Projecting the fiscal impact of immigration in the EU

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Abstract

The increasing flow of immigrants into Europe over the last decade has generated a range of considerations in the policy agenda of many receiving countries. One of the main considerations for policy makers and public opinion alike is whether immigrants contribute their "fair" share to their host country's tax and welfare system. In this paper, we assess the net fiscal impact of intra- and extra-EU migration in 27 EU Member States. We find that migrants in the EU, on average, contribute more than natives to welfare states. However, when we take an age-specific life-cycle perspective, we find that natives generally show a higher net fiscal contribution than both groups of migrants. Among migrants, extra-EU migrants contribute less than intra-EU migrants. We then use a demographic micro-simulation model to project the potential net fiscal impact of migration in the EU into the future. We show that despite the fact that intra-EU migration contributes to reducing the strong negative impact of population ageing, its contribution is not sufficient to offset the negative fiscal consequences.

Keywords: Migration, Microsimulation, Fiscal impact, Tax-benefit system, EUROMOD
JEL codes: F22, J15, H2, H5

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1. Introduction

The number of third-country nationals living in the EU has increased in recent years. According to Eurostat figures for 2018, there are more than 22 million third-country nationals residing in the 27 Member States (MSs) of the EU and the UK. This is up from 19 million in 2014, the first available year for this series, corresponding to a 14% increase in five years. For many MSs, this phenomenon inevitably generates a range of social, political, and economic considerations. One of the main considerations for policy makers and public opinions alike is whether migrants contribute their "fair" share to their host country tax and welfare system. Fears of welfare abuse are common among European citizens (Boeri, 2010), along with worries that European welfare systems might act as a magnet for welfare-dependent migrants (De Giorgi and Pellizzari, 2009). These concerns are so deep that they outweigh even concerns about the effects of immigration on the labour market on the evaluation of public opinion (Dustmann and Preston, 2007) and are hard to ignore for governments.

Apart from public attitudes on migration and questions of perceived fairness, understanding the fiscal impacts of immigration is especially salient for the EU MSs' decision-making processes, because it enables the design of an appropriate immigration strategy. EU countries maintain a comparably extensive and generous welfare coverage[1] against the backdrop of deteriorating fiscal balances, in some MSs more than others, since the onset of the global financial crisis.

Migration can have both positive and negative consequences for the economies and public purse of the receiving countries. On the one hand, a growing migrant population, mostly migrating in their most productive years, can help alleviate the financial burden that an ageing population imposes on the pension systems of many MSs.[2] On the other hand, migrants may represent a burden because of the costs associated with their integration and inclusion, family structure and/or to the safety net for their labour career. Depending on whether positive or negative effects prevail, the fiscal impact of migrants might be different from that of the typical native on whom the European welfare states were originally designed.

In this article, similar to Fiorio et al. (2022) we analyse the direct net fiscal effects of immigration into the EU, that is, the taxes immigrants pay minus the benefits they receive. For this purpose, we use EUROMOD, the tax-benefit microsimulation model for the EU that represents a unique tool for international comparative research on the effects of taxes and benefits. EUROMOD is based on detailed information at the individual level on taxes paid and benefits received contained in the European Union Statistics on Income and Living Conditions (EU-SILC). More

[1] According to the OECD, on average, EU MSs spent 23% of their GDP to fund their social security programmes in 2018. The average for the other non-EU OECD members was 18%. (Source: https://stats.oecd.org/Index.aspx?datasetcode=SOCX_AGG, last accessed on 07/11/2019.)

[2] The effective impact of migration on the pension system of the receiving country is ambiguous. As migrants enter the labour market of their destination country primarily at the beginning of their career, they improve the dependency ratio. But, as they tend to earn lower wages than the native population for long periods of their working life, they could end up receiving higher pensions than their contributions would cover, especially in defined benefit and national account systems. The actuarial fairness of a pension system is also not the only factor to consider when assessing the impact of migration on pension systems. Another important consideration is how portable contributions are across pension systems. In the case of return or repeated migration, migrants may not be entitled to full–or even partial–portability of their contribution due to legal waiting periods that might prevent the establishment of eligibility.

specifically, we use the EUROMOD migration extension (see Fiorio et al. (2018)) which adds information on in-kind benefits. We also complement individual-level data with detailed information on indirect taxation, similar to Fiorio et al. (2022). In this way, we are able to provide a detailed assessment of the fiscal impact of migration. Additionally, contrary to the National Transfer Accounts approach (see, e.g., Istenic et al. (2016)), our approach allows us to distinguish between natives, intra-EU and extra-EU migrants and account for the socioeconomic factors, such as education or labour force differentials, that drive the difference in their net fiscal impact.

We estimate the net fiscal impact for natives and migrants in three steps. First, similar to Fiorio et al. (2022), we calculate the current impact of migrants on state budgets and recover the average net fiscal impact of migration. Second, following the approach of Hinte and Zimmermann (2014), we estimate the contribution over the life cycle of each population group. Third, we use these estimates to calibrate CEPAM-Mic, a demographic microsimulation model, to project the net fiscal impact of migration up to 2035.

Fiorio et al. (2022) analyse the net fiscal impact of migrants for the EU-14, also focussing on five countries, France, Germany, Italy, Spain and Sweden, for the period 2014 to 2018. They show that the EU-14 spent on average 9,600 euros per year for each native, compared to 8,200 euros for each migrants. In addition, migrants receive similar fiscal payments (9,600 euros) to natives. Overall, while natives made net contributions to public finances of on average 32 euros during this period, migrants contributed on average 1,510 euros. We follow this approach by focussing on the whole EU, specific welfare-state regimes, and on three origin groups, natives, intra- and extra-EU migrants. Our analysis also goes beyond previous studies on the fiscal impact of immigration that focus on one country (Chojnicki and Ragot, 2016; Dustmann and Frattini, 2014; Storesletten, 2003) or only on subpopulations, such as migrants from the EU (Nyman and Ahlskog, 2018). Rather, we are able to account for the different statutes governing welfare provisions across the EU and compute and project the fiscal positions for the whole population.

Our research is quite unique in combining both 'static' and 'perspective' approaches, allowing us to determine the extent to which differences in the age structure between migrants and natives determine their fiscal balance. The life-cycle approach can offer precious indications to policy makers on the possible evolution of the fiscal balance once recently arrived migrants start to age approaching the age distribution of natives. Therefore, it also indicates a more long-term perspective of the net fiscal impact of immigration.

Our main findings can be summarised as follows: First, in accordance with Fiorio et al. (2022), the average net fiscal impact (ANFI) for all three groups is negative, but natives show the highest imbalance, indicating that the average immigrant is currently less costly in monetary terms for the state. Accounting for the demographic composition further increases the overall deficit for all groups, but improves the relative position of natives who in a life cycle contribute in net terms more than intra-EU migrants, who in turn exhibit a less negative net fiscal impact than extra-EU migrants.

Second, we also find substantial differences between EU MSs with respect to both concepts of net fiscal impact. Most likely, this reflects the differences in types and history of migration that characterise EU MSs. Especially in traditional welfare states, differences in the net fiscal impact between natives and extra-EU migrants over the life cycle are substantial, while differences between natives and intra-EU migrants seem to be less pronounced.

Third, using a demographic microsimulation model, we estimate the future net fiscal impact of migration on the EU level up to 2035. We find that the average net fiscal impact (per capita) on EU level is expected to decline, indicating that migration will not be able to offset the burden an ageing population will place on EU budgets.

The paper is organised as follows. In Section 2.2, we discuss the literature related to the fiscal impact of immigration, focussing on the European context and the general patterns of immigration in the EU. Section 3 describes the data and methodology that we use. In Section 4, we present the simulation results from both the EU perspective and the perspective of each MS. Section 5 concludes and discusses our main results.

2. Background

2.1. Evidence on the fiscal impact of migration

The analysis of the fiscal impact of immigration in Europe has gained attention in recent years due to growing concerns about the sustainability of welfare states in the context of the major demographic changes and challenges facing Europe (Lutz et al., 2019).

Empirical evidence on this topic is mixed and largely depends on the economic context, the methodology adopted, and the characteristics of migrants. This literature adopts two main approaches: static or dynamic. The static accounting approach captures a snapshot of public finances over one or more years by allocating contributions made and benefits received between native and immigrant populations. Static analyses result largely from the demographic unit of analysis (individuals or households), its demographic and socioeconomic characteristics, as well as the benefits and taxes covered, and the years analysed. The advantage of the static approach is that it does not require assumptions about future demographic trends or public spending. However, the results lack the forward-looking perspective that is increasingly needed to inform public fiscal policy.

Generally, the fiscal impact of immigration is quantified as modest and on average below (+/-) 1% of the national GDP (Chojnicki, 2013). Studies using this approach find that the favourable demographic structure of migrants, biased toward a younger and active population, benefits their fiscal position (Fiorio et al., 2022; Bogdanov et al., 2014; Dustmann et al., 2010; Chojnicki, 2013). The socioeconomic factors that influence the fiscal impact commonly identified in the literature are the age of arrival in the host country,[3] the number of children in the family[4] and whether migrants are high-skilled (who generally contribute positively to the fiscal balance) or low-skilled (who typically have a less favourable fiscal position).[5]

Dynamic approaches typically focus on the entire life cycle. They can be classified into three groups: Net Present Value (NPV) Approach, Generational Accounting Analysis (GA), and Dynamic Applied General Equilibrium Model (DAGEM). This evidence is forward-looking and the

[3]This is due to potential savings on education in young ages (Economics, 2018).

[4]E.g. Dustmann and Frattini (2014) estimate that migrants from countries of the European Economic Area (EEA) contributed positively to the public finances of the UK during the period 1995-2011, while the net fiscal impact of migrants from outside the EEA was negative. The higher number of children of non-EEA migrants may also explain these results, as they represent a fiscal cost for the destination country.

[5]For Ruist (2014), a cohort of Bulgarian and Romanian migrants in Sweden contributed positively to the country's finances in 2011, however, the lack of language skills was an important barrier to entering the labour market. See also Christl et al. (2020).

results depend heavily on assumptions about future population and migration trends, government taxes and expenditures, or migrants' rights to access public services and benefits (Vargas-Silva, 2015).

Studies using a NPV approach have been conducted, for example, in Sweden, where Storesletten (2003) and Ekberg (2011) estimate a negative net contribution of immigrants. They estimate that immigration to a traditional welfare state such as Sweden typically causes a fiscal burden on the state; however, this result crucially depends on the characteristics of migrants.[6]

GA methods account for the intertemporal distribution of public debt (OECD, 2013). Evidence using this methodology is available for several countries, while cross-country comparisons are rather scarce (Hinte and Zimmermann, 2014). The results show considerable variation depending on immigration and integration policies, but generally tend to demonstrate a positive effect of increasing immigration flows on the future tax burdens of natives.[7] For Bonin et al. (2000), immigration generates a positive fiscal effect and reduces the fiscal burden of future generations in Germany; however, this effect is not sufficient to eliminate future fiscal imbalances resulting from an ageing German population.[8]

As a more comprehensive economic impact assessment, DAGEM considers the direct and indirect effects of immigration. Adopting this methodology, Schou (2006) finds a positive effect of immigration in Denmark only for immigrants with immediate experience of integration into the labour market and a negative effect for other immigrants. Hansen et al. (2017) show for Denmark that immigrants from western countries generally have a positive fiscal impact, whereas immigrants from non-Western countries have a strongly negative fiscal impact. The negative fiscal impact can be mainly attributed to weak labour market performance and early exit from the labour market. Finally, the comparative analysis of Berger et al. (2016) shows a high heterogeneity in the results on the contribution of future immigration up to 2060, which is largely dependent on the volume of immigration and the institutional system of the host country.[9]

2.2. Immigration in Europe: recent trends and characteristics

In recent years, most European countries have seen an increase in foreign-born individuals as a share of the total population. In 2019, Eurostat recorded 40 million people born outside the EU and residing in one of the 27 MSs plus the UK, and 22.4 million people born in a MSs other

[6] Storesletten (2003) attributes the negative effect that he encounters to migrants' difficult assimilation in the labour market. It should also be noted that he finds a positive contribution for those aged 20-30 years. Similarly, Gustafsson and Österberg (2001) show the importance of integration in the labour market for the net fiscal impact of migration.

