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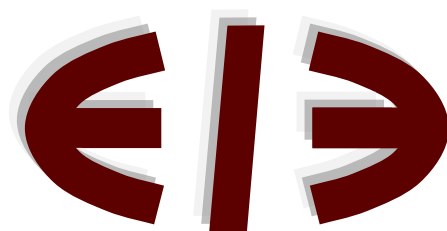## Long-run Economic, Budgetary and Fiscal Effects of Roma Integration Policies

Pavel Ciaian, Andrey Ivanov, d'Artis Kancs

Long-run Economic, Budgetary and Fiscal Effects of Roma Integration Policies[☆]

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Abstract

Although, the need for an efficient Roma integration policy is growing in Europe, surprisingly little robust scientific evidence regarding potential policy costs and expected benefits of alternative policy options has supported the policy design and implementation so far. The present study attempts to narrow this evidence gap and aims to shed light on long-run economic, budgetary and fiscal effects of selected education and employment policies for the inclusion of the marginalised Roma in the EU. We employ a general equilibrium approach that allows us to assess not only the direct impact of alternative Roma integration policies but also to capture all induced feedback effects. Our simulation results suggest that, although Roma integration policies would be costly for the public budget, in the medium- to long-run, economic, budgetary and fiscal benefits may significantly outweigh short- to medium-run Roma integration costs. Depending on the integration policy scenario and the analysed country, the full repayment of the integration policy investment (positive net present value) may be achieved after 7 to 9 years. In terms of the GDP, employment and earnings, the universal basic income scenario may have the highest potential, particularly in the medium- to long-run.

Keywords: Roma, social marginalisation, education, labour market, integration policy, universal basic income.
JEL code: J6, J11, J24, O17, O43, I32.

1. Introduction

The marginalisation of Roma is widespread in Europe and takes various forms, it encompasses almost all aspects of life spanning from education and employment to health and housing (O'Higgins and Ivanov 2006; FRA 2011; FRA 2018a; FRA 2018b). In order to improve the Roma situation, there is a strong political willingness and commitment in the EU (European Parliament 2011). It is surprising however how little robust scientific evidence regarding potential costs and benefits of Roma integration policies has supported the policy design and implementation so far.

To narrow this evidence gap and provide policy makers with the missing scientific evidence, the present study undertakes a comparative analysis of long-term economic, budgetary and fiscal costs and benefits of alternative Roma integration policies in the areas of education and employment in five EU Member States with the largest share of the Roma population – Bulgaria, the Czech Republic, Hungary, Slovakia and Romania.[1] We employ a general equilibrium approach that allows us to assess not only the direct impact of selected Roma integration policies but also to capture all induced feedback effects.

In the five studied EU Member States from the Central and Eastern Europe (CEE) live around 4 million Roma (Council of Europe 2012). Many Roma communities are among the most socially and economically marginalised groups in these countries; they perform worse than the mainstream society in almost all socio-economic spheres of life, being relegated to the fringe of society. On average, Roma are found to have lower income level, higher poverty rate regardless of the poverty metrics applied (Ivanov and Kagin 2014), higher unemployment rate (FRA 2018b), they are less educated, face higher incidence of undernourishment, have lower life expectancy, higher child mortality, less access to drinking water, sanitation and electricity, etc. (O'Higgins and Ivanov 2006; Kertesi and Kézdi 2011).

These evident and sizeable well-being differences between Roma and the mainstream population make the Roma inclusion issue high on the policy agenda in EU Member States. The key priorities of inclusion policies include the integration of Roma into the schooling system, labour markets and improving access to social services and infrastructure (Achim 2004; Ringold, Orenstein and Wilkens 2005; Ciaian and Kancs 2016). At the European level, two policy initiatives (and policy frameworks) highlight the political

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[1]In the present study we neglect impacts on humanitarian, human right and many social issues, the positive impact of which is uncontested though.

importance of the Roma inclusion: the Decade of Roma Inclusion (2005-2015), and the EU Framework for National Roma Integration Strategies (2011-2020). Similarly important is the Paris Declaration,[2] which aims at mobilising the education system to prevent and tackle marginalisation, intolerance, racism and radicalisation, and to preserve a framework of equal opportunities for all, including an inclusive education for all children, independent of the social background. Further, the European Commission has increased its policy support under the European Semester of the Europe 2020 strategy, and has linked the EU funding to the policy implementation. For example, in 2016 the European Commission issued Country Specific Recommendations to improve access to the schooling and employment of Roma in five EU Member States with most acute marginalisation challenges, i.e. Bulgaria, the Czech Republic, Hungary, Romania and Slovakia. In addition, there is also legislation for fighting discrimination against Roma (the Racial Equality Directive),[3] as well as European Structural and Investment Funds can be used for the Roma inclusion in the EU.[4] At the national level, policy instruments include targeted national Roma integration strategies and measures, reforms of mainstream policies impacting Roma and the enforcement of an anti-discrimination legislation. Both national and EU funds are being used either for Roma-targeted measures or for inclusive mainstream reforms (European Commission 2018).

Despite of a growing demand for and supply of Roma integration policies, the existing evidence base supporting the design, implementation and evaluation of Roma integration policies is scarce and inconclusive. On the one hand, there are only few studies in the scientific literature looking at these questions systematically. On the other hand, the few existing studies apply at most a partial equilibrium approach or undertake a reduced form analysis to estimate costs and benefits of Roma integration policies. For example, Kertesi and Kézdi (2006) have estimated long-term budgetary effects of investments in Roma children in the secondary education in Hungary. Bogdanov and Angelov (2007) have estimated costs and benefits of an improved education of Roma in Bulgaria. Marcinčin and Marcinčinová (2009) and a team of the World Bank experts have conducted a similar analysis for Slovakia (World Bank 2012). There have been also

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[2]Declaration on promoting citizenship and the common values of freedom, tolerance and non-discrimination through education adopted by the Commissioner Navracsics and Education Ministers in 2015, see https://webgate.ec.europa.eu/fpfis/mwikis/eurydice/images/1/14/Leaflet_Paris_Declaration.pdf.

[3]Council Directive 2000/43/EC, http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:32000L0043

[4]ESIF Investment priority 9(ii) 'Integration of marginalised communities such as the Roma'.

attempts to estimate economic and fiscal costs and benefits of the Roma inclusion in the labour market in the Czech Republic and Romania. Despite providing some evidence, an important limitation of reduced form / partial equilibrium analyses is that they do not take into account economy-wide interactions and medium- to long-run feedback effects and adjustments on labour markets. As result, without accounting for all direct and indirect rebound effects provides only a partial and/or biased picture of true policy effects.

In order to narrow this evidence gap, the present study undertakes a holistic analysis of long-run economic, budgetary and fiscal costs and benefits of selected Roma inclusion policies in five EU countries from the CEE: Bulgaria, the Czech Republic, Hungary, Slovakia and Romania. We have selected these five countries, because more than two thirds of the total EU Roma population reside in these EU Member States. The second reason for choosing these countries is that the Roma marginalisation is particularly widespread and represent an acute and rapidly growing socio-economic problem in these countries (see section 2). They cause frictions not only at the national level, but may also have EU-wide implications, e.g. through migration (Halasz 2009; Korando 2012). From the EU policy perspective, these five countries are the only EU Member States with country specific recommendations regarding Roma issued by the European Commission.

By complementing previous findings, the current study undertakes a comparative analysis of long-run economic, budgetary and fiscal impacts of alternative Roma integration policies by following the modelling approach of Tanaka et al. (2018) and Kancs and Lecca 2018) implemented for the five EU Member States. This modelling framework allows us to undertake a holistic analysis of long-run social, economic and fiscal impacts of alternative Roma integration policies. The modelling of education is based on Tanaka et al. (2018), who propose an education model in the context if immigrants versus natives with two channels of adjustment: the education quantity and quality. Given that Roma are long-term immigrants with important differences in educational attainment rates and in the education quality with respect to the mainstream population in host countries, we adopt this approach in the present study. The labour market is modelled following Bonacich (1975), who proposes a split labour market between migrant and native workers. The empirical implementation of the split labour market follows Kancs and Lecca (2018).

The adopted general equilibrium framework has important advantages over alternative methods in the context of our study. As summarised by the OECD (1986):

"The most important strength of the general equilibrium methodology is its solid

microeconomic foundation, which precludes ad-hoc specification and makes the model structure more transparent. The theoretical foundation of such models makes it possible to trace back, in every case, the simulation results and determine which factors are crucial in explaining them."

"*Moreover, the general equilibrium models ensure the internal consistency of the analysis. This makes general equilibrium models extremely useful in the case of economy-wide policy issues with many ramifications, sometimes acting in opposite directions, and generating feedback effects which are crucial to the final result.*"

In collaboration with Roma experts and policy makers in the EU, we have designed two alternative Roma integration policy scenarios and assess long-run economic, budgetary and fiscal effects. In addition to assessing the impacts of Roma integration policy initiatives currently being planned/implemented in the five EU Member States, we also design and simulate a hypothetical – universal basic income – scenario, where the same amount of public funding for the Roma integration is disbursed in form of direct cash transfers. According to the existing evidence (Aizer et al. 2016; Nikiforos et al. 2017, Kela 2018; Pareliussen et al. 2018; Jones and Marinescu 2018; Marinescu 2018), there are good reasons to believe that providing direct cash transfers to poor/marginalised households, such as Roma, may be the preferred policy option over complex supply-side programs conditioned on many factors. Indeed, Roma integration policies that attempt to increase the supply of certain public services, e.g. education, are often being criticised: key drivers of low educational attainment rates are not tackled, private costs of Roma households often exceed social benefits, wrong incentives are created and high administrative costs imposed that significantly reduce the net amounts actually arriving at Roma households.[5] Also, supply-driven programs tend to reflect donor's understanding the challenges Roma are facing, which may diverge from the reality on the ground. In the long-run, this top-down approach facilitated by layers of intermediaries makes participatory approaches more difficult to implement ultimately encouraging a culture of dependency of the communities commonly referred to as 'target groups' (FRA 2018c). For these and other reasons, direct cash transfers to poor households and marginalised communities are being increasingly implemented not only in developing but also in

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[5]Among others, discussions during the European Commission's workshop on Roma communities in Europe "Taking stock of current science-based knowledge and what is needed for effective policy development".

developed countries, such as the USA, Canada and Finland (de Janvry and Sadoulet 2004; Bassett 2008; Kela 2018).

Our simulation results suggest that, although the Roma integration e.g. by providing targeted education assistance services and reducing the labour market discrimination would be costly for the public budget, in the medium- to long-run, economic, budgetary and fiscal benefits may significantly outweigh short- to medium-run Roma integration costs. Depending on the integration policy scenario and the analysed country, the annual long-run GDP effect would be between 16.47 and 109.93 million Euro above the baseline growth, and the full repayment of the integration policy investment (positive net present value) would be achieved after 7 to 9 years. In terms of the GDP, employment and earnings, the universal basic income scenario clearly outperforms currently implemented Roma integration policies, particularly in the medium- to long-run.

The rest of the paper is organised as follows. The next section provides a brief background of the Roma population in Europe and summarises the socio-economic situation of Roma in the five study countries. Section 3 sketches the underlying modelling framework, whereas section 4 details the construction of alternative policy scenarios and main assumptions behind each of them. Section 5 presents simulation results, whereas the final section concludes.

2. Roma in Europe: A historical background and current situation

2.1. Historical background

Since their arrival in Europe in the 15-16th century, Roma have faced various types of discrimination by the mainstream society lasting for many centuries. Throughout the centuries, the concept of otherness was (and still is) shaping the relationships between the Roma and the surrounding (Gadzo) societies. Both Roma and non-Roma looked at the others as dangerous, putting own group's identity at risk. In the case of the Roma, the hostility on the side of the Gadzo and the factual exclusion of Roma was augmented by the Roma's implicit resistance to engage with the disciplining structures of sedentary societies and their non-Roma hierarchies, both cleric and secular. The process intensified with the consolidation of nation-states in the 19th and 20th century (Ivanov 2012).

The discriminatory attitudes against Roma that were later incorporated in the public legislation and regulations in Europe have varied between countries and over time and have included, among others, banishment to enter and stay in countries, expulsion, deportation, imprisonment, forced labour, death penalty without trial on the grounds of

being Roma, banishment of certain occupations (e.g. trade), confiscations of possessions, forceful taking of Roma children from families and placing them in non-Roma families, forced assimilation and integration, deportation to colonies and enslavement in several parts of Europe. One of the worst records in the European history of Roma occurred during the World War II, when Roma were subject to deportations and mass executions, similar to Jews. Historians estimate that 220,000 to 600,000 Roma were killed by Nazis and their collaborators, in other words, between 22% and 60% of the around 1 million Roma in Europe at the time. The biggest losses in Roma lives were recorded in CEE countries, particularly in Romania and Hungary (Fraser 1995; Hancock 2005; Holocaust Encyclopedia 2016; Ciaian and Kancs 2016).

After the World War II, the attitude of state authorities towards Roma started to change. The countries of Central and Eastern Europa (the former socialist block) adopted a class-based approach addressing Roma integration in the context of 'elevating' inferior groups to proletariat status trough full employment – in the case of Roma, mostly in heavy industry and agriculture. In the Western Europe, the approach was based on respect to individual rights and minority integration gradually became one of the EU policy paradigms to address the challenges of social and economic marginalisation. Since 2010 the marginalisation of Roma is seen as violation of fundamental rights and not merely as socio-economic vulnerability prompting the active involvement of the European Commission in Roma integration (EC 2011). Since then, inclusion policies in the EU seek to integrate Roma into the mainstream society, i.e. in the schooling system, labour markets and improve access to social services. In contrast, countries under the Communist regime followed a different path, as a forced assimilation remained to be the main government policy paradigm, e.g. sterilisation of Roma women in Czechoslovakia, taking away Roma children from their families and destruction of Roma villages in Hungary; assimilation policy in Romania. Only after the fall of the Communist regime in around 1990, CEE countries started to adopt a more integrated approach towards Roma (Achim 2004; Ringold, Orenstein and Wilkens 2005; Ciaian and Kancs 2016).

Even though the anti-Roma discrimination by state authorities has reduced significantly during last decades, it has not been eliminated completely in Europe. Discriminatory attitudes of state authorities against Roma can still be observed in many European countries, particularly in the Central and Eastern Europe. The most widespread forms of the anti-Roma discrimination are linked to ethnic bias in the provision of various public institutions and/or the way regulations are implemented and/or enforced by central,

regional and local authorities. Examples of the formal anti-Roma discrimination taking place in CEE countries include an abusive behaviour of police towards Roma, failure of the justice system to investigate racist abuses, forced evictions, an unequal treatment of Roma children by the mainstream schooling system, e.g. segregation, abusive behaviour of teachers, inferior education, failure of official authorities to take active actions (stand) against racist attitudes towards Roma, etc. (Petrova 2004; Mudde 2005; Cviklova 2015; Ciaian and Kancs 2016).

In addition, various extremist and radical political parties (active in almost all European countries) exploit the anti-Roma attitudes fuelling them further. Many of these political parties legitimise their existence and build their political capital by prototyping minorities as a burden to the mainstream society and as a cause of societal problems. Roma and immigrants are among the most common targets of extremist and radical political parties in Europe to gain votes and the political power (Halasz 2009; Stewart 2012; Ram 2014; Ciaian and Kancs 2016).

Despite discriminations and genocides in past, Roma is one of the largest ethnic minorities in Europe nowadays. Although, the exact size of the Roma population is notoriously hard to estimate, because statistical data by the ethnic origin are not collected in an accurate and systematic way (mostly due to privacy reasons), their size in Europe is estimated between 11 and 20 million. In the EU, Roma population is estimated to be between 4 and 8 million (Barany 2002; Council of Europe 2012; Ringold et al. 2005). Most of European Roma (around 80%) live in former communist countries in the CEE; Bulgaria, Hungary, Slovakia and Romania have the largest Roma populations in Europe. The share of Roma in the total population is close to 10% in Bulgaria, around 9% in Slovakia and Romania and 7% in Hungary, followed by the Czech Republic. More than one third of European Roma live in these five CEE countries, whereas the share of Roma account for more than two thirds of all Roma in the EU.

Finally, it is important to note that Roma is one of the fastest growing population groups in Europe at the beginning of the 21st century, with an increasing share of the Roma population being comprised of youth: 36% of the Roma population are under 15 compared to 16% of the overall population in Europe. The average age is 25 years among Roma, compared to around 40 years among non-Roma (Fundacion Secretariado Gitano 2009; Roma Education Fund 2004). Particularly in the CEE, Roma represent a significant and growing share of the school age population and therefore the future workforce.

