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The Effects of Refugee Immigration on Income Inequality in Germany: A Case Study

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Gerrit Manthei*

Abstract

Income inequality is a major public concern in many Western countries. The problem has intensified with the recent high immigration rates in Europe, particularly from outside the continent. However, the linkage between refugee immigration and income inequality in host countries has not been adequately investigated. This article employs a two-step approach to examine whether and to what extent refugee immigration affects income inequality. The first step is a literature review, the second the formulation and utilization of a classic production model with labor sub-divided into different qualification groups. After a discussion of the theoretical implications of the model, it is then applied to Germany's refugee immigration situation in 2015 and 2016. The results suggest that a rise in mostly low-skilled immigration may be accompanied by an increase in income inequality. The linkage between the concepts highlights the need for further research as well as for efforts to curb uncontrolled, low-skilled immigration.

Keywords: *Refugees; Immigration; Income Inequality; Qualifications; Wages*

JEL codes: *J31, J60, O15*

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Introduction

Income inequality is a major concern in many Western countries. For instance, in Germany, a survey conducted in 2009 revealed that 68% of the population considered income distribution to be unfair (IfD Allensbach 2008). In another survey, 64% of the respondents said that perceived social equity in Germany had been steadily declining for years up until the time of the survey interviews in 2012 and 2013 (IfD Allensbach 2013), although, in reality, the Gini coefficient had remained relatively constant at around 29 during the years prior to the survey (Eurostat 2020a),¹ and the S80/S20 income quintile share ratio showed only little deviation from 4.6 (Eurostat 2020b).² Apart from this, unemployment has been recognized as the biggest concern among residents of more than 24 countries (GfK Verein 2018), as it would worsen their income situation.

Lately, the fear of unemployment in Germany has transformed into public anxiety toward immigration. In 2016, 83% of German respondents viewed the immigration situation as the country's biggest challenge (GfK Verein 2018). This development distinguishes Germany from most other countries, where unemployment has remained the main concern (GfK Verein 2018). Further, this development coincides with growing rates of immigration throughout Europe, particularly in Germany, since 2015.³ Between 2015 and 2016, Germany experienced the largest inflow of immigrants since the establishment of the Schengen Agreement. In 2015, the number of immigrants from inside the EU, for family reunification as well as refugees from Syria and Iraq, was higher than in 2014 (Federal Office for Migration and Refugees 2016a). Because Germany has endured the highest number of immigrants in absolute numbers, and because it can be considered a midpoint of Europe, not only geographically but also in terms of per-capita prosperity, it was chosen for this case study.

Refugees constitute an important factor that differentiates the immigration in 2015 and 2016 from other immigration movements in German history. It differs from past migration peaks, not only in number, but also in demographic structure. In previous years, the average age of immigrants in Germany was around 32 years (Federal Statistical Office of Germany 2019), while the majority (67%) of refugees entering Germany in 2015 and 2016 were 29 or younger (Federal Office for Migration and Refugees 2016b, 2017a). Their education levels were also significantly different from those of earlier immigrants. Of the total 1.17 million refugees that entered Germany in 2015 and 2016 (Federal Ministry of the Interior 2016, 2017), about a quarter had only basic education (German Institute for Economic Research 2017). In terms of the *International Standard Classification of Education* (ISCED11-A),⁴ their education levels were one (primary education) or lower. The refugees were considerably less educated than the foreign nationals who had immigrated earlier and were already living in Germany. In 2015, only 17.9% of foreign nationals in Germany could be classified as low qualified (Federal Statistical Office of Germany 2017). Thus, the immigration situation in 2015 and 2016 presents a unique case in Germany's history and therefore is worth investigating.

Human inflows—particularly those from outside Europe—are most likely to continue, given that the ever-enlarging prosperity gap between Europe and, for example, Sub-Saharan Africa is apparent to anyone with access to online information. Further, growing unemployment rates in Maghreb countries continue to push individuals to find better prospects outside (Klingholz and Sievert 2014; Meier 2015). Finally, with the partial suspension of the Dublin Regulation, which controlled the allocation of newly arrived refugees to EU countries, refugees may be lured by false incentives and the varying levels of basic security benefits between EU states.

¹ The Gini coefficient is a measure of inequality in disposable income with a scale from 0 (maximal equality) to 100 (maximum inequality). The S80/S20 income quintile share ratio considers the edges of the distribution. Here the income limits of two deciles (8:2 ratio) are set in relation to each other. The value indicates how much higher the income in the upper decile group is than in the lower group (Spannagel and Molitor 2019).

