International Migration to Germany:

A CGE-Analysis of Labour Market Impact[*]

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Abstract

Although it is widely accepted that additional migration is needed to mitigate ageing, among the present Member States of the European Union (EU) concerns are widespread that free movement of labour for the accession countries will result in falling wages and increasing unemployment. This paper analyses the impact of migration on factor income and employment on basis of a computable general equilibrium model. The analysis is undertaken with a dynamic multi-regional CGE model of Germany and the rest of EU15. This model, called LEAN (Welsch, 1996), allows to represent labour markets with various degrees of wage rigidities in an open-economy framework.

The focus is placed on different scenarios with regard to the scale of migration and the qualification of migrants. Simulation results are evaluated with respect to economic growth, employment, factor income, and the implicit distributive effects. The results show that even substantial levels of migration need not overstrain the adaptive capacity of the German labour market. A change of the structure of the qualification of migrants may pose more of a challenge. A higher share of highly qualified migrants could strain this relatively small labour market segment. A higher share of low-skilled workers could cause higher unemployment because this labour market segment is more rigid and additionally reduce the average productivity and GDP.

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1 Introduction

Populations age rapidly around the globe. This secular process of ageing is, at 1.3 births per woman, particularly emphasised in Germany and other countries of the European Union (EU). It is a consent in the literature that international migration can mitigate, but not solve the demographic problem in the receiving countries. According to a study of the United Nations, an average annual net immigration of 1.4 million people will be needed to keep the proportion of the working-age population in the European Union stable until 2050 (UN, 2000). This corresponds to an increase in the net annual inflow from 0.8 persons per thousand in western Europe between 1950 and 2000 to 3.7 per thousand over the next five decades. Although it is hardly realistic that immigration will accelerate to this level, migration can nevertheless contribute to mitigating the ageing process significantly. In the German case, the ratio of the population above 64 relative to those aged 16-64 will increase from 0.24 in 2000 to 0.65 in 2050 at a net migration of zero, to 0.53 at an annual net immigration of 200,000 persons, which corresponds to its historical level, and to 0.43 if annual net immigration increases to 400,000 persons.

Whether international migration will have an significant impact on the demographic structure is hard to assess. On the one hand, the income gap between the developed countries and their neighbouring regions will remain high for long time periods. This holds both for the US and Canada and their neighbours in middle and southern America, and the western European countries and their neighbours in northern Africa and eastern and south-eastern Europe. On the other hand, the propensity to migrate is likely to decline with the age of the populations in the sending countries. Since international migration involves substantial fixed costs, the net present value of migration declines with the age of the migrant. Indeed, the age of more than three quarters of immigrants in the European Union (EU) is below 30 and econometric studies show that the propensity to migrate declines with age (e.g. Fertig and Schmidt, 1999; Lundborg, 1991). Figure 1 shows the proportion of the 20-29 age cohort in the male population, i.e. those individuals, which have the highest propensity to migrate, for the EU-15 and a representative sample of source countries. In the latter, the share of this age cohort is expected to decline by around one-third until 2050. Thus, as a consequence of ageing in the sending countries, net migration will presumably decrease the longer the receiving countries wait to open their labour markets for immigration.

Against the background of ageing, the welfare states of the receiving countries can benefit from immigration. As an example, several studies find for Germany that these gains can be substantial in the long-run (Bonin *et al*., 2000; Bonin, 2001; Löffelholz and Köpp, 1998). Although migrants are more than proportional affected by unemployment and rely more than proportional on social assistance, they are net-contributors to pension schemes and reduce the per-capita tax burden for future generations. Moreover, receiving countries benefit from a 'brain gain', i.e. the human capital of immigrants, which has been financed by the sending countries. Altogether, there is a net benefit for the welfare state in the receiving countries from immigration, at least in case of countries with pay-as-you-go pension schemes.