2.2. Socio-economic situation of Roma in study countries

The social and economic deprivation of Roma is widespread in all five studied countries and takes various forms, it encompasses almost all aspects of life spanning from educational, economic (e.g. labour market, income) to social (e.g. housing, health) and infrastructure (e.g. Creţan and Turnock 2009; Kézdi and Suranyi 2009; Kertesi and Kézdi 2011; O'Higgins 2012; Brüggemann 2012; Mihailov 2012; Perić 2012; Ivanov and Kagin 2014; Cviklova 2015). However, not all Roma households are marginalised. In order to identify the share of marginalised Roma (and non-Roma) households, we adopt the UNDP's social exclusion index (Peleah and Ivanov 2013). The UNDP index contains three dimensions, each being described by 8 indicators (24 in total). Given that the primary focus of our study are those policy interventions that improve the educational and employment situation of economic and social dimensions, we adopt narrower definition of marginalisation in our analysis.[6] According to this adjusted definition of the UNDP's social exclusion index, a Roma adult is considered as 'socio-economically excluded' if it has accumulated deprivations in these indicators: (i) adults with a not completed upper secondary education; (ii) being an unemployed (or a discouraged worker).[7] For Roma children, we use one socio-economic indicator: (iii) children of compulsory school-age not attending school. These three key indicators are complemented by four further indicators: (iv) children with/without a pre-school education; (v) illiteracy; (vi) paid employment; and (vii) at risk of poverty. We use the FRA / European Commission's survey data to compute the three marginalisation indicators.[8]

Children with preschool education. Education problems of Roma are pervasive at all stages of education. The gap between Roma and non-Roma in accessing the education system starts already with the preschool education. The European Union Agency for Fundamental Rights (FRA) and European Commission's 2011 survey conducted in selected EU countries among Roma and non-Roma which share a similar environment reveals a significant gap in the preschool attendance between Roma and the mainstream population. In contrast to 87%-96% of similar non-Roma, only 44% of Roma aged 6-15

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[6]In the original UNDP definition of the social exclusion person is considered as 'socially excluded' if it has accumulated 9 or more deprivations from the 24 indicators.

[7]The original UNDP labelling for three of these indicators – (i) Household with young children not in school or pre-school, (ii) Low educational achievements (basic schooling) and early school leavers; (iii) Being unemployed or a discouraged worker – has been adjusted to match them more precisely with those available in the European Commission's 2011 survey data.

[8]Data from 2011 Roma survey are accessible from the FRA's online data explorer: http://fra.europa.eu/en/publications-and-resources/data-and-maps?mdq1=theme&mdq2=3508
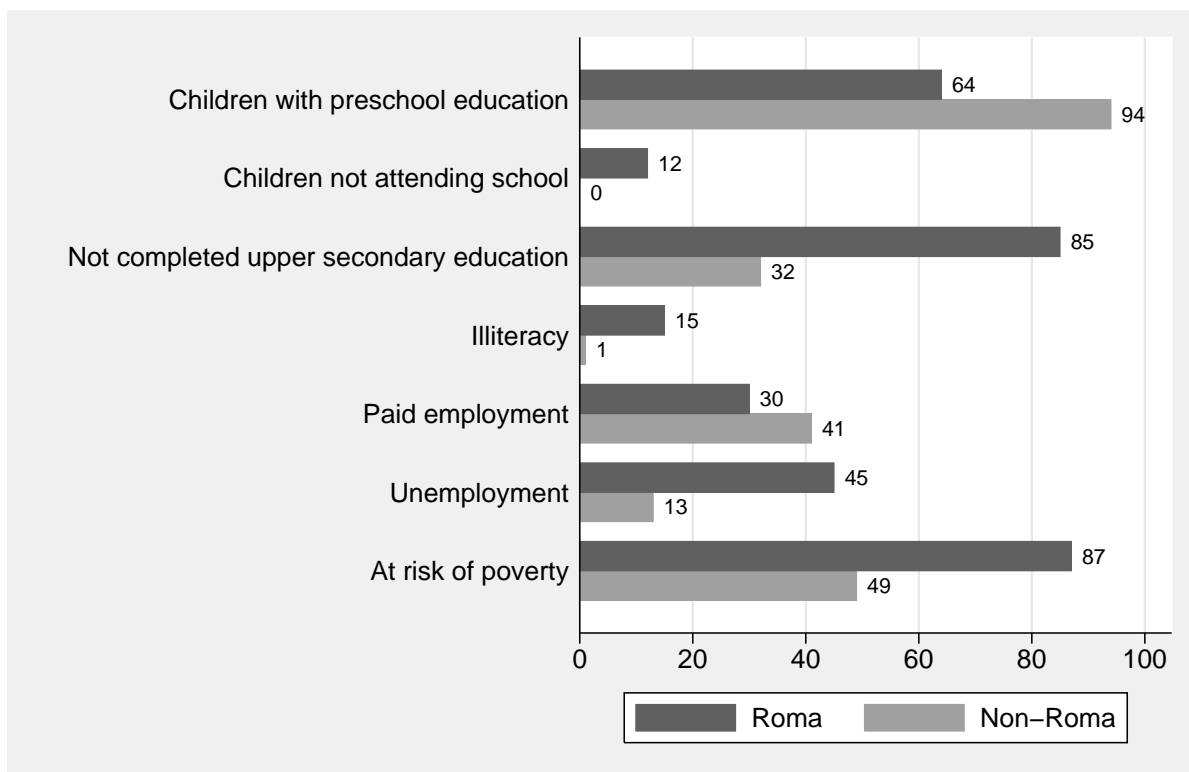
Figure 1: Socio-economic characteristics of Roma in **Bulgaria**, percent of respondents. Sources: Children with preschool education (age group 6-15); Children of compulsory school age not attending school in 2010/2011; Adults with not completed upper secondary education (age group between 18-24); Self perceived illiteracy (age group 16 and above): FRA (2014c); Paid employment (age group 16 and above) (including full-time, part-time, ad-hoc jobs, self-employment): FRA (2014a); Self-perceived unemployment: FRA (2011); At risk of poverty (below 60 % of the national median): FRA (2014b).

in the Czech Republic, 48% in Slovakia, 55% in Romania and 64% in Bulgaria had ever attended the preschool education (Figures 1, 2, 4 and 5). Although, in Hungary the preschool education participation of Roma is somewhat higher, it is still below that of a similar non-Roma population 3. The very low preschool attendance indicates that Roma children will likely face difficulties to catch up with non-Roma at subsequent schooling stages (primary and secondary education) and thus represents an important cause of the early school drop-out (European Commission 2012; FRA 2014a).

Children not attending school. The FRA / European Commission's 2011 survey results also reveal important differences in the compulsory school attendance (at the age between 7 and 15) between Roma and non-Roma children in the five studied countries: between 5% and 22% of the Roma children aged 7 to 15 are not attending the compulsory school education compared to between 0% and 6% of non-Roma children. According to Figures 1 and 4, the school attendance gap is particularly sizeable in Bulgaria and Romania,
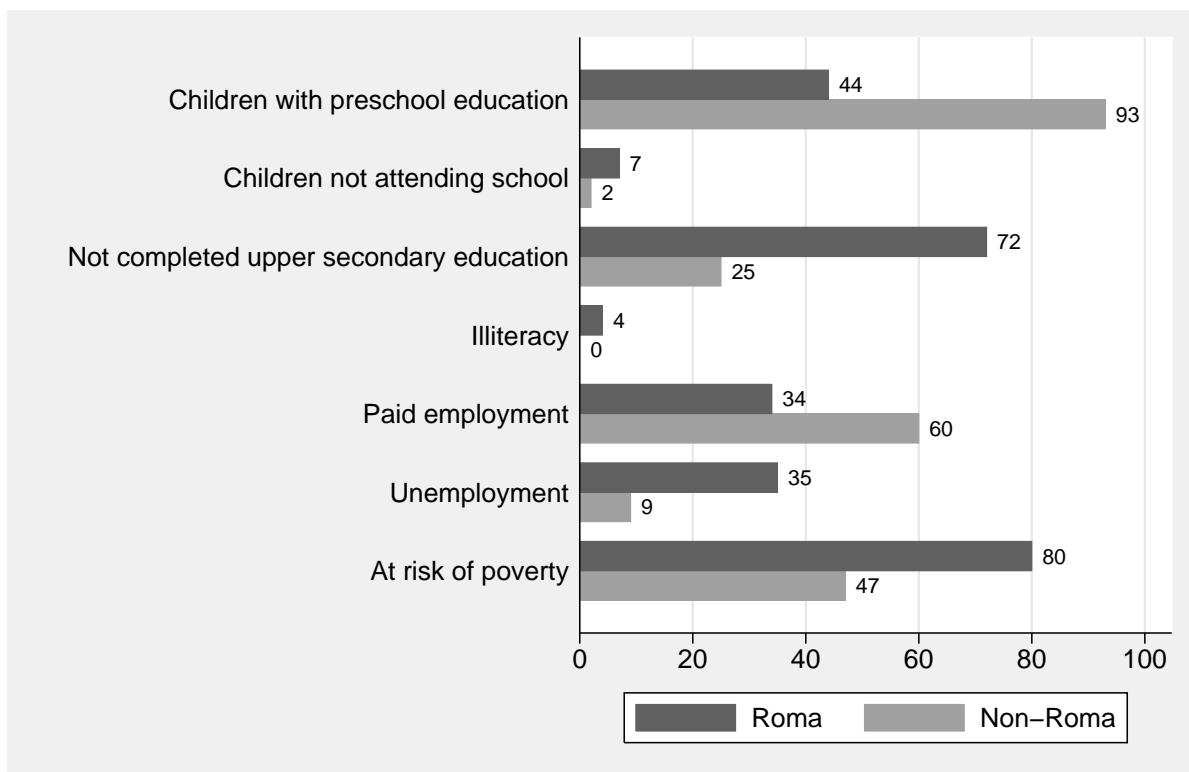
Figure 2: Socio-economic characteristics of Roma in the **Czech Republic**, percent of respondents. Sources: Children with preschool education (age group 6-15); Children of compulsory school age not attending school in 2010/2011; Adults with not completed upper secondary education (age group between 18-24); Self perceived illiteracy (age group 16 and above): FRA (2014c); Paid employment (age group 16 and above) (including full-time, part-time, ad-hoc jobs, self-employment): FRA (2014a); Self-perceived unemployment: FRA (2011); At risk of poverty (below 60 % of the national median): FRA (2014b).

where respectively 12% and 22% of Roma children in the compulsory school age are not attending a compulsory school education either because they are still in preschool, not yet in education, skipped the year, stopped school completely or are already working (European Commission 2012; FRA 2014a).

Not completed upper secondary education. With respect to the upper secondary education, the FRA / European Commission's 2011 survey results suggest that only a fraction of Roma children have completed the upper secondary education compared to non-Roma in the five study countries. Between 72% and 93% of Roma in the age group between 18 to 24 have not completed the upper secondary education compared to between 7% and 50% of non-Roma in the five study countries. The secondary education situation of Roma is particularly alarming in Bulgaria, the Czech Republic and Slovakia, where educational gaps to the mainstream population are more than 50%. For example, in Slovakia only 7% of Roma have completed the upper secondary education, compared to 83% of non-Roma.
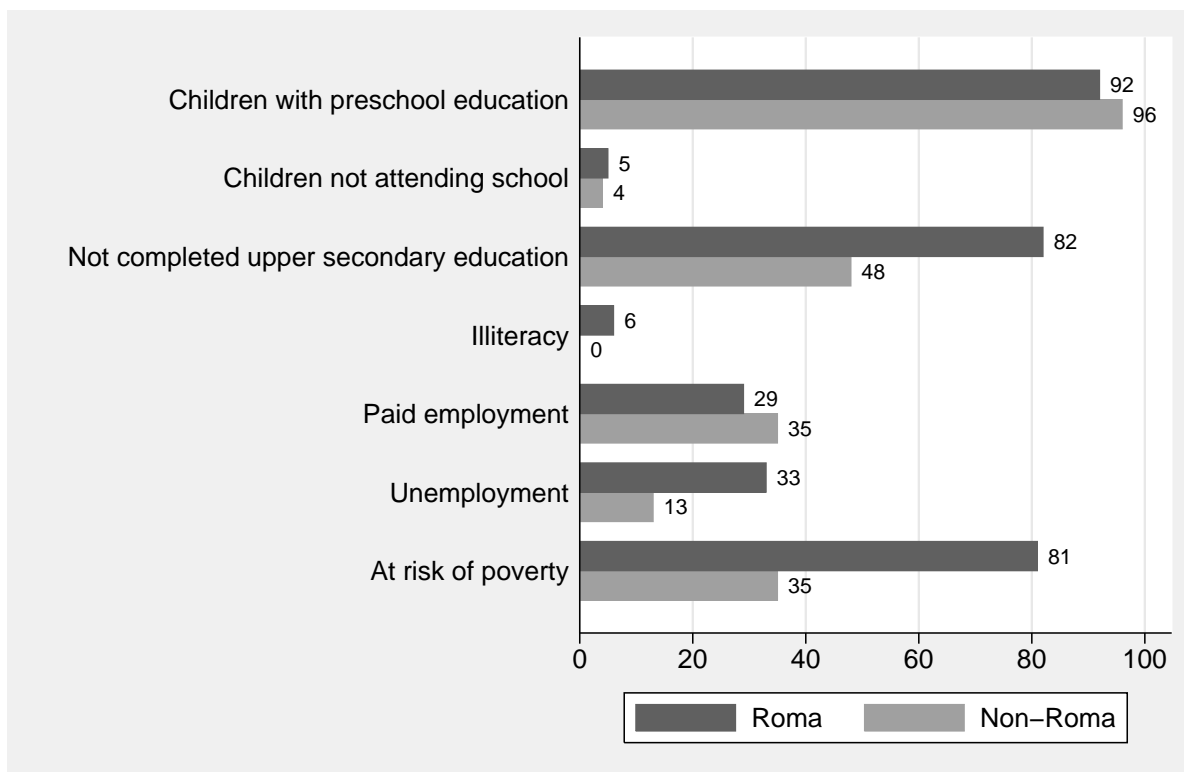
Figure 3: Socio-economic characteristics of Roma in **Hungary**, percent of respondents. Sources: Children with preschool education (age group 6-15); Children of compulsory school age not attending school in 2010/2011; Adults with not completed upper secondary education (age group between 18-24); Self perceived illiteracy (age group 16 and above): FRA (2014c); Paid employment (age group 16 and above) (including full-time, part-time, ad-hoc jobs, self-employment): FRA (2014a); Self-perceived unemployment: FRA (2011); At risk of poverty (below 60 % of the national median): FRA (2014b).

Illiteracy. The illiteracy rate of Roma aged 16 and above is between 4% and 31% compared to 1% or less for non-Roma in the five study countries. The illiteracy rate is particularly high in Romania (31%) and Bulgaria (15%) (Figures 1 and 4) (European Commission 2012; FRA 2014a). The very high illiteracy rate of Roma is both cause and implication of their socio-economic marginalisation. According to UNESCO (2010), illiteracy not only limits the full development of individuals and their participation in society, but also has repercussions throughout life, affecting a person's family environment, restricting access to the benefits of development, and hindering the enjoyment of other human rights.

Paid employment. Roma are significantly worse off also on labour markets compared to non-Roma, particularly in terms of the employment share. According to the FRA / European Commission's 2011 survey, in the five studied countries only 21% to 34% of Roma aged 15 and above were in a paid employment (including full-time, part-time,

Figure 4: Socio-economic characteristics of Roma in **Romania**, percent of respondents. Sources: Children with preschool education (age group 6-15); Children of compulsory school age not attending school in 2010/2011; Adults with not completed upper secondary education (age group between 18-24); Self perceived illiteracy (age group 16 and above): FRA (2014c); Paid employment (age group 16 and above) (including full-time, part-time, ad-hoc jobs, self-employment): FRA (2014a); Self-perceived unemployment: FRA (2011); At risk of poverty (below 60 % of the national median): FRA (2014b).

ad-hoc jobs, self-employment) compared to between 35% and 60% of non-Roma that share a similar environment. For example, in Slovakia only 21% of the surveyed Roma were in a paid employment, compared 53% of a similar non-Roma population (Figure 5). A significant gap – of more than 20% in a paid employment between similar Roma and non-Roma – is also observed in Bulgaria and the Czech Republic (Figures 1 and 2) (FRA 2012c).