² Other income inequality measures, such as the Palma and Theil indices, showed larger variations, but approximated their long-term averages between 2005 and 2013 (Spannagel and Molitor 2019).

³ In 2015, 2.1 million people immigrated to Germany (Federal Office for Migration and Refugees 2016a). Consequently, the net immigration was at a record height of about 1.14 million net-migrants.

⁴ The *International Standard Classification of Education* was introduced by the UNESCO to ease the comparison of educational achievements between different countries. ISCED11-A segments education into 10 levels, split into two categories: attainment (A) for individuals that graduated in that segment, and a category program (P) for those who attended educational classes in that segment (UNESCO-UIS 2011). Education is classified by attainment in this article.

These circumstances call for an extensive examination of the potential economic effects of low-skilled immigration in host countries, especially as the German population's greatest concern—income inequality (unemployment)—and immigration may possibly be linked to each other. In fact, there is a wealth of literature that connects immigration to economic effects in host countries, including changes in fiscal sustainability, economic growth, and changes in labor supply (Bahnsen et al. 2016a; Barone and Mocetti 2011; Borjas 2003, 2013; Ceritoglu et al. 2017; Cortés and Tessada 2011; Davies and Wooton 1992; Dustmann et al. 2013, 2017; Giulietti et al. 2013; Guzi et al. 2014, 2018; Kahanec and Guzi 2017; Kemnitz 2001; Manthei and Raffelhüschen 2018; Peri 2016; Piras 2011; Ruist 2015).

Furthermore, in light of recent developments, it seems even more important to disclose these connections. While populists have taken advantage of the public anxiety toward income inequality in the past decades, the considerable rise in immigration numbers has led to recent popularity gains of far-right populist parties all over Europe (Otto and Steinhardt 2017; Steinmayr 2017). To preserve liberal values and democratic achievements in this challenging political environment, European governments need to find comprehensive solutions to these two interconnected problems—refugee immigration and income inequality.

This article aims to provide insights into the relationship between low-skilled immigration, especially recent refugee immigration, and the income and wealth inequality in host countries using a two-step approach. First, an overview of the existing literature is given, and the various economic effects of immigration on a host country are presented and discussed. Next, by theoretically analyzing these effects and applying a classic production model to Germany's refugee immigration in 2015 and 2016, with a heterogeneous factor of labor, the potential winners and losers of such uncontrolled immigration movements are identified. Finally, the study explores how (existing) gaps in income and wealth distribution could widen and what its implications are for public policy.

The remainder of this article proceeds as follows. It first analyzes and classifies the extensive literature on the linkage between low-skilled migration and economic developments in host countries. It then presents a theoretical framework that covers the possible implications of refugee immigration. In the following section the effects of low-skilled immigration are illustrated by applying the model to the immigration case of Germany in 2015 and 2016. The last section presents the conclusions and discusses the possible implications of the article for policy makers and researchers.

Literature Review

The multitude of literature on the economic effects of immigration not only confirms their presence, but also highlights their complexity. The direction of the effects, however, is not always clear. While the majority of studies address the implications of migration for the economy, research into the reverse is scant. Some studies have analyzed why migrants leave their homeland (Haas 2007; Haug 2008; Klingholz and Sievert 2014), while others have focused on factors promoting immigration into certain countries (Zimmermann 1996; McKinnish 2005; De Giorgi and Pellizzari 2006; Giulietti and Wahba 2012; Giulietti et al. 2013), specifically social benefits (Giulietti et al. 2013) and wage differences between the countries of origin and host countries (Zimmermann 1996).

Broadly, most studies examining the effects of immigration on the economy (or related topics) focus on its fiscal effects or its impact on economic growth, which can be categorized as overall economic effects. This category includes studies by scholars such as Hansen et al. (2017) and Manthei and Raffelhüschen (2018), who find that immigrants from outside Europe are more likely to pose a burden for the host country's fiscal sustainability and result in intergenerational inequality. It also includes studies that find that immigration can provide absolute growth, but rarely causes growth per capita (Kemnitz 2001; Felbermayr et al. 2010; Hentze and Kolev 2016) and hence negatively impacts nationals.

However, as the majority of studies on economic effects primarily focus on how immigration influences the overall economy, they do not consider immigration-induced impacts on different levels of income or wealth. Thus, the economic effects of immigration on labor supply and/or wages form the second main category of migration-induced economic effects: labor market effects. Immigration can result in many possible effects on the labor

market, both positive and negative. These effects cannot be evaluated by examining income inequality alone; in fact, other labor market effects may possibly outweigh the income effects.