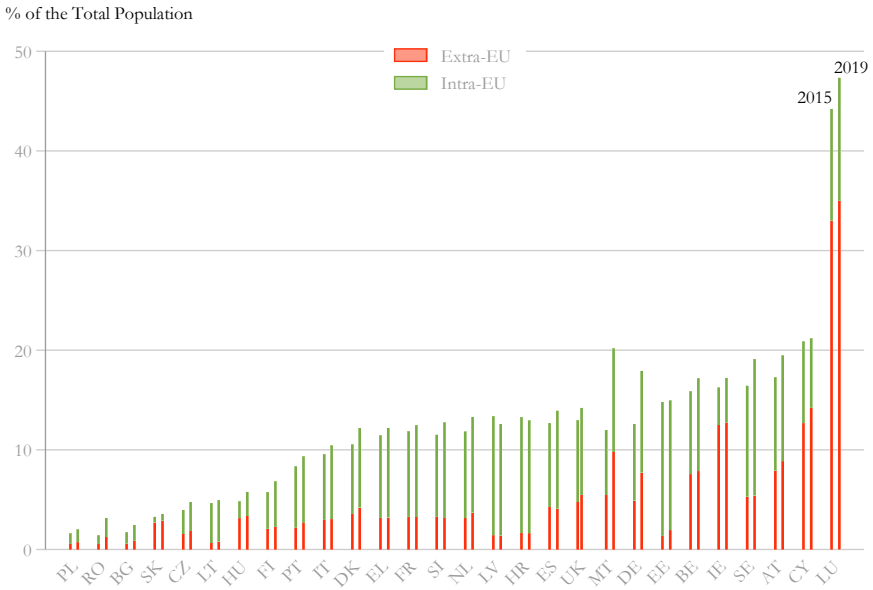
[7] See, e.g., Collado et al. (2004), Mayr (2005), Chojnicki et al. (2011), Chojnicki (2013) or Chojnicki and Ragot (2016).

[8] Other analyses that take into account the life cycle of immigrants show that greater fiscal gains can come from increasing the education levels of new immigrants, as suggested in Chojnicki (2013) for France. Hinte and Zimmermann (2014) show how the fiscal impact of immigration is positive when labour migrants represent the largest share of the migrant population.

[9] In addition to the evidence described above, there is an expanding body of evidence on how public policy design changes in response to migrant inflows. This is an effect that is not captured by our microsimulation models. According to this evidence, immigration may reduce welfare spending and redistribution (Tabellini, 2020) or, conversely, it can increase welfare spending if migrant groups are highly skilled (Böheim and Mayr, 2005). For a full discussion of this issue, see Elsner and Concannon (2020).

than their country of residence. Figure 1 shows the share of the foreign-born population over the total population for each MS, distinguishing between intra- and extra-EU migrants. Evidently, the aggregate data hide considerable heterogeneity between MSs. Luxembourg is the country with the highest share of population born elsewhere, as it hosts an exceptionally high number of foreign-born population, corresponding to a share of 47% of the total population. In this ranking, Luxembourg is followed by Cyprus, where 21% of the resident population are born abroad, and Malta and Austria, whose shares of foreign-born populations are 20% and 19.2%, respectively. We observe the lowest share of foreign population in countries in Central and Eastern Europe: in Slovakia, Poland, Bulgaria, and Romania, less than 4% of the population is born abroad. Ireland, Cyprus, Luxembourg, Hungary, and Slovakia are the only MSs where intra-EU migrants are more than extra-EU migrants.

Figure 1: Foreign-born population by country of birth, 2015 - 2019



Source: Own elaboration based on Eurostat data (online data code: migr_pop3ctb)

Regarding the main indicators of labour market performance, the three groups differ substantially. According to Eurostat, in 2019, 80% of intra-EU migrants were active in the labour market, while this percentage dropped to 74% for natives and to 71.5% for extra-EU migrants. The unemployment rates tell a partially different story, according to which natives show the lowest rate (6.1%), followed by intra-EU migrants (7.5%) and extra-EU migrants whose unemployment rate across the union is as high as 12.5%, twice that of natives.

Both the unemployment rate and the activity rate are heavily influenced by the demographic structure of the three groups. In fact, only 62.6% of the natives are of working age, compared to 71.4% of the intra-EU migrants and up to 81.7% of the extra-EU migrants. The different demographic structure directly influences the activity rates of the three groups and will affect the type

of social security benefits on which the three populations will rely. We can expect that retirement benefits will accrue mostly to natives, while a comparatively high share of extra-EU migrants will receive unemployment benefits, with intra-EU migrants being the group less reliant on social assistance due to their high activity rate and low unemployment rate.

3. Data and methodology

3.1. Tax-benefit modelling

Similarly to Fiorio et al. (2022), we evaluate the fiscal impact of immigration using EUROMOD, the tax-benefit microsimulation model for the EU (see Sutherland (2007)) based on individual and household data from the EU-SILC for 2015. We define migrants by country of birth and distinguish between intra-EU and extra-EU (born) migrants.[10] EUROMOD simulates individual and household tax liabilities and benefit entitlements based on the policy rules in place in each EU MS (see also Sutherland and Figari (2013)). EUROMOD is a unique tool for comparative research on the effects of taxes and benefits at the EU level as it calculates, in a comparable manner, the static effects of the tax-benefit system on household and individual incomes for each EU MS and for the EU as a whole. The data source used in EUROMOD is individual microdata based on EU-SILC for 2015.[11]

For the purpose of this analysis, we rely on the EUROMOD migration extension, developed by Fiorio et al. (2018) and used in Fiorio et al. (2022), which integrates with EUROMOD information on citizenship and the length of stay of migrants. This information is key in at least two respects. First, the duration of stay in the host country is an important indicator of the integration of newcomers[12]. Second, several legislatures require minimum residence or contributory periods for eligibility to several benefits.This allows us to include restrictions imposed by tax-benefit policies based on residence or the citizenship status.

EUROMOD is used to simulate direct taxes and cash benefits. However, a good part of income redistribution occurs through in-kind benefits, which represent a fiscal cost for the public purse. The highest share of public in-kind transfers is related to health care, followed by education, child care, housing, and active labour market policies.[13] According to OECD Health Statistics 2020,[14] on average, the OECD countries dedicated 8.8% of their GDP to health expenditures in 2018. On the other hand, indirect or consumption taxes are a substantial component of the country's tax system. As shown in the 2020 OECD revenue statistics for 2018, the total share of government revenue raised through consumption is about a third, which is higher than the direct income tax.

Despite their significance for public budgets, in-kind benefits and indirect taxes are not simulated in EUROMOD due to the lack of direct information on expenditures and non-cash income in the underlying EU-SILC data. Therefore, we calculate indirect taxes following Christl et al.

[10] Please note that given this definition of migrants, the second generation is not counted as migrants.

[11] Please also note that we use data for 2015, meaning that more recent migration flows to Europe are not covered in our data.

[12] See, e.g., Sinn and Werding (2001).

[13] See https://www.oecd.org/tax/revenue-statistics-2522770x.htm.

[14] See https://www.oecd.org/health/health-expenditure.htm.

(2022) and in kind benefits using the EUROMOD migration extension, developed by Fiorio et al. (2018). More details on the modelling of in-kind benefits as well as indirect taxation can be found in the Appendix.

3.2. Aggregated concepts of the net fiscal impact

We add in-kind benefits and indirect taxation to individual income, following Figari and Paulus (2015) who use indirect taxes, imputed rent, and in-kind benefits to replace the standard disposable income (DI) concept by an extended income (EI) concept.

The extended income concept uses the original income of an individual i ($ORIGY_i$) and subtracts direct taxes ($SSC_i + TIN_i$) and indirect taxes ($+VAT_i$) while adding all the cash benefits received ($BUN_i + BPEN_i + BREST_i$) and the in-kind benefits ($BINK_i$). Equations (1) and (2) highlight the differences between both approaches.

$$DI = ORIGY_i - (SSC_i + TIN_i) + (BUN_i + BPEN_i + BREST_i) \tag{1}$$

$$EI = ORIGY_i - (SSC_i + TIN_i + VAT_i) + (BUN_i + BPEN_i + BREST_i + BINK_i) \tag{2}$$

where SSC_i is the social security contributions, TIN_i is the income taxes, and VAT_i is the value-added tax (VAT) paid by the individual i. On the contribution side, we subtract cash benefits BUN_i (such as unemployment benefits), pension benefits $BPEN_i$, other cash benefits $BREST_i$ (such as family benefits), and in-kind benefits $BINK_i$.

We define the net fiscal impact (NFI) for an individual i as the difference between the taxes paid and the transfers received:

$$NFI_i = (SSC_i + TIN_i + VAT_i) - (BUN_i + BPEN_i + BREST_i + BINK_i) \tag{3}$$

We introduce two concepts to estimate the net fiscal impact of migration at the national and aggregate EU level. First, to estimate a snapshot of the current net fiscal impact, we calculate the $ANFI^j$ by migration status j, which we define as the average NFI_i^j of all individuals i with migration status j:

$$ANFI^j = \frac{\sum_{i=1}^{N} NFI_i^j}{n} \tag{4}$$

Second, to quantify the life cycle impact, we calculate the life cycle deficit (LCD) according to migration status j, and assume that an individual has the ANFI of the specific age group during his or her life cycle (0 to 80 years). We define the LCD by migration status j as:

$$LCD^j = \sum_{age=1}^{80} \frac{\sum_{i=1}^{N} NFI_i^{age,j}}{n} \tag{5}$$

Where $\frac{\sum_{i=1}^{N} NFI_i^{age,j}}{n}$ is the ANFI of each age group, age, and migration status, j. We then sum up the age groups from 0 to 80 (in 5-year bands), to obtain an estimate of the life-cycle impact by

migration status. In other words, we assume that each demographic group has an ANFI at each age and calculate the life-cycle contributions of the three migration states. In our model, the age-specific NFI is calculated and summed up by migration status. This approach ignores possible age effects resulting from differences in the age structure.

3.3. Demographic microsimulation modelling

We use the CEPAM-Mic microsimulation model to project both cross-sectional (population-based) and life course (cohort-based) estimates of the future net fiscal impact in the EU countries. This microsimulation model, developed by Bélanger et al. (2019), is designed to provide forward-looking analyses of the socioeconomic and cultural consequences of population changes in high-immigration countries. In addition to the age and gender dimensions of a classical cohort component demographic projection model, the CEPAM-Mic model includes information on education, labour force participation, and employment status, as well as immigrant-related variables such as region of birth, age at immigration, and duration of residency in the host country. These additional dimensions are useful for assessing the future economic impact of immigrants.

Unlike the traditional cohort component projection method[15], which uses aggregated population estimates as inputs and outputs, the CEPAM-Mic microsimulation model operates at the individual level. The main advantage of microsimulation is that it allows for the simultaneous projection of a large number of dimensions, going beyond the limits of conventional projection models based on aggregated data. CEPAM-Mic projects the population of EU27 Member States under several socioeconomic and ethnocultural dimensions. Its base population counts 13 variables: age, sex, country of residence, education level, student status, education of the mother, participation in the labour force, employment, region of birth (11 clusters of world countries), age at immigration, duration of residence in the host country for migrants, religion, and language. The base population was created from the microdata from the EU-Labour Force Survey (LFS) and other surveys, including the European Social Survey, to impute characteristics not available in the EU-LFS. CEPAM-Mic projects demographic and socio-economic events that shape the future characteristics of individuals and their future offspring, using a series of interrelated multivariate prediction models.