Even when Roma are in paid employment, they often have to rely on seasonal and occasional type of jobs (Troc 2002; O'Higgins and Ivanov 2006). According to the FRA / European Commission's 2011 survey, only between 34% and 81% of Roma in paid employment have full-time jobs in the five study countries, while the rest of Roma in a paid employment face precarious employment conditions, i.e. hold ad-hoc jobs, are self-employed and are employed part-time. Two thirds of those who are in a paid employment do not have a full time job (4) (FRA 2012c).
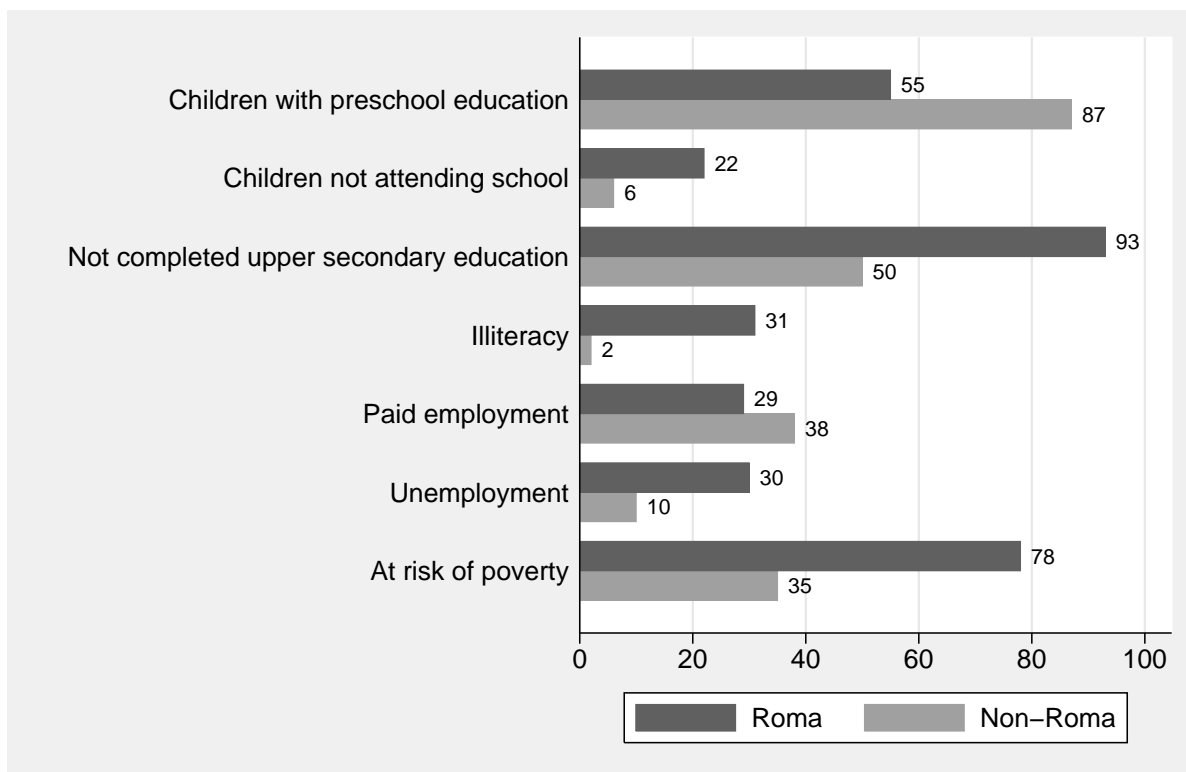
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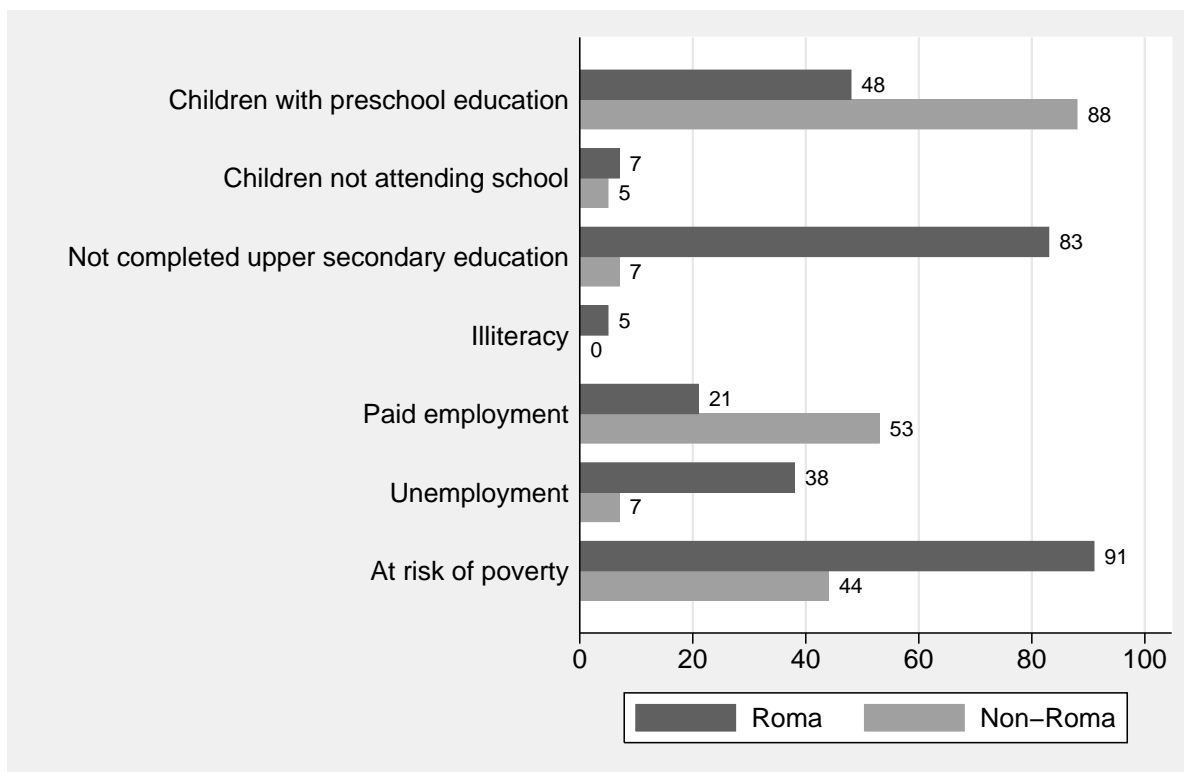
Figure 5: Socio-economic characteristics of Roma in **Slovakia**, percent of respondents. Sources: Children with preschool education (age group 6-15); Children of compulsory school age not attending school in 2010/2011; Adults with not completed upper secondary education (age group between 18-24); Self perceived illiteracy (age group 16 and above): FRA (2014c); Paid employment (age group 16 and above) (including full-time, part-time, ad-hoc jobs, self-employment): FRA (2014a); Self-perceived unemployment: FRA (2011); At risk of poverty (below 60 % of the national median): FRA (2014b).

Unemployment. Regarding the unemployment rate in the five study countries, the FRA / European Commission's 2011 survey revealed that between 30% and 45% of Roma were unemployed; which is more than two times higher compared to a similar non-Roma population. In Bulgaria, the Czech Republic, Romania and Slovakia, the Roma unemployment rate was between 3 to 6 times higher than that of a comparable non-Roma population (Figures 1, 2, 4 and 5) (FRA 2011).

Based on the UNDP Roma survey results conducted in CEE countries in 2002 and 2004, O'Higgins and Ivanov (2006) have found that most Roma suffered from a long-term unemployment. While in the 2002 survey, more than half (51%) of the unemployed Roma were without job since 1996 or earlier, in the 2004 survey, the average share of those without job since 1996 has increased to 64% (ranging from 55% in Bulgaria to 88% in Romania). A further effect of the long-term unemployment is reflected also in the fact that many Roma are not eligible for unemployment benefits and must rely among others

on a minimal social assistance.

Further, O'Higgins and Ivanov (2006) have found that Roma unemployment rates decrease with the educational attainment level, a fact which is known also from the mainstream population. However, survey results reveal that unemployment rates among Roma fall much slower with the educational attainment level than among non-Roma living in a close proximity to Roma. This discrepancy between Roma and non-Roma indicates a presence of an anti-Roma discrimination in the labour market. According to O'Higgins and Ivanov (2006), among others, this contributes to explaining the fact that the early school leaving of Roma pupils is larger than of non-Roma children, as the gains from education (schooling premium) are considerably smaller for Roma. However, this may also indicate lower quality education attained by Roma for the same grade, as many Roma tend to attend lower quality schools and/or segregated classes.

Risk of poverty. According to the FRA / European Commission's 2011 survey, the large majority of Roma households (more than 78%) have an *income* level below the national risk-of-poverty level (i.e. lower than 60% of the national median disposable income), compared to less than 49% of similar non- Roma households in the five study countries (Figures 1 – 5). This latter figure represents a poverty risk significantly above the average rate at the national level. The poverty risk is positively correlated with the household size, though the variation between household sizes is relatively small (FRA 2014b).

Kertesi and Kézdi (2011) have identified a significant wage gap between Roma and non-Roma in Hungary in surveys conducted between 1993 and 2007. According to their results, differences in observable characteristics, e.g. the educational background and geographic isolation, explain 40% of the wage gap between the employed Roma and non-Roma, whereas the rest of the wage gap has to be attributed to differences in unobserved skills and the anti-Roma discrimination on the labour market.

2.3. Education quality

When thinking about fundamental differences in the educational attainment between Roma and non-Roma children, it is useful to distinguish between two broad types of education pathways:[9] (i) Vocational education – education pathway leading to an apprenticeship; and (ii) general education – education pathway finishing with a matriculation examination (matura).[10]

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[9]Note that in reality there are many more types of education pathways possible in the five studied CEE countries and there is a certain mobility between the two broad types identified in the present study.

[10]A type of a matriculation examination exists in each of the five studied CEE countries.

The apprenticeship education pathway implies finishing a primary school plus a vocational training. Hence, apprenticeship is the lower standard of a school education qualification: it is less demanding for children (and their parents), but usually also labour market outcomes are lower. There are several types of schools offering education that finishes with this lower standard of qualification: practical schools, vocational schools, etc. In the context of Roma, also special schools and segregated schools are relevant, as they all do not lead to the matura exam. For example, in the Czech Republic there are 'mainstream schools with special educational programmes for pupils with special education needs', which are more commonly referred to as 'practical schools'. According to European Parliament (2011), 27 percent of Roma children attend these practical schools, which is in stark contrast with 2 percent of children from the mainstream population. According to Stejskalova (2012), these practical schools are the preferred option by many Roma households. First, in these schools parents are only little involved and taken as responsible for their child's education and homework preparation. Second, these practical schools are usually located in a close neighbourhood of Roma communities, implying lower transport/commuting costs for children to attend school. Third, because the majority of classmates are from disadvantageous families, children in these schools experience less discrimination from peers. On the other hand, the education quality in these practical schools is considerably lower than in regular schools. According to European Parliament (2011), 65 percent of Roma pupils who follow the practical school educational pathway finish school with the lower standard of qualification (secondary school with apprenticeship) and less than one percent of Roma pupils graduate with the highest form of qualification – matura.

The matura education pathway implies finishing a primary school plus a secondary school with a matriculation examination. Hence, mature is the higher standard of a school education qualification: it is more demanding for children (and their parents), but usually also labour market outcomes are higher. A matriculation examination is taken at the end of the secondary education, and generally must be passed in order to apply to a university or other institutions of higher education. After passing the matriculation examination, students receive a school leaving certificate, which allows them to matriculate at university and take up their studies. In other words, completing a secondary school with a matriculation examination makes a higher education possible. There are different types of schools leading to the matura exam, they vary from country to country: high schools, gymnasiums, lyceums, upper schools, etc.

According to the Roma Education Fund (2018), around 46% of Roma children attend special schools in the CEE, which compares to just below 5% of children of the mainstream society (see also Kertesi and Kezdi 2011). Hence, there are important differences not only in educational attainment rates between Roma and non-Roma, but also in the quality of the received education.

3. Modelling framework

As noted in introduction, the existing evidence base supporting the design and implementation of Roma integration policies is scarce and inconclusive. The few existing studies estimating costs and benefits of Roma integration policies apply at most a partial equilibrium approach or undertake a reduced form analysis. A key limitation of reduced form / partial equilibrium analyses, which are being used to assess Roma integration policies, is that they do not take into account economy-wide interactions and medium- to long-run feedback effects and adjustments on labour markets. For example, usually, they assume that policy-induced investments in the human capital of Roma would not change wages and employment probabilities of the mainstream population. Justifications for such rather limiting assumptions are provided by evidence that Roma are minorities in countries where they reside and their share in the total labour force is relatively small. However, from the dual labour market theory (e.g. Dickens and Lang 1985) we know that an integration policy that would improve the labour market participation and employment of the economically inactive population would shift the labour supply, which in turn would affect labour market outcomes in the medium- to long-run. Furthermore, the inclusion of Roma into labour markets is expected to generate more economic activity, which will affect demand, the tax revenue of government, etc. Although, both types of general equilibrium effects affect the overall costs and benefits of the Roma integration policy in the medium- to long-run, they are not accounted for in reduced form / partial equilibrium analyses.

Capturing general equilibrium feedback effects and the above discussed sizeable differences between Roma and non-Roma in education and labour markets pose challenges to the analytical framework. First, the model must be able to identify Roma and non-Roma children in education and workers on the labour market separately, as section 2 suggests sizeable differences between the two population groups. Second, the modelling framework should be able to capture all short- and long-run policy-induced general equilibrium feedback effects on labour markets, public budget, etc. Third, the

modelling framework should allow for an integration policy-induced social mobility.

Taking these aspects into consideration, in the present study we follow the modelling approach of Tanaka et al. (2018) and Kancs and Lecca 2018) that allows us to undertake a holistic analysis of long-run social, economic and fiscal impacts of alternative Roma integration policies. The modelling of education and labour markets is less traditional, therefore, all key equations are presented and discussed in detail. The rest of the underlying model (firms, government, equilibrium conditions) is rather standard, therefore, it's description is kept concise. The modelling of education is based on Tanaka et al. (2018), who propose an education model in the context if immigrants versus natives with two channels of adjustment: the education quantity and quality. Given that all main results of this model apply also to Roma (who share key patterns of exclusion and discrimination based on social constructs and prejudice because of their 'otherness'), we adopt the Tanaka et al. (2018) approach in the present study. The labour market is modelled following Bonacich (1975), who proposes a split labour market between migrant and native workers (see Kancs and Lecca 2018).

The adopted general equilibrium framework offers several advantages in our study, compared to partial equilibrium and reduced form methods. According to the European Commission's Better Regulation Toolbox (p.359), [11] a general equilibrium framework, which captures linkages between markets across the entire economy, is the most appropriate when indirect impacts are likely to be the most significant ones in terms of magnitude of expected impacts:

> "*General equilibrium models are able to simulate the shifts in supply curves and corresponding demand changes that can result from any change in the economy, from a price shock in raw materials to a new form of price regulation. Accordingly, they are able to model the links between connected markets in a way that shows the ultimate impact on outputs and consumption of goods and services in the new market equilibrium; and they can also determine a new set of prices and demands for various production factors (labour, capital, land). As a final result, they can also provide indications and estimates as regards macroeconomic changes, such as GDP, overall demand, etc.*" Better Regulation Toolbox (p.359)

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[11] https://ec.europa.eu/info/better-regulation-guidelines-and-toolbox_en

3.1. Overview of the model[12]

Key economic 'agents' in the model are households, firms and government; key production factors are different types of labour and capital. The model economy is represented by five EU Member States: Bulgaria, the Czech Republic, Hungary, Slovakia and Romania, the rest of the EU and the rest of the world. Being a general equilibrium, the model captures all flows of goods and services of the global economy in the base year. Through international trade linkages, the model covers also the rest of the world, which for the sake of simplicity is modelled in a fairly aggregated way though.

Each EU Member State's economy is composed of a number of economic sectors, the supply of educational services representing one such sector.[13] Each economic sector produces goods or services for the intermediate and final use by combining inputs from materials, capital and labour according to a nested Constant Elasticity of Substitution (CES) production function framework. In each sector goods are either vertically differentiated (education services) or horizontally differentiated (all other sectors).[14] In sectors producing horizontally differentiated goods, the competition between firms is monopolistic, implying that many small firms offer similar products or services, which however are not perfect substitutes. Barriers to entry and exit in each economic sector are sufficiently low, such that the production/pricing decision of any one firm does not directly affect those of its competitors. The equilibrium nature of the model implies that all revenues from the production of goods and services are allocated either to households (as returns to labour or capital), to other industries as payments for the intermediate output, or to government as taxes.

The demand for goods and services produced in all economies stems from households, firms in the same or other sectors and the public sector (government). As usual, the government budget (net of taxes, subsidies, transfers and savings) is allocated among different commodities according to a CES utility function.

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[12]See Appendix for a formal description of the model.

[13]The SAM data set to which the model is calibrated provides a considerable flexibility to re-aggregate the model into different sectoral groupings, which we exploit intensively in a sensitivity analysis, in order to assess impacts on low-tech versus high-tech sectors, skill-intensive versus skill-extensive sectors, etc. In the this study we employ a five sector version of the model: Low-skill manufacturing; Medium-skill manufacturing; High-skill manufacturing; Education and the Rest of the economy (see Appendix for details of the sectoral classification).

[14]See Lutz and Turrini (2006) for vertically differentiated skills.

3.2. Education

Each of the five EU Member State is populated by heterogenous households. Following Tanaka et al. (2018), households are differentiated according to their ethnic origin, f, that include mainstream society's households and Roma households. Households between different ethnic origin groups differ with respect to the number of children, the preference for education, costs of education (opportunity costs of a child labour in household) and the disposable income.

Following Tanaka et al. (2018), households have a nested utility structure, where at the top level, household with the ethnical background, f, derive utility, u_f, from the consumption of horizontally differentiated consumption goods and services, C, and from vertically differentiated education services, E_f (in per-child units):[15]

$$u_f = \underbrace{\frac{1}{\alpha}(C)^\alpha}_{Consumption\ goods} + \underbrace{\frac{\gamma_f}{\alpha}(E_f)^\alpha}_{Educaiton\ services} \tag{1}$$

where $\alpha < 1$ is parameter determining the share of the aggregate income devoted to education by the government, that is, and implicit tax rate determining the tax elasticity of demand for educational services, and $\gamma_f > 0$ is a preference parameter for education relative to consumption that is common to all households from the same ethnic group.

As regards consumption goods, see Appendix for a description of the household consumption behaviour. As regards education services, at the second tier households decide on a particular education quality from a range of vertically differentiated education services, each firm in the education sector supplying a different quality education services. All firms in the education sector receive a per-student subsidy from government, denoted by $b \geq 0$. This education subsidy constitutes a public cost of education that is financed through taxes, t. In addition, households face also a private cost of education, e.g. school fees, $z_f \geq 0$, that are education quality-specific: higher quality education costs more to households and vice versa. Households choose their preferred education quality among a range of vertically differentiated education services indexed by the quality premium, z_f. The household indirect utility can then be rewritten as:

$$u_f = \max_{z_f \geq 0} \frac{1}{\alpha}\left(y_f(1-t) - c_f n_f z_f\right)^\alpha + \frac{\gamma_f}{\alpha}(b+z_f)^\alpha \tag{2}$$

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[15]Country subscripts are omitted in this section for the sake of brevity.

which is increasing in the disposable (net of taxes, t) household income, y_f, and education units (quality), $b + z_f$. The household utility is decreasing in education costs, $c_f n_f z_f$, where c_f captures ethnic origin-specific education costs that are not related to schools, e.g. the opportunity cost of a child labour in household or cost of additional language courses that are not equal/relevant for all ethnic groups, e.g. the mainstream population. Whereas b is an exogenous policy variable, z_f is an endogenous decision variable of households.

