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TRADE AND QUALIFICATION

LINKING QUALIFICATION NEEDS TO GERMANY'S TRADE FLOWS

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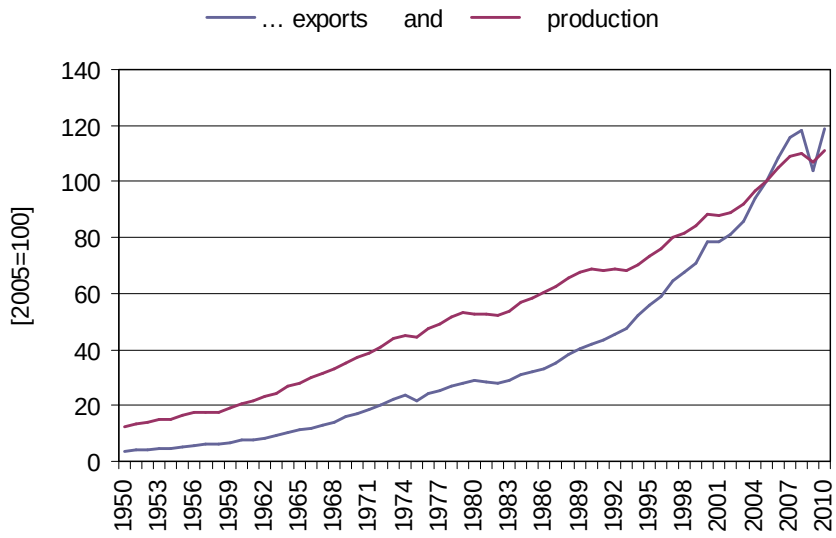
1 INTRODUCTION

Studies on foreign trade and its economic impacts are numerous. Since Ricardo (1817), it is standard economic thinking that international division of work is welfare enhancing even if a country shows comparative disadvantages in the production of all goods. Based on that, free trade has been seen as superior to protectionism although later studies e.g. Samuelson (2004) relativized Ricardo by showing constellations when international division of work can also lead to a permanent loss in welfare. Nevertheless, accompanied by the institutional setting of the General Agreement on Tariffs and Trade (GATT) in the wake of the Second World War, the world experienced a fast increase of total trade. Between 1950, two years after GATT came into force, and 2010, fifteen years after the set-up of the GATT's successor the World Trade Organization (WTO), world merchandise exports increased on average by 6% per year, while world merchandise production only increased by 3.7% p.a..[1]

Graph 1: World merchandise in …



Source: www.world.org

For Germany, the trade channel has become one of the major contributors to economic growth. In the last years, studies on foreign trade in Germany concentrated mostly on the analysis of the phenomenon of the "bazaar economy" that was firstly introduced to the German economy by Sinn in 2005 (Sinn 2005). Whereas some studies concentrated more on the international comparison of export-induced performances (Ahlert 2010, Brautzsch & Ludwig 2005), others tested the bazaar-hypothesis (Kfw 2004) or extended the analysis by its effect on the labour market (IMK 2008). All studies are based on the application of

[1] Data taken from the webpage of the World Trade Organisation – www.wto.org.

input-output tables as they differentiate between intermediate and final, direct and indirect as well as between domestic and imported goods and services.

Different to most other studies, Prognos (2011) has connected German exports to major trading partners of Germany and measured their direct and indirect impact on Germany's economic performance in terms of production and employment. This paper at hand aims to extent this analysis in two important fields.

1. First, this paper applies a dynamic econometric input-output-model which produces long-term projection and hence enables to look at future changes in trade structures and its effects on the local economy.
2. Second, this paper enhances the employment analysis by connecting employment by industries to occupational fields and qualification levels.

The rest of the paper is structured as follows: First, the methodology applied in this paper is introduced. Then, the structure of Germany's trading relations is identified. Following-up, the export-induced effects on production, employment, occupation and qualification are presented. The paper closes with a summary and implications of the results.