One way in which immigration can positively affect the labor market is through the supply of certain skills that are needed in host countries or in specific sectors within them. On average, for example, migrants are more responsive to labor shortages in certain areas or economic sectors (Guzi et al. 2018) and helping labor markets adjust during times of asymmetric economic shocks (Kahanec and Guzi 2017). However, their responsiveness can drop in countries with high immigration movement and extensive social benefits (Guzi et al. 2018). Therefore, their effect are not clear in countries with pronounced welfare states and are experiencing increased immigration, such as Germany. Further, with digitization and high-skills shortages (Anding 2018), it is questionable if low-skilled immigration actually relieves labor market shortages. An on-demand immigration policy that facilitates the movement of highly skilled labor may be a better choice (Manthei and Raffelhüschen 2018). Thus, whether refugee migration has an overall positive or negative effect on labor demand depends on the migration structure and the shape of the labor market in the host country.

Refugee immigrants rely on a well-functioning integration program to find jobs that match their qualifications and thus increase the labor supply. However, designing such a program is a challenge, and immigrants (especially those with little education) often encounter discrimination in their host countries, making successful integration difficult (Constant et al. 2009). Further, the perception of refugee immigrants depends on their characteristics as von Hermanni and Neumann (2019) find. Their findings suggest that physically and politically persecuted refugees experience a higher acceptance among the local population, while other groups could be received as threats by the locals. This underlines the importance of political efforts and their challenges in equal measure. Thus, refugee immigrants might be unable to utilize their qualifications, which in turn would negatively affect their average (available) employability. This situation adds to doubts about whether refugee immigrants can satisfy current or future labor demands.

A widely recognized pitfall of immigration is the negative effect on the wages of the host country's natives. For instance, Borjas (2003) and Dustmann et al. (2013) present evidence of how certain types of immigration affect the wages of competing native workers. While natives with low incomes are negatively affected, those in the middle- and high-income groups are positively affected, which deepens the inequality between different income and/or education groups (Dustmann et al. 2013). In contrast, other studies (Card 2012; Manacorda et al. 2012; Ottaviano and Peri 2008) find that immigration has little to no impact on the wages of nationals. Experts in the US labor market explain that immigrants are imperfect substitutes for native workers and therefore not in direct competition (Ottaviano and Peri 2008). Thus, in general, the actual wage effect of immigration strongly depends on the degree of substitutability between immigrants and nationals.

The wage effects of refugee immigration, in particular, are not well researched or tend to be retrospectively looked at. For instance, Card (1990) analyzed the wage impact of the Marielitos, the Cuban refugees who immigrated to Florida in 1980, and reported no negative wage or employment effects. Friedberg (2001), too, did not find evidence for any adverse impact of Soviet Union émigrés on the Israeli labor market in the early 1990s.

However, contradictory results have been reported for these refugee movements. For instance, Borjas (2017) found that the labor supply shock resulting from the movement of mostly low-qualified Marielitos led to a decrease in the wages of other low-skilled workers in Florida. Similar results were found for the Jewish émigrés from the Soviet Union and the refugee immigration into European countries from the former Yugoslavia after 1991 (Borjas and Monras 2017). These exogenous supply shocks adversely affected the respective labor market opportunities of competing natives. Further, in the case of repatriation of French nationals from Algeria in 1962, Hunt (1992) found that the exogenous labor market shock resulted in an average annual salary decrease of at most 1.4%. Overall, these studies indicate the plausibility of the effects of refugee immigration on the wage levels in the host country.

Further evidence is provided by studies analyzing the effects of migration on income inequality between men and women. These studies suggest that low-skilled migration could reduce gender pay gaps, as it might have positive effects on income equality between sexes (Barone and Mocetti 2011; Cortés and Tessada 2011). These

findings provide evidence for the linkage between low-skilled immigration and the labor supply (and, subsequently, labor income) of high-skilled women. However, as these labor-supply gains of high-skilled women are attributed to lower wages for low-qualified workers (Cortés and Tessada 2011), it appears possible that low-qualified immigration might still reinforce income inequality across skill and/or income levels in the host country.

