers from either section of a highway. Significance levels: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6: Comparison of the unemployment share and the variables used for matching in the preatreatment period for the two treated groups and their counterfactuals and the control group

	r^1			r^2		
	Treatment value	Clone value	Control group value	Treatment value	Clone value	Control group value
Intercept	57.00	57.00	57.00	203.00	203.00	203.00
altitude	157.54	157.54	334.12	358.82	358.83	278.97
element_ratio	51.90	51.90	51.57	49.46	49.46	53.13
manu_ratio	12.70	12.70	14.74	16.14	16.14	13.67
roma_ratio	0.31	0.31	1.05	0.82	0.82	1.08
unemp_1996	11.50	11.50	11.47	10.04	10.04	12.55
unemp_1997	11.38	11.38	12.18	8.51	8.51	12.96
unemp_1998	13.67	13.67	15.86	8.36	8.36	16.52
unemp_1999	16.41	16.41	19.26	12.31	12.31	20.24
unemp_2000	16.57	16.57	18.52	11.79	11.79	19.32
unemp_2001				12.63	12.63	21.97
unemp_2002				14.51	14.51	21.34
unemp_2003				17.46	17.46	20.40
unemp_2004				17.91	17.91	16.53
unemp_2005				18.73	18.73	14.20
unemp_2006				16.63	16.63	11.84
unemp_2007				16.79	16.79	9.59
unemp_2008				13.63	13.63	9.22
unemp_2009				10.43	10.43	13.27
unemp_2010				10.01	10.02	12.93

Note: The left side of the table shows information about the Trnava-Nitra segment of the R1 highway, while the right side corresponds to information about the Nitra-Banská Bystrica segmemt. The columns show the values for the respective treatment groups and the municipalities that are part of their respective clones with their weighted values (Clone value) and unweighted values (Control group value).

Table 7: List of municipalities that make the clone for TT-NR with their weights.

	ID	Municipality	weight
1	501221	Lipové	1.59
2	556050	Úľany nad Žitavou	1.36
3	501107	Dedina Mládeže	1.34
4	503045	Bánov	1.30
5	503151	Dolný Ohaj	1.17
6	503193	Hul	1.13
7	503452	Palárikovo	1.06
8	505323	Pažiť	1.06
9	503479	Podhájska	1.00
10	511919	Tomášovce, Okres Lučenec	0.98
11	557307	Vidiná	0.98
12	503495	Radava	0.97
13	503291	Komoča	0.96
14	502871	Tupá	0.94
15	501344	Sokolce	0.92
16	556157	Jacovce	0.89
17	503169	Dubník	0.85
18	503177	Dvory nad Žitavou	0.83
19	502634	Pečenice	0.81
20	501077	Búč	0.78
21	515914	Čeláre	0.76
22	503517	Rúbaň	0.76
23	502154	Demandice	0.76
24	512001	Veľká Ves	0.75
25	502243	Hokovce	0.74
26	503614	Tvrdošovce	0.72
27	501069	Brestovec	0.71
28	503436	Nová Vieska	0.68
29	511471	Kalinovo	0.66
30	556092	Nána	0.65
31	518409	Hontianske Moravce	0.65
32	502715	Santovka	0.65
33	503070	Bešeňov	0.64
34	501361	Tôň	0.60
35	502928	Veľké Turovce	0.59
36	501328	Pribeta	0.58
37	503029	Andovce	0.57
38	511528	Lehôtka	0.56

39	503053	Bardoňovo	0.55
40	501255	Moča	0.55
41	515248	Orávka	0.55
42	514284	Opatovce nad Nitrou	0.55
43	503649	Zemné	0.54
44	516546	Záhorce	0.53
45	502391	Jur nad Hronom	0.53
46	503550	Strekov	0.53
47	501271	Mudroňovo	0.53
48	511781	Prša	0.51
49	514454	Zemianske Kostoľany	0.51
50	501379	Trávnik	0.51
51	511293	Buzitka	0.50
52	502103	Brhlovce	0.49
53	511676	Nové Hony, Okres Lučenec	0.49
54	503231	Kamenica nad Hronom	0.47
55	556033	Pavlová	0.46
56	505129	Malé Kršteňany	0.45
57	503932	Neded	0.43
58	516473	Veľká Ves nad Ipľom	0.43
59	503606	Trávnica	0.41
60	502944	Vyškovce nad Ipľom	0.41
61	555819	Bodzianske Lúky	0.40
62	505722	Veľké Uherce	0.40
63	503118	Čechy	0.39
64	515141	Lenka	0.39
65	501093	Číčov	0.39
66	503207	Chľaba	0.37
67	513962	Diviaky nad Nitricou	0.37
68	513946	Čereňany	0.37
69	502375	Ipeľský Sokolec	0.37
70	513911	Bystričany	0.36
71	514209	Nedožery-Brezany	0.35
72	515868	Balog nad Ipľom	0.34
73	511609	Mašková	0.33
74	502286	Horné Turovce	0.32
75	511269	Breznička	0.32
76	502677	Pohronský Ruskov	0.30
77	502472	Keť	0.30
78	502278	Horné Semerovce	0.29