Following Tanaka et al. (2018), from equation (2) the utility-maximising education quality, z_f, chosen by household with f ethnical background, n number of children and y income level can be expressed as:

$$z_f = \frac{y_f (1 - t) - \left(\frac{\gamma_f}{c_f n_f} \right)^{\frac{1}{\alpha - 1}}}{\left(\frac{\gamma_f}{c_f n_f} \right)^{\frac{1}{\alpha - 1}} + c_f n_f} \tag{3}$$

According to equation (3), households with higher disposable income, $y_f (1 - t)$, or ethnic groups with higher taste for education, γ_f, will choose higher quality education that is more expensive. In contrast, households with more children, n_f, or facing higher opportunity costs of sending children to school, c_f, will choose relatively lower quality education that is less expensive.

This adopted education modelling framework of Tanaka et al. (2018) allows us to capture fundamental education differences between Roma and non-Roma in the five CEE study countries. On average, Roma households have lower level of income and more children than non-Roma households (see Ciaian and Kancs 2018). According to the FRA / European Commission's 2011 survey data, Roma children have lower educational attainment compared to non-Roma children both in terms of quality and quantity. Third, the education demand of Roma households is decreasing in opportunity costs e.g. of the child labour in household. In contrast, higher preference for education of non-Roma households contributes to higher educational outcomes. Further, the quality of education positively affects the returns to education. According to Castelló-Climent and Hidalgo-Cabrillana (2012), there are increasing marginal returns to the education quality. Hence, a further implicit result of the model is that those households that choose lower quality schools will have lower marginal returns to education and vice versa.

3.3. Labour markets

Households own production factors – capital and labour – which they rent to firms. Labour is disaggregated according to skill levels into three categories: low-skill (primary and lower secondary education, ISCED 0-2); medium-skill (upper-secondary and post-secondary education ISCED 3-4); and high-skill: (tertiary education, ISCED 5-6). Net wage differences between low-, medium- and high-skill workers together with employment probabilities determine the share of low-, medium- and high-skill workers in each country in the long-run.

The labour market is represented by a downward sloping labour demand curve and a wage curve determining the relationship between wage and unemployment. The slope and position of each curve is skill-specific, implying that also the wage rate and employment are differentiated between the low-, medium- and high-skill labour. In order to account for the ethnically split labour market widely observed in the CEE (Ciaian and Kancs 2016), we follow (Bonacich 1975) and further introduce two types of parallel labour markets – Roma and non-Roma (see Kancs and Lecca 2018, for details). According to Bonacich (1975), there may be several reasons for the existence of a split labour market: (i) discrimination from the mainstream population, (ii) differences and the quality of education and/or professional qualifications; (iii) differences in worker preferences (e.g. reservation wage), etc. In our model, the split labour market is country-specific, it depends on differences in the education quality between Roma and non-Roma. According to the data that we use to calibrate the model, the larger is the education quality gap (measured by national test scores of schools with predominantly Roma children and predominantly non-Roma children), the larger are wage differences for a comparable work between the two parts of the split labour market. On the labour demand side, the two types of workers are substitutable (though not perfectly), implying that each mainstream economy's firm can hire either Roma workers or non-Roma workers for the production of goods and services.

4. Scenario construction

4.1. Baseline and setup

In order to undertake a comparative scenario analysis and assess impacts of selected Roma integration policies in the five CEE countries, first, a baseline scenario is constructed and simulated. Alternative policy scenarios will be measured against this baseline. In the context of the European Roma, one of the key assumptions regards the future Roma

population growth. As detailed in Ciaian and Kancs 2018, Roma is one of the fastest growing population groups in Europe. In order to account for this fact, we use Eurostat's population projections for the general population, which provide '*what-if*' scenarios about the likely future size and structure of population groups, based on assumptions about fertility, mortality and migration (Eurostat, proj_15npms). We complement Eurostat data with FRA / European Commission's 2011 survey data for Roma to derive projections about the future Roma population growth the rate of which, as detailed in Ciaian and Kancs 2018, is considerably higher than that of the mainstream population.

Second, alternative integration (counterfactual) scenarios for the marginalised Roma inclusion are constructed and simulated. In the designed alternative integration policy scenarios, the education and labour market outcomes of Roma depend on implemented Roma integration policies. Together with marginalised community inclusion policy makers and Roma experts in the five studied countries and the European Commission, we have designed two Roma integration scenarios that could be useful for better understanding of the potential magnitude and distribution of economic, budgetary and fiscal costs and benefits of policy options regarding the Roma integration:[16]

- Policy Status Quo scenario;

- Universal Basic Income scenario.[17]

The *policy status quo scenario* is based on estimates of actual current/future policy expenditure data, in which already allocated and/or foreseen Roma integration policy expenditures serve a starting point. Subsequently, improvements in the Roma educational and labour market outcomes are projected, and finally using the model economic, budgetary and fiscal effects simulated.

Most of Roma integration policies currently implemented in the EU and simulated in the policy status quo scenario aim at expanding the supply of social and economic services (both availability and quality) by improving the education, health and other socio-economic infrastructure. Whereas supply-side policies may be effective in increasing the supply of educational services, according to OECD (2017) they do not always lead to the

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[16]Main ideas and key inputs for the Roma integration scenario construction were crystallised at the European Commission's workshop on Roma communities in Europe "Taking stock of current science-based knowledge and what is needed for effective policy development".

[17]A universal basic income, also referred to as a guaranteed minimum income or income guarantee, is a cash transfer that everyone within a geographic territory or social community receives on a regular basis with no conditions on a long-term basis (Thigpen 2016).

desired uptake and use of these services. The European Court of Auditors has voiced similar concerns in its special report on EU policy initiatives and financial support for Roma integration (ECA 2016). Even when costs for these services are kept low or even free, nevertheless, supply-side policies often fail to satisfactory increase the use of these services (de Janvry and Sadoulet 2004; Bassett 2008; World Bank 2010).

In order to address deficiencies of supply-side policies, the use of direct cash transfers is becoming more and more popular in many countries (both developing and developed), as they can more effectively help to overcome liquidity constraints preventing the use of supplied public services by poor/marginalised households and are less costly in terms of their implementation (Tabor 2002; OECD 2017). The idea of direct cash transfers is not new, it is rooted in the neoclassical economics, according to which individuals make rational decisions to maximise their own wellbeing by taking into consideration benefits and costs associated with each decision. When liquidity constrained households receive cash transfers, their cost-benefit considerations change, which in turn affect their decision-making calculus. For example, a direct income transfer can reduce the household opportunity cost of sending children to school, making the benefits of the schooling & education decision outweigh the costs (de Janvry and Sadoulet 2004; Bassett 2008).

The second scenario – *universal basic income* – is a hypothetical scenario, in which we analyse policy impacts under 'what would happen if' assumptions. In particular, we assess economic, budgetary and fiscal effects by assuming that the same amount of Roma policy expenditure as under the policy status quo scenario would be disbursed in form of direct cash transfers. The analysis investigates the impact of direct cash transfers but it does not call for such transfers to be targeting only Roma. To the contrary, they might be more cost-efficient tool for addressing the multiple poverty, deprivation and discrimination any other group at risk of marginalisation faces, as previous studies suggest (see section 5.3).

Three types of assumptions need to be made when constructing Roma integration scenarios: the magnitude and distribution of policy costs (section 4.2); associated improvements in the educational attainment (section 4.3); policy-induced improvements in labour market outcomes (section 4.4); and policy financing sources and methods (section 4.5).

4.2. Policy costs

We can distinguish between two types of education and training programs and their related costs in the *policy status quo* scenario. (i) Roma-specific education and training programs. Costs of these programs include, for example, teacher salaries and school buildings for Roma children. (ii) Education programs for children from a socially disadvantaged environment in general. Costs of these programs include, for example, equipment in classrooms designated for the instruction of children from socially disadvantaged environments through the use of special teaching aids, didactic media and teaching technology.

Roma-specific education and training programs cover policy initiatives that are designed and implemented specifically for Roma. These costs (per child) differ substantially between the five studied countries. In counterfactual policy scenarios, these costs are also identified by the educational attainment level, wherever possible. Costs of other education and training programs, which cannot be associated to children from a particular educational attainment level as main beneficiaries, are assumed to incur to all educational attainment levels (primary, secondary and tertiary) proportionally.

Education assistance programs for children from socially disadvantaged environments include, among others, children from marginalised Roma families. Per child costs of these programs differ significantly between the five studied countries. However, in our simulations they are not specific to a particular educational attainment level, as many of education assistance programs for children from socially disadvantaged environments, e.g. the early childhood development and pre-school education, are beneficial for children from all educational attainment levels (primary, secondary and tertiary).

An overview of total Roma integration policy cost estimates in the policy status quo scenario in each of the five studied countries during 2014-2020 is provided in Table 1. The expenditure estimates reported in Table 1 suggest that, in terms of the total funding, the marginalised Roma community in Romania (721.82 million Euro) followed by Hungary (675.70 million Euro) would be the largest beneficiaries of those Roma integration policies that are analysed in the present study.[18] The total funding made available for Roma integration policy measures that we simulate in counterfactual policy scenarios is considerably lower in Bulgaria (254.35 million Euro), the Czech Republic (276.48 million Euro) and Slovakia (272.72 million Euro).

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[18]Note that these selected funds do not correspond to entire policy expenditures on Roma integration in the five studied EU countries.

Table 1: Policy costs: yearly amounts made available under selected national, EU and international measures for the Roma integration in the five study countries during 2014-2020

	Bulgaria	Czechia	Hungary	Romania	Slovakia
Million Euro					
2014	36.05	39.33	98.67	102.81	41.08
2015	36.57	40.14	94.31	106.04	40.83
2016	37.72	38.49	98.65	103.03	37.93
2017	35.48	39.76	98.05	100.86	39.38
2018	36.68	39.05	93.57	98.54	39.38
2019	35.63	39.66	95.25	106.43	37.42
2020	36.23	40.06	97.21	104.11	36.69
Total	254.35	276.48	675.70	721.82	272.72
Percent of GDP					
2014	0.090	0.026	0.101	0.073	0.057
2015	0.092	0.027	0.096	0.075	0.057
2016	0.095	0.026	0.101	0.073	0.053
2017	0.089	0.027	0.100	0.071	0.055
2018	0.092	0.026	0.096	0.070	0.055
2019	0.089	0.027	0.097	0.075	0.052
2020	0.091	0.027	0.099	0.074	0.051
Average	0.091	0.026	0.099	0.073	0.054

Source: Authors' estimates based on national Roma integration authorities; European Commission (2017) and Roma Education Fund (2017).

For the sake of comparability between the two policy scenarios, in the *universal basic income* scenario we assume that the same total amounts of the Roma integration funding are made available to Roma in each of the five studied countries as under the policy status quo scenario (Table 1). The key difference between the two policy scenarios is that in the universal basic income scenario these funds are disbursed directly to marginalised Roma households. Specifically, we assume that direct cash transfers are disbursed without coupling them to any spending condition.[19] Being administratively simple, low-cost and fundamentally market neutral, unconditional cash transfers do not introduce any market

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[19]In sensitivity analyses we also explore a potential value added of conditional cash transfers. For that purpose, we construct an additional sub-scenario where cash transfers to Roma households are conditioned on the children school attendance. In order to account for costs associated with verifying and imposing the compliance with transfer conditionalities, we follow Caldes et al. (2006) and assume that policy implementation and verification costs burn 24 percent of total policy expenditures in the conditional cash transfer scenario.
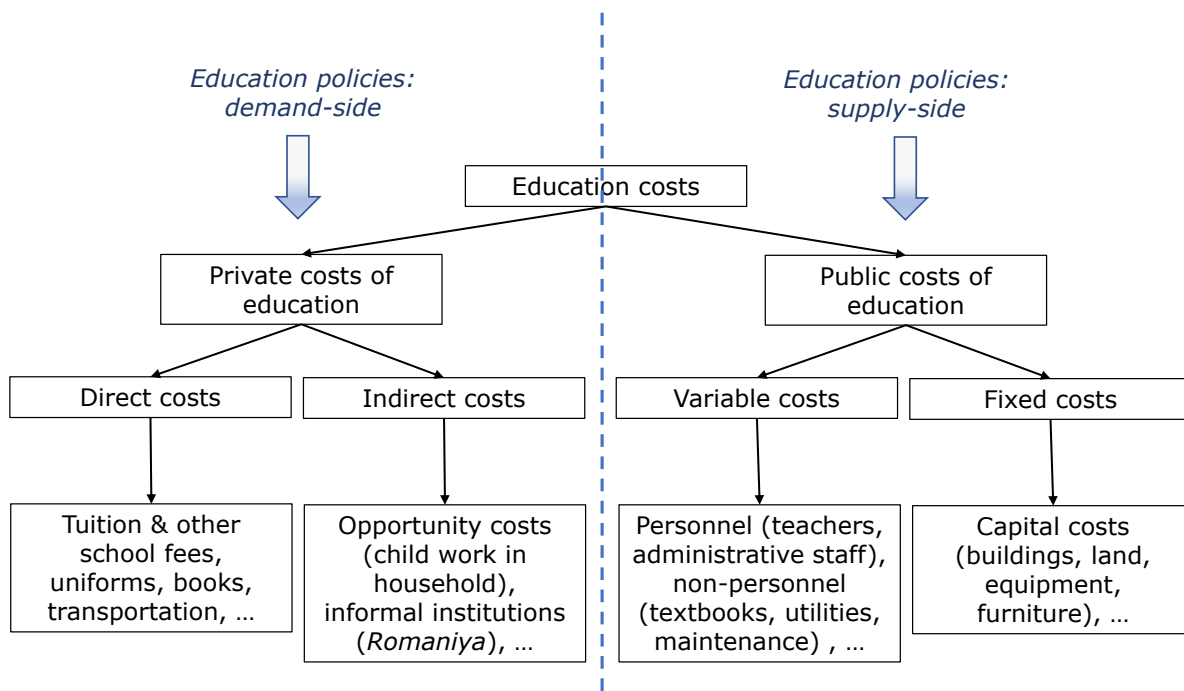
Figure 6: Education costs: public versus private. Source: Based on Tsang (1988).

distortions (Standing 2007).

As shown in Figure 6, education costs consist of two parts: private and public (Tsang 1988; Mehrotra et al. 1996). Both types of education costs are captured explicitly in the underlying model. Whereas education demand-side policies attempt to reduce mainly private education costs (see right panel of Figure 6), education supply-side policies are related mainly to public education costs (see left panel of Figure 6).

4.3. Policy impact on education

We can distinguish between policy-induced improvements in educational outcomes and improvements in labour market outcomes. As regards educational outcomes, their impact depends on policy implementation details (parameter α in equation (1) and variable b in equation (2)) and also on a number of household-specific factors, which in the underlying model are captured through decision variables (variable z_e in equation (2)). Two important elasticities governing the policy impact on the Roma education are the income elasticity of demand for education and the price elasticity of demand for education.

According to the previous literature (Dur and Teulings 2003), an important determi-

nant of the education policy impact is the *price elasticity of demand for education*. Among others, the elasticity of demand for education with respect to the schooling cost determines the effectiveness of supply-side education policies in increasing the stock of the human capital through education. Households choose their demand for education such that the marginal return to education is equal to its cost. A supply-side education policy reduces the education cost and hence also the marginal return. The larger is the elasticity of demand for schooling with respect to its cost, the lower is the amount of a policy intervention that is required for a given increase in the mean level of the human capital, and hence the smaller is the adverse effect on the income distribution. The sensitivity of demand for education to supply-side education policies is particularly important, when the innate ability of individuals and the education demand are complementary. The baseline value of this elasticity is adopted from Campbell and Siegel (1967) and is set to -0.44. In sensitivity analyses we explore the impact in 5% steps of up to 50% lower/higher elasticities (see section 5.2).

As regards the *income elasticity of demand for education*, generally, the previous literature suggests positive relationship, implying that an increase in the household income results in higher demand for education (Becker 1990). However, the relationship between the education demand and household income is complex and non-linear, as the demand for education depends among others on household preferences and budget constraints faced by (marginalised) households, both in turn being influenced by the household income. For example, given the labour-supply potential of children in poor households, higher household income decreases (lower income increases) – as in the universal basic income scenario – the opportunity cost of sending children to school. Overall, an increase in the household income is expected to positively influence schooling decisions, particularly of poor households. Also the baseline value of this elasticity is adopted from Campbell and Siegel (1967) and is set to 1.20. In sensitivity analyses we explore the impact in 5% steps of up to 50% lower/higher elasticities (see section 5.2).

In line with the previous literature (Tsang 1988), we assume that Roma policies implemented through the *policy status quo* scenario function primarily through lowering costs, by covering e.g. personnel costs such as teachers and administrative staff, non-personnel costs such as textbooks, utilities and the school maintenance, as well as capital costs such as buildings, land, equipment and furniture and hence increasing the supply of educational services (see the right panel of Figure 6 as captured by parameter α in equation (1) and variable b in equation (2)). Building new schools/classes in a close

proximity to Roma communities, reduces the cost of accessing educational services. This reduction however risks contributing to the segregation of Roma children in education diluting the potential benefits from reduced costs through a sub-standard quality of education services provided and underdeveloped social skills necessary for a sustainable integration of children in the mainstream society after completing education. Similarly, training teachers to new integrated education methods increases the accessibility of education for Roma children (Kertesi and Kezdi 2011). Hence, educational outcomes in the policy status quo scenario will depend primarily on the *price elasticity* of the household demand for education as well as on the implementation of policy measures to offset the potential negative implications of focused interventions (e.g. through an increased segregation).