In summary, the current state of research indicates that refugee immigration might have a two-fold impact on a host country's economy. On the one hand, it affects the economy as a whole. Here, the vast majority of the literature shows that locals are not likely to benefit from low-skilled immigration. On the other hand, it affects the labor market, though the respective literature is not as clear on whether the overall labor-market effects of refugee and/or low-skilled immigration are positive or negative. However, as far as income inequality is concerned, studies suggest that low-skilled immigration tends to increase income differences between skill groups. Nonetheless, given the lack of definite conclusions, specifically with regard to refugee immigration, further research on the connection between refugee immigration and income inequality is warranted.⁵

The Model

Evaluation of the Theoretical Framework

The theoretical framework of this article is based on an augmented Cobb-Douglas production function. Originally, the model was presented by Chiswick (1982), who differentiates between two types of labor, and later simplified by Steinhardt (2006). In this work, the production factor of labor is divided into three groups: a less qualified (N), a moderately qualified (M), and a highly qualified (H). Thus, the specific effects of various kinds of immigration on the incomes of different groups can be compared. Further, the development of the wage proportions of these groups over time allow an analysis of their effects on the inequality of labor income.

Assuming perfect competition, constant return to scales, and full employment, the output (Y) is given by⁶

$$Y = K^\alpha \cdot N^\beta \cdot M^\gamma \cdot H^v, \quad (1)$$

where $\alpha + \beta + \gamma + v = 1$ and $\alpha, \beta, \gamma, v > 0$.

The factor prices are equal to the marginal products of the respective factors. The price of capital (K) is the interest rate (r)

$$r = \frac{\partial Y}{\partial K} = \alpha \cdot \frac{Y}{K}. \quad (2)$$

The price of the less qualified labor type (wage: w_N) is derived by

$$w_N = \frac{\partial Y}{\partial N} = \beta \cdot \left(\frac{K^\alpha}{N^\alpha}\right) \cdot \left(\frac{M^\gamma}{N^\gamma}\right) \cdot \left(\frac{H^v}{N^v}\right). \quad (3)$$

The first fraction can be described as a conditional capital-labor ratio for the less qualified labor type. The other two fractions are the ratios of moderately and highly qualified labor to the less qualified labor type.

Accordingly, the wage of the medium-qualified labor type (w_M) is

$$w_M = \frac{\partial Y}{\partial M} = \gamma \cdot \left(\frac{K^\alpha}{M^\alpha}\right) \cdot \left(\frac{N^\beta}{M^\beta}\right) \cdot \left(\frac{H^v}{M^v}\right), \quad (4)$$

⁵ The causality between the two, specifically that refugee immigration affects income inequality, should be clear. There are no convincing theoretical arguments for why income inequality in the host country could attract more refugees, nor can statistical arguments be found. In fact, a Granger causality test on time series of the Gini coefficient and the yearly asylum applications in Germany did not show any causality in this direction in any of the specifications tested.

⁶ Although different points of time are compared in the further course of the paper, the representation of a time index (t) is omitted for reasons of simplification.

And the wage of the high-qualified labor type (w_H) is

$$w_H = \frac{\partial Y}{\partial H} = v \cdot \left(\frac{K^\alpha}{H^\alpha}\right) \cdot \left(\frac{N^\beta}{H^\beta}\right) \cdot \left(\frac{M^\gamma}{H^\gamma}\right), \quad (5)$$

To compare the three wages, the ratios of the different wage types (w_N/w_M , w_M/w_H , and w_N/w_H) are calculated. With these tools, the expected effects of certain immigration flows on overall and specific incomes can be estimated.

Theoretical Implications

If less qualified migrants enter the country and the labor market, the supply of less qualified labor increases. *Ceteris paribus*, the economy's total output grows, as indicated in Equation (1). Equation (2) suggests that this growth in output may result in increased interest rates, or in other words, an increasing factor price of capital.

In addition to these effects on output and the price of capital, the increase in the less qualified labor force will lower this group's wages (w_N) as the denominators of all three fractions in Equation (3) increase. However, the wages of the moderately and highly qualified groups increase as the second fractions of Equation (4) and (5) grow. Thus, the relation between the less qualified group's wages and the other two groups' wages decreases, and inequality grows.

Interestingly, the immigration of a moderately qualified labor force has a different impact on wages. Higher numbers of medium-skilled workers will result in a decrease in their average wages (w_M) because all fractions of Equation (4) will be lower than before. However, the effect on the wages of the low-skilled (and high-skilled) workers is diametrically opposite. Their wages grow because of the increase of the second (third) fraction of equation (3) ([4]). Consequently, the gap between the wages of the less qualified and the moderately qualified groups is reduced, whereas the gap between the moderately and highly qualified groups widens. The effect on the output and the price of capital is the same as for low-skilled immigration.