The model is time- and event-based, dynamic, continuous-time, open to international migration, and stochastic. Therefore, the characteristics of individuals are modified in "real time", allowing easier treatment of competing events. For each potential event that may occur during the simulated actor's lifetime (birth, migration, graduation, entry into the labour force, death, etc.), we estimate the probability of its occurrence and derive its waiting time via regression. The individual waiting times of all events are then ordered, and the shortest waiting time becomes the next event. When an event occurs, the characteristic of the simulated actor specific to this event (e.g., increasing age, changing education level or changing country of residence, etc.) is changed, the waiting times are re-estimated accordingly, and the projection continues to the next event until death, emigration, or the horizon of the projection (see Bélanger et al. (2019)). It is important to note that each event can have its own set of determinants. The parameters of the different modules deriving the waiting time of each event are estimated from different micro-data sources. Bélanger

[15]For an overview, see Smith et al. (2002)

Table 1: Baseline assumption in the CEPAM-Mic model

Assumption	Baseline
Volume of immigration	10 million every 5 years
Education of future immigrants	Same as recent immigration
Integration of immigrants	Average of 1020-2015
Labour force participation	Constant entry and exit rates
Net fiscal impact	Estimation based on EUROMOD, 15 years and beyond by age
Fertility	Slight increase from 1.6 to 1.8
Emigration	Constant country-specific emigration rates by age and sex
Mortality	Continuous improvements in life expectancy
Educational attainment	Past trends continue, constant social characteristics
EU-internal migration	Average of 2013-2016

et al. (2019) provide an overview of the parameters driving all the modules that generate events. Marois et al. (2019a) provide a detailed description of the labour force module and Marois et al. (2019b) describe the education module, while Potančoková and Marois (2020) describe the fertility module.

Our baseline scenario describes a continuation of the status quo, as observed for the years 2008-2014, namely: (a) a constant flow of 2 million third country nationals per year admitted to the Union with a dominance of humanitarian admission (asylum, humanitarian protection, marriage, and family reunion as main pathways) and about 30% third country nationals admitted as labour migrants; (b) employment rates of the admitted third county nationals lower than those of natives during the first 20 years after arrival.

We then estimate the average net fiscal impact for the population over 15 years of age[16] by age group and immigrant status in 2015 to calibrate our model and project the future impact of migration in the baseline scenario. We estimate the net fiscal impact for different educational groups, labour market status, as well as migrant status. For Eastern European countries and Baltic countries, we estimate the NFI jointly due to the lack of data for immigrants, accounting for country-specific differences. The general assumptions are described in Table 1.

4. Results

This section discusses the pattern of the individual NFI simulated as explained above. First, we discuss the results at the EU level and, more specifically, show how the estimated average net

[16]We present the results for the population aged 15 and over because the main objective of this projections are to compare the net contributions of immigrants and natives. Before the age of 15, there are little or no fiscal contributions, and the benefits are mainly related to the cost of education. These costs are mainly age dependent and do not necessarily vary by the place of birth of the child. Furthermore, the costs of educating children born in Europe from foreign-born parents are the result of the immigration of the latter and should be attributed to immigration.

fiscal impact varies by cohort (age), gender, and educational level. Next, we adopt a life cycle approach based on several simplifying assumptions and perform a comparative analysis with the ANFI at the country level. After discussing this concept on EU-level, we also provide an analysis by different welfare state regimes (and on country level).

4.1. The European perspective

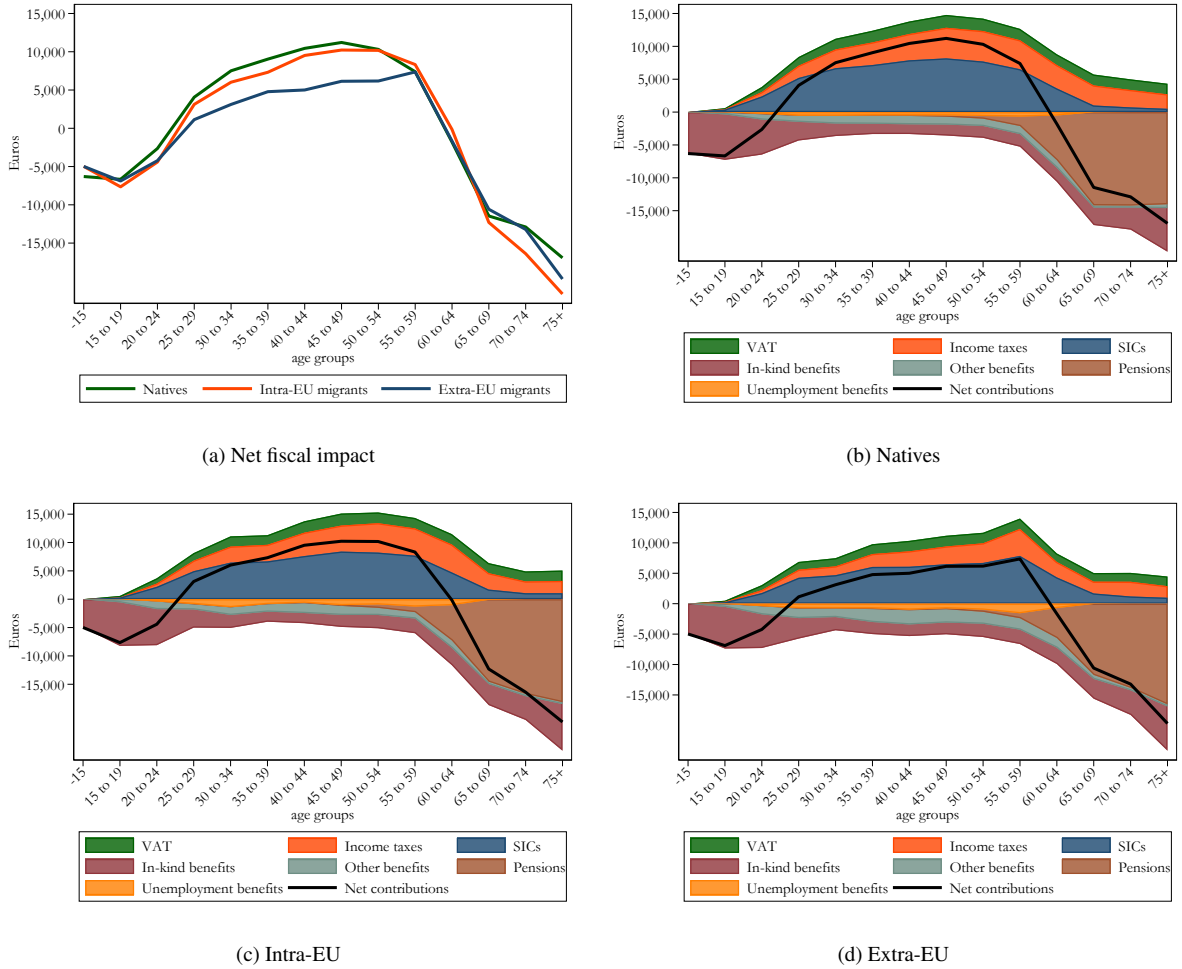
Here, we describe the patterns of the net fiscal impact and the tax benefit components by cohorts, gender, and education level, separately, for natives, extra-EU migrants, and intra-EU migrants, at the EU level. Although these calculations share similarities with Fiorio et al. (2022), they differ because they cover the entire EU area and not EU-14. Additionally, we distinguish between EU and extra-EU migrants. Figure 2a shows a large variation in the net fiscal impact between cohorts, as well as between natives and migrants. Overall, the net fiscal impact is positive and monotonically increases with age until a person's late 50s, and becomes negative and decreases thereafter. The positive peak in net contributions is reached faster for natives compared to migrants and coincides with the general retirement age. For most of the working life span, the per capita contributions of natives are higher than those of intra-EU and extra-EU migrants. This pattern reflects the earnings differences between natives and migrants, which, in turn, is related to differences in their participation in the labour market and wages.

The decomposition of the net fiscal impact by its main components and by migration status, as shown in Figures 2b, 2c and 2d, reveals that pension and other benefits related to old age account for a very high share of social expenditures. Conversely, social security contributions (including Social Security Contribution for pension) account for the highest share of fiscal contributions, followed by taxes on income and taxes on consumption. When comparing natives with extra-EU migrants, three noticeable facts emerge: (1) natives contribute more than extra-EU migrants in income taxes; (2) pension amounts are higher for natives than extra-EU migrants; (3) social transfers are higher for extra-EU migrants than natives. The first and second facts can be readily explained with natives' higher current wages and past social security contributions, respectively. The third fact is mostly explained by differences in sociodemographic characteristics, such as the number of children or people employed within a family.

Looking at gender differences, Figure 3, we can see that women generally have a lower net fiscal impact during their working age period, most likely due to the unequal share of unpaid work in most European countries and a persistent gender gap in participation in the labour force. This also results in lower pension entitlements and therefore a less negative impact of net fiscal impact on average. Again, natives and intra-EU migrants tend to have a similar NFI for both genders over the life cycle. However, the NFI of extra-EU migrants is found to be lower, but the gender gap between natives and extra-EU migrants is almost null.

Finally, we decompose the net fiscal impact by three levels of education. As shown in Figure 4b, there are no significant differences in the net fiscal impact between middle-educated migrants and natives. In fact, the shape of the net fiscal impact is very similar, where middle-educated natives tend to have a slightly higher ANFI during working time than migrants. The picture looks very different for lower educated individuals, shown in Figure 4a: natives and extra-EU migrants behave very similarly, while intra-EU migrants do not. Indeed, low-educated intra-EU migrants contribute more than the rest of population, and consequently are entitled to higher pensions.

Figure 2: Disaggregation of the average net fiscal impact by age and migration status in the EU



(a) Net fiscal impact

(b) Natives

(c) Intra-EU

(d) Extra-EU

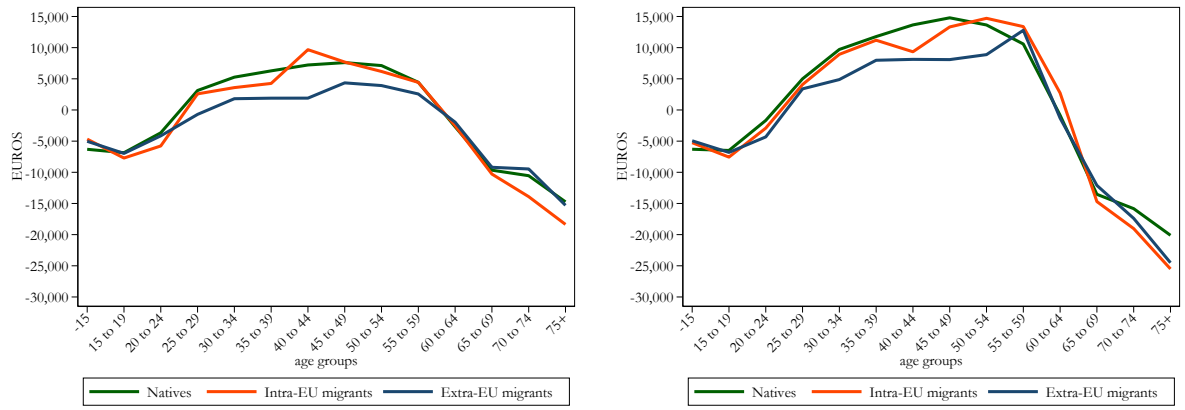
Looking at highly educated individuals, Figure 4c highlights especially high differences during working age, where natives have a higher ANFI compared to intra-EU migrants, which in turn have a higher ANFI than Extra-EU migrants.

4.2. The net fiscal impact over the life cycle

An analysis of the average net fiscal impact of migrants can reveal useful information on the current impact of migrants on the public budget. However, it does not help reveal any element on their contribution over their lifetimes. As argued by Hinte and Zimmermann (2014), only analysing the net fiscal impact of immigration for one fiscal year alone leaves out an important part of the picture. A life-cycle perspective approach could help to add additional information on the long-term impact of migration.