Figure 1   **Share of the 20-29 age-cohort in total population, 2000-2050**
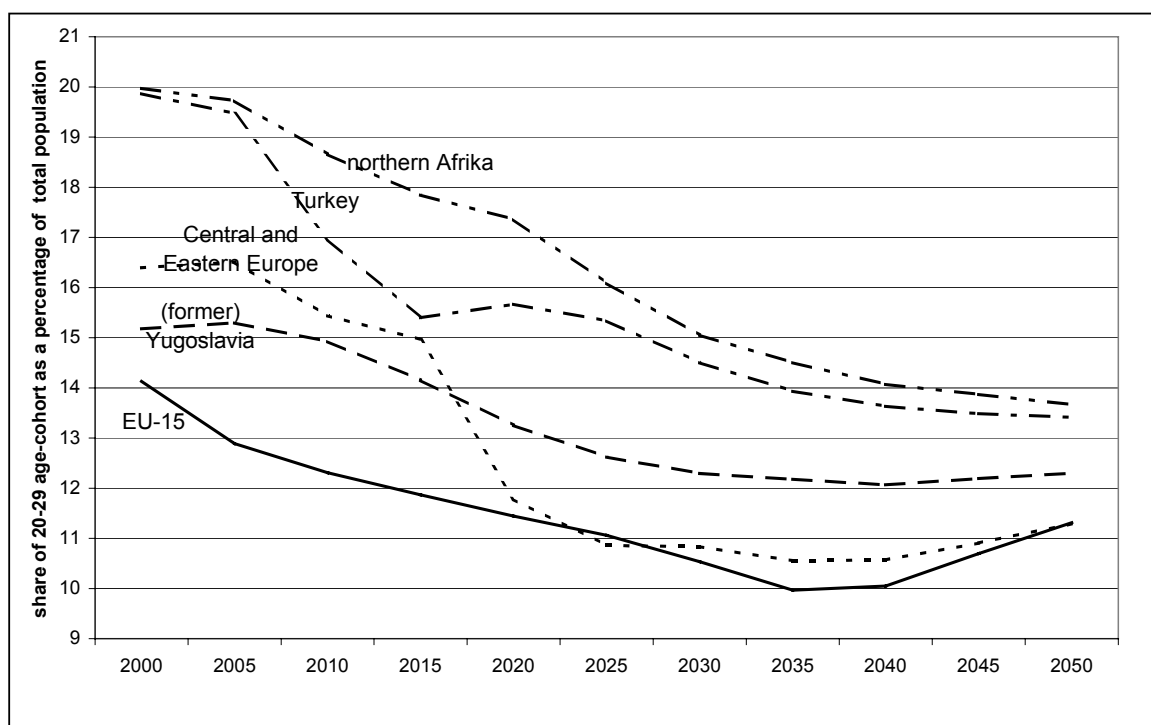
Sources: World Bank, World Development Indicators; calculations of the authors.

However, the main receiving countries in the EU are affected by relatively high unemployment rates at present. Widespread fears that immigration will increase unemployment and reduce wages have so far prevented that these countries open their labour markets for immigration. Even within the EU, where the free mobility of labour and other persons is acknowledged as one of the four fundamental freedoms of the Single Market since the Treaty of Rome, transitional periods

for free labour mobility have been agreed for the new Member States from Central and Eastern Europe. As a consequence of these restrictions, total immigration is relatively low in the EU and other developed countries at present. Given that the immigration potentials tend to decline against the background of the global ageing, these restrictive immigration policies can create substantial welfare losses in receiving countries.

In this paper, we address the question whether fears that immigration results in higher unemployment and lower income for natives are justified. More specifically, we calculate on basis of a computable general equilibrium (CGE) model the impact of a different scale of immigration and different skill structures of the migrant population on wages, other factor income and employment. At first glance, economic intuition suggests that an additional supply of labour reduces wages and increases capital income in the receiving country. Moreover, if wages do not adjust sufficiently, unemployment increases. However, open economies can adjust by changing their volume and structure of production and trade, such that a change in labour endowment has no impact on wages and other factor income. In the real world, the actual effects of a change in the labour supply depend both on the importance of tradable sectors for marginal labour demand and the flexibility of labour markets.

Against this background, our analysis is based on a dynamic CGE-model which allows for different degrees of wage flexibility. The model consists of 13 sectors and is based on an open-economy framework. Following the Armington (1969) assumption, foreign and domestic goods are imperfect substitutes in production and consumption. We include three types of labour, high-skilled, medium-skilled and low-skilled, which are imperfect substitutes in production. Wages are fixed in a bilateral bargaining-monopoly between trade unions and employers federations. They respond to a change in the (un-)employment rate, albeit incompletely.