Finally, the immigration of a high-skilled labor force results in a *ceteris paribus* decrease of w_H , while w_N and w_M increase. As with other cases of immigration, the output and the price of capital increase. In terms of wage effects, inequality of income declines as the gaps between the highly qualified group on the one hand and the less and moderately qualified groups on the other hand shrink.

In summary, an increase in any factor of labor results in higher output and interest rates, regardless of the qualification endowment. Thus, according to this model, individuals with significant amounts of capital—the wealthy—benefit from any kind of immigration. The effects on the factor prices of all three kinds of labor, which depend on the type of immigrants, are entirely different. The immigrants' complementary groups benefit from rising wages, whereas the substitute group loses because of falling wages. Furthermore, high-skilled migration could lower income gaps and decrease inequality, whereas low-skilled immigration could increase inequality in income.

Limitations

It is important to acknowledge that such a model has limitations, which in turn restrict the conclusions that can be drawn about refugee immigration. For example, the existence of wage rigidities such as minimum wages can mitigate the effects of low-skilled immigration on wages, as wages cannot fall beyond a certain threshold. However, in settings with minimum wages, the consequence for low-skilled nationals (and immigrants) would be unemployment (Eichhorst et al. 2011), which would affect their average economic situation in a similar manner.

The assumption of inflexible capital is another limitation of the model. A fixed capital over time implies that refugees do not bring capital with them when entering the country. However, given that refugees on average

pay 7,100 Euros per person to flee to Germany (Federal Office for Migration and Refugees 2016c), which is possibly their entire mobile capital, this assumption seems more realistic. Nonetheless, the inflexible capital factor appears unlikely. In the long run, a higher price for capital and a higher capital-labor ratio would, following the macroeconomic theory, lead to an inflow of capital from abroad and thus reduce the refugees' effects on capital. However, even if capital inflows occur, the model is valid because Equations (3) to (5) show that increasing the capital stock mainly affects the levels of wages, affecting their proportions to a lesser degree.

A third limitation is the degree of substitutability between immigrants and nationals. This article assumes that nationals and foreign nationals with the same levels of qualification are perfect substitutes. While this may not always be the case, this notion does not pose a serious problem to the validity of the approach because, unlike studies by Card (2012) and Manacorda et. al. (2012), this article does not distinguish between nationals and foreigners after immigration—only between different income and qualification groups. Thus, even if the new immigrants form a separate income group below type N , the gap between the highest and the lowest income groups in the country is likely to widen further, regardless of their place of origin. In other words, policy makers striving to reduce income inequality and promote social harmony cannot rely on passports as a criterion for decision-making.

Aside from methodological limitations, one other inaccuracy has to be kept in mind. As refugees with subsidiary protection are meant to leave their host countries when the situation in their home countries improves, their long-term economic impacts could be less significant. However, under the current laws, many refugees can be granted a right of residence after three to five years. A new law, recently passed in the Bundesrat, underpins this assumption (*Gesetz über Duldung bei Ausbildung und Beschäftigung* [Bundesrat 2019]). As a result, it is highly possible that a large proportion of refugees will have the opportunity to stay in Germany for the long term. Furthermore, given the double-aging process,⁷ the on-average younger, more fertile refugees may bring a solution, or at least some relief, to the challenges that an aging society inevitably faces. As a result, the granting of permanent rights of residence may be politically driven, and this limitation is not entirely applicable.

Germany's Refugee Immigration Situation in 2015 and 2016

Data and Assumptions

To apply the model to Germany's refugee immigration in 2015 and 2016, 2014 serves as a reference year. The projection period in this article lasts from 2014 to 2023; thus, a full decade is simulated. At the end of 2014, the total labor force of Germany consisted of about 46.8 million people (Federal Statistical Office of Germany 2018). For the purpose of analysis, the labor force has been divided according to ISCED11-A-qualifications. Individuals with only basic education (ISCED11-A level of one or lower) are classified as low-skilled workers. Those with ISCED11-A levels two to five are categorized as moderately qualified, and individuals with a bachelor's degree or higher (ISCED11-A six) are considered highly qualified. According to this classification, 12% of the workforce (the people between 25 and 65 years of age) belonged to the less-skilled group, 61% were moderately skilled, and 27% were highly skilled (OECD 2013). In terms of absolute numbers, N accounts for 5.6 million people, M for 28.5 million, and H for 12.6 million. The gross stock of fixed assets at current replacement prices is used to represent the capital stock (K). At the end of 2014, K totaled about 16.8 trillion Euros (Federal Statistical Office of Germany 2018). The exponentials for the model have been derived from the wage income component of the gross domestic product (GDP) because, under the standard assumptions of neoclassical theory, the exponents correspond to the respective proportions of production factors in GDP (van Suntum and Schultewolter 2016). In 2014, the total wage income in Germany was 1.5 trillion euros, which accounted for 50.5% of the 2014 GDP of about 2.9 trillion Euros (Federal Statistical Office of Germany 2018). Thus, $\beta + \gamma + v = 0.505$, and, consequently, $\alpha = 0.495$. Given that individuals with ISCED11-A levels six to eight, on average, have an income 47.5% higher than that of people with ISCED11-A levels two to five, and that every person below ISCED11-A two earns 15.6% less (KfW Bankengruppe 2012), the variables β , γ , and v can be estimated from the sizes of the workforce groups and the total wage income. The results are $\beta = 0.041$, $\gamma = 0.281$, and $v = 0.183$.