When comparing the results attained under both concepts, the ANFI and the LCD, it can be seen that at the EU level migrants have a negative ANFI (-208 euro for intra-EU and -219 euro for extra-EU), although higher than natives (-476 euro). This means that in 2015, migrants are

Figure 3: Average net fiscal impact by migration status and gender in the EU



(a) Females

(b) Males

less of a burden on the EU public budget than natives. However, when looking at the aggregate LCD estimate (controlling for age structure), it can be seen that the fiscal impact is less negative for natives (-753 euros) than for intra-EU migrants (-1,223 euros) and extra-EU migrants (-2,594 euros). These numbers suggest that the negative fiscal impact of migrants during the life cycle is expected to be stronger than that of natives. Furthermore, to account for potential differences between migration statuses over the life time, we also estimate the discounted life cycle deficit (DLCD), using a discount rate of 2% per year. This allows us to calculate the net present value (NPV) of the LCD at birth for each migrant status. While the relative results across the migration groups stay the same (natives and intra-EU migrants show similar DLCD, while Extra-EU migrants show substantially lower ones), the DLCD is substantially lower than the LCD, simply because the biggest expenditures (pensions) occur late in the life cycle and are valued less than, e.g., the contributions during the working age.

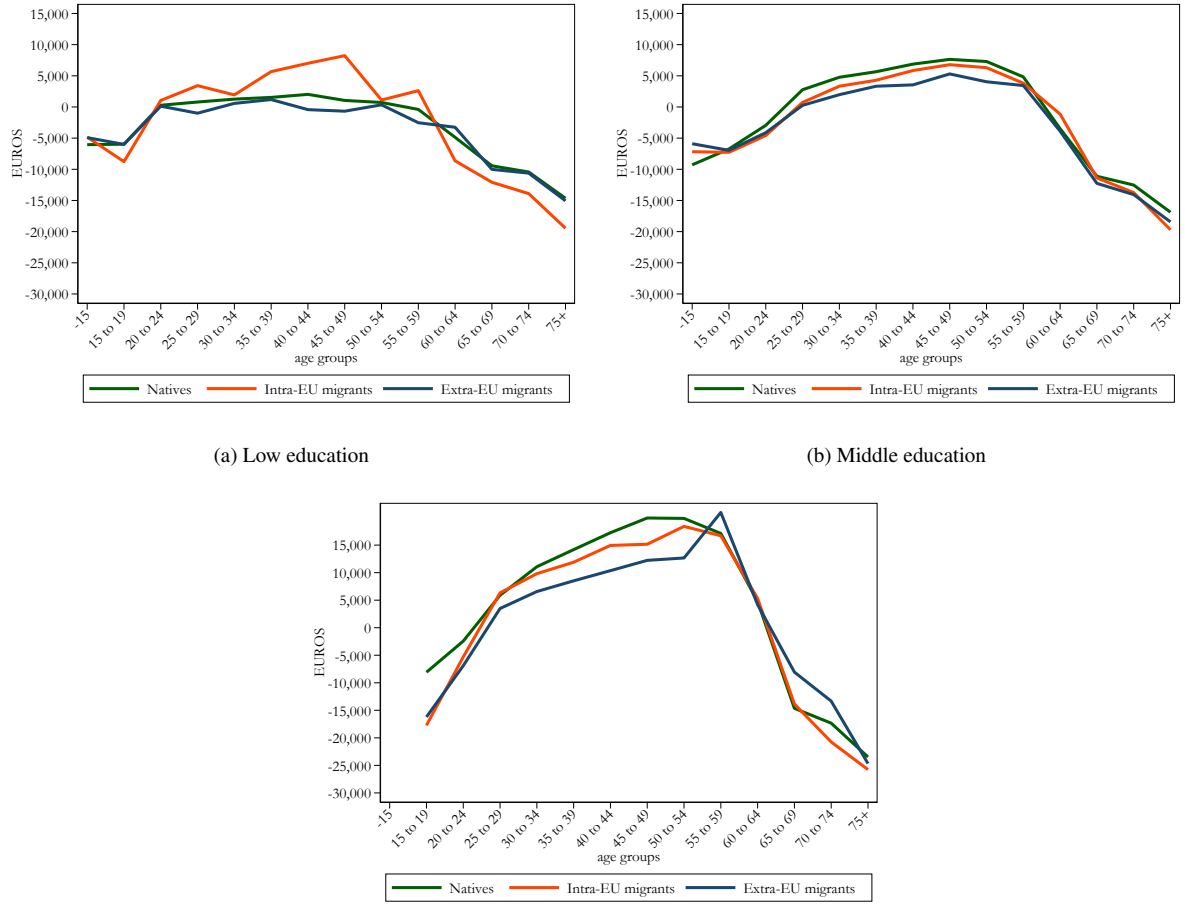
Table 2: Average net fiscal impact and life-cycle deficit in the EU in euros, 2015

	ANFI	LCD (0-80)	LCD (0-75)	LCD (0-85)	DLCD
Natives	-476	-753	208	-1855	-583
Intra-EU	-208	-1223	-70	-2526	-773
Extra-EU	-219	-2594	-1612	-3791	-1477

Note: SIC stands for social insurance contributions; VAT for value-added taxes.

There are several reasons for the higher magnitude of the negative life-cycle impact compared to ANFI. First, the life-cycle impact is estimated by selecting a sample from the age of 0 to the age of 80 (80.6 years was the official average life expectancy in 2015 in the EU). However, migrants may have different mortality rates than natives. As a robustness check, we also add LCD estimates for different age limits (75 years and 85 years). We can see that if we assume a lower age limit, the LCD turns positive for natives, while for intra-EU and extra-EU migrants, the LCD remains negative. When an age limit of 85 is assumed, the LCD turns substantially more negative.

Figure 4: Average net fiscal impact by migration status and education in the EU



(a) Low education

(b) Middle education

(c) High education

Note: SIC stands for social insurance contributions; VAT for value-added taxes.

Second, this approach controls for different population weights. Currently, in most countries, more people are of working age (15-64) and thus on average net contributors, while fewer people are young (0-15) and older (65 and older), who are usually net recipients. When using an average indicator, such as the ANFI, this obviously has an impact on the fiscal outcome. However, for the LCD, these differences do not matter.

The differences between the ANFI and LCD indicators are clearly visible. When we look at the ANFI, migrants tend to have a better NFI for the state than natives. However, when we focus on the LCD, migrants, and especially extra-EU migrants, exhibit a substantially higher deficit than natives, which stems from their more favourable age structure, which the ANFI estimates do not control for. When focussing on the long-run fiscal impact of migration, the LCD might be the more interesting concept, while when looking at the immediate effects on the welfare state, the ANFI might be the indicator of interest.

4.3. Welfare-regime-specific differences in ANFI and LCD

In this section, we discuss the current ANFI of migrants for different welfare-state regimes in Europe. Furthermore, we compare these static impacts with welfare-regime-specific estimates derived from the LCD approach. In Appendix D, we additionally provide country-specific results for both measures.

We group countries on their welfare regimes based on social protection systems (such as social insurance, family benefits, and health insurance), labour market regulations, and differences in tax systems, following Österman et al. (2019). Classifying countries according to their welfare regime allows an assessment of whether more generous regimes act as welfare magnets for migrants (Borjas, 1999; Levine and Zimmerman, 1999; Razin and Wahba, 2015).

We distinguish between five different regimes in Europe:

1. **Basic security:** Ireland, Malta and the UK;
2. **Continental corporatist regimes:** Austria, Belgium, France, Germany, and the Netherlands;
3. **Mediterranean corporatist models:** Cyprus, Greece, Spain, Italy, Portugal;
4. **Universal regimes:** DK, Finland, and Sweden;
5. **State insurance regimes:** Eastern EU countries and Baltics;

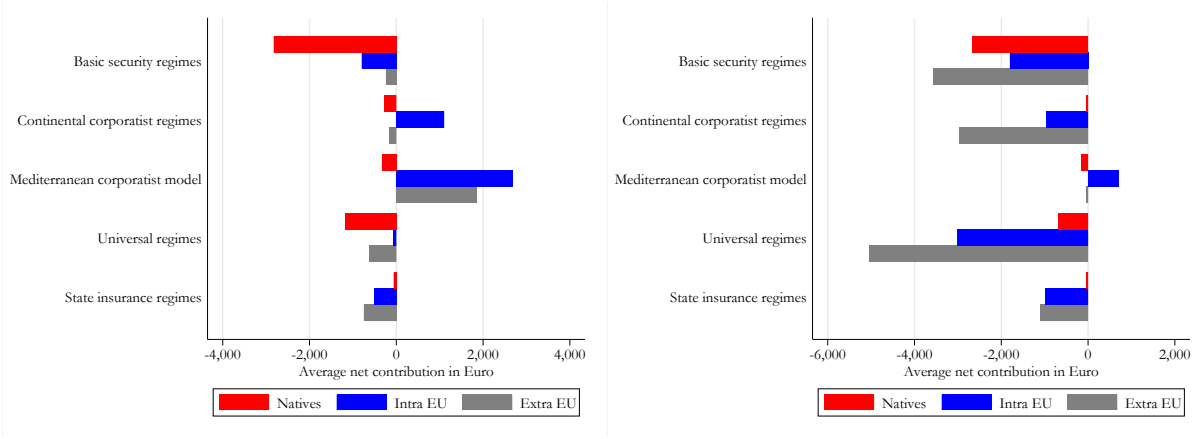
One of the difficulties in estimating the net fiscal impact by place of birth is the attribution of costs associated with the children of immigrants born in the host country. Before the age of entry into the labour market, children are important net recipients of in-kind transfers for health care or education. From a cohort perspective, as most immigrants land as adults, a good part of these costs, especially in education, have been incurred in the country of origin and it can be concluded that the host country benefits from a gain in human capital.

However, from a cross-sectional perspective, the costs of education should be seen as an investment by the state in the human capital of the next generation of workers. If the state did not pay the costs of education or health care, parents would have to pay for the education or health care of their children. These costs should therefore rather be seen as an intergenerational transfer, and attributing the net benefits received by children born in the host country from foreign-born parents to the natives increases the cost of services for natives and reduces the cost for migrants, distorting the results in favour of foreign-born.

As illustrated in the two panels of Figure 5, allocating these costs according to the place of birth of the child (panel 5a) or its parents (panel 5b) generates important differences in the ANFIs according to migration status and welfare regime. These differences are even more important the higher the level of immigration, since a larger share of the costs associated with childhood is reallocated when the second generation of immigrants is larger. While in panel 5a the ANFI of natives is lower than that of migrants (intra- and extra-EU) in all welfare regimes except those of the state insurance regime, the picture is diametrically opposed in panel 5b showing the ANFI when attributing the cost of benefits received by second-generation children to their immigrant parents.

Under this condition, only the countries of the Mediterranean corporatist model show a higher ANFI for intra-EU migrants than for natives. Moreover, on average, countries in the most generous regimes (universal and continental corporatist) show larger negative differentials in favour of migrants, especially with respect to extra-EU migrants. In the case of countries belonging to the state insurance regime, the difference between the two ways of allocation is of little importance, as migration flows are generally in favour of other EU countries.

Figure 5: Average net fiscal impact (ANFI) by welfare state regime and migration status



(a) Children included by country of birth

(b) Children included by country of birth of parents

Note: Exact values, as well as confidence intervalls are presented in Table F.5 in Appendix F.

However, these results can be driven by differences in the age structure or other characteristics (such as the level of education) of the three subgroups. As shown in Table F.6, the ANFI is substantially different between skill levels, where the ANFI of the low-skilled is substantially lower than that of the high-skilled. Furthermore, Figure D.10a in Appendix Appendix D highlights the strong correlation, especially between the share of people of working age and the ANFI.