79	511641	Mýtna	0.29
80	501212	Kravany nad Dunajom	0.28
81	503274	Kolta	0.28
82	501336	Radvaň nad Dunajom	0.27
83	514331	Pravenec	0.27
84	503096	Branovo	0.24
85	514128	Lazany	0.23
86	514233	Nitrianske Rudno	0.22
87	502197	Dolný Pial	0.21
88	516571	Želovce	0.21
89	516074	Ipeľské Predmostie	0.21
90	502324	Hronovce	0.20
91	557714	Jalovec, okres Prievidza	0.19
92	502073	Bielovce	0.19
93	501395	Bátorove Kosihy	0.18
94	502448	Kubáňovo	0.18
95	502537	Malé Ludince	0.17
96	514110	Koš	0.17
97	502464	Kuraľany	0.16
98	557706	Lipník	0.16
99	502642	Plášťovce	0.16
100	514063	Kamenec pod Vtáčnikom	0.15
101	502626	Pastovce	0.15
102	503525	Salka	0.14
103	502740	Slatina	0.14
104	516147	Kováčovce	0.14
105	511927	Trebeľovce	0.12
106	514438	Veľká Čausa	0.11
107	515973	Dolné Plachtince	0.10
108	514551	Bottovo	0.09
109	502499	Lontov	0.08
110	514071	Kanianka	0.08
111	501034	Bajč	0.08
112	504190	Žihárec	0.08
113	502189	Dolné Semerovce	0.08
114	505731	Veľký Klíž	0.07
115	511421	Halič	0.07
116	514292	Oslany	0.07
117	516554	Závada, Okres Veľký Krtíš	0.06
118	502090	Bory	0.06

119	505561	Tesáre	0.05
120	514021	Chrenovec-Brusno	0.05
121	511692	Panické Dravce	0.04
122	514373	Sebedražie	0.04
123	511994	Veľká nad Ipľom	0.04
124	503088	Bíňa	0.03
125	503487	Pozba	0.03
126	511552	Lovinobaňa	0.02
127	501042	Bodza	0.02
128	511480	Kalonda	0.02
129	501263	Modrany	0.01
130	518867	Terany	0.01
131	514314	Poluvsie	0.01
132	515957	Dolinka	0.00
133	511749	Podrečany	0.00

Table 8: List of municipalities that make the clone for NR-BB with their weights.

	Idobec	obec	weights
1	502634	Pečenice	3.19
2	512087	Blažovce	2.87
3	512559	Rakša	2.58
4	510815	Lúčky, okres Ružomberok	2.22
5	556050	Úľany nad Žitavou	2.07
6	501271	Mudroňovo	2.05
7	514381	Seč	2.00
8	503495	Radava	1.98
9	518549	Kriváň	1.97
10	508811	Mýto pod Ďumbierom	1.95
11	503151	Dolný Ohaj	1.95
12	510530	Kalameny	1.93
13	557706	Lipník	1.92
14	557714	Jalovec, okres Prievidza	1.90
15	514217	Nevidzany, okres Prievidza	1.89
16	511374	Kotmanová	1.85
17	509086	Valaská	1.84
18	514071	Kanianka	1.82
19	512451	Moškovec	1.81
20	508624	Horná Lehota, Okres Brezno	1.76
21	510661	Liptovská Štiavnica	1.74
22	512222	Dubové, okres Turčianske Teplice	1.69
23	512460	Mošovce	1.67
24	512079	Blatnica	1.61
25	512109	Borcová	1.60
26	508462	Beňuš	1.58
27	511919	Tomášovce, Okres Lučenec	1.57
28	502286	Horné Turovce	1.57
29	512265	Háj, okres Turčianske Teplice	1.56
30	557251	Bystrá, Okres Brezno	1.54
31	514373	Sebedražie	1.53
32	557307	Vidiná	1.52
33	512494	Ondrašová	1.51
34	503045	Bánov	1.51
35	512303	Ivančiná	1.48
36	513962	Diviaky nad Nitricou	1.48
37	514021	Chrenovec-Brusno	1.47
38	556157	Jacovce	1.46