In line with the previous evidence (Aizer et al. 2016; Nikiforos et al. 2017; Marinescu 2017), we further assume that Roma policies implemented through the *universal basic income* scenario function primarily through increasing the household income and hence provide additional financial resources to households for lowering e.g. opportunity costs of a child work in household, covering tuition and other school fees, uniforms, books and transportation costs (see the left panel of Figure 6 as captured by variable z_e in equation (2)) resulting in higher demand for education. Increasing a household income that is not related to household economic activities may also optimise consumption/investment decisions, resulting in more efficient allocation of household resources, including education. Hence, educational outcomes in the universal basic income scenario will depend primarily on the *income elasticity* of the household demand for education. Finally, the universal basic income scenario has important empowerment implications reinforcing the agency of marginalised populations that are difficult to factor in the model but should be kept in mind when interpreting simulation results.

Differences in the channels of adjustment (reducing public versus private education costs) and in values between the income elasticity and price elasticity of demand for education will result in different educational outcomes between the *policy status quo* and *universal basic income* scenarios. In line with Roma policy expenditure data discussed in the previous section, we assume that Roma education-related policy expenditures improve children educational attainment rates in all three levels (primary, secondary and tertiary). Further, we also assume that the quality of education improves, which will reduce the Roma / non-Roma labour market segregation. Note that there will be important differences in educational outcomes (in terms of policy-induced improvements

in the education quality and quantity) between the two simulated policy scenarios.

4.4. Labour market outcomes

As regards policy-induced improvements in labour market outcomes, in line with the empirical evidence (e.g. O'Higgins and Ivanov 2006; O'Higgins 2012), in both scenarios higher educational attainment rates and higher education quality of Roma children result in better labour market outcomes of Roma – employment and earnings – increase. In order to link policy expenditures on the Roma education to labour market outcomes (i.e. the employment rate and wage rate) in both the *policy status quo* and *universal basic income* scenarios, we base our estimates on European Commission's 2017 data, according to which there are substantial differences in unemployment rates between those Roma who have completed a tertiary education, secondary, primary or have less than the primary education. On average, in the five studied countries, respective unemployment rates are 29%, 38%, 55% and 81%. These figures are comparable to those reported in O'Higgins and Ivanov (2006) for Roma in nine CEE countries. Note that in both scenarios we assume the same relationship between policy-induced improvements in educational outcomes and labour market outcomes. Hence, an equivalent increase in the educational attainment in the *policy status quo* and *universal basic income* scenarios will result in an equal increase in the employment probability and wage rate.[20]

Key assumptions linking policy-induced improvements in educational attainment rates and higher education quality and labour market outcomes of Roma – employment and earnings – are summarised in Table 2. As shown in the Table, one extra year of schooling has higher impact on the Roma unemployment than earnings. The opposite is true for the increase in test scores by one standard deviation. For comparison, in Table 2 we have also provided the estimated impact of marginal labour market effects of one extra year of schooling and one standard deviation increase in test scores on employment and earnings for the USA, Canada, UK and OECD countries.

4.5. Policy financing methods and sources

In the *policy status quo* scenario, we simulate impacts of selected national government, EU and internationally funded programmes of the Roma inclusion. Nationally funded Roma integration programs simulated in the present study include both Roma-specific

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[20]We are aware of the significant role of the quality of education (the breadth and depth of knowledge acquired). We assume however that quality remains the same under both scenarios.

Table 2: Scenario construction: Marginal labour market effects

Effect on:	Education quantity channel One extra year of schooling	Education quality channel One s.d. higher test scores
Unemployment		
Policy status quo	-13.3%	-2.5%
Universal basic income	-13.3%	-2.5%
Previous studies		
USA	-40.6%	
Canada	-21.0%	
UK	-18.2%	
OECD		-1.4%
Earnings		
Policy status quo	6.1%	+3.3%
Universal basic income	6.1%	+3.3%
Previous studies		
USA	+15.7%	
Canada	+13.8%	
UK	+7.3%	
OECD		+2.0%

Source: Authors' estimates based on European Commission (2017): Roma integration indicators scoreboard (2011-2016), SWD(2017) 286 final. Notes: s.d. denotes standard deviation, estimates for the USA, Canada and UK based on Oreopoulos (2007), estimates for OECD countries based on Hanushek and Woessmann (2007).

programs as well as general programs for marginalised society groups from which Roma benefit, e.g. programs for children from a socially disadvantaged environment. As for EU funds, we have selected the European Structural and Investment Funds (ESIF), which provide allocations to Roma under the investment priority 'Integration of marginalised communities such as the Roma' for the 2014-2020 programming period. As for the international funding of the Roma integration, we have chosen programmes managed by the Rome Education Fund, which include allocations to the Roma education under the heading 'Programs and Grants'.

Table 3 provides an overview of the total funding made available under national, EU and international financing tools for the Roma integration simulated in the present study during 2014-2020, by the source of funding. The expenditure estimates reported in Table 3 suggest that, from those Roma integration funds considered in the present study, the ESIF make available the largest funding (1284.00 million Euro), followed by national Roma integration programmes (881.94 million Euro) and the Roma Education

Table 3: Total amounts made available under selected national, EU and international measures for the Roma integration during 2014-2020 by the source of funding, million Euro

	Bulgaria	Czechia	Hungary	Romania	Slovakia	Average
National Funding	104.84	74.03	197.19	334.36	171.52	176.39
ESIF	143.00	200.00	470.00	372.00	99.00	256.80
Roma Education Fund	6.52	2.45	8.51	15.46	2.20	7.03
Total	254.35	276.48	675.70	721.82	272.72	440.21

Source: Authors' estimates based on national Roma integration authorities; European Commission (2017) and Roma Education Fund (2017). Notes: The national funding includes selected Roma-targeted measures and general programmes for marginalised society groups; the ESIF includes European Structural and Investment Funds investment priority 9(ii) 'Integration of marginalised communities such as the Roma'; the Roma Education Fund includes all investment in the Roma education listed under 'Total Programs and Grants'.

Fund (35.13 million Euro).[21]

For the sake of comparability between the two policy scenarios, in the *universal basic income* scenario we assume not only the same total amounts in each country but also the same funding sources as under the *policy status quo* scenario.

Important for both scenarios is that in the general equilibrium framework adopted in the present study all expenditures have to be covered through an additional government revenue (or an equivalent reduction in the existing government expenditure), either at the national, EU or international level. Note, however, that there are important differences between the three financing sources of Roma integration programs, and these differences are fully accounted for in our model. Whereas national Roma integration policies are entirely financed from respective Member State budgets, EU funds are financed by all EU taxpayers. This implies that EU-level Roma integration programs are partially financed by other EU Member States, as the distribution of net contributing and receiving payments across EU Member States according to the EU budgetary data (European Commission 2017) is fully captured in the model. As regards internationally funded Roma inclusion programs, such as the Roma Education Fund, their financing is not modelled explicitly,

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[21]Note that for those Roma integration policies for which there is available information also about planned expenditures in future we use these data. For example, the ESIF provide allocations to EU Member States under the investment priority 'Integration of marginalised communities such as the Roma' for the entire 2014-2020(+3) programming period. For other programs, for which no expenditure data about future Roma integration programs are available year-by-year for 2014-2020, e.g. national Roma integration programmes and the Roma Education Fund, we use average expenditures from the last three years (2014-2016) also for the remaining period (2017-2020).

they are considered as pure financial transfers from the rest of the world.

5. Simulation results

5.1. Main results

Aggregated simulation results are reported in Figure 7, where we plot the percentage deviation in the GDP from baseline values for the two alternative Roma integration scenarios (policy status quo and universal basic income) for the five studied countries (Bulgaria, the Czech Republic, Hungary, Romania and Slovakia) for the 2014-2040 period.[22] Whereas the solid and dashed lines denote GDP impacts of the policy status quo and universal basic income scenarios, respectively, bars represent policy costs as a share of the GDP. Note that bars correspond to figures reported in Tables 1 and 3. For the sake of comparability, both policy costs and impacts are plotted on the same scale – as percent of the GDP – and hence are directly comparable.

Generally, our simulation results suggest that in the first years of the policy implementation policy costs (bars in Figure 7) would be higher than the GDP growth generated through Roma integration in labour markets. Second, in the medium- to long-run both types of Roma integration policies would have positive and significant impact on the GDP (solid and dashed lines in Figure 7) (in addition to likely positive humanitarian and other non-economic effects, which are not considered here). However, there are remarkable differences in terms of the economic impact between the five studied countries, the two Roma integration scenarios and the time period considered.

From the very first year of the integration policy implementation, the positive impact on the GDP increases continuously in all five studied countries. The policy-induced GDP growth reaches its peak in 7-10 years, after which is starts to decline. It is not surprising to observe a declining impact on the GDP, as in our simulations the Roma policy funding stops after 2020(+3). Depending on the policy scenario and country, the policy-induced long-run growth path stabilises at around 0.01 % to 0.10 % above the baseline growth (see Figure 7). While all five countries share a similar short-run dynamics, differences in the GDP impact between countries become more visible when, because of the Roma integration, the labour force and hence economies expand.

The result that the medium-term impact on the GDP is larger than the long-run effect is due to the fact that the simulated Roma integration policy measures imply a

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[22]We are aware also of the positive non-monetary implications of integration policies. We assume however that these are correlated with the GDP impact that can be quantified.
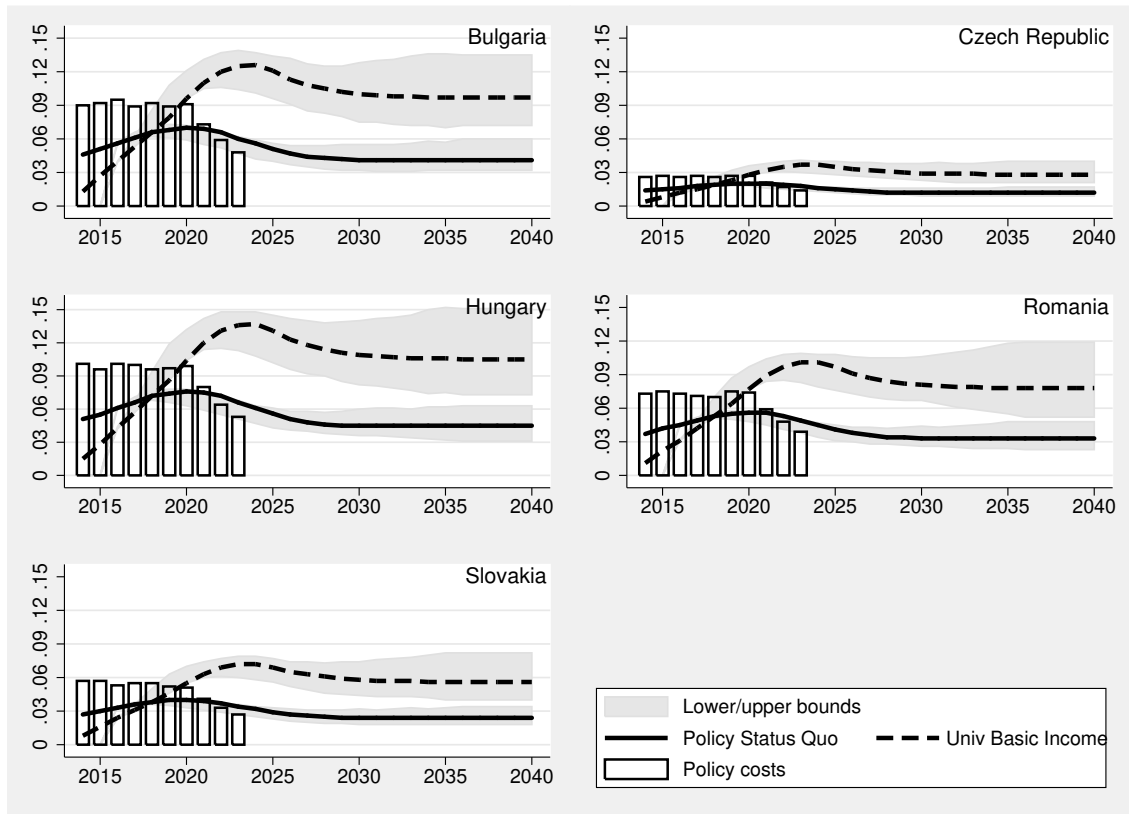
Figure 7: The simulated impact on the GDP and policy costs in percent of the GDP in the five studied countries under the Policy Status Quo and Universal Basic Income scenarios. Source: Authors' simulations. Notes: Y axis: percent of the GDP; X axis: years. See section 5.2 for lower/upper bounds.

combination of one short-run demand-side shock and one long-run supply-side shock. In the short- to medium-run, on the demand side there is an increase in current government expenditures related to policy costs of the Roma integration into the labour market and the corresponding reduction in the disposable household income (due to lower transfers / higher taxes). The latter effect arises, because we account for the fact that all integration policy costs are fully financed by EU Member States.[23] On the supply-side the integration of Roma into labour markets increases the labour supply in EU Member States in the medium- to long-run. As detailed in section 4, the increase in the labour force is Member

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[23]We believe that by assuming that integration policy costs could be financed through a government borrowing could bias the interpretation of simulation results. For example, more integration policy expenditures could be always better than less, if associated policy costs were not borne by economic agents through appropriate financing mechanisms. Therefore, we assume that all Roma integration policies are fully financed by households in the form of a reduction in government transfers to the household income or, equivalently, an increase in income taxes.

State-, skill- and year-specific, and differs between the two Roma integration policy scenarios. Peak in the policy-induced GDP growth is reached after 7-10 years, when the demand-side shock is still present and in addition also the supply-side shock already materialises.

The integration policy-induced growth rate of the GDP is comparably high in all five studied countries in the short-run. It is a remarkable result in light of the negligible share of the Roma population in the total labour force (see first years in Figure 7). According to our simulation results, in the short-run, the strongest positive GDP effect can be expected in Romania, followed by the Czech Republic and Bulgaria. The lowest short-run GDP growth rate can be expected in Hungary. In the medium-run, as more educated and trained Roma workers enter the labour market, all five economies continue to expand, though the marginal effect is decreasing.

After a transitionary dynamics, GDP growth rates reach a new steady state above the baseline growth path of the GDP. In terms of the GDP level, under the universal basic income scenario expected policy-induced deviations above the base line are significantly larger in the long-run than in the short-run, which is consistent for all five studied countries. This however, is not true under the policy status quo scenario, implying that policy demand-side effects are stronger than policy supply-side effects in the medium- to long-run.

Comparing GDP impacts between the two Roma integration scenarios, we can notice that in the short-run the policy status quo scenario generates more economic activities, resulting in higher GDP effects compared to the universal basic income scenario (see Figure 7). In the medium- to long-run (starting from year 5), however, the policy-induced GDP growth generated under the universal basic income scenario becomes larger than under the policy status quo scenario. It is also interesting to notice that in all five studied countries the GDP reaches the highest impact earlier under the policy status quo scenario than under the universal basic income scenario (2020-2021 and 2023-2024, respectively). This result is in line with previous studies on assessing impacts of the universal basic income, which find that conditioning a public policy support to marginalised society groups can sooner produce higher impact in terms of GDP, income and employment (Akee et al. 2010; Butcher 2017; Colombino 2015; Hum and Simpson 1993; Kela 2016; Nikiforos et al. 2017; Pareliussen et al. 2018). In the medium- to long-run, however, the positive effect remains below that of universal basic income policies.

Turning to country-specific results, we notice that Hungary, followed by Bulgaria, has

Table 4: Annual and cumulative impact on the GDP, Million Euro

	Bulgaria	Czechia	Hungary	Romania	Slovakia	EU-5
Annual (long-run)						
Policy status quo	16.47	18.04	43.94	47.00	17.24	142.69
Universal basic income	38.53	42.19	102.79	109.93	40.32	333.75
Cumulative, net						
Policy status quo	212.47	234.63	568.27	610.04	217.11	1842.52
Universal basic income	661.69	726.67	1766.94	1892.02	686.89	5734.21
Cumulative, discounted						
Policy status quo	71.53	80.10	191.95	207.43	69.98	620.99
Universal basic income	295.09	324.98	788.50	845.44	303.75	2557.75

Source: Authors' simulations. Notes: All figures are in Million Euro in 2040. In all computations a 4% discount rate is applied.

the highest potential to boost the GDP through the Roma integration under the universal basic income scenario. The long-run GDP deviation above the baseline scenario can be expected at +0.10 percent for Hungary and +0.09 percent for Bulgaria under the universal basic income scenario (see Figure 7). These results are in line with our expectations, considering that the education gap between Roma and non-Roma in Hungary and Bulgaria is particularly large, and the Roma share in these countries in (8% and 10%, respectively) is among the highest in the EU. Note, however, these two countries would have to allocate a significant funding to reap such benefits from the Roma inclusion. In contrast, the lowest long-run GDP effect can be expected in the Czech Republic (+0.03%), followed by Slovakia (+0.06%) under the full integration scenario (see Figure 7). Also these results are not surprising, when considering the lower amounts of funding allocated for Roma inclusion programs and the projected share of Roma in the total population in these countries. A similar cross-country pattern can be observed also for the policy status quo scenario, though, all five countries can expect a comparably lower GDP growth effect under the policy status quo scenario.