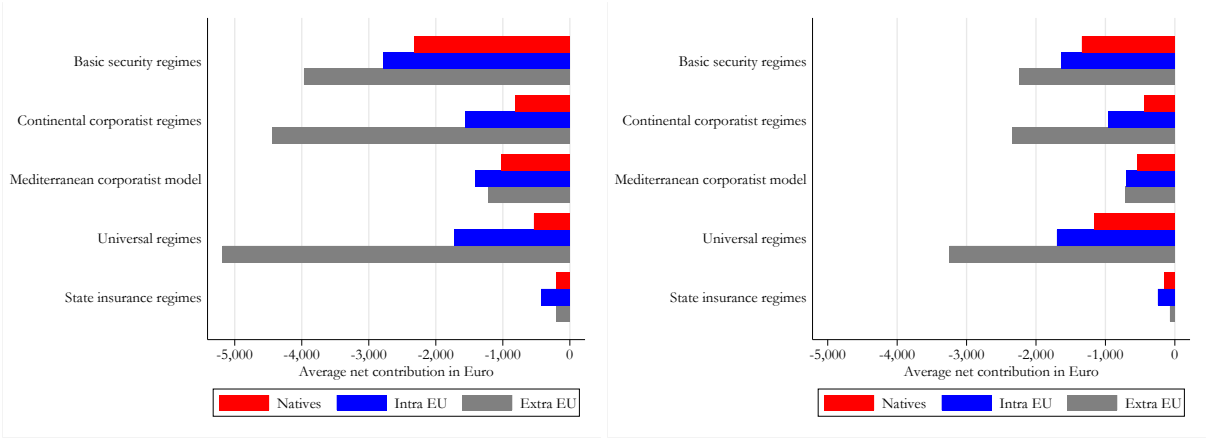
Therefore, we also analyse the LCD related to our three groups of interest. As expected, these results are substantially different from the ANFI. Again, results by welfare regime show very different patterns. Figure 6 highlights substantial differences among the different migration statuses when looking at the LCD.

We can see a pattern in which the LCD of natives tends to be higher (and less negative) than the one of intra-EU migrants, with not very large differences. However, when comparing natives with Extra-EU migrants, this difference increases substantially across all welfare-state regimes. This result does not hold for all countries, as can be seen in the country-specific results in Appendix D.

Looking further in the data, we can see that this result is mostly related to the lower labour market participation of extra-EU migrants. Especially in continental corporatist regimes, as well as in universal regimes, differences in the NFI between natives and extra-EU migrants (but also differences between intra-EU and extra-EU migrants) over the life cycle are substantial.[17]

[17]Please note that in most of the State insurance regimes extra-EU migrants are a very small group, which leads to

Figure 6: NPV of the Life-cycle deficit (LCD) by welfare state regime and migration status



(a) Life-cycle deficit (LCD)

(b) Discounted life-cycle deficit (LCD)

Note: A discount rate of 2% per year was used to calculate the net present value.

One has to be careful when interpreting these results. The LCD approach does not account for the fact that many first-generation migrants have already attained their educational level in their country of origin. This means that the educational costs of migrants are often not paid for by the host country. Therefore, ignoring them would lead to an overestimation of the average costs in young ages of migrants and an increase in the estimated LCD for migrants.

Figure F.12 in the Appendix highlights the differences in the net contribution by migrant status in all EU MSs over the life cycle. Furthermore, to account for potential differences between migration status over the life time, we also estimate the discounted LCD, using a discount rate of 2% per year. This allows us to calculate the net present value (NPV) of the LCD at birth for each migrant status in each welfare regime.

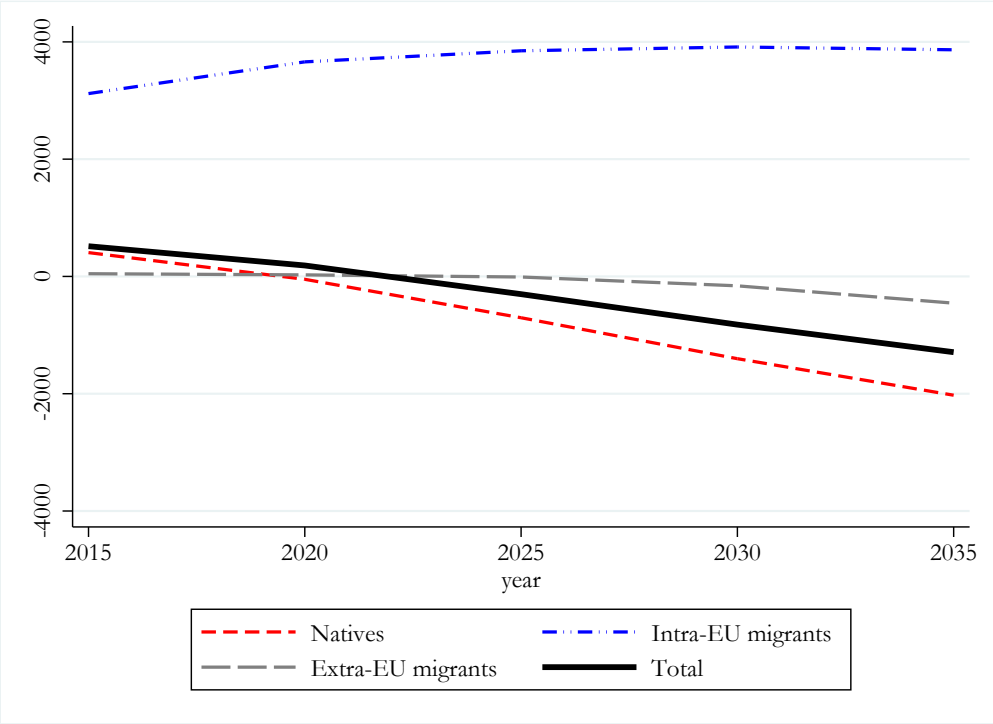
Panel 6b highlights that the NPV of the LCD is substantially lower than that of the general LCD, mainly driven by the fact that pension benefits, the highest benefits received over the life cycle, are achieved at a very late stage in life. Overall, there seems to be little difference in the relative results. However, applying time discounting, which assigns less value to future occurrences than to current ones, results in less pronounced differences between both natives and intra-EU migrants, as well as natives and extra-EU migrants.

4.4. Projecting the net fiscal impact

Figure 7 illustrates the results of our dynamic microsimulation model. It shows the projected annual net fiscal impact over the period 2015-2035, by migration status of the population groups, and under the baseline scenario's assumptions. Since we assume a constant net fiscal impact over the long term, the projected evolution over time results only from changes in the demographic composition of the population groups. The most important demographic trend is certainly the

substantial uncertainty in our results.

Figure 7: Projected average net fiscal impact (beyond the age of 15) by migration status, EU, 2015-2035



Source: Own elaboration based on CEPAM-MIC and EUROMOD.

ageing of the population, which would have a considerable impact on the future financial situation, particularly for those countries with the fastest ageing populations.

Population ageing is more prominent for natives than for immigrants since, by definition, native population is not rejuvenated by the arrival of younger than average immigrants. This explains the negative slope of the native curve. On the contrary, the curve for extra-EU migrants is flatter, and the projection shows that the current slightly higher net contributions of natives compared to extra-EU migrants would reverse in 2020 under the baseline scenario assumptions. In 2035, although both ANFIs turn out to be negative, the average annual net fiscal impact of extra-EU immigrants could exceed the contributions of natives by about 1,570 euros per capita. Finally, intra-EU migrants present the largest annual net fiscal impact of the three population groups, and their fiscal contribution is likely to increase over time. This is certainly due to the favourable age and education composition of intra-EU migrants.

Our projections are based on the central assumption that welfare policies, the selection of migrants, and their integration into European labour markets will follow the trends of recent years. Our results suggest that given the expected flows of migrants in the near future, the impact of migration on the overall sustainability of European welfare states would be limited. Under any realistic migration scenario, natives will make up the vast majority of the resident population in the EU. This group will pay most of the taxes and receive most of the benefits. Therefore, the sustainability of the European welfare states depends mainly on them.

Future research could focus on alternative scenarios that could differ on the assumptions regarding labour market participation, unemployment, the educational composition of future immigrants, the tax contributions and social benefits gaps between immigrants and natives, as well as on the integration assumptions.

5. Conclusion and discussion

There is a long-lasting discussion on the ANFI of migration. For decades, economists, and especially policy makers, have been asking whether a more favourable account balance is expected from migration. In other words, how could expenditures on benefits, pensions, and other social security services be more or less balanced by revenues collected in the form of taxes and social security contributions? Our paper tackles this question by using the NFI in the EU for natives and migrants following a microsimulation modelling approach and projecting this net fiscal impact in the future, using the dynamic microsimulation model CEPAM-Mic.

Following the approach of Fiorio et al. (2022), we compute the NFI of migration and extend the EU-SILC data in several ways. First, we take into account in-kind benefits by using the EUROMOD migration extension developed by Fiorio et al. (2018). The extension enriches the EU-SILC with information on in-kind benefits, based on OECD statistics that allow us to apportion the cost of education, social housing, and health care provisions among individuals. Second, we add VAT taxes by simulating VAT rules using the HBS to take into account the different consumption patterns of migrants and natives.

In this paper, we combine static microsimulation modelling with a life-cycle approach to estimate long-term implications of migration. To this end, we calculate two concepts of NFI: the average net fiscal impact (ANFI) that reveals the current impact of migrants on state budgets, following Fiorio et al. (2022); and the life cycle deficit (LCD), following Hinte and Zimmermann (2014) to obtain an estimate of the long-term implications. Our results suggest that when considering the ANFI, both intra-EU and extra-EU migrants have a negative but higher NFI than natives. This means that, currently, the average immigrant is less of a burden on the public budget than the average native. However, this result could be influenced by the difference in the demographic composition of each group. To account for the impact of demographic composition of the three groups, we control for age structure and obtain an estimate of NFI over the life cycle (LCD). The estimates indicate that the net fiscal impact appears to be even more negative over the life cycle, although natives show a higher contribution than intra-EU migrants, who in turn exhibit a higher (less negative) NFI than extra-EU migrants.

Additionally, we find that there are substantial differences between different welfare regimes in the EU regarding the net fiscal impact of migration in both concepts. This potentially reflects the differences in types and history of migration that characterise EU MS. Especially in **continental corporatist regimes** (Austria, Belgium, France, Germany and the Netherlands), as well as in **Universal regimes** (Denmark, Finland and Sweden), the differences in the NFI between natives and extra-EU migrants over the life cycle are substantial, while the differences between natives and intra-EU migrants seem to be less pronounced. This divergent picture attracts attention to the ongoing challenges of integration (especially of labour market integration) related to extra-EU

migration and suggests that better (labour market) integration is needed to improve the NFI of migrants.

When projecting the net fiscal impact for the period until 2035, we find that population ageing is more prominent for natives than for immigrants. We find a further decline in the net fiscal impact for natives. On the contrary, currently the impact for extra-EU migrants is lower than that of natives. However, a much slower decrease in net fiscal impact of extra-EU migrants leads to a higher net fiscal impact of extra-EU migrants after 2025 compared to natives. Finally, intra-EU migrants present the largest annual net fiscal impact of the three population groups, and their fiscal contribution is bound to increase over time. This is certainly due to the favourable age and education composition of intra-EU migrants. The higher contributions of migrants compared to natives for 2015, as well as the higher contributions of intra-EU and extra-EU migrants (whether positive or negative) for 2035, counter the narrative that migrants drain the welfare state resources. However, these results are crucially dependent on how we treat second-generation migrants. Identifying the net fiscal contribution of migration is important to develop policies that promote positive attitudes toward immigration and reduce the economic and fiscal concerns associated with new immigration flows.

We also show that the average net fiscal impact (per capita) on EU level is expected to decline in the future, indicating that migration is not able to offset the strong pressure of the population ageing on the state budgets in the EU.

It is worth mentioning some caveats in our analysis. Our analysis provides evidence on the direct fiscal effects attributable to immigrants and natives for Europe, for groups of countries clustered by welfare regimes as well as for individual MSs. A limitation of microsimulation models is that they do not include the characteristics of general equilibrium models (Chojnicki et al., 2011), which consider both direct and indirect effects of immigration when assessing its impact on the public finances of host countries (Chojnicki and Ragot, 2016). On the other hand, the dynamic microsimulation projection model allows for the age structure of the different populations and their evolution to be explicitly taken into account.