39	511102	Valaská Dubová	1.46
40	515931	Červeňany	1.46
41	512630	Socovce	1.46
42	503169	Dubník	1.43
43	508691	Jarabá	1.41
44	514233	Nitrianske Rudno	1.41
45	503517	Rúbaň	1.39
46	510301	Bešeňová	1.38
47	514209	Nedožery-Brezany	1.37
48	503177	Dvory nad Žitavou	1.37
49	513920	Cigeľ	1.36
50	516546	Záhorce	1.32
51	511641	Mýtna	1.31
52	512443	Malý Čepčín	1.31
53	503452	Palárikovo	1.30
54	516317	Príbelce	1.29
55	514136	Lehota pod Vtáčnikom	1.29
56	511005	Liptovské Sliače	1.23
57	514284	Opatovce nad Nitrou	1.23
58	510823	Ludrová	1.22
59	511315	Cinobaňa	1.21
60	513971	Dlžín	1.21
61	511421	Halič	1.20
62	503053	Bardoňovo	1.19
63	514314	Poluvsie	1.19
64	503479	Podhájska	1.19
65	515388	Ratkovská Lehota	1.17
66	514551	Bottovo	1.16
67	557323	Ďubákovo	1.16
68	514128	Lazany	1.15
69	514179	Malá Čausa	1.15
70	512354	Kláštor pod Znievom	1.15
71	512788	Veľký Čepčín	1.12
72	508772	Michalová	1.11
73	502715	Santovka	1.11
74	502448	Kubáňovo	1.11
75	502928	Veľké Turovce	1.07
76	508730	Lom nad Rimavicou	1.07
77	502944	Vyškovce nad Ipľom	1.07
78	502391	Jur nad Hronom	1.06

79	511471	Kalinovo	1.06
80	510637	Liptovská Osada	1.05
81	503614	Tvrdošovce	1.05
82	508870	Pohorelá	1.05
83	510670	Liptovská Teplá	1.04
84	512621	Slovenské Pravno	1.04
85	514110	Koš	1.02
86	514390	Šútovce	1.02
87	516406	Stredné Plachtince	1.02
88	511552	Lovinobaňa	1.01
89	518514	Kozí Vrbovok	1.01
90	514144	Liešťany	1.01
91	514098	Kocurany	1.00
92	508667	Hronec	0.97
93	508527	Čierny Balog	0.97
94	503606	Trávnica	0.97
95	514063	Kamenec pod Vtáčnikom	0.96
96	507407	Turík	0.93
97	556416	Ješkova Ves	0.93
98	510548	Komjatná	0.93
99	512257	Folkušová	0.92
100	507300	Ivachnová	0.92
101	510629	Liptovská Lúžna	0.91
102	512001	Veľká Ves	0.91
103	516422	Suché Brezovo	0.90
104	511561	Ľuboreč	0.90
105	510742	Liptovský Michal	0.90
106	502197	Dolný Pial	0.88
107	513946	Čereňany	0.88
108	512796	Vrícko	0.87
109	518816	Stará Huta	0.86
110	502154	Demandice	0.85
111	511781	Prša	0.85
112	514454	Zemianske Kostoľany	0.84
113	514331	Pravenec	0.82
114	515248	Orávka	0.82
115	511277	Budiná	0.82
116	502103	Brhlovce	0.81
117	505323	Pažiť	0.80
118	511811	Ratka	0.80