Our analysis refers to the German economy. Note that Germany is, at a share of approximately 40%, by far the largest destination for immigrants in the EU. Moreover, it receives, at approximately 60%, the overwhelming share of migrants from the new EU Member States. We base the analysis on a number of migration scenarios. Our baseline scenario assumes that both the scale of migration and the skill structure of the migrant population remains constant. This corresponds to an annual net immigration of 200,000 persons p.a. to Germany. In several policy scenarios we analyse how a change in (i) the scale of migration and (ii) the skill structure of migrants affects wages and employment relative to the baseline scenario.

The remainder of the paper is structured as follows: Section 2 discusses the predictions of comparative-static and dynamic theories on the impact of migration on factor income and employment. Section 3 describes the CGE-model. Section 4 presents the results of the simulations. Finally, Section 6 concludes.

2 Theoretical considerations

Public concerns about labour migration refer usually on the most simple case of an otherwise isolated economy, where only one good is produced and labour supply of natives is inelastic. In this case, the labour market bears the whole burden of adjustment. Assume that the good is produced with capital, skilled and unskilled labour and that the production technology has constant returns to scale. Capital and both types of labour are complements, while high-skilled and low-skilled labour are imperfect substitutes. An additional supply of low-skilled labour will then reduce wages of low-skilled workers, raise the income of capital and expand production. The impact of migration on high-skilled labour is ambiguous: the fall in wages for low-skilled workers may lead to the substitution of high skilled workers by less skilled ones, while the scale effect increases the demand for high-skilled labour. The total effect on the income of natives is positive. The converse holds for the sending country: wages for low-skilled labour increase, income from capital falls and the total effect on the income of those left behind is negative. Thus, in the absence of remittances and other transfers, the receiving countries benefit from immigration while the sending countries loose. However, the inequality in the distribution of factor income increases in the receiving country, and is reduced in the sending country.

Adding dynamics to these comparative-static considerations does not change the overall picture: In simple neoclassic growth models both of the Solow (1956)-type with a constant saving rate, or of the Ramsey-Cass-Koopmans-type with an endogenous saving rate, a permanent inflow of labour reduces the per-capita endowment of capital and, hence, increases the marginal productivity of capital in the receiving country. In the steady state, the physical capital stock, output and consumption per capita of the *total* population falls in the receiving country as long as the endowment of migrants with physical and human capital is below that of natives. However, the capital stock, income and consumption per capita of the *native* population increases with the immigration of labour. The converse holds for the sending country.

The result that immigration increases the aggregate income of natives relies on the assumption that labour markets clear. This changes if we consider wage rigidities and unemployment. Assume that wages of manual workers are fixed above equilibrium levels by a bilateral bargaining monopoly of trade unions and employer federations and that wages for high-skilled workers are flexible. As a consequence, part of the unskilled labour force is unemployed and the wage for skilled labour is below its equilibrium level. The impact of migration on wages and employment depends then on the collective wage setting: in the most extreme case, wages do not respond to unemployment at all, such that an additional supply of unskilled labour through migration simply increases aggregate unemployment of unskilled workers and the aggregate welfare of natives falls. If wages adjust partially to the additional labour supply, the effect of the immigration of unskilled labour on the income of natives is ambiguous: production expands, the rate of return to capital increases, the wage for unskilled labour falls, and the unemployment rates increases. In contrast, the immigration of skilled labour reduces unemployment, and, hence, increases aggregate welfare of natives more than in case of flexible labour markets. However, the latter result depends on the assumption that wages for skilled labour are flexible. Altogether, the impact of migration on welfare in the receiving and sending countries in comparative-static and dynamic models depend highly on the assumptions on the wage-setting mechanism.

So far we have assumed that the economy is closed. In this case labour markets bear the whole brunt of adjustment. Immigration, however, does not necessarily affect wages and employment in case of an open economy. In the standard Heckscher-Ohlin-Samuelson (HOS) model, factor prices depend on the prices of traded goods, not on domestic factor endowments. An influx of labour is completely absorbed by decreasing imports of labour intensive goods, declining exports of capital intensive goods and by a shift in the output-mix towards labour-intensive goods (the so-called Rybczynski-effect). Thus, as long as immigration is not so large that the patterns of specialisation are changed, it does not affect relative wages and the distribution of income in either the receiving or the sending country.