Our analysis uses a partial equilibrium approach, as in the NPV and GA approaches, where some factors, such as consumption, labour productivity, wages, job opportunities, and housing market conditions, are assumed to be not affected by the arrival of new immigrants. In focussing exclusively on demographic changes among populations, we overlook the indirect (or general equilibrium) effects of immigration, which nevertheless affect public finances over time and through tax changes. For example, as discussed in Colas and Sachs (2020), immigration-induced population growth can indirectly affect public finances through an effect on native wages and labour supply in the case of low-skilled immigrants.[18]

Although indirect effects of immigration are quantified as minor relative to overall economic activity and are overlooked due to the difficulty of operationalising a general equilibrium approach, evidence suggests that they could nonetheless be substantial for some market sectors and geographic regions. To better inform immigration policies and improve national fiscal planning, a

[18]The authors find that the indirect fiscal benefit of a low-skilled immigrant is between 770 and 2,100 dollars per year. The indirect fiscal benefit may exceed the negative direct fiscal effect, thus counteracting public opinion according to which low-skilled immigration represents a fiscal burden (Colas and Sachs, 2020).

more comprehensive analysis must consider both the direct and indirect effects of immigration on the economy.

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Appendix A. Tax and benefit disaggregation

Tax and benefit systems differ substantially across EU Member States. However, EUROMOD allows us to aggregate all the benefits and taxes in each country in a comprehensive way. Taking advantage of this aggregation feature of EUROMOD, we aggregate the calculated outcome variables into several categories according to the nature of the variables themselves. On the government expenditure side, we have information about the following cash benefits received by each individual in the survey:

- family and child benefits, which include child care and child education, family, maternity, and parental leave benefits;
- health and health-related benefits and pensions, which include accidents, receiving care, caring, disability and health benefits, disability and health pensions;
- housing benefits and pensions, which include housing, heating, and municipality benefits;
- old age and age-related benefits and pensions, which include old age, survivors, and early retirement benefits, civil servant, minimum, old age, survivors and early retirement pensions;
- work-related benefits, which include unemployment and work-related benefits;
- social assistance benefits and pensions, which include social assistance and military benefits;
- social insurance contributions.

In terms of direct benefits received, we, therefore, aggregate the benefits into the following categories:

- ”BENEFITS: unemployment”: Covers all unemployment benefits (contributory, as well as noncontributory) as well as work-related benefits;
- ”BENEFITS: pension”: Covers all pension benefits (survivor pensions, old-age pensions);
- ”BENEFITS: rest”: Covers all additional benefits, such as family benefits, health benefits, housing benefits, and social assistance benefits.

  On the government revenue side, we have information on income and other types of taxes, as well as on social security contributions. We aggregate them as follows:

- ”TAXES: on income”: Covers all taxes on income sources (labour income, capital income, property income, and other specific taxes such as church, health, municipal, pension insurance, wealth, and early retirement tax) that are simulated in EUROMOD;
- ”TAXES: social insurance contributions”: Covers all social security contributions paid by the employer, the employee, and the self-employed.

To calculate the final net contribution of individuals, we subtract the sum of all benefits received from the individual from the contributions (income taxes and social insurance contributions) made:

- ”NET Contributions (contributions - benefits)”: Covers all individual contributions net of benefits received.

Appendix B. Imputation of in-kind benefits

The imputation of in-kind benefits is based on the EUROMOD migration extension developed by Fiorio et al. (2018) and used by Fiorio et al. (2022). EUROMOD was extended to include restrictions imposed by tax-benefit policies based on residence or citizenship status. Finally, the EUROMOD output was enriched with data on in-kind benefits, based on the OECD data for apportioning the cost of education social housing and health care provision (Fiorio et al., 2018).

Below, we describe the imputed in-kind benefits and the method of imputation. For more details, see Fiorio et al. (2022). In-kind benefits are calculated based on EUROSTAT aggregate statistics on expenditures on health, education, and social housing and then apportioned based on observed information. We identify recipients of in-kind benefits related to social housing (at household level) and education (at individual level) in the microdata.

For in-kind health benefits, we assign them according to age groups in the microdata based on OECD statistics on the distribution of total cost for public health care. However, this imputation method does not account for the potential difference in use between natives and intra-EU migrants and extra-EU migrants. In fact, there is a wide range of literature dedicated to the 'health immigrant effect' from a time path perspective. It says that the health of immigrants is substantially better than that of comparable natives just at arrival at the host country, but deteriorates with the duration of migration. The 'healthy immigrant effect' is attributed to a number of factors. Immigrant self-selection is one of these factors based on which healthier people are more likely to immigrate. In addition, an important factor may be the under-utilisation of health care services by immigrants. There are studies that show that health care services are underused by migrants due to a lower level of health literacy, language difficulties to ask for appropriate health care, lack of trust in medical structures, cultural barriers, or discrimination reasons. The sorting immigrants into more dangerous occupations also appears to be a factor in the deterioration of health status among immigrants.

In this study, there are three types of in-kind benefits that are monetised: (1) health-related benefits, (2) education-related benefits, and (3) social housing benefits.

- Health-related benefits are calculated based on EUROSTAT information on general government expenditure in 2014. Such expenditures include medical products, appliances and equipment (01), outpatient services (02), hospital services (03), public health services (04), R&D in health (05), health for non-specified categories (06). The average per capita expenditure on health is apportioned by age groups based on the OECD statistics on the distribution of total cost for public health care by age class for the Netherlands in year 2011 (OECD, 2017), assuming that this is representative of distribution of health care expenditure across the EU countries by age classes, and that this distribution does not change over time. These assumptions are somehow strong, but this is the only information available on general health costs by age classes in the EU area.

- Education-related benefits are calculated based on EUROSTAT statistics on the total public expenditure on education per full-time equivalent student by education level and type of programme (EUROSTAT database), which is available for most EU countries for year 2014. Total education expenditures are apportioned based on the observed information on

the level of education in the microdata and then assigned to the child in education. For some countries (Czech Republic, France, Ireland), the dataset for 2013 is used (as the 2014 dataset was missing) and updated to be equivalent for 2014 using the country-specific consumer price index, assuming no expenditure change in real terms. For countries with missing information (such as Croatia for all levels of education and Denmark for primary and secondary education), other available sources are used (EUROSTAT educ-uoe-enra02 database, namely students enroled by education level, sex, and age, and EUROSTAT educ-uoe-fine02 database, namely public educational expenditure by education level, programme orientation, type of source, and expenditure category), and per capita expenditures are computed as the ratio between total expenditures over the number of students/pupils by educational level. For countries without any information on education expenditure, such as Croatia and Greece, the per capita expenditures are calculated as a weighted average of similar countries normalised by per capita GDP. For example, for Greece, the average educational expenditures of three southern European countries (Italy, Spain, and Portugal) is used to proxy the per capita educational expenditure, while for Croatia, information on Romania, Bulgaria, and Slovenia is considered.

- Social housing benefits are calculated based on Classifications of the Functions of Government (COFOG) database on the total amount spent by public authorities or public institutions on housing and community amenities, which include housing development, community development, water supply, street lighting, R&D housing and communities amenities. We then use EU-SILC-provided information on the tenure status of households to obtain an estimate of the number of individuals living in social housing, which is used to compute an estimate of the average cost of social housing in each EU country. Again, the in-kind benefits for social housing are further assigned to the head of the household.

Appendix C. Modelling of indirect taxes (VAT)

To additionally account for indirect taxation, we include information on household expenditures from the HBS from 2010 (latest available data). The HBS dataset contains detailed information on household expenditures for several EU countries. The HBS is a sample survey in which the statistical units of interest are private households. It is carried out regularly under the responsibility of the National Statistical Offices in each EU MS. The countries provide information about final consumption expenditures of households on goods and services with considerable detail in the categories used, plus information on income and some additional demographic and socioeconomic characteristics. Note that each MS has great freedom to decide the objectives, methodology, programming, and allocation of resources for their respective HBS.

The VAT is a consumption tax that aims to tax the sale of goods and services to the final consumer along the whole supply chain. It is defined as a percentage of the purchase price, including other potential taxes or excises. Theoretically, the tax burden is borne by the end consumer, but there are several reasons why businesses sometimes bear some of it. For example, some services are exempted from VAT, which means that the service provider cannot recover the VAT paid on the inputs needed to provide exempted services (e.g. health care). Additionally, businesses are

restricted from deducting certain inputs (e.g. corporate gifts or inputs not used for business activity). Consistent with the literature and for simplicity, we assume that the end consumer (the households) is bearing the whole VAT burden.

In most countries, goods can be taxed at the standard rate, reduced rates, zero VAT rate, or can be VAT exempted. We take information on what goods are taxed at what rate in each MS from the 'Worldwide VAT, GST and Sales Tax Guide 2015' of Ernst and Young, which reports detailed information on indirect taxes around the world. This guide summarises the VAT, goods and services tax and sales tax systems in 122 jurisdictions. For our simulations, we use information on tax laws for 2015. Our result should be interpreted as a rough approximation for the VAT tax burden, bearing in mind that the information on detailed consumption of goods and services, as well as information on the taxation of certain goods and services, is not complete.

The general framework for the VAT systems of EU MSs is based on the EU VAT Directive, which obliges EU Member States to have a VAT rate of at least 15% and allows for reduced rates for certain categories of goods and services. Therefore, MSs have wide flexibility in setting the VAT rates, leading to substantial differences in the national VAT systems. Most of the consumption in the EU countries is taxed by a standard VAT rate. This standard VAT rate varied substantially between EU countries in 2015, from 17% in Luxembourg to 27% in Hungary. Additionally, on certain products, a reduced VAT rate applies. Typically, food is taxed at a reduced rate. Some countries have even more than one reduced VAT rate. Luxembourg and France had in total four different VAT rates in 2015. In addition to those rates, many countries have exempted some goods and services from VAT. Typically, these are financial services, health services, and education.

Additional taxes, called excises, are typically added on some goods such as alcohol, gasoline, diesel, oil, or cigarettes. In our model, we focus purely on the VAT, leaving the excises out of the model. This is mainly due to the fact that excises are often based on the amount rather than on the price of a certain good (such as tobacco). In our data, we can only observe expenditures related to goods. Therefore, it is not possible to calculate the excises in a proper way.

In general, the VAT on products varies substantially across the MSs. But the group of goods and services that are taxed at a reduced rate or those that are exempted from VAT also differs substantially between countries. Quite detailed information on consumption behaviour is needed to estimate the VAT paid by households. Although the HBS data are quite detailed, there are some limitations in identifying the expenses that are taxed on a reduced rate or exempted from VAT. We try to cover those categories as well as possible, but obviously there are some limitations in our approach that might lead to slight over- or under-estimation in the VAT.

Following Christl et al. (2022), indirect taxes are simulated for all European countries and cover all the applicable VAT rates, the standard VAT rates and the main reduced rates for the year 2015, based on HBS 2010 data. Excises (applicable to goods consumed by households) are not included in the analysis. The calculations of the VAT cover the standard rate, the reduced rates, the zero VAT rate, and the VAT exempted goods. Since we assume full pass through of indirect taxes on to the consumer, the model does not distinguish between a zero rate and VAT exemption.

In the first step, we analyse the consumption patterns of natives and migrants. The HBS, similar to the EU-SILC dataset, contains information on citizenship and country of birth, split into three groups: national, non-national but EU-national, non-national and extra-EU-national for most of the countries. For consistency, we again define migrants by country of birth. By simulating indirect

taxation, we can see that migrants and natives show not only different consumption patterns, but also different indirect tax burdens. On the one hand, migrants tend to save more; therefore, they consume less and pay less VAT. On the other hand, migrants often have lower incomes and those groups typically pay a higher share of indirect taxes. Therefore, it is important to distinguish between migrant and native households when implementing indirect taxation in our data set (see Christl et al. (2022)).

We assume that the VAT burden of the household is split according to the household income share of the household. Therefore, we are able to calculate the individual VAT burden. By using simple regression methods, we estimate the VAT burden of households, depending on the overall income of the household, as well as sociodemographic characteristics, such as migration status, household type, number of children, and so on. We use the estimated parameters to impute the VAT burden of households in the EU-SILC data. There are different methods to impute the VAT burden in the EU-SILC data (see, e.g., Decoster et al. (2010)), but since the main interest in this research falls on the average VAT burden by age groups and immigration status, we argue that implementing VAT rates in this way is the most convenient. In the literature, VAT rates are often implemented on an aggregated level by income deciles (see, e.g., Dustmann and Frattini (2014)). The method used in this research has an advantage over standard approaches, as we do not lose heterogeneity and maintain the microlevel structure. This allows us to distinguish between different expenditure and saving behaviours between migrants and natives.