119	508489	Braväcovo	0.79
120	515345	Potok, Okres Rimavská Sobota	0.79
121	512320	Jazernica	0.77
122	511943	Tuhár	0.77
123	502278	Horné Semerovce	0.75
124	503029	Andovce	0.74
125	511366	Dobroč	0.74
126	514080	Kľačno	0.74
127	514187	Malinová	0.74
128	511269	Breznička	0.74
129	514225	Nitrianske Pravno	0.73
130	514632	Dolné Zahorany	0.72
131	505731	Veľký Klíž	0.72
132	511544	Lipovany	0.72
133	514900	Hrnčiarska Ves	0.72
134	515043	Klenovec	0.70
135	517160	Počúvadlo	0.70
136	503193	Hul	0.70
137	512125	Budiš	0.69
138	505722	Veľké Uherce	0.68
139	513911	Bystričany	0.68
140	502189	Dolné Semerovce	0.68
141	511226	Ábelová	0.68
142	502871	Tupá	0.67
143	510718	Liptovské Revúce	0.67
144	511340	České Brezovo	0.65
145	515914	Čeláre	0.65
146	503291	Komoča	0.63
147	511579	Lupoč	0.62
148	503070	Bešeňov	0.60
149	556092	Nána	0.60
150	511510	Látky	0.58
151	514004	Horná Ves, okres Prievidza	0.57
152	514101	Kostolná Ves	0.57
153	501107	Dedina Mládeže	0.56
154	516091	Kiarov	0.56
155	511528	Lehôtka	0.55
156	509051	Telgárt	0.54
157	512575	Rudno	0.53
158	515949	Dačov Lom	0.52

159	515973	Dolné Plachtince	0.52
160	505561	Tesáre	0.51
161	510955	Potok, okres Ružomberok	0.51
162	518409	Hontianske Moravce	0.51
163	518310	Dolný Badín	0.49
164	515591	Sušany	0.49
165	514659	Drienčany	0.49
166	514306	Podhradie, okres Prievidza	0.47
167	511927	Trebeľovce	0.46
168	511684	Ozdín	0.45
169	503487	Pozba	0.44
170	502065	Beša, Okres Levice	0.44
171	503436	Nová Vieska	0.44
172	514322	Poruba	0.44
173	511358	Divín	0.43
174	512737	Turčiansky Ďur	0.43
175	516554	Závada, Okres Veľký Krtíš	0.42
176	511501	Krná	0.42
177	514403	Temeš	0.41
178	502651	Plavé Vozokany	0.40
179	514438	Veľká Čausa	0.40
180	557790	Nižný Skálnik	0.40
181	508993	Sihla	0.40
182	515906	Čebovce	0.39
183	516082	Kamenné Kosihy	0.38
184	515108	Kružno	0.38
185	503631	Veľké Lovce	0.36
186	502626	Pastovce	0.35
187	511293	Buzitka	0.34
188	503550	Strekov	0.34
189	515736	Veľké Teriakovce	0.33
190	501361	Tôň	0.32
191	501212	Kravany nad Dunajom	0.32
192	515981	Dolné Strháre	0.31
193	516601	Baďan	0.29
194	508888	Pohronská Polhora	0.28
195	516147	Kováčovce	0.27
196	502537	Malé Ludince	0.24
197	501395	Bátorove Kosihy	0.24
198	501328	Pribeta	0.23

199	503134	Dedinka	0.23
200	503207	Chľaba	0.23
201	515051	Kociha	0.21
202	518271	Detvianska Huta	0.21
203	514918	Hrnčiarske Zalužany	0.20
204	516236	Nenince	0.20
205	505129	Malé Kršteňany	0.20
206	511731	Podkriváň	0.19
207	501263	Modrany	0.19
208	515451	Rimavské Brezovo	0.16
209	518417	Hontianske Nemce	0.15
210	512427	Liešno	0.15
211	516571	Želovce	0.14
212	516376	Sklabiná	0.14
213	514608	Čerenčany	0.13
214	516384	Slovenské Ďarmoty	0.13
215	508900	Polomka	0.13
216	503231	Kamenica nad Hronom	0.10
217	511617	Mládzovo	0.09
218	511714	Pinciná, Okres Lučenec	0.09
219	516414	Sucháň	0.07
220	503339	Ľubá	0.06
221	502642	Plášťovce	0.06
222	512095	Bodorová	0.06
223	518905	Uňatín	0.05
224	518239	Cerovo	0.04
225	514411	Tužina	0.03
226	501034	Bajč	0.02
227	514292	Oslany	0.02
228	514349	Radobica	0.01
229	501255	Moča	0.01
230	511609	Mašková	0.01
231	511846	Stará Halič	0.01
232	502324	Hronovce	0.00