If the standard assumptions of the HOS-model are relaxed, the picture may change: differences in the level of technology, complete specialisation in the production of different kind of goods, immobility of factors between sectors, and the existence of sectors which produce non-tradable goods can imply that trade may even complement migration (see Venables, 1999, and Trefler, 1997, for discussion). Moreover, if foreign and domestic goods are only imperfect substitutes in

consumption, trade can only to a limited extend mitigate the effects of changes in factor endowments. Nevertheless, models which ignore the integration of national economies in international markets may tend to exaggerate the impact of migration on labour markets.

Against this background, a realistic taxonomy of the impact of immigration on factor income and employment has to consider the following features of an economy: first, real wage-setting mechanisms do not allow that wages adjust completely to changing supply and demand conditions. Second, changes in the volume and structure of international trade and production can mitigate the impact of an increasing labour supply. Third, the existence of non-tradable sectors and the fact that foreign and domestic goods are imperfect substitutes in consumption limits to the role of trade in the adjustment process.

3 The model[1]

The model we employ for the further analysis divides the economy in thirteen sectors, which are linked to each other by input-output relations. The sectors include agriculture, energy, several manufacturing sectors, construction, transport, services and government. Trade with other countries is divided into trade with the EU and the rest of world (ROW). The EU is explicitly modelled as a region in the model. Trade with ROW is pooled. The model assumes that prices for goods imported from ROW in international currency are exogenous, i.e. that both Germany and the EU are too small to affect demand on the world market. The total volume of the ROW's imports is fixed; the volume of the exports of Germany and the EU to ROW however depend on their export prices, which equals marginal costs under the zero profit condition. The EU has a common currency. The exchange rate between the EU and the ROW is flexible and reacts to changes in the EU's balance of current account vis-à-vis ROW. The model takes account for the heterogeneity of commodities within one industry and, hence, allows for intra-industry trade. Following Armington (1969), the model assumes that foreign and domestic goods are imperfect substitutes in production and consumption. Thus the aggregate amount of each good is divided among imports and domestic production. For exports, there is a similar, but nested, structure: first, the world trade volume of each good is allocated to exports from ROW and exports from EU. The latter is then subdivided among German and EU exports. Altogether, modelling of the

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[1] See Welsch (1996) for a detailed description of the LEAN model.

trade relations in this way allows to analyse the effects of migration in an open economy framework.

The production function in all sectors is characterised by constant returns to scale. More specifically, we employ a nested production function with a constant elasticity of substitution (CES). Each step of the production function is characterised by different elasticities of substitution. The factor labour is divided into three skill levels: high, medium, and low. The category 'high-skilled' covers individuals with a university or applied university degree (Universitäts- and Fachhochschulabschluss), the category 'medium-skilled' individuals with a vocational training and/or higher schooling degree (abgeschlossene Berufsausbildung, Abitur, Fachabitur and Fachschulabschluss), and the category 'low-skilled' individuals without a vocational training or a higher schooling degree. Labour is mobile between the sectors of a region, but not between regions. As a consequence, the wage for each type of labour is identical in all sectors in each region of the model.

Wages and the demand for labour are determined sequentially. As an example, consider the following wage-setting mechanism.[2] In the first stage, wages are fixed by a bilateral bargaining monopoly between trade unions and employer federations. In the second stage, profit-maximising firms hire labour until the marginal product of labour equals the wage rate. The participants in the wage negotiations are aware of this. Given this wage-setting mechanism, wages are a function of the (un-)employment rate, labour productivity and consumption prices. They respond – albeit imperfectly -- to an increasing unemployment rate in the economy, and, hence, to an increasing labour supply. More specifically, we can write the wage function for labour of skill type i as

$$w_{it} = \pi \cdot w_{i,t-1} \left(\frac{L_i}{L_i^*} \right)^{\varepsilon_i} ,$$

where w_{it} is the wage rate in the current period, $w_{i,t-1}$ the wage rate of the previous period, L_i employment of workers of skill type i, L_i^* the ‚normal' level of employment, and π a factor, which is defined as 1 + the increase in consumption prices + the growth rate of labour