We face several data issues when imputing the VAT behaviour from the HBS into EU-SILC. First, countries like Austria and the Netherlands are not included in the HBS 2010 wave. Therefore, VAT imputation is done based on other data sources or imputation methods. For example, for Austria we use the national HBS of Statistics Austria for 2009/2010 and the Indirect Tax Tool of the Commission to calculate VAT taxes for all households. On the other hand, for the Netherlands, we follow the approach used by Dustmann and Frattini (2014) using information on effective VAT rates by income quintile (Bettendorf and Cnossen (2014)) to impute the VAT tax burden of households. Both these imputations do not allow us to distinguish between migrant and native consumption patterns, as no information is available on the country of origin. Second, for Italy, information on income is missing in the HBS. Therefore, we impute the VAT assuming a constant saving rate of 10.52 as reported by EUROSTAT for the year 2015. Lastly, due to problems with the income data in the HBS for Luxembourg, Luxembourg is not considered in this research.

Table C.3: In-kind benefits for health in euros (annual per person)

age group	AT	BE	BG	CY	CZ	DE	DK	EE	EL
0 to 5	1262	1190	132	254	489	1008	1732	320	298
5 to 10	1001	944	105	201	388	800	1374	254	236
10 to 15	1407	1327	148	283	545	1124	1932	356	332
15 to 20	1492	1406	156	300	578	1192	2048	378	352
20 to 25	1650	1556	173	332	639	1318	2265	418	390
25 to 30	1861	1755	195	375	721	1487	2555	471	440
30 to 35	1927	1817	202	388	747	1539	2645	488	455
35 to 40	1905	1796	200	383	738	1521	2614	482	450
40 to 45	1970	1858	207	397	763	1574	2705	499	465
45 to 50	2250	2122	236	453	872	1798	3089	570	531
50 to 55	2583	2435	271	520	1001	2063	3545	654	610
55 to 60	2962	2793	311	596	1148	2366	4066	750	700
60 to 65	3303	3114	346	665	1280	2639	4534	837	780
65 to 70	4191	3951	439	843	1623	3348	5752	1062	990
70 to 75	5209	4911	546	1049	2018	4161	7151	1320	1230
75 to 80	7095	6689	744	1428	2749	5667	9739	1797	1675
80+	14211	13398	1490	2860	5505	11352	19507	3600	3356
	ES	FI	FR	HR	HU	IE	IT	LT	LU
0 to 5	553	1281	1090	279	219	1389	726	280	2030
5 to 10	438	1016	864	221	174	1101	576	222	1610
10 to 15	616	1428	1215	311	244	1548	810	312	2264
15 to 20	653	1514	1288	330	259	1641	858	331	2400
20 to 25	723	1675	1425	365	286	1816	950	366	2655
25 to 30	815	1889	1607	412	323	2048	1071	413	2994
30 to 35	844	1956	1664	426	334	2120	1109	428	3100
35 to 40	834	1933	1645	421	330	2096	1096	423	3064
40 to 45	863	2000	1702	436	342	2168	1134	437	3170
45 to 50	985	2284	1943	498	390	2476	1295	499	3621
50 to 55	1131	2621	2230	571	448	2842	1486	573	4155
55 to 60	1297	3007	2558	655	514	3260	1704	657	4766
60 to 65	1446	3352	2852	731	573	3634	1900	733	5314
65 to 70	1835	4253	3619	927	726	4611	2411	930	6742
70 to 75	2281	5287	4498	1152	903	5732	2997	1156	8381
75 to 80	3106	7200	6127	1569	1230	7806	4082	1574	11414
80+	6222	14423	12272	3143	2463	15636	8177	3153	22863
	LV	MT	NL	PL	PT	RO	SE	SI	SK
0 to 5	183	486	1377	221	409	130	1293	492	458
5 to 10	145	385	1092	176	324	103	1026	390	363
10 to 15	204	542	1535	247	456	145	1442	549	511
15 to 20	217	574	1627	262	483	154	1529	581	542
20 to 25	240	635	1800	289	535	170	1691	643	599
25 to 30	270	717	2030	326	603	192	1908	726	676
30 to 35	280	742	2102	338	624	199	1975	751	700
35 to 40	276	733	2078	334	617	197	1952	742	692
40 to 45	286	759	2149	346	638	203	2020	768	716
45 to 50	327	866	2455	395	729	232	2307	877	817
50 to 55	375	994	2817	453	837	267	2647	1007	938
55 to 60	430	1140	3231	520	960	306	3036	1155	1076
60 to 65	479	1272	3603	579	1070	341	3385	1288	1199
65 to 70	608	1613	4571	735	1358	433	4295	1634	1522
70 to 75	756	2005	5682	914	1688	538	5339	2031	1892
75 to 80	1030	2731	7739	1244	2299	732	7272	2766	2576
80+	2063	5471	15501	2492	4604	1467	14566	5540	5160

Source: Fiorio et al. (2018)

Table C.4: In-kind benefits for education in euros (yearly per country on current education level)

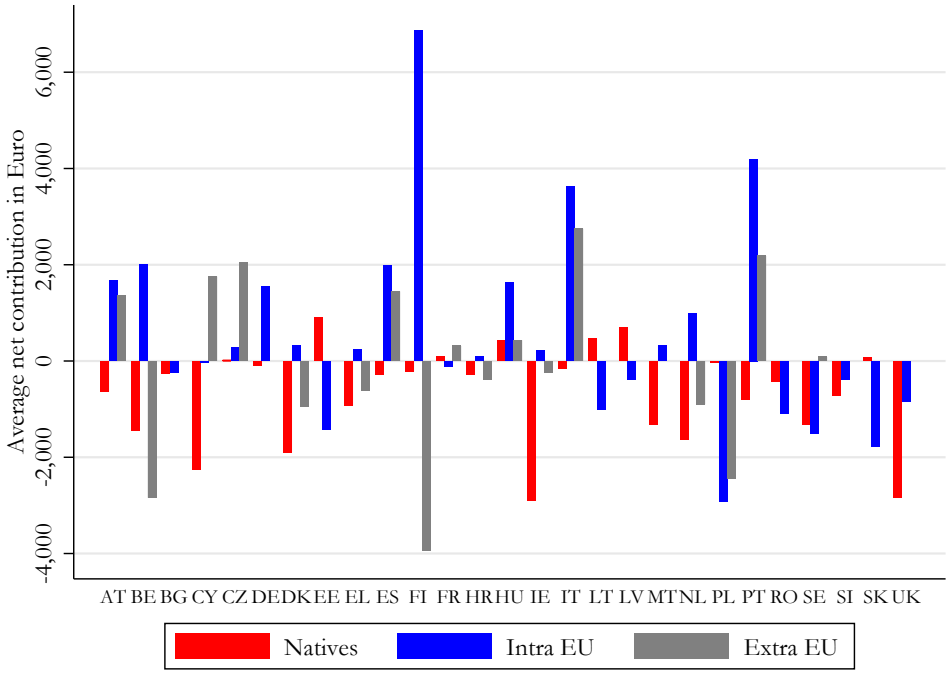
Education level	1	2	3	4	5	6
AT	6894	8808	11928	11426	11426	13960
BE	6101	7976	9898	10823	10823	13825
BG	1868	1370	1537	1314	1314	1275
CY	2715	6630	8017	8134	8134	7420
CZ	2316	2249	3728	3260	3260	3154
DE	6662	6412	7898	8693	8693	14090
DK	10079	11798	13412	16185	16185	34809
EE	2666	3052	3254	3396	3396	5283
EL	2572	3432	4249	4130	4130	4470
ES	3427	3996	5071	5430	5430	6319
FI	9897	7952	12511	8543	8543	18236
FR	5841	5734	7870	10250	10250	11151
HR	2027	2095	2095	1950	1950	2318
HU	2675	1557	1610	3465	3465	2938
IE	5358	6418	8308	10292	10292	10329
IT	4082	5694	6276	6278	6278	7009
LT	1905	2304	2214	2611	2611	3563
LU	17526	17422	18625	17649	17649	25670
LV	2607	3237	3227	3432	3432	3580
MT	4900	5306	7849	5953	5953	10344
NL	6221	6751	9553	9128	9128	15194
PL	2028	2750	2829	2376	2376	3367
PT	2769	3972	5306	4674	4674	4594
RO	927	681	1233	1153	1153	1965
SE	13267	10390	11221	12449	12449	26975
SI	4433	4985	5570	4349	4349	5621
SK	2355	2792	2880	3088	3088	4942

Source: Fiorio et al. (2018)

Appendix D. Country-specific differences in ANFI and LCD

Figure D.8 shows the ANFI for all MSs. It can be observed that in Austria, Belgium, Spain, Finland, Denmark, the Netherlands, Ireland, Italy, and Portugal, the current fiscal impact of intra-EU migrants is higher than for natives. Additionally, in countries such as Austria, Cyprus, the Czech Republic, the Netherlands, Denmark, France, Italy, and Portugal, the ANFI is higher even for extra-EU migrants compared to natives. There are also substantial differences between intra-EU and extra-EU migrants.

Figure D.8: Average net fiscal impact (ANFI) by country and migration status

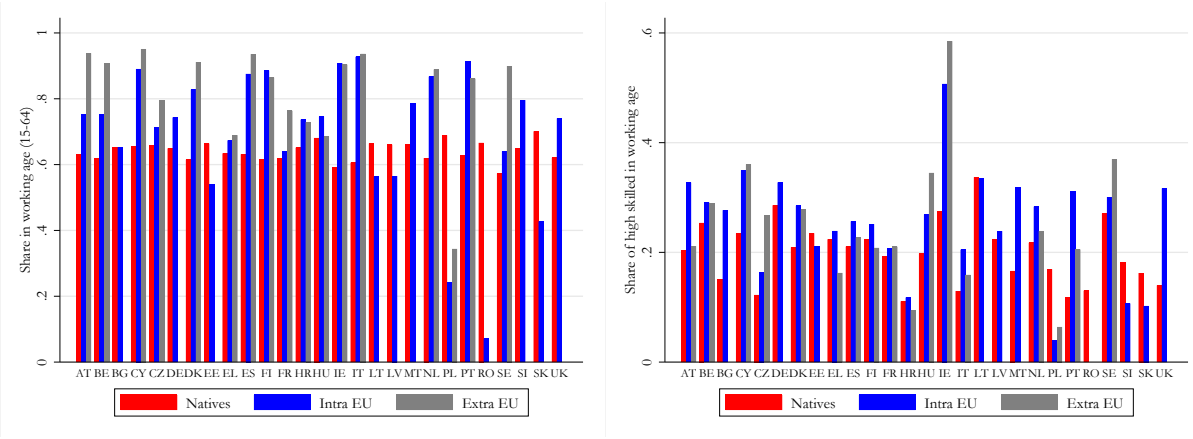


Note: In some countries, intra-EU and extra-EU migrants are combined into one group due to data limitations.

However, these results can be driven by the age structure or other characteristics that differ between the three subgroups. Figure D.9a highlights that there is a substantial difference in the age structure in several MS, especially between natives and intra-EU and extra-EU migrants. We can see that the share of the migrant population in working age is substantially higher in most European countries, with some exceptions in eastern European countries. The same holds when we focus only on the share of high-skilled workers in working age, as shown in Figure D.9b.

To make this point more visible, we show the correlation between the characteristics of the different population groups and the ANFI. Figure D.10a highlights a strong positive correlation between the ANFI and the percentage of people of work age. The same holds true when looking at the correlation of the ANFI and the share of high-skilled people in working age; however, the correlation seems to be weaker. The correlation between the ANFI and the share of the population in working age becomes even stronger when only looking at the immigrant population.