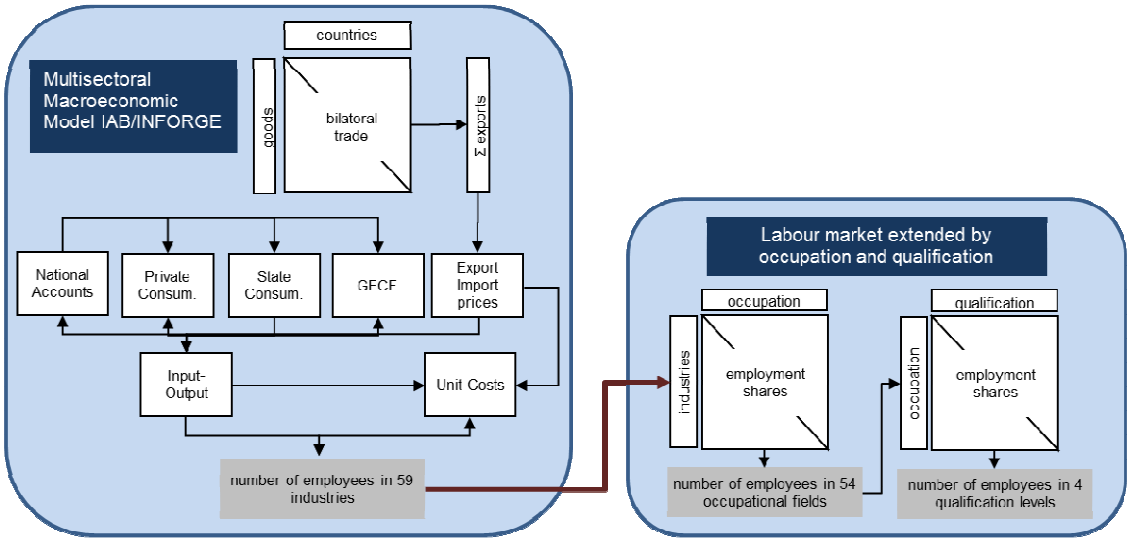
2 METHODOLOGY

2.1 THE MODELING FRAMEWORK

This paper uses a modeling approach that extends the dynamic macro-econometric input-output model INFORGE in two economic areas: First, German exports are linked to and determined by a trade module that explicitly considers bilateral trade by countries and by products. Second, the labour market is extended by a labour demand module that converts employment by economic industries to employment by occupational fields and qualification levels.[2] Figure 1 shows an overview of the modeling framework. The economic core of the model including the trade module is represented by the macroeconomic IAB/INFORGE model. Whereas the IAB/INFORGE model itself is basically constructed as a bottom-up model, the overall modeling framework follows a top-down approach with no feedbacks from employment by occupational fields and/or employment by qualification levels. In the subsequent sectors, the macroeconomic IAB/INFORGE model and its trade module are described in detail followed by the specification of the transformation of employment to occupational fields and qualification levels.

[2] Compare also www.qube-projekt.de.

Figure 1: Simplified Illustration of the Modeling Framework



2.1.1 THE MULTISECTORAL MACROECONOMIC MODEL IAB/INFORGE

The IAB/INFORGE-model has been developed by the Institute of Economic Structures Research (GWS) and has been tested in numerous applications in the field of research and policy analysis (Ulrich et al. 2012, Barker et al. 2011, Lindenberger 2010). The model belongs to the INFORUM family of modeling (Almon 1991) that rests on two basic fundamentals: bottom-up construction and total integration. The former indicates that each industrial sector is modeled individually and that macroeconomic variables are calculated through explicit aggregation. This approach ensures that each individual sector is embedded within the economic context and that industrial interdependencies are explicitly incorporated and used to explain economic interaction. The latter describes a complex and simultaneous solution which takes into consideration inter-industrial dependence as well as the distribution of income, the redistribution effects of the state and the usage of income for goods. Thus, the input-output tables are fully implemented in the national accounts (Ahlert et al. 2009, Distelkamp et al. 2003). Both datasets are specified for improving the identification for gross fixed capital formation, private consumption, state consumption and foreign trade. Labour market specifics are consistently embedded in the macroeconomic context through output and unit costs. Macroeconomic indicators are determined by aggregation of 59 industries.

INFORGE solves simultaneously, is dynamic over time and is described with non-linear functions. Its basic dataset consists of input-output-tables and national accounts. The applied model in this paper follows the school of evolutionary economics (Nelson & Winter 1982) as features like technological change, imperfect competition and interdependencies, or partially sticky prices are standard characteristics. In INFORGE, parameters and their elasticity values are estimated econometrically with given time series for a large number of variables.

An integral element of input-output-modeling is the determination of intermediate demand between industries. Input coefficients represent the relation of intermediate demand to total production. In IAB/INFORGE technological change is identified by applying variable

input coefficients. They are endogenously determined by relative prices and time trend. Using the Leontief-inverse $(I-A)^{-1}$ – with A as input coefficient matrix and I as identity matrix – and multiplying it with final demand (fd) gross production (y) by 59 industries is given. In the following equations the notations are as follows: lower case letters are vectors, upper case letters are either times series or matrices. The dimension of vectors and matrices are indicated with subscripts. The subscript t indicates time dependency.

[1] $$y_t = \left(I - A_t\right)^{-1} \cdot fd_t$$

In many macroeconomic models, private consumption is based on the almost ideal demand system (AIDS) approach (e.g. Kratena & Wüger 2006), which allows for the estimation of consumption structures according to utility maximization behaviour and consequently does build upon the assumption of a representative individual (Deaton & Muelbauer 1980). Different to this approach, INFORGE estimates consumption patterns by 41 purposes of use (c) as a function of real disposable income (Y/P) and relative prices (p/P). For some consumption purposes, trends (T) as proxy for long-term change in consumption behaviour or demographic indicators (DI) like households or different age groups is used as explanatory variable.