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[2] The argument elaborated here is consistent with different models of wage setting, i.e. models with a monopoly union or a bilateral bargaining monopoly (e.g. Layard et al., 1991), efficiency wage theories (e.g. Salop, 1979) or shirking models (e.g. Shapiro and Stiglitz, 1984).

productivity, and ε_i the elasticity of the wage rate with respect to the employment rate. The subscript t denotes the time period. The elasticity of the wage rate varies for different types of labour. We assume that that wages for the high-skilled respond stronger to changes in the employment rate than wage rates of the medium and the low skilled.

Investment in each sector is determined by inter-temporal cost minimisation. More specifically, investment is a function of the real rate of return on capital, expected prices for the variable factors of production, and expected demand. Expectations on prices are myopic, and expectations on demand are derived from an extrapolation of the development of output during the last two years. The capital stock is fixed in the short-run, i.e. decisions which have been made in the beginning of the period (year) cannot be revised within the period. Average cost curves have therefore a U-shape in the short-run. As a consequence, prices depend on the volume of production.

The household sector is modelled in form of a representative household in each region. The representative household is characterised by a linear expenditure system (LES). Consumption is divided for each group of commodities in two components: a minimum consumption, which is independent from prices, and the remaining consumption, which is a negative function of the price level. The state budget is a constant ratio of GDP and thus endogenous.

The real rate of return to capital is uniform in both regions, Germany and the rest of the EU. It is the ‚*closure*‘ variable of the model, i.e. it is implicitly derived from the consistency condition of the system. The uniform rate of return on capital is based on the implicit assumption that financial capital is completely mobile. As a result, physical capital is allocated to sectors and regions such that the expected rate of marginal net return is equalised.

Finally, the rate of labour-augmenting technological progress, and, hence, the long-run growth rate, is treated as exogenous. Thus, the model shares the basic assumptions of neoclassical growth models.

4   Simulation results

Table 1 gives an overview of the scenarios analysed. The baseline scenario assumes that both the scale of migration and the skill structure of the migrant population remain constant. This corresponds to an annual net immigration of 200,000 persons p.a. to Germany.

Two groups of policy scenarios can be distinguished: The policy scenarios 1, 2 and 3 all assume in accordance with the baseline scenario that migrants have the same qualification as the domestic population, but differ from the baseline scenario by the number of migrants in order to focus on the impact of the level of migration. In the case of the first policy scenario, the labour force in Germany shrinks by 6.5%, in the second scenario it remains constant and in the third scenario it grows by 6.5% compared to the base year within 15 years.

Table 1:   Baseline and policy scenarios

	Net immigration p.a.	Qualification of migrants
Reference Scenario	225.000	same as domestic population
Policy Scenario 1	Null	-
Policy Scenario 2	300,000	same as domestic population
Policy Scenario 3	600,000	same as domestic population
Policy Scenario 4	225,000	low
Policy Scenario 5	225,000	high

In the policy scenarios 4 and 5, the number of migrants is held constant, whereas different assumptions about their qualification are made in order to explore the importance of the qualification. *Scenario 4* (low qualification) assumes that 63% of the migrants are low-skilled (individuals without a vocational training or a higher schooling degree), 33% medium-skilled (vocational training and/or higher schooling degree) and 4% high-skilled (university or applied university degree). This corresponds to the qualification of foreign workers in Germany. In *scenario 5* only 15% of the migrants are low-skilled, 50% medium-skilled and 35% high skilled, reflecting a selective migration policy.

Table 2 reports the results of the simulation of scenario 1 which assumes zero net migration, implying that the labour force in Germany will contract by about 4.4% compared to the baseline within 15 years. The economy, however, shrinks to a lesser degree, reflecting the share of labour in GDP. The rate of unemployment declines for all qualifications, wages rise by almost 3%. Overall, in the model, a shrinking population does not cause any adjustment problems. This is mainly due to fact that LEAN does not model relevant feedbacks of the demographic structure on the economic system. For example, there is no distinction between labour force and resident

population. Therefore, the feedback of demographic changes on the German pay-as-you-go pension system and the social security contributions cannot be taken into account.