Figure D.9: Differences in characteristics across migration status

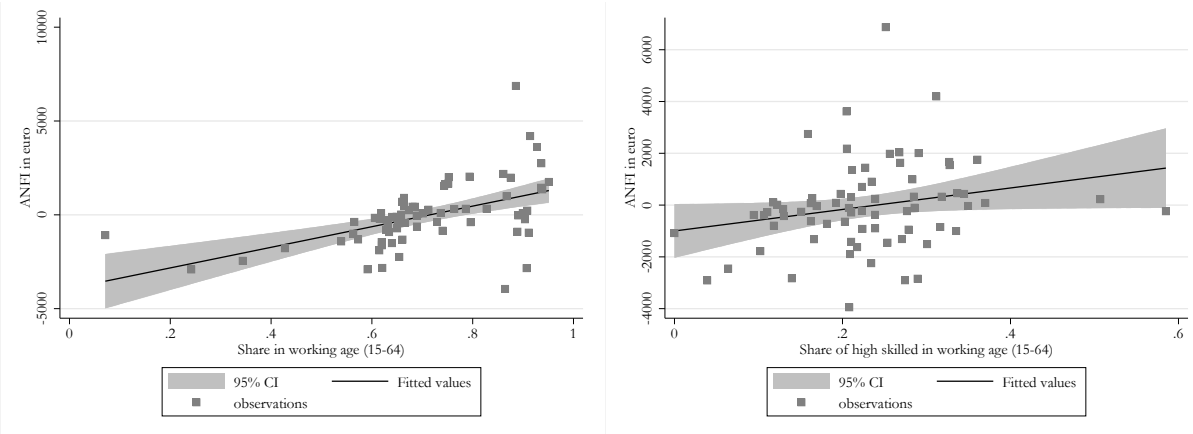


(a) Share of working age population (15-64)

(b) Share of high skilled working age population (15-64)

Note: In some countries, intra-EU and extra-EU migrants are combined to one group due to data limitations.

Figure D.10: Differences in characteristics across migration status

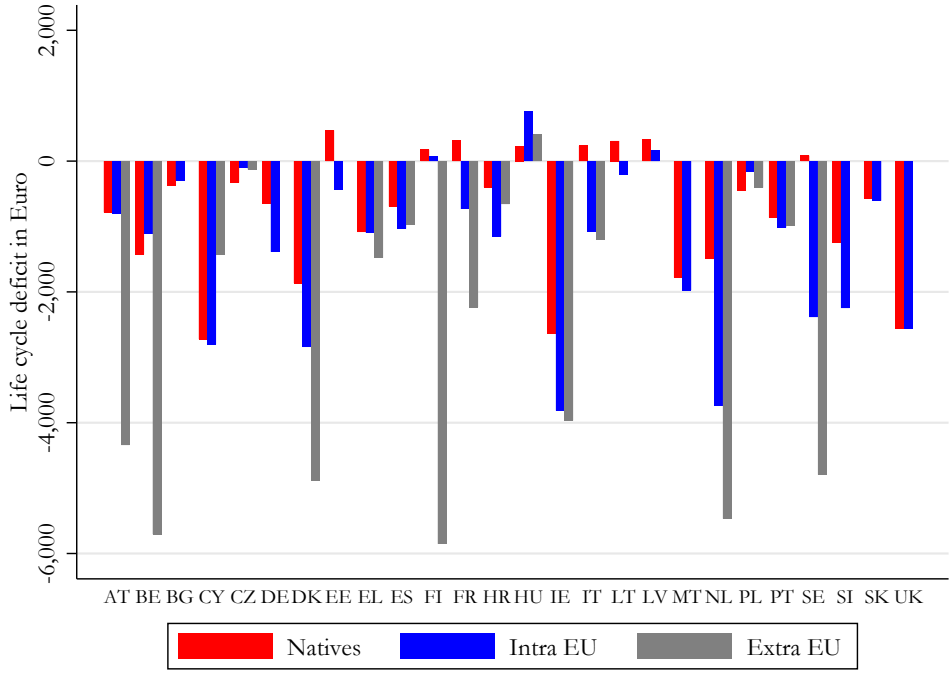


(a) ANFI vs Share in working age

(b) ANFI vs. Share working age and high skilled

Note: In some countries, intra-EU and extra-EU migrants are combined to one group due to data limitations.

Figure D.11: Life-cycle deficit (LCD) by country and migration status



Note: In some countries, intra-EU and extra-EU migrants are combined to one group due to data limitations.

To control for the influence of the age structure across the three groups of interest, we also analyse the LCD by migration status. As expected, these results are substantially different from the ANFI. Again, results at the country level show different patterns across different MSs. Figure D.11 highlights substantial differences between the different migration statuses when looking at the LCD.

In general, the figures on LCD of natives and intra-EU migrants are often quite similar. However, in some countries, such as Belgium and some eastern European countries, the NFI of intra-EU migrants over the life cycle is even higher than for natives.

Extra-EU migrants typically show significantly higher LCD than natives and migrants. Looking further into the data, it can be seen that this is mostly related to their lower participation in the labour market. Especially in traditional welfare states, such as Austria, Belgium, Denmark, Finland, the Netherlands, and Sweden, differences in the NFI between natives and extra-EU migrants (but also differences between intra-EU and extra-EU migrants) over the life cycle are substantial.[19]

One has to be careful when interpreting these results. The LCD approach does not account for the fact that many first-generation migrants have attained their education level in their country of origin. This means that the educational costs of migrants are often not paid for by the host country.

[19]Please note that in most of the Eastern European countries, extra-EU migrants are a very small group, which leads to substantial uncertainty in our results.

Therefore, ignoring them would lead to an overestimation of the average costs in young ages of migrants and an increase in the estimated LCD for migrants.

Appendix E. The impact of children on the ANFI

Appendix F. Additional graphs and tables

Table F.5: ANFI by welfare regime and migration status - summary statistics

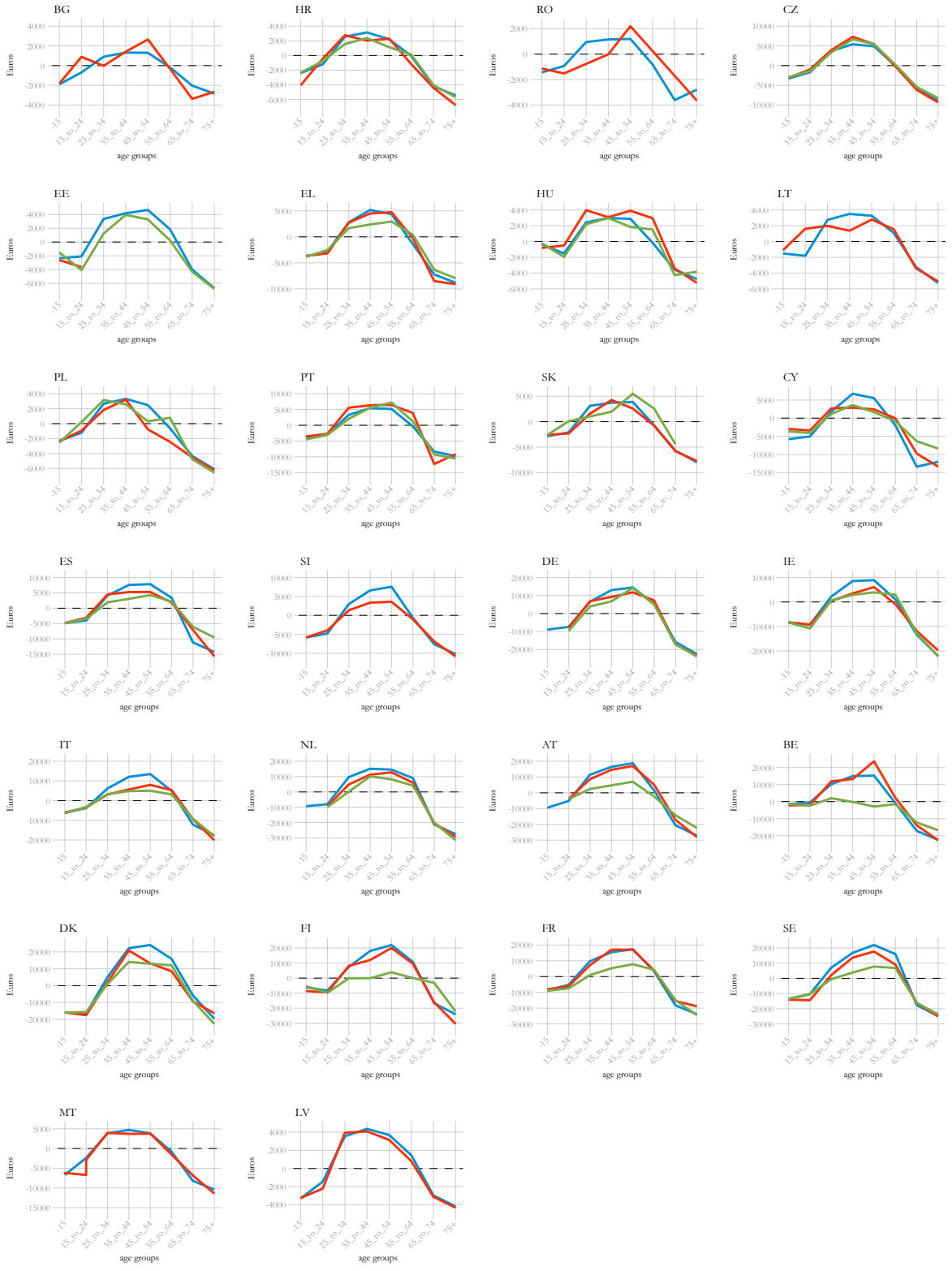
migrant status	welfare regime	ANFI	95%-CIs	
Basic security regimes	natives	-2824	-2820	-2827
	Intra-EU	-796	-788	-804
	Extra-EU	-238	-157	-318
Continental corporatist regimes	natives	-275	-273	-277
	Intra-EU	1102	1116	1089
	Extra-EU	-156	-144	-169
Mediterranean corporatist model	natives	-330	-328	-332
	Intra-EU	2680	2687	2674
	Extra-EU	1851	1855	1847
Universal regimes	natives	-1179	-1170	-1188
	Intra-EU	-62	-11	-114
	Extra-EU	-616	-586	-646
State insurance regimes	natives	-59	-58	-60
	Intra-EU	-510	-504	-517
	Extra-EU	-746	-739	-754

Table F.6: ANFI by welfare regime, migration status and skill level - summary statistics

welfare regime	migration status	skill level	ANFI	95% Cis	
Basic security regimes	natives	low	-5578	-5574	-5583
		medium	-1408	-1399	-1417
		high	10574	10586	10561
	Intra-EU	low	-7162	-7125	-7200
		medium	-3711	-3672	-3751
		high	6904	6986	6822
	Extra_EU	low	-4347	-4330	-4363
		medium	-3622	-3607	-3638
		high	8179	8198	8160
Continental corporatist regimes	natives	low	-8474	-8470	-8478
		medium	899	902	896
		high	9165	9172	9159
	Intra-EU	low	-5232	-5216	-5248
		medium	2085	2107	2063
		high	8784	8814	8754
	Extra_EU	low	-5440	-5428	-5453
		medium	-1438	-1421	-1456
		high	10129	10163	10095
Mediterranean corporatist model	natives	low	-4489	-4487	-4491
		medium	3366	3369	3362
		high	9453	9460	9446
	Intra-EU	low	-151	-142	-161
		medium	2786	2794	2779
		high	6821	6838	6803
	Extra_EU	low	554	559	550
		medium	2740	2746	2734
		high	4830	4843	4817
Universal regimes	natives	low	-10854	-10841	-10868
		medium	1978	1992	1964
		high	10525	10549	10501
	Intra-EU	low	-3422	-3348	-3497
		medium	-3528	-3447	-3608
		high	7629	7737	7520
	Extra_EU	low	-3294	-3257	-3331
		medium	-2220	-2165	-2275
		high	5284	5353	5215
State insurance regimes	natives	low	-1471	-1470	-1472
		medium	288	290	286
		high	3114	3116	3112
	Intra-EU	low	-2948	-2939	-2956
		medium	-451	-443	-460
		high	2184	2204	2164
	Extra_EU	low	-2233	-2223	-2242
		medium	-439	-428	-449
		high	2539	2574	2504

Note: Statistics for population above 15 years.

Figure F.12: Net contribution by country and migration status



Note: In some countries, intra-EU and extra-EU migrants are combined to one group due to data limitations.