Whereas Figure 7 reported year-by-year GDP results as percentage deviations above baseline, Table 4 provides an overview of long-run GDP results expressed in million Euro. Also these results confirm that the long-run GDP impact would be positive under both types of integration policies in all five studied countries. Table 4 suggests that in nominal terms (million Euro) Romania followed by Hungary would benefit most from the simulated Roma integration policies. Bulgaria, in contrast to Figure 7, would

benefit the least, as in these computations the size of economies plays a role as well. According to Table 4, the positive GDP effects generated under the universal basic income scenario are considerably larger than under the policy status quo scenario (as already seen in Figure 7). Aggregated for the five studied countries, annually, the universal basic income scenario would generate more that two times higher GDP impact than the policy status quo scenario: 142.69 and 333.75 million Euro, respectively (last column in Table 4). Cumulatively, the difference in the discounted net GDP effect is even larger: by 2040 the universal basic income scenario would have generated almost 2 billion more GDP than the policy status quo scenario (2557.75 and 620.99 million Euro, respectively).

Finally, the general equilibrium nature of the model allows us to identify policy leakages to non-targeted groups/expenditures of Roma integration policies. According to our simulation results, the main source of a potential policy leakage in the policy status quo scenario is the inter-household competition for additional / less costly education services stemming from non-Roma households. Between 16.9% and 47.1% of Roma integration policy expenditures end up in non-Roma households in the five study countries. In the universal basic income scenario, the main source of a potential policy leakage is the intra-household competition for additional financial resources from other (non-education) expenditures of Roma households. Between 24.3% and 55.8% of Roma integration policy expenditures result in non-education expenditures of Roma households. These two sources of potential policy leakages need to be kept in mind when designing and implementing Roma integration policies in the EU.

As next, we investigate whether and to what extent the costs associated with Roma integration policies would be offset by positive economic, budgetary and fiscal benefits generated from the increase in workforce in the long-run. To identify relative policy benefits, we compute the net present value (NPV) associated with each integration scenario until 2040, as it should provide an idea of the time in which the economy is able to fully absorb the exogenous demand shock. The NPV is calculated as a difference between the discounted present value of the policy-induced GDP growth above baseline values and the discounted present value of government expenditures. Following the EU Better regulation guidelines,[24] the discount rate applied in these calculations is equal to 0.04.[25] NPV results for the five studied countries for both scenarios are reported in Figure 8.

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[24] https://ec.europa.eu/info/better-regulation-guidelines-and-toolbox_en

[25] In order to assess differences in the simulated policy impact under alternative discount rates, we
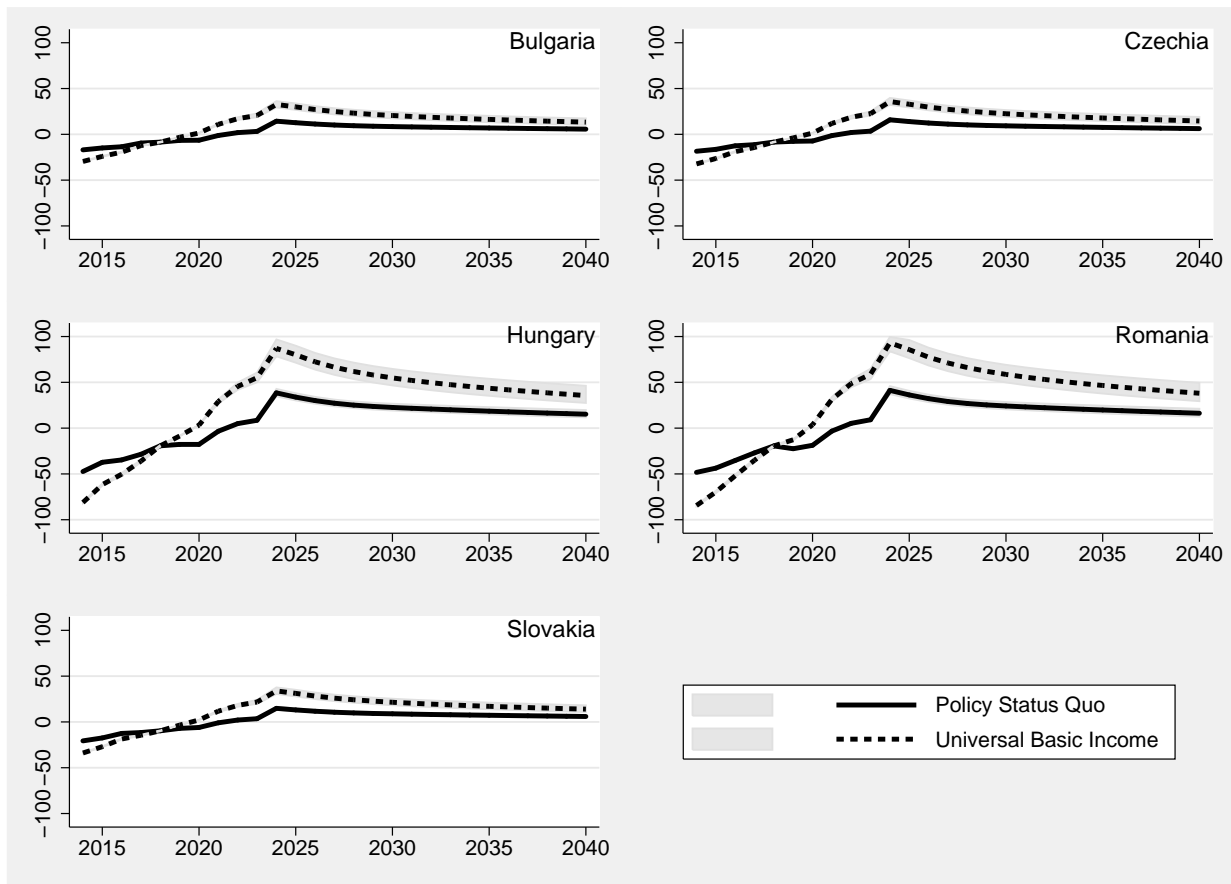
Figure 8: **Net present value**, Million Euro. Source: Authors' simulations. Notes: In all computations a 4% discount rate is applied. Shaded areas around main NPV results represent 3% and 5% discount rates, respectively.

Results from NPV computations suggest that the NPV is negative in initial years but then eventually becomes positive in the medium- to long-run (Figure 8). More important is fact that the NPV becomes positive under both Roma integration scenarios. Depending on the scenario and country of analysis, the full repayment of the integration policy investment (positive net present value) would be achieved after 7 to 9 years. Note that the NPV gives us the size of the (discounted) financial multiplier effect in each period. Hence, even if the NPV is negative in the short- to medium-run, not necessarily the overall impact on the economy is negative. These results could simply imply that the financial multiplier effect is lower than one. Hence, our results suggest that, in order to be able to gain from the full potential of the Roma integration in EU labour markets,

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perform sensitivity analyses with 0.03 and 0.05 discount rates.

taxpayers should be prepared to accept certain costs in the short-run. Moreover, even these short-run disadvantages are associated with positive growth effects in all five studied countries (Figure 7).

Comparing the two alternative integration policy scenarios, we notice that in the short-run the policy status quo scenario is associated with higher NPV. In the medium- to long-run however, the generated benefits in terms of an additional GDP growth are higher under the universal basic income scenario. In order to assess robustness of presented simulation results with respect to alternative discount rate assumptions, we perform NPV computations with 1 percentage point lower/higher discount rates, the results of which are reported as shaded areas around main NPV results (solid line for the policy status quo scenario and dashed line for the universal basic income scenario) in Figure 8. These results suggest that there are no qualitative changes in the simulated NPV when applying different (+/- 1 percentage point) discount rates in a reasonable range.

5.2. Sensitivity analysis and robustness checks

In order to ensure that our simulation results are robust with respect to reasonable changes in underlying parameter values and assumptions, we undertake a global sensitivity analysis of the parameterised model and the two Roma integration scenarios, selected results of which are presented in Figure 7. Given that the objective of the present study is to simulate, assess and compare impacts of alternative Roma integration policies, those assumptions that govern the scenario construction are particularly critical for the robustness of our simulation results. Therefore, all these assumptions are scrutinised extensively in sensitivity and uncertainty analyses.

Because of its prominent role, we report and discuss the results of the sensitivity analysis obtained under alternative assumptions of the integration policy elasticities (the income elasticity of demand for education and the price elasticity of demand for education, see section 4.3), as these assumptions have been identified among key determinants driving simulation results. In this exercise, we decrease and increase default policy elasticities by 5% to 50% (see Table 5), respectively, and compare model results with those under our default assumptions. The main purpose of this exercise is to evaluate the extent to which marginal changes in underlying model assumptions would alter the direction and magnitude of the projected policy impacts reported in preceding sections.

The sensitivity analysis results for these two key parameters (the income elasticity of demand for education and the price elasticity of demand for education) are reported as shaded areas in Figure 7, which report the possible outcome range (lower/upper bounds)

Table 5: Values of income and price elasticities of demand for education used in the sensitivity analysis

| | Elasticities of demand for education | |
	Income elasticity	Price elasticity
Lower value	0.60	-0.66
Central value	1.20	-0.44
Upper value	1.80	-0.22

Source: Education elasticity values based on Campbell and Siegel (1967).

identified in these simulations. For each scenario, we show a case where policy elasticities are reduced (lower), augmented (upper) and kept at their default (central) value.

Sensitivity analysis results reported in Figure 7 suggest that in both Roma integration scenarios the short-run impact of altering policy elasticities in a reasonable range does not generate qualitatively different and statistically significant deviations in simulation results. However, as the labour force expands and economies grow due to the integration of Roma workers into labour markets, the impact of higher/lower policy elasticities realises more prominently. In line with our expectations, by lowering policy elasticities, the simulated GDP impact is lower; whereas by increasing policy elasticities, the GDP impact becomes larger. We do not observe, however, qualitative changes in simulation results under alternative policy efficiency assumptions.

In addition to the above presented sensitivity analysis results, we have also performed further sensitivity analyses with respect to the Roma population growth in the five studied countries, key model assumptions and parameter values. Also these sensitivity analysis results suggest that the underlying simulation model is robust with respect to qualitatively reasonable changes in baseline assumptions, key model assumptions and values of behavioural parameters. Hence, we may conclude that the results presented in this study are robust and therefore can be made available for an evidence-based policy support.

5.3. Comparison with previous studies

The results reported in previous two sections that unconditional income transfers to poor and marginalised households (as simulated under the universal basic income scenario) have positive and a statistically significant impact on children education, adult earnings and employment and the GDP in the medium- to long-run, are supported by the previous literature. Our main findings could be summarised by the words of Marinescu

(2018):

> "*Providing cash directly to individuals has often been met with criticism, suspicion, and fear: the thinking goes that people who need financial assistance are not to be trusted, as their financial position reflects a moral failing rather than a societal one. These objections to cash transfer programs are rooted more in myth than empirical evidence.*"

Hum and Simpson (1993) review research from five universal basic income experiments in Canada and the United States. In order to make results for different unconditional income transfer programs comparable, the authors account for differences in the designs of policy experiments. The primary focus of Hum and Simpson (1993) is the work-incentive issue, both nonstructural estimates of the experimental effects and elasticity estimates of structural labour-supply functions, though the authors also provide initial estimates of nonstructural and structural models for the Canadian universal basic income experiments. Hum and Simpson (1993) find only few adverse effects from the universal basic income. More importantly, those adverse effects found, such as the work response, were smaller than suggested by the economic theory.

Kertesi and Kézdi (2006) estimate the expected long-term budgetary benefits from investing into the Roma education in Hungary. The authors estimate the net benefit of an extra investment (on top of the existing pre-school and primary school financing) that enables a young Roma to successfully complete secondary school. The results of Kertesi and Kézdi (2006) indicate that an investment that makes one young Roma successfully complete secondary school would yield significant direct long-term benefits to the national budget. According to benchmark estimates discounted to age 4, the net present value of future benefits is about EUR 70 000 relative to the value the government would collect on the representative Roma person in case if she had not continued her studies after the primary school.

Akee et al. (2010) study the role of an exogenous increase in the household income due to government transfers that are unrelated to household characteristics on children's long-run outcomes. The authors look at households in which incomes have been increased exogenously and permanently through a governmental transfer program without regard to the parental human capital, ability or other household characteristics. Akee et al. (2010) find that children in treated households have higher levels of education in their young adulthood and lower incidence of criminality; though effects differ by the initial

household poverty status. On average, an unconditional income support of USD 4 000 per year for the poorest households increases the educational attainment by one year at age 21.

Also Colombino (2015) finds that, if correctly designed and implemented, a guaranteed unconditional basic income might be an important policy innovation for redistributing the gains from automation and globalisation, building a buffer against shocks and systemic risks, and generating positive labour supply incentives among poor people. Colombino (2015) also notes that while an unconditional basic income policy is simple and transparent with low administration costs, financing it might require higher taxes (which however is the case of any public policy).

Aizer et al. (2016) estimate the long-run impact of cash transfers to poor families on children's educational attainment, nutritional status longevity and income in adulthood. To do so, the authors have collected individual-level administrative records of applicants to the Mothers' Pension program—the first government-sponsored welfare program in the US (1911-1935) —and matched them to census, WWII and death records. The results of Aizer et al. (2016) suggest that male children of accepted applicants lived one year longer than those of rejected mothers. Male children of accepted mothers received one-third more years of schooling, were less likely to be underweight, and had higher income in adulthood than children of rejected mothers.

Butcher (2017) surveys the empirical literature on the long-run impact on children of unconditional cash transfers, food and nutrition programs, health care and health insurance and housing initiatives. Butcher (2017) finds a mounting and dramatic evidence that transfers to low-income families early in children's lives greatly manifest later in their lives. These findings lead to conclude that children's environment in the prenatal, neonatal, and early childhood periods can profoundly affect the capacities that children develop. According to Butcher (2017), these capacities persist into adulthood, affecting earnings, health, and other life outcomes.

Nikiforos et al. (2017) examine three versions of unconditional cash transfers: USD 1 000 a month to all adults, USD 500 a month to all adults, and a USD 250 a month child allowance. For each of the three versions, the authors assess the macroeconomic effects of these transfers using two different financing plans - increasing the federal debt, or fully funding the increased spending with increased taxes on households. Nikiforos et al. (2017) find that the economy can not only withstand large increases in federal spending, but could also grow thanks to the stimulative effects of cash transfers on the economy.

Under the smallest spending scenario, USD 250 per month for each child, the GDP is 0.79% larger than under the baseline forecast after eight years. The largest cash program – USD 1 000 for all adults annually – expands the economy by 12.56% over the baseline after eight years. These macroeconomic model-based results are directly comparable to our results.

Kela (2018) is currently evaluating the guaranteed basic income experiment in Finland. During the basic income experiment that runs from 2017 to 2018 (2019), a total of 2 000 unemployed persons between 25 and 58 years of age receive a monthly payment of EUR 560, unconditionally and without means testing. The policy evaluation is being done by comparing the treated group of 2 000 persons with a control group of about 173 000. The control group is made up of persons included in the target population who were not selected for the study. The preliminary evidence suggests that there are positive and significant differences in employment rates between those receiving and those not receiving a guaranteed basic income.

Pareliussen et al. (2018) at the OECD compare the currently implemented Finland's benefit system with two benefit reform scenarios: a uniform benefit for all ("basic income") and a universal tapering rule ("universal credit"). The policy scenarios are modelled with the OECD TaxBen model and the TUJA micro-simulation model. Pareliussen et al. (2018) find that replacing current benefits with a universal basic income would improve work incentives for many poor households, though may be also associated with a redistribution of income. Merging working-age benefits with similar aims and coordinating their tapering against earnings would on the other hand consistently improve work incentives and transparency, while preserving or improving social protection.

Jones and Marinescu (2018) study the effects of universal and permanent cash transfers on the labour market. Using data from the Population Survey and a synthetic control method, the authors show that the universal basic income had no adverse effect on employment, and increased part-time work by 1.8 percentage points (17 percent). Although the economic theory suggests that individual cash transfers may decrease the household labour supply, Jones and Marinescu (2018) interpret their results as evidence that general equilibrium effects of widespread and permanent transfers tend to offset this effect, at least on the extensive margin. Consistent with their results, Jones and Marinescu (2018) provide suggestive evidence that tradeable sectors experience employment reductions, while non-tradable sectors do not.

Marinescu (2018) explore how unconditional cash transfers affect the behaviour of

recipients in three major natural experiments in the USA. While the amounts dispersed and time periods were distinct in each policy experiment, each of them have provided money without setting conditions and without a means test. As regards education, Marinescu (2018) found that the school attendance, grades, and test scores for the children of negative income tax recipients were typically higher than the control population, especially for younger and poorer children. An additional USD 4 000 per year for the poorest households in the casino dividend program increased educational attainment by one year. Further, the programs analysed suggest either no effect on the labour market supply or a slight reduction in work. Results, however, do not suggest that an average worker will drop out of the labour force when provided with an unconditional cash transfer, even when the transfer is large.

6. Conclusions

The present study undertakes a comparative analysis of long-term economic, budgetary and fiscal costs and benefits of alternative Roma integration policies in the areas of education and employment in five EU Member States with the largest share of the Roma population – Bulgaria, the Czech Republic, Hungary, Slovakia and Romania. We employ a general equilibrium approach that allows us to assess not only the direct impact of selected Roma integration policies but also to capture all induced feedback effects.