⁷ Low birth rates and continuously rising life expectancy will likely increase the average age in Germany significantly over the next 40 years (Bahnsen et al. 2016b).

To analyze the effects of Germany's refugee immigration in 2015 and 2016, only this kind of immigration has been considered while all other types of immigration, the total emigration movements, and future migration have been hypothetically assumed to be zero. This allows for a *ceteris paribus* analysis between a reference period 2014/2015 and the other years of the projection.⁸

The total number of refugee immigrants in 2015 (0.89 million people [Federal Ministry of the Interior 2016]) and 2016 (0.28 million people [Federal Ministry of the Interior 2017])⁹ has been categorized into three qualification groups on the basis of data obtained from the German Institute of Economic Research (2017) on the 2016 refugees. According to the data, about 25% of the refugees belong to the less qualified group, 57% are moderately qualified, and 17% can be considered highly qualified.

The process of attaining refugee status in Germany takes some time, as immigrants orient themselves and try to learn the native language. Hence, their entry into the labor market does not occur immediately after their arrival in the host country, irrespective of their education levels. Thus, the immigrants are expected to have a logarithmic labor market integration that takes up to six years.¹⁰ Essentially, all the immigrants of 2015 and 2016 are likely to be fully integrated into the labor market in the seventh year after their arrival (2021/2022), although the majority may be fully integrated much sooner.¹¹ However, about 39% of asylum applicants in Germany in 2015 and 2016 were likely not fleeing war and could be received as threats by the local population.¹² This could hamper their integration (von Hermanni and Neumann 2019), which marks this assumption as optimistic. If one follows Laubenthal (2019), who sees a transformation of Germany into an immigration country between 2013 and 2017, the integration assumption made should nevertheless be appropriate.

As in the theoretical model, full employment is assumed, as a rise in labor supply will most likely affect the price of labor regardless of whether all migrants are employed. If one assumes that wages depend only on the number of employed workers and not on the total labor supply, a qualification-independent employment quota would only lead to a slight weakening of the effects.¹³ The conclusions from the results would remain the same.

Results

Table 1 shows the net effects of refugee immigration in Germany, obtained by substituting all values into Equation (1) to (5), normalized to the reference period 2014/2015.¹⁴ A comparison of results from the reference-period with those for 2023, which is the last year of the projection, offers insights into the output and the price of capital, as discussed in the third section. Refugee immigration, *ceteris paribus*, increases the overall output of the economy ($Y = +1.15\%$) and, subsequently, the interest rate ($r = +1.15\%$). Thus, people with a (high) capital endowment seem to profit from this type of refugee immigration.

⁸ For modeling purposes, it is assumed that immigration always occurs at the end of a year. Therefore, the results for 2014 and 2015 are the same and can be combined as a reference period.

⁹ The term *refugee* is only partially applicable here, because, according to German asylum law, only immigrants who enter the EU for the first time when entering Germany are defined as refugees. All other immigrants with the intention to apply for asylum fall into the category of *tolerated immigrants*. However, the term refugee is often used as a synonym for asylum applicants in public discussions.

¹⁰ A logarithmic six-year integration process was chosen in line with the arguments of Manthei and Raffelhüschen (2018). A logarithmic trend implies that the majority enter the labor market more quickly than under a linear integration process.

¹¹ A detailed evaluation of underage refugee immigrants, which may imply extended integration time, was omitted for reasons of simplification.

¹² A total of 61% of asylum applicants in Germany in 2015 and 2016 had Syrian, Afghan or Iraqi citizenship (Federal Office for Migration and Refugees 2017b).