Table 2: Effects of migration: Scenario 1

Deviation compared to reference scenario in percent

	Year 1	Year 5	Year 10	Year 15
Employment				
low-skilled	-0.15	-0.74	-2.11	-3.90
medium-skilled	-0.15	-0.75	-2.13	-3.94
high-skilled	-0.17	-0.82	-2.32	-4.24
Unemployment				
low-skilled	-0.02	-0.11	-0.26	-0.44
medium-skilled	-0.03	-0.10	-0.25	-0.43
high-skilled	-0.01	-0.03	-0.08	-0.13
Wage rate				
low-skilled	0.00	0.91	1.67	2.99
medium-skilled	0.00	0.00	1.64	2.92
high-skilled	0.00	0.88	1.59	2.82
Labour force				
low-skilled	-0.17	-0.86	-2.40	-4.38
medium-skilled	-0.17	-0.87	-2.40	-4.38
high-skilled	-0.17	-0.87	-2.40	-4.38
GDP	0.00	-0.50	-1.45	-2.76
Consumption	0.00	-0.48	-1.40	-2.61
Investment	0.00	-0.30	-1.05	-1.98
Exports	0.00	-0.21	-0.56	-1.05
Imports	0.00	-0.11	-0.41	-0.76
Capital stock	0.00	-0.02	-0.12	-0.36
Exchange rate	0.00	-0.01	-0.04	-0.10
Real interest rate(%)	0.00	0.00	0.00	0.00
Scenario: zero net migration				

The net migration of 300,000 in scenario 2 (table 3) is somewhat higher than in the reference scenario resulting in a growth of the labour force by about 2.3% compared to the base run. Accordingly, the wages decline by 1.5 to 2.1%. Unemployment increases slightly by 0.2% for low- and medium-skilled workers and 0.06% for high-skilled labour. The differences between labour market segments is primarily due to the choice of elasticity parameters in the wage equation which has been set about four times higher for high-skilled than for other labour. This is

due to the fact that labour unions are less influential in sectors which employ a high share of high-skilled labour and that the wages of high-skilled labour are above the negotiated minimum in many cases anyway.

Table 3: Effects of migration: Scenario 2

Deviation compared to reference scenario in percent

	Year 1	Year 5	Year 10	Year 15
Employment				
low-skilled	0.05	0.26	1.48	2.03
medium-skilled	0.05	0.26	1.50	2.06
high-skilled	0.06	0.30	1.63	2.21
Unemployment				
low-skilled	0.01	0.03	0.18	0.21
medium-skilled	0.00	0.04	0.17	0.21
high-skilled	0.00	0.01	0.06	0.06
Wage rate				
low-skilled	-1.01	0.00	-0.83	-1.49
medium-skilled	0.00	-0.89	-0.82	-1.46
high-skilled	0.00	0.00	-1.59	-2.11
Labour force				
low-skilled	0.06	0.30	1.69	2.29
medium-skilled	0.06	0.30	1.69	2.29
high-skilled	0.06	0.30	1.69	2.28
GDP	0.00	0.17	1.00	1.42
Consumption	0.00	0.17	0.96	1.34
Investment	0.00	0.10	0.71	1.02
Exports	0.00	0.07	0.40	0.53
Imports	0.00	0.04	0.28	0.39
Capital stock	0.00	0.01	0.07	0.21
Exchange rate	0.00	0.00	0.02	0.06
Real interest rate(%)	0.00	0.00	0.00	0.00

Scenario: Net migration 300,000 persons p.a.; same qualification as domestic population

In the third scenario, net migration is twice that of the previous scenario. Within 15 years labour force will have by 9% compared to the baserun. The pattern of the induced changes are very similar to the previous scenario. Unemployment of highly qualified labour again increases by far then than for other labour with wage rates declining more for high-skilled labour.