Our simulation results suggest that, although the Roma integration (e.g. by providing education assistance services and a targeted professional training) would be costly for the public budget, in the medium- to long-run, economic, budgetary and fiscal benefits may significantly outweigh the short- to medium-run Roma integration costs. Second, the policy status quo scenario creates higher GDP growth in the short-run, whereas the universal basic income scenario is more beneficial in the medium- to long-run. These findings do not provide any empirical evidence for the criticism, suspicion and fear associated with policies that provide cash directly to individuals. Depending on the integration policy scenario and the analysed country, the annual long-run GDP effect would be from +16.47 Million Euro to +109.93 Million Euro above the baseline GDP, and the full repayment of the integration policy investment (positive net present value) would be achieved after 7 to 9 years. Finally, our results suggest that there would be no displacement effects to mainstream worker employment/wages. In contrast, by filling vacancies, the Roma workers included in the labour market would generate an additional economic activity, which in turn would contribute to the growth of the GDP, exports,

public tax revenue, etc.

Our results have important policy messages. First, these findings suggest that investing into integration policies that facilitate the inclusion of Roma into the school education and labour markets is important not only for ethical, humanitarian and fundamental rights reasons, but may be beneficial also for economic, budgetary and fiscal reasons in the medium- to long-run. Second, we show that integrated Roma workers can play an important role in filling vacancies with specific skill requirements, addressing Europe's alarming demographic challenges, improving the ratio of economically active to those who are inactive – a ratio that is decreasing in many Member States – and boost jobs and growth in the EU. In terms of the GDP, employment and earnings, the universal basic income scenario clearly outperforms currently implemented Roma integration policies, particularly in the medium- to long-run.

Turning to limitations of our study, we recognise that in the presented analysis we have focused solely on socio-economic impacts (both costs and benefits) of the Roma integration. In reality, however, there are many more aspects, such as humanitarian, fairness, equality and fundamental rights, etc., which all need to be taken into account by policy makers, when designing Roma integration policies. Analysing all these aspects in an integrated framework comprises a promising though also challenging avenue for the future research. Second, our simulation results depend on a large number of assumptions that yield uncertainties both in the scenario construction and in the underlying simulation model. While, we have been using the best data available to date, have attempted to be as transparent as possible about all key assumptions underlying our simulations and have been running extensive sensitivity and uncertainty analysis to test the simulation result sensitivity with respect to them, the robustness of presented findings would benefit significantly from complementary micro-econometric analysis (e.g. econometric estimation of the household demand for education), which invites for a follow-up research on Roma integration policies in future. Third, in the present study we have focused on the main channels of household adjustment to policies shocks. A promising area for the future research would be, for example, to endogenise the number of children per household (by household type), and consequently also the cost of education.

Finally, the analysis conducted on the specific group (Roma) might be expanded to other groups vulnerable to discrimination and social exclusion. Although, we intuitively expect unconditional cash transfers under a basic minimum income schemes to yield

similar results for other vulnerable groups, additional research is required to generate a sound evidence in this regard.

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Online Appendix: Long-run Economic, Budgetary and Fiscal Effects of Roma Integration Policies ☆

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A.1 Model description

The general equilibrium model adopted in the present study follows the approach of Ciaian and Kancs (2016) and Kancs and Lecca (2018). The employed model offers a flexible modelling framework containing many options that can be selected from, depending on the policy question.[1] The model version that we employ in the present study and describe below is tailored for the analysis of socio-economic consequences of integration policies, while keeping the model as tractable as possible by focussing on the main drivers and impacts of integration, without unnecessary complicating the model that would make results difficult to interpret. To better identify and understand the main drivers and determinants of the outcomes generated by the model, a skeletal version of the model representing the main mechanics and adjustment channels are presented below. In their simplest form, the key optimising behaviour and equilibrium conditions can be summarised as follows.

A.1.1 Consumption

In each country (indexed by subscript r), the representative household has a nested utility structure. In each time period,[2] consumers in country r receive utility from consumption, C_r.[3] The household problem consists of the maximisation of a nested Constant Elasticity of Substitution (CES) utility function by choosing optimal levels of consumption subject to a budget constraint. The first order condition of this optimisation problem implies that the aggregate consumption level, X_d, is increasing in the disposable income, Y_d, (net of savings, S_d, the rate of which, s_d, is a fixed share of income) but decreasing in the general price level of consumption goods:

$$X_d = \frac{(1 - s_d)Y_d}{P_d} \tag{1}$$

where X_d is the total consumer demand in country d, Y_d is the household income in country d and P_d is the general price index for consumption goods in country d.

The representative household is endowed with different types of labour and capital, the services of which are leased to firms. The household income, Y_d, in country d is

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[1]For example, the model incorporates several alternative forms of modelling the labour market, endogenous versus exogenous household investment in children education, disaggregation into several household income classes and others.

[2]For the sake of brevity, we omit time subscripts when describing static equations in this section.

[3]Notation: we use Latin letters for variables and Greek letters for parameters. Small Latin letters refer to varieties, capital letters denote goods (sectors). Indices o and d denote **o**rigin and **d**estination countries, respectively. Indices i and j denote producing and consuming **i**ndustries (which may overlap), respectively.

composed of income from all primary factors and government transfers to households net of taxes, T_o:

$$Y_o = \sum_{f=1}^{F} w_{fd}F_o + T_o \tag{2}$$

where w_f is the factor wage (rental rate) and F_o denotes the set of factor owned by households (capital and several types of labour, see below).

The consumer price index, P_{id}, takes the same CES form in both sub-utility tiers, therefore spelled out only for the sectoral demand:

$$P_{id} = \left[\sum_{r=1}^{R} N_{io}\lambda_i \left(p_{io}\tau_{iod} \right)^{1-\sigma} \right]^{\frac{1}{1-\sigma}} \tag{3}$$

where N_{io} describes the mass (number) of firms exporting from the origin country o, p_{io} is the output price and τ_{iod} are *iceberg* transport costs of shipping goods produced in the origin country, o, to the destination country, d.[4]

Using the price index from equation (3), consumer demand for each variety of differentiated good i can be expressed as:

$$x_{iod} = \alpha_{id} Y_d \lambda_i \frac{\left(p_{io}\tau_{iod} \right)^{-\sigma}}{P_{id}^{1-\sigma}} \tag{4}$$

where x_{iod} is country d's demand for variety x of good X_i produced in country o.

A.1.2 Production

Each firm uses two types of inputs for producing goods: intermediate goods, X_{jo}, and primary factors, F_{fo}. The use of intermediate inputs is determined by their relative prices. The price index for intermediate goods, $\mathbf{P}_{jd}$, takes a CES form:

$$\mathbf{P}_{jd} = \left[\sum_{i=1}^{I} \lambda_j P_{id}^{1-\sigma} \right]^{\frac{1}{1-\sigma_Q}} \tag{5}$$

where P_{id} is the same price index as for consumer goods, i.e. we implicitly assume that consumers and industries demand goods in the same proportions.[5] The use of

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[4]Iceberg transportation costs, τ_{iod}, imply that $(1 + \tau_{od})$ units of good i have to be shipped from the origin country, o, in order for one unit to arrive at the destination country, d, (see equation 13).

[5]This simplifying assumption is required because of data limitations allowing to differentiate between intermediate inputs and consumptions goods. Modelling different consumer and industry demand shares

intermediates from own as well as other industries implies inter-industry and intra-industry linkages. The presence of these linkages between low-skill, medium-skill and high-skill manufacturing, together with country differences in the skill endowment, will generate an additional channel of adjustment and imply asymmetric responses to policy shocks across countries.

As above, also the price index of primary production factors takes the CES form:

$$W_{io} = \left[\sum_{f=1}^{F} \lambda_f w_{fo}^{1-\sigma} \right]^{\frac{1}{1-\sigma_W}} \tag{6}$$

where W_{io} is the aggregate price for all primary factors used in the production by sector i's firms in country o and, as above, w_f is the factor wage (rental rate).

As usual in the monopolistic competition framework, we assume that each country contains a large number of firms, each producing a single variety, implying the following constant mark-up equation for profit maximising firms:

$$p_{io} = \frac{\sigma}{\sigma - 1} MC_{io} \tag{7}$$

where MC_{io} is the marginal cost of industry i producing in country o. The parameter restriction $\sigma > 1$ ensures that the output price, p_o, is always positive. According to equations (5) and (6), the marginal cost, MC_{io}, is specified as a nested CES function with two arguments: primary factors and intermediate inputs:

$$MC_{io} = \beta_{io} \left[\delta_{io}^{\sigma_{MC}} \mathbf{P}_{jd}^{1-\sigma_{MC}} + (1 - \delta_{io})^{\sigma_{MC}} W_{io}^{1-\sigma_{MC}} \right]^{\frac{1}{1-\sigma_{MC}}} \tag{8}$$

where σ_{MC} is the elasticity of substitution between intermediate goods and primary factors, whereas parameter δ_{io} determines input shares of intermediate goods and primary factors.

A.1.3 Inputs: primary and intermediary

As usual, demands for primary factors and intermediate inputs are obtained by taking partial derivatives of the marginal cost function (equation 8) with respect to input price indexes (equations 5 and 6) according to the Shephard's lemma:

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would solely shift within industry demand ratio, which, however, would not affect our empirical results.

$$F_{fo} = \sum_{i=1}^{I} \beta_{io}^{1-\sigma_{MC}} \delta_{io} \left[\frac{MC_{io}}{W_{io}} \right]^{\sigma_{MC}} \left[\frac{W_{io}}{w_{f,o}} \right]^{\sigma_W} N_{io} \left(\mathbf{X}_{io} + FC_{io} \right) \qquad (9)$$

where FC_{io} is the fixed cost.[6] The labour demand for different skill levels, e, at the second tier of the production function and demand for labour with different ethnical backgrounds, m, at the lower tier of the production function takes the same CES form as demand for primary factors and intermediate inputs at the upper tier.

The employed labour in each country is determined via a wage curve, which accounts for labour market imperfections (see Kancs and Lecca 2018). Hence, the model incorporates an imperfect competition in the labour market. The general formulation, expressed in the logarithmic form, follows Blanchflower and Oswald (1995):

$$w_{oem} = \xi_{oem} - \iota_{oem} u_{oem} \qquad (10)$$

where ξ and ι are econometrically estimated wage curve parameters. Equation (10) describes a conventional wage curve, as defined in Blanchflower and Oswald (1995), according to which the real wage, w_{oem}, of m type workers with skills, e, is negatively related to the unemployment rate, u_{oem}.

The capital supply in each country is determined endogenously by adjusting the capital stock such that the real rate of return to capital equals the steady state rate of return: $\frac{W_{ko}}{P_o} = \rho_o$, where P_o is the price level in country o and ρ_o is the steady state rate of return.

The demand for intermediate inputs is derived analogously to the primary factor demand by applying the Shephard's lemma:

$$X_{jd} = \sum_{j=1}^{I} \beta_{jd}^{1-\sigma_{MC}} \left(1 - \delta_{jd} \right) \left[\frac{MC_{jd}}{\mathbf{P}_{jd}} \right]^{\sigma_{MC}} \left[\frac{\mathbf{P}_{jd}}{P_{id}} \right]^{\sigma_Q} N_{jd} \left(\mathbf{X}_{jd} + FC_{jd} \right) \qquad (11)$$

The industry demand for individual variety x of good X_j is analogous to the consumer demand in equation (4):[7]

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[6]The fixed cost would be set to zero and the number of firms to one, if we would model some industries as perfectly competitive industries.

[7]Given that workers consume only final goods, the consumer demand function, X_{id}, is less involved than X_{jd}, in equation (4) we have already substituted for X_{id}.

$$x_{jod} = X_{jd}\lambda_i \frac{\left(p_{jo}\tau_{jod}\right)^{-\sigma}}{P_{jd}^{-\sigma}} \tag{12}$$

A.1.4 Equilibrium

The total demand for good i produced in origin country o is given by the sum of demand for the final consumption and demand for the intermediate use:

$$\mathbf{X}_{iod} = \sum_{r=1}^{R} \left(x_{iod} + x_{jod}\right)\left(1 + \tau_{od}\right) \tag{13}$$

The labour market equilibrium is ensured through endogenous adjustments in the unemployment rate:

$$\sum_{i} N_{io}L_{ioem} = \left(1 - u_{oem}\right)L_{oem} \tag{14}$$

The long-run equilibrium also requires that the number of firms in each country is no longer changing in response to short-run profits, which implies zero profits wherever there is a positive number of firms and negative profits (for potential, if not for actual, firms) wherever the number of firms is zero:

$$MC_{id}\left(\mathbf{X}_{id} + FC_i\right) \geq p_{id}\mathbf{X}_{id} \tag{15}$$

As usual, the firm entry and exit is free, as economic sectors are modelled as imperfectly competitive.[8] The number of manufacturing varieties produced in country r equals the number of firms operating in country r, which is defined by the zero profit condition:

$$\pi_{id} = \left[p_{id}\mathbf{X}_{id} - MC_{id}\left(\mathbf{X}_{id} + FC_j\right)\right]N_{id} = 0 \tag{16}$$

A.2 Model calibration

The model economy is represented by five EU Member States: Bulgaria, the Czech Republic, Hungary, Slovakia and Romania, the rest of the EU and the rest of the world. Each EU Member State's economy of the five studied countries is composed of a number of economic sectors. In order to account for differences in the skill intensity between economic sectors and hence structural differences between the five studied countries, in the

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[8]As noted above, if modelling some sectors as perfectly competitive, the fixed cost would be set to zero and the number of firms would equal to one.

Table 1: Calibrated shares of economic sectors in the five study countries, 2014

	Bulgaria	Czechia	Hungary	Romania	Slovakia
High-skill manufacturing	0.097	0.133	0.156	0.070	0.075
Medium-skill manufacturing	0.149	0.435	0.414	0.352	0.442
Low-skill manufacturing	0.051	0.086	0.041	0.073	0.081
Education	0.039	0.040	0.051	0.034	0.041
Rest of the economy	0.665	0.306	0.339	0.472	0.361

Source: Authors' calibration of the model.

present study each EU Member State's economy is disaggregated into five economic sectors: Low-skill manufacturing; Medium-skill manufacturing; High-skill manufacturing; Education and the Rest of the economy.

The classification of the first three economic sectors (low-skill, medium-skill and high-skill manufacturing) follows the skill and technology-intensity product definition from the United Nations Conference on Trade and Development (UNCTAD).[9] The UNCTAD's classification distinguishes products according to their level of skill- and technology-intensity; all products are regrouped into seven categories: (i) High skill- and technology intensive manufactures; (ii) Medium skill- and technology intensive manufactures; (iii) Low skill- and technology intensive manufactures; (iv) Resource-intensive manufactures; (v) Non-fuel primary commodities; (vi) Mineral fuels; and (vii) Unclassified products. For the purpose of the present study, we make use of the first three categories ((i)-(iii)), other four groups are aggregated together in a 'Rest of the economy' aggregate. Further, SITC Revision 2 product data are converted into NACE Rev. 2 industry data using United Nations Statistics Division and Eurostat Ramon correspondence tables (see Tables A1-A3). The Education sector corresponds to the NACE Rev. 2 Division 85 'Education'. In the Rest of the economy sector all other economic activities and services from NACE Rev. 2 Divisions 01-16, 19, 31, 33-84, 86-99 are aggregated together.

The relative importance of each of the five economic sectors in the GDP in each study country is reported in Table 1. According to Table 1, the share of the high-skill manufacturing sector in the GDP is the lowest in Romania (7%) whereas it is the highest in Hungary (15.6%). The GDP share of the medium-skill manufacturing sector varies between 14.9% in Bulgaria to 44.2% in Slovakia. The low-skill manufacturing sector is relatively smaller in all five countries, ranging from 4.1% in Hungary to 8.6% in the Czech

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[9]http://www.unctad.info/en/trade-analysis-branch/data-and-statistics/other-databases/

Table 2: Concordance between ISCED education levels and skill levels in the model

	ISCED	Model
Code	Label	Skill-level
0	Pre-primary education	Low-skill
1	Primary education or first stage of basic education	Low-skill
2	Lower secondary education or second stage of basic education	Low-skill
3	Upper secondary education	Medium-skill
4	Post-secondary non tertiary education	Medium-skill
5	First stage of tertiary education*	High-skill
6	Second stage of tertiary education**	High-skill

Source: Based on the UNESCO's International Standard Classification of Education (ISCED) definition. Notes: In line with the OECD, the primary and lower secondary education (ISCED 0-2) corresponds to low-skills; the upper-secondary and post-secondary education (ISCED 3-4) corresponds to medium-skills; and the tertiary education (ISCED 5-6) corresponds to high-skills. *not leading directly to an advanced research qualification; **leading to an advanced research qualification.

Republic. The relative size of the education sector is rather similar across the five study countries, ranging from 3.4% in Romania to 5.1% in Hungary. Finally, the relative size of the 'Rest of the economy' sector that aggregates all other economic activities and services is determined by the relative size of the low-, medium- and high-skill manufacturing and education services in these countries (Table 1).

In order to account for differences in the education intensity between worker skill levels and hence differences in the workforce structure between the five studied countries, in the model labour is disaggregated according to skill levels into three skill categories: low-skill, medium-skill and high-skill. The skill aggregation follows the UNESCO's International Standard Classification of Education (ISCED): the primary and lower secondary education (ISCED 0-2) corresponds to low-skills; the upper-secondary and postsecondary education (ISCED 3-4) corresponds to medium-skills; and the tertiary education (ISCED 5-6) corresponds to high-skills. See Table 2 for concordance between the ISCED categories and those adopted in the model.