¹³ There is currently no long-term data of qualification-dependent employment rates for refugees in Germany.

¹⁴ A normalization to the reference period 2014/2015 was chosen as the actual sizes of the results are not of much interest: the model does not include a total factor productivity variable, which could scale the results to real-world GDP. In a *ceteris paribus* analysis, the changes relative to the reference period are the most interesting.

Table 1 Overview of Normalized Results

	2014/2015	2016	2017	2018	2019	2020	2021	2022	2023
Y, r	100.00	100.31	100.59	100.78	100.92	101.03	101.13	101.15	101.15
w_N	100.00	98.92	97.97	97.35	96.89	96.52	96.21	96.14	96.14
w_M	100.00	99.68	99.40	99.21	99.07	98.96	98.86	98.84	98.84
w_H	100.00	99.89	99.79	99.72	99.67	99.62	99.59	99.58	99.58
w_N/w_M	100.00	99.23	98.56	98.12	97.80	97.54	97.32	97.27	97.27
w_M/w_H	100.00	99.79	99.61	99.49	99.40	99.33	99.27	99.26	99.26
w_N/w_H	100.00	99.03	98.18	97.62	97.21	96.88	96.61	96.55	96.55

Note: The results are normalized to the reference period 2014/2015. Y and r grow at the same rate due to the design of equations 1 and 2.

Contrary to trends in the price of capital and overall output, the wages of all three workforce groups decline between 2014/2015 and 2023 (Fig. 1). Although the effects on the three different wages follow the same trend, the magnitudes are not identical. Because the share of refugee immigrants with ISCED11-A level two or lower is twice that of nationals with the same qualifications (25% vs. 12%), the wage-sinking effect is strongest for this workforce group. Over the complete projection time, w_N sinks by a total of 3.86%. These results of adverse wage effects mostly align with the findings of, for example, Borjas (2003) and Dustmann et al. (2013). However, the share of the other two groups in the total workforce decrease; thus, the negative effect on these wages ($w_M = -1.16\%$; $w_H = -0.42\%$) must result from the decreasing capital-labor ratio. This result is not in line with, for example, the results of Dustmann et al. (2013), who found positive wage effects for income groups with relatively less immigration. One explanation for this could be the different assumptions on capital mobility, although Dustmann et al. (2013) describe this effect as marginal. Their assumption is that immigrants earn wages below their marginal product (Dustmann et al. 2013).

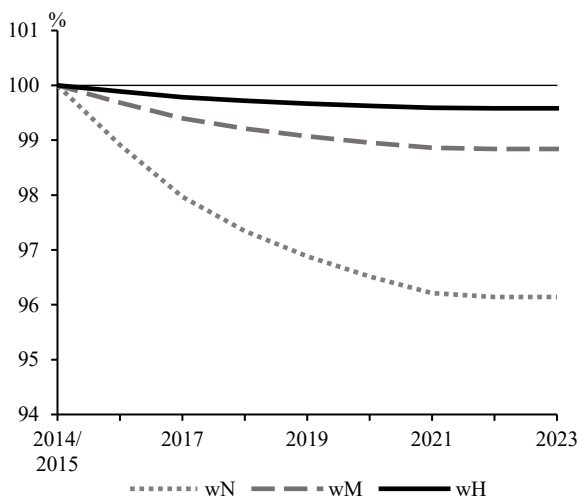


Fig. 1 Normalized Wage Development

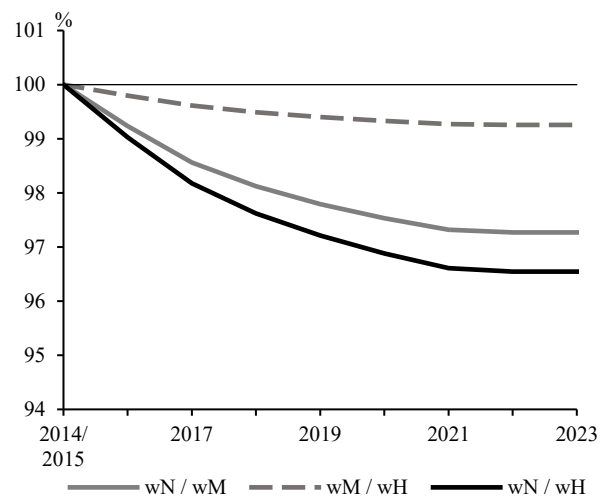


Fig. 2 Normalized Relative Wage Development

Note: The results in Figures 1 and 2 are normalized to the reference period 2014/2015. The y-axis starts at 94% to illustrate the results.