Table 4: Effects of migration: Scenario 3

Deviation compared to reference scenario in percent

	Year 1	Year 5	Year 10	Year 15
Employment				
low-skilled	0.24	1.26	5.06	7.92
medium-skilled	0.25	1.27	5.12	8.01
high-skilled	0.27	1.42	5.57	8.66
Unemployment				
low-skilled	0.04	0.18	0.60	0.83
medium-skilled	0.04	0.18	0.59	0.81
high-skilled	0.01	0.06	0.19	0.25
Wage rate				
low-skilled	-1.01	-0.91	-3.33	-5.22
medium-skilled	0.00	-0.89	-3.28	-5.11
high-skilled	-0.99	-0.88	-3.97	-6.34
Labour force				
low-skilled	0.29	1.47	5.78	8.95
medium-skilled	0.29	1.47	5.78	8.95
high-skilled	0.29	1.47	5.78	8.95
GDP	0.00	0.84	3.38	5.44
Consumption	0.00	0.80	3.23	5.09
Investment	0.00	0.50	2.40	3.82
Exports	0.00	0.36	1.33	2.07
Imports	0.00	0.19	0.93	1.44
Capital stock	0.00	0.04	0.25	0.74
Exchange rate	0.00	0.01	0.08	0.20
Real interest rate(%)	0.00	0.00	0.00	0.00

Scenario: Net migration 600,000 persons p.a.; same qualification as domestic population

In order to illustrate the influence of elasticity of wage setting with respect to the rate of unemployment, table 5 reports the results of a sensitivity analysis. In this simulation, the elasticity of wage setting with respect to the rate of unemployment is multiplied by ten for low- and medium-skilled labour, by 2.5 for high-skilled labour. In this case, unemployment would hardly rise any more. Interestingly, this could be achieved without further cuts of the wage rate due to higher investment and GDP in this scenario.

Table 5: Effects of migration: Sensitivity analysis Scenario 3

Deviation compared to reference scenario in percent

	Year 1	Year 5	Year 10	Year 15
Employment				
low-skilled	0.29	1.44	5.70	8.83
medium-skilled	0.29	1.45	5.71	8.84
high-skilled	0.29	1.44	5.72	8.86
Unemployment				
low-skilled	0.00	0.02	0.07	0.10
medium-skilled	0.00	0.02	0.06	0.09
high-skilled	0.01	0.02	0.07	0.08
Wage rate				
low-skilled	0.00	-0.90	-3.33	-5.93
medium-skilled	0.00	-0.89	-3.25	-5.07
high-skilled	0.00	-0.88	-3.20	-5.67
Labour force				
low-skilled	0.29	1.47	5.78	8.95
medium-skilled	0.29	1.47	5.78	8.95
high-skilled	0.29	1.47	5.78	8.95
GDP	0.00	0.94	3.74	5.97
Consumption	0.00	0.91	3.58	5.60
Investment	0.00	0.56	2.66	4.21
Exports	0.00	0.41	1.47	2.26
Imports	0.00	0.21	1.02	1.57
Capital stock	0.00	0.04	0.28	0.83
Exchange rate	0.00	0.01	0.09	0.22
Real interest rate(%)	0.00	0.00	-0.01	0.00

Scenario: Net migration 300,000 persons p.a.; same qualification as domestic population

4.1 Impact of a change of qualification of migrants

The next two scenarios focus on the qualification of migrants and keep the total volume of migration at the same level as the reference scenario. In the reference scenario the assumption was made that migrants have the same qualification as the domestic labour force, i.e. the qualification of the total labour force will not be changed by migration.

With changes of the qualification structure a drop of wages is to be expected in those segments of the labour market where supply increases more than proportionately in order to absorb (part of) the additional supply. Furthermore, with sluggish wages unemployment is likely to increase.

Scenarios 4 and 5 (tables 6 and 7) confirm this pattern. The ease with which labour of one qualification can be substituted by another is represented by the elasticity of substitution. Empirical studies of these elasticities, however, are contradictory or inconclusive (cf. Ochsen, Welsch forthcoming). Therefore, these simulations are subject to substantial uncertainty.