The calibrated shares of the labour workforce by the educational attainment level in each study country in 2014 are reported in Table 3. According to Table 3, the highest share of low-skill workers (ISCED 0-2) is in Romania (29.75%), followed by Bulgaria (20.55%). The lowest share of low-skill workers is in the Czech Republic (8.35%). As regards medium-skill workers (ISCED 3-4), they their share ranges from 54.35% in Bulgaria to 71.30% in the Czech Republic. The relative size of the high-skill workforce is the most

Table 3: Calibrated shares of the labour workforce by the educational attainment level in the five study countries, 2014

	Bulgaria	Czechia	Hungary	Romania	Slovakia
Low-skill	0.21	0.08	0.19	0.30	0.11
Medium-skill	0.54	0.71	0.59	0.56	0.69
High-skill	0.25	0.20	0.22	0.14	0.20

Source: Authors' calibration of the model.

homogenous across the five study countries. It ranges from 14.20% in Romania to 25.10% in Bulgaria (Table 3). It has to be noted that differences in the education quality are not captured in these statistics. They may be significant though and offer a promising area for a future research.

In addition to the construction of the base year data (2014) base, a further important step of the empirical implementation of the model is model's parameterisation, i.e. assigning numerical values to all model parameters. As usual in applied general equilibrium models, part of parameter values are based on econometric estimates (either own or from the literature), whereas the other part is calibrated within the model. In particular, all elasticities of substitution/transformation are based on econometric estimates. In the present study, we assume a rather low elasticity of substitution in production (0.4) (Chirinko 2008), a relatively high elasticity of substitution in consumption (1.5) (Okagawa and Ban 2008) and a fairly high for trade between countries (6.0) (Aspalter 2016). The elasticity of substitution between different types of skills equate to 2.0 (Krussel et al. 2000), while the elasticity of substitution between Roma and non-Roma workers equate to 6.0, which corresponds to elasticity estimates between foreign-born and native-born workers of Ottaviano and Peri (2012). As for the wage curve parameterisation, we typically assume a long-run wage curve, implying a wage elasticity equal to -0.1 (Nijkamp and Poot 2005).[10] The interest rate (faced by producers, consumers and investors) follows the European Commission's Better Regulation Guidelines and is set to 0.04,[11] the rate of depreciation to 0.15.

The rest of model parameters, notably, shift and share parameters are calibrated within the model such as to reproduce exactly each study country's base year (2014) data

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[10]Most of previous studies on the relationship between unemployment and wages find an elasticity close to -0.1, as summarised by the meta-analysis carried out by Nijkamp and Poot (2005). This confirms the original estimates of Blanchflower and Oswald (1995).

[11]https://ec.europa.eu/info/better-regulation-guidelines-and-toolbox_en

Table 4: Calibrated shares of main macro-economic variables in the five study countries, 2014

	Bulgaria	Czechia	Hungary	Romania	Slovakia
Exports/GDP	0.65	0.83	0.88	0.41	0.92
Imports/GDP	0.66	0.76	0.81	0.42	0.88
Value added/GDP	0.87	0.90	0.84	0.89	0.91
Labour/GDP	0.41	0.40	0.43	0.33	0.38
Investment/GDP	0.21	0.26	0.23	0.25	0.22

Source: Authors' calibration of the model.

in national accounts. The model calibration process assumes study country economies being in a steady-state equilibrium initially. This implies that the data observed should provide an unbiased information about preferences and technologies in each country and therefore relative magnitudes should not vary in the baseline. The capital stock is calibrated to allow depreciation to be fully covered by investments.

For illustrative purposes, selected calibrated share parameters are reported in Table 4. If the theoretical model is specified correctly, then the reproduction of the base year equilibrium is ensured by construction, which is the case of the underlying model. Comparing the calibrated shares in the model with those of the Eurostat's national account data, we can observe that the model is able to reproduce exactly the statistical base year data. Although not a sufficient condition, it is a necessary condition to check that the model is correctly specified and parameterised. The General Algebraic Modeling System (GAMS) programme that is used to solve the model allows to check for this in many other ways. For example, in order to ensure that there are no errors in the calibration of the model, we solve the model with zero iterations.

Further, it is important to note that, apart from the above explained baseline scenario assumptions with respect to the population growth, we do not make any further assumptions about the future development of the EU economy, i.e. how would it develop in absence of the integration policy. Hence, all results reported above are deviations off the baseline, i.e. we compare different policy scenarios with the baseline scenario without policy interventions; difference between the two is then attributed to the particular policy that is simulated.

In order to ensure the robustness of the underlying modelling framework, a further step is the model validation. However, given that the model is designed as an impact assessment model for undertaking *what if* type of analysis, but not as a forecasting tool,

the validation of an applied general equilibrium model using historical data is extremely challenging. Among others, because we cannot observe the true impact of a particular policy simulated by the model. We can only observe the historical development of certain variables, in which however the true policy impact is confounded by many other simultaneous developments, such as financial crisis, oil price shock, etc. These conceptual limitations are important to bear in mind, when considering and interpreting simulation results produced by any applied general equilibrium model, including the present one. They suggest that, whereas these type of models can be useful for understanding the direction and underlying mechanics of impacts, the exact magnitude of true effects may be different from those projected in model simulations.

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Table A.1: Concordance between SITC Rev. 3 products and NACE Rev. 2 industries: **Low-skill manufacturing**

SITC Code	Revision 3 Label	NACE Code	Revision 2 Label
511	Hydrocarbons, n.e.s., halogenated, nitr. derivative	20	Manufacture of chemicals and chemical products
512	Alcohols, phenols, halogenat., sulfonat., nitrat. der.	20	Manufacture of chemicals and chemical products
513	Carboxylic acids, anhydrides, halides, per.; derivati.	20	Manufacture of chemicals and chemical products
514	Nitrogen-function compounds	20	Manufacture of chemicals and chemical products
515	Organo-inorganic, heterocycl. compounds, nucl. acids	20	Manufacture of chemicals and chemical products
516	Other organic chemicals	20	Manufacture of chemicals and chemical products
522	Inorganic chemical elements, oxides, halogen salts	20	Manufacture of chemicals and chemical products
523	Metallic salts, peroxysalts, of inorganic acids	20	Manufacture of chemicals and chemical products
524	Other inorganic chemicals	20	Manufacture of chemicals and chemical products
525	Radio-actives and associated materials	20	Manufacture of chemicals and chemical products
531	Synth. organic colouring matter, colouring lakes	20	Manufacture of chemicals and chemical products
532	Dyeing, tanning extracts, synth. tanning materials	20	Manufacture of chemicals and chemical products
533	Pigments, paints, varnishes and related materials	20	Manufacture of chemicals and chemical products
541	Medicinal and pharmaceutical products, excluding 542	21	Manufacture of basic pharmaceutical products and pharmaceutical preparations
542	Medicaments (incl. veterinary medicaments)	21	Manufacture of basic pharmaceutical products and pharmaceutical preparations
551	Essential oils, perfume, flavour materials	20	Manufacture of chemicals and chemical products
553	Perfumery, cosmetics or toilet prepar. (excluding soaps)	20	Manufacture of chemicals and chemical products
554	Soaps, cleansing and polishing preparations	20	Manufacture of chemicals and chemical products
562	Fertilizers (other than those of group 272)	20	Manufacture of chemicals and chemical products
571	Polymers of ethylene, in primary forms	20	Manufacture of chemicals and chemical products
572	Polymers of styrene, in primary forms	20	Manufacture of chemicals and chemical products
573	Polymers of vinyl chloride or halogenated olefins	20	Manufacture of chemicals and chemical products
574	Polyethers, epoxide resins; polycarbonat., polyesters	20	Manufacture of chemicals and chemical products
575	Other plastics, in primary forms	20	Manufacture of chemicals and chemical products
579	Waste, parings and scrap, of plastics	20	Manufacture of chemicals and chemical products
581	Tubes, pipes and hoses of plastics	22	Manufacture of rubber and plastic products
582	Plates, sheets, films, foil, strip, of plastics	22	Manufacture of rubber and plastic products

SITC Code	Revision 3 Label	NACE Code	Revision 2 Label
583	Monofilaments, of plastics, cross-section > 1mm	22	Manufacture of rubber and plastic products
591	Insectides, similar products, for retail sale	20	Manufacture of chemicals and chemical products
592	Starche, wheat gluten; albuminoidal substances; glues	20	Manufacture of chemicals and chemical products
593	Explosives and pyrotechnic products	20	Manufacture of chemicals and chemical products
597	Prepared addit. for miner. oils; lubricat., de-icing	20	Manufacture of chemicals and chemical products
598	Miscellaneous chemical products, n.e.s.	20	Manufacture of chemicals and chemical products
751	Office machines	28	Manufacture of machinery and equipment n.e.c.
752	Automatic data processing machines, n.e.s.	28	Manufacture of machinery and equipment n.e.c.
759	Parts, accessories for machines of groups 751, 752	28	Manufacture of machinery and equipment n.e.c.
761	Television receivers, whether or not combined	26	Manufacture of computer, electronic and optical products
762	Radio-broadcast receivers, whether or not combined	26	Manufacture of computer, electronic and optical products
763	Sound recorders or reproducers	26	Manufacture of computer, electronic and optical products
764	Telecommunication equipment, n.e.s.;, parts, n.e.s.	26	Manufacture of computer, electronic and optical products
776	Cathode valves, tubes	28	Manufacture of machinery and equipment n.e.c.
792	Aircraft, associated equipment; spacecraft, etc.	30	Manufacture of other transport equipment
871	Optical instruments, apparatus, n.e.s.	26	Manufacture of computer, electronic and optical products
872	Instruments, appliances, n.e.s., for medical, etc.	26	Manufacture of computer, electronic and optical products
873	Meters, counters, n.e.s.	26	Manufacture of computer, electronic and optical products
874	Measuring, analysing, controlling apparatus, n.e.s.	26	Manufacture of computer, electronic and optical products
881	Photographic apparatus, equipment, n.e.s.	26	Manufacture of computer, electronic and optical products
882	Cinematographic, photographic supplies	26	Manufacture of computer, electronic and optical products
883	Cinematograph films, exposed, developed	26	Manufacture of computer, electronic and optical products
884	Optical goods, n.e.s.	26	Manufacture of computer, electronic and optical products
885	Watches, clocks	26	Manufacture of computer, electronic and optical products
891	Arms, ammunition	25	Manufacture of fabricated metal products, except machinery and equipment
892	Printed matter	18	Printing and reproduction of recorded media
896	Works of art, collectors' pieces, antiques	32	Other manufacturing
897	Jewellery, articles of precious materia., n.e.s.	32	Other manufacturing

Source: Based on the United Nations Statistics Division and Eurostat Ramon correspondence tables.

Table A.2: Concordance between SITC Rev. 3 products and NACE Rev. 2 industries: **Medium-skill manufacturing**

SITC Code	Revision 3 Label	NACE Code	Revision 2 Label
621	Materials of rubber (pastes, plates, sheets, etc.)	22	Manufacture of rubber and plastic products
625	Rubber tyres, tyre treads or flaps, inner tubes	22	Manufacture of rubber and plastic products
629	Articles of rubber, n.e.s.	22	Manufacture of rubber and plastic products
711	Vapour generating boilers, auxiliary plant; parts	25	Manufacture of fabricated metal products, except machinery and equipment
712	Steam turbines, other vapour turbin., parts, n.e.s.	25	Manufacture of fabricated metal products, except machinery and equipment
713	Internal combustion piston engines, parts, n.e.s.	28	Manufacture of machinery and equipment n.e.c.
714	Engines, motors, non-electric; parts, n.e.s.	28	Manufacture of machinery and equipment n.e.c.
716	Rotating electric plant, parts thereof, n.e.s.	28	Manufacture of machinery and equipment n.e.c.
718	Other power generating machinery, parts, n.e.s.	28	Manufacture of machinery and equipment n.e.c.
721	Agricultural machinery (excluding tractors), parts	28	Manufacture of machinery and equipment n.e.c.
722	Tractors (excluding those of 71414, 74415)	28	Manufacture of machinery and equipment n.e.c.
723	Civil engineering, contractors' plant, equipment	28	Manufacture of machinery and equipment n.e.c.
724	Textile, leather machinery, parts thereof, n.e.s.	28	Manufacture of machinery and equipment n.e.c.
725	Paper mill, pulp mill machinery; paper articles man.	28	Manufacture of machinery and equipment n.e.c.
726	Printing, bookbinding machinery, parts thereof	28	Manufacture of machinery and equipment n.e.c.
727	Food-processing machines (excluding domestic)	28	Manufacture of machinery and equipment n.e.c.
728	Other machinery for particular industries, n.e.s.	28	Manufacture of machinery and equipment n.e.c.
731	Machine-tools working by removing material	28	Manufacture of machinery and equipment n.e.c.
733	Mach.-tools for working metal, excluding removing mate.	28	Manufacture of machinery and equipment n.e.c.
735	Parts, n.e.s., accessories for machines of 731, 733	28	Manufacture of machinery and equipment n.e.c.
737	Metalworking machinery (excluding machine-tools), parts	28	Manufacture of machinery and equipment n.e.c.
741	Heating, cooling equipment, parts thereof, n.e.s.	25	Manufacture of fabricated metal products, except machinery and equipment
742	Pumps for liquids	28	Manufacture of machinery and equipment n.e.c.
743	Pumps (excluding liquid), gas compressors, fans; centr.	28	Manufacture of machinery and equipment n.e.c.
744	Mechanical handling equipment, parts, n.e.s.	28	Manufacture of machinery and equipment n.e.c.

SITC Code	Revision 3 Label	NACE Code	Revision 2 Label
745	Other non-electr. machinery, tools, mechan. appar.	28	Manufacture of machinery and equipment n.e.c.
746	Ball or roller bearings	25	Manufacture of fabricated metal products, except machinery and equipment
747	Appliances for pipes, boiler shells, tanks, vats, etc.	25	Manufacture of fabricated metal products, except machinery and equipment
748	Transmis. shafts	25	Manufacture of fabricated metal products, except machinery and equipment
749	Non-electric parts, accessor. of machinery, n.e.s.	25	Manufacture of fabricated metal products, except machinery and equipment
771	Electric power machinery, and parts thereof	27	Manufacture of electrical equipment
772	Apparatus for electrical circuits; board, panels	27	Manufacture of electrical equipment
773	Equipment for distributing electricity, n.e.s.	27	Manufacture of electrical equipment
774	Electro-diagnostic appa. for medical sciences, etc.	27	Manufacture of electrical equipment
775	Household type equipment, electrical or not, n.e.s.	27	Manufacture of electrical equipment
778	Electrical machinery, apparatus, n.e.s.	27	Manufacture of electrical equipment
781	Motor vehicles for the transport of persons	29	Manufacture of motor vehicles, trailers and semi-trailers
782	Motor vehic. for transport of goods, special purpo.	29	Manufacture of motor vehicles, trailers and semi-trailers
783	Road motor vehicles, n.e.s.	29	Manufacture of motor vehicles, trailers and semi-trailers
784	Parts, accessories of vehicles of 722, 781, 782, 783	29	Manufacture of motor vehicles, trailers and semi-trailers
811	Prefabricated buildings	23	Manufacture of other non-metallic mineral products
812	Sanitary, plumbing, heating fixtures, fittings, n.e.s.	23	Manufacture of other non-metallic mineral products
813	Lighting fixtures, fittings, n.e.s.	27	Manufacture of electrical equipment
893	Articles, n.e.s., of plastics	22	Manufacture of rubber and plastic products
894	Baby carriages, toys, games, sporting goods	32	Other manufacturing

Source: Based on the United Nations Statistics Division and Eurostat Ramon correspondence tables.

Table A.3: Concordance between SITC Rev. 3 products and NACE Rev. 2 industries: **Low-skill manufacturing**

SITC Code	Revision 3 Label	NACE Code	Revision 2 Label
671	Pig iron, spiegeleisen, sponge iron, powder, granu	24	Manufacture of basic metals
672	Ingots, primary forms, of iron or steel; semi-finis.	24	Manufacture of basic metals
673	Flat-rolled prod., iron, non-alloy steel, not coated	24	Manufacture of basic metals
674	Flat-rolled prod., iron, non-alloy steel, coated, clad	24	Manufacture of basic metals
675	Flat-rolled products of alloy steel	24	Manufacture of basic metals
676	Iron, steel bars, rods, angles, shapes, sections	24	Manufacture of basic metals
677	Rails, railway track construction mat., iron, steel	24	Manufacture of basic metals
678	Wire of iron or steel	24	Manufacture of basic metals
679	Tubes, pipes, hollow profiles, fittings, iron, steel	24	Manufacture of basic metals
691	Structures, parts, n.e.s., of iron, steel, aluminium	25	Manufacture of fabricated metal products, except machinery and equipment
692	Metal containers for storage or transport	25	Manufacture of fabricated metal products, except machinery and equipment
693	Wire products (excluding electrical) and fencing grills	25	Manufacture of fabricated metal products, except machinery and equipment
694	Nails, screws, nuts, bolts, rivets, the like, of metal	25	Manufacture of fabricated metal products, except machinery and equipment
695	Tools for use in the hand or in machine	25	Manufacture of fabricated metal products, except machinery and equipment
696	Cutlery	25	Manufacture of fabricated metal products, except machinery and equipment
697	Household equipment of base metal, n.e.s.	25	Manufacture of fabricated metal products, except machinery and equipment
699	Manufactures of base metal, n.e.s.	25	Manufacture of fabricated metal products, except machinery and equipment
785	Motorcycles, cycles	30	Manufacture of other transport equipment
786	Trailers, semi-trailers	29	Manufacture of motor vehicles, trailers and semi-trailers
791	Railway vehicles, associated equipment	30	Manufacture of other transport equipment
793	Ships, boats, floating structures	30	Manufacture of other transport equipment
895	Office, stationery supplies, n.e.s.	17	Manufacture of paper and paper products

Source: Based on the United Nations Statistics Division and Eurostat Ramon correspondence tables.