The relative wage developments of the three qualification groups are depicted in Fig. 2. All three relative wages decrease over time. A wage decrease of 0.74% among the moderately qualified workers, relative to that of the highly qualified workers (w_M/w_H), denotes the smallest effect of the analyzed immigration. A clearly stronger effect can be observed for w_N/w_M , which shrinks by 2.73%. The most significant effect of refugee immigration is on w_N/w_H which decreases by 3.45%.¹⁵

These results support the theoretical analysis in the third section. They imply that refugee immigration widens the gaps between the different workforce groups, mostly affecting the economically weak—the less qualified (and, consequently, low-income) type. Further, given that people with high qualifications and/or income are more likely to have significant savings, high interest rates may offset their labor-income losses. Therefore, the negative effects of refugee migration may be largely borne by the middle- and low-income groups, with the latter suffering the most. Thus, refugee migration would worsen the existing levels of income inequality in Germany. These findings show some parallels to, for example, those of Borjas (2017) about the Marielitos arriving in Florida in 1980. However, Borjas' approach was an ex post empirical analysis, which makes a direct comparison difficult. Thus, additional (empirical) research is necessary for Germany's immigration situation in 2015 and 2016 once long-term data is available.

Conclusion

This case study provides valuable insights into the relationship between refugee (or low-skilled) immigration and income inequality. The extant literature on the topic is discussed and classified into two main categories. Subsequently, a classic production model with a heterogeneous labor factor is used for a theoretical analysis and then applied to the case of refugee immigration in 2015 and 2016 in Germany.

The literature analysis suggests that while refugee immigration may have beneficial macroeconomic effects, nationals might not necessarily benefit from it. Some studies show that in a country like Germany, which has a strong but unsustainable welfare system, immigration is a burden on fiscal sustainability. In terms of labor market effects, while immigration may broadly help buffer future labor shortages, it is doubtful if low-skilled immigration can mitigate the already apparent shortage of skilled workers. Moreover, the findings in the second section indicate that, irrespective of whether immigrants have skills similarly to equally qualified nationals (i.e., whether or not they are substitutes), they may affect wage levels in host countries adversely. Although the wage impacts of refugee immigration have not been studied extensively, the existing body of knowledge hints at some adverse impacts. Thus, overall, the literature seems to indicate that income inequality will increase rather than decrease when (refugee) immigration occurs.

These impacts of refugee immigration on the income of the low-skilled group are reiterated by the theoretical discussion and results of this article: the 2015 and 2016 refugee immigration in Germany could result in an almost 4% decline in this group's wages over time, while the wages of the other skill groups might remain less affected. The estimated relative decline in the wages of the low-skilled group would position them as the biggest losers of refugee immigration. These results suggest that a connection between refugee immigration and income inequality does indeed exist and that an inflow of (on average) low-qualified immigrants may widen existing gaps in income and wealth distribution. However, the limitations in the theoretical framework of this case study and the lack of literature on the specific effects of refugee immigration on income inequality highlight the need for extensive future research.

Nevertheless, the transferability of results to the international level should be possible if the qualification structure of refugee immigration is lower than that of the local population and if entry into the labor market can be achieved without major delays. In Germany, the Gini coefficient increased in the last three years from 29.5 in 2016 to 31.1 in 2018 (Eurostat 2020a), and the income quintile share ratio S80/S20 grew from 4.62 to 5.07 (Eurostat 2020b), thus, supporting this article's findings. However, without a detailed analysis, it is not clear whether refugee

¹⁵ This result remains valid despite the uncertainty about the actual length of stay of the subsidiary-protected refugees.

immigrants indeed contributed to this development, or whether other (nation-specific) factors might be responsible.

Given that recent political and economic trends indicate that low-skilled immigration is likely to continue and that many people in Western Europe are concerned about their income situations, the results of this work offer thought-provoking insights to the policy-makers in host countries. Efforts should be made to limit such movement as largely uncontrolled immigration cannot favor nationals. A possible solution for European countries could be to strictly apply the Dublin Regulation and introduce mandatory and/or permanent quotas for the relocation of asylum-seekers, which may then reduce false-incentive effects on refugees, which arise from different levels of basic security benefits in EU states.

However, with the double-aging process in most Western countries and consequently the unfulfilled needs of skilled workers, complete isolation may not be the best alternative for host countries. Rather, an on-demand immigration policy, which facilitates the immigration of highly skilled labor, could lead towards income equality in host countries.

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