Table 6: Effects of migration: Scenario 4

Deviation compared to reference scenario in percent

	Year 1	Year 5	Year 10	Year 15
Employment				
low-skilled	0.15	0.72	1.99	3.58
medium-skilled	-0.06	-0.31	-0.89	-1.64
high-skilled	-0.04	-0.34	-1.04	-1.95
Unemployment				
low-skilled	0.07	0.33	0.92	1.66
medium-skilled	-0.02	-0.10	-0.26	-0.47
high-skilled	-0.01	-0.03	-0.08	-0.15
Wage rate				
low-skilled	-1.01	-0.91	-4.17	-7.46
medium-skilled	0.00	0.00	1.64	2.19
high-skilled	0.00	0.88	1.59	2.82
Labour force				
low-skilled	0.23	1.11	3.06	5.58
medium-skilled	-0.08	-0.42	-1.17	-2.13
high-skilled	-0.04	-0.38	-1.13	-2.11
GDP	0.00	-0.07	-0.23	-0.47
Consumption	0.00	-0.06	-0.21	-0.41
Investment	0.00	-0.04	-0.16	-0.32
Exports	0.00	-0.03	-0.08	-0.16
Imports	0.00	-0.02	-0.08	-0.15
Capital stock	0.00	0.00	-0.02	-0.05
Exchange rate	0.00	0.00	-0.01	-0.02
Real interest rate(%)	0.00	0.00	0.00	0.00

Scenario: Net migration 225,000 persons p.a.; lower qualification than domestic population

There are two differences which are straightforward to interpret: Firstly, changes in the qualification have a substantial influence on GDP. The higher the qualification – i.e. the more human capital – the higher GDP will be. Secondly, if a given number von migrants is "swapped" from one qualification to another, this will affect the smaller market segment more than the larger

one. In general, the segment for highly qualified labour is relatively small and thus more sensitive to migration.

Table 7: Effects of migration: Scenario 5

Deviation compared to reference scenario in percent

	Year 1	Year 5	Year 10	Year 15
Employment				
low-skilled	-0.04	-0.21	-0.61	-1.14
medium-skilled	-0.02	-0.09	-0.25	-0.47
high-skilled	0.62	2.94	8.07	14.65
Unemployment				
low-skilled	-0.02	-0.16	-0.43	-0.77
medium-skilled	-0.02	-0.10	-0.28	-0.50
high-skilled	0.06	0.29	0.76	1.33
Wage rate				
low-skilled	0.00	0.91	2.50	3.73
medium-skilled	0.00	0.00	1.64	2.19
high-skilled	-1.98	-5.31	-13.49	-23.24
Labour force				
low-skilled	-0.07	-0.39	-1.09	-2.00
medium-skilled	-0.04	-0.20	-0.55	-1.00
high-skilled	0.69	3.26	8.95	16.29
GDP	0.00	0.16	0.40	0.67
Consumption	0.00	0.11	0.27	0.44
Investment	0.00	0.05	0.19	0.31
Exports	0.00	0.05	0.11	0.15
Imports	0.00	0.05	0.16	0.25
Capital stock	0.00	0.00	0.02	0.06
Exchange rate	0.00	0.00	0.01	0.02
Real interest rate(%)	0.00	0.00	0.00	0.00

Scenario: Net migration 225,000 persons p.a.; higher qualification than domestic population

5   Summary and conclusions

Demographic change is predicted to put a strain on the pay-as-you-go pension system in Germany in the decades to come. One way that has been proposed to alleviate this problem is immigration of younger people from other countries. Currently, however, this solution is

considered as problematic in light of the high unemployment in Germany. Often proponents of immigration stipulate that the benefits of migration are the larger the more qualified migrants are.

This paper focuses on the labour market impact of migration on the German economy, especially on labour markets taking into account the qualification of migrants. Theoretical analyses have shown that migration can affect wages and employment, but need not in an open-economy framework. However, since none of the highly stylised models in the theoretical literature represents real economies, the outcome of migration needs to be examined in an empirically founded model. In this paper several scenarios of migration with variations in the level and the qualification of migrants have been analysed with an applied general equilibrium model of the German economy. The results of the simulations suggest that even relatively high levels of migration need not overstrain the adaptive capacity of the German labour market. A change of the structure of the qualification of migrants may pose more of a challenge. A higher share of highly qualified migrants could strain this relatively small labour market segment. A higher share of low-skilled workers could cause higher unemployment because this labour market segment is more rigid and additionally reduce the average productivity and GDP. However, these results should be interpreted carefully. They rely on a number of important assumptions of the model and parameter values, which are empirically not sufficiently founded.

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