[2] $$c_{l,t} = c_{i,t}\left(Y_t / P_t, p_{l,t} / P_t, T_t, DI_t\right) \qquad l \in [1,...,41]$$

INFORGE differentiates between ten classifications of the functions of governments for modeling state expenditures as final consumption. 80% of total expenditures are due to four government functions alone: (i) public administration, (ii) education, (iii) health and (iv) social welfare. Driving forces for state consumption are disposable income of the government (YG), employment (E) as well as demographic change (B).

[3] $$g_{k,t} = g_{k,t}\left(YG_t, E_t, B_t\right) \qquad k \in [1,...,10]$$

Gross fixed capital formation is the result of separate modelling of production investment (including other investments in equipment) and building investment. Production investments (i) by 59 industries are determined by industrial production (y). In some industries time lags are explicitly considered.

[4] $$i_{i,t} = i_{i,t}\left(y_{i,t}, y_{i,t-1}\right) \qquad i \in [1,...,59]$$

Prices are estimated econometrically. Basic prices (p) which are decisive for entrepreneurs are the result of unit costs (uc) and mark-up pricing. The extent to which mark-up pricing can be realised depends on the market form prevailing in specific industrial sectors. In industries with monopolistic structures, mark-up pricing is easier to realise than in competitive industrial structures. Industries that are strong in exports also have to consider import prices (pim) as they are exposed to foreign competitors as well.

[5] $$p_{i,t} = p_{i,t}\left(uc_{i,t}, pim_{i,t}\right) \qquad i \in [1,...,59]$$

The labour demand function depends on the number of hours employees work (volume of work). This approach depends on two important observations: first, a volume-based approach to labour demand considers the growing importance of part-time employees; second, labour policy instruments such as short-time work can be explicitly addressed. Working hours (h) are determined by sector-specific production (y). In some industries real wages (ae/p) are also influential. Average earnings are determined by using a Phillips curve approach. Accordingly, average earnings by industry (ae) on the one hand depend on tariff wages (AE) (e.g. in machine construction) and on the other hand on sector-specific productivity (y/h). Finally, the number of employees (e) is derived by definition, dividing the number of working hours (h) by working time per year and head (hy). The latter is preset exogenously.

[6] $$e_{i,t} = h_{i,t} / hy_{i,t} \cdot 1000 \qquad i \in [1,...,59]$$

2.1.2 THE TRADE MODULE: DETERMINING EXPORTS

In INFORGE, exports are driven by world trade dynamics for German goods which are modelled in two dimensions: by goods and services and by export demanding countries. This allows accounting for diverging speeds in economic developments as well as for different demand structures by countries.

Starting point in INFORGE are the economic forecasts (gdpf) for 54 countries and two regions (OPEC and Rest of World) taken from the International Monetary Fund[3], the European Commission[4] and the International Energy Agency[5]. The import share (impq) is calculated for each country. The ratio is assumed to remain constant over time. The development of imports (impf) is specified by the economic growth path of each trading partner.

[7] $$impf_{cc,t} = impq_{cc,t} / 100 * gdpf_{cc,t} \qquad cc \in [1,...,56]$$

Bilateral trade matrices[6] (TRAD) for Germany are applied to determine the share of Germany in each country's import function (impqd). In the baseline scenario, these shares remain constant.

[8] $$impqd_{cc,t} = \sum_{g} \left(TRAD_{g,cc,t} \right) / 10000 / impf_{cc,t} \qquad cc \in [1,...,56], g \in [1,...,43]$$

[3] World Economic Outlook Database of the International Monetary Fund (IMF)

[4] Ameco Database of the European Commission (EC)

[5] World Energy Outlook of the International Energy Agency (IEA)

[6] Published by the Organization of Economic Cooperation and Development (OECD)

Total export demand for German products can be derived by multiplying the import shares (impqd) with the projected import demand (impf) of each economy. The total export demand is distributed to 43 categories of goods by using the export shares on total export demand taken from the bilateral trade matrices (TRADQ). In the baseline scenario, these shares remain constant as well.

[9] $$TRAD_{g,cc,t} = TRADQ_{g,cc,t} / 100 * \left(impqd_{cc,t} * impf_{cc,t} * 10000\right) \qquad cc \in [1,...,56],\ g \in [1,...,43]$$

The sum over all countries (exnsv) is than used to estimate German exports (x).

[10] $$exnsv_{g,t} = \sum_{cc} \left(TRAD_{g,cc,t}\right) / 1000000 \qquad cc \in [1,...,56],\ g \in [1,...,43]$$

[11] $$x_{j,t} = x_{j,t}\left(exnsv_{g,t}\right) \qquad cc \in [1,...,56],\ g \in [1,...,43]$$

2.1.3 Modeling Occupation and Qualification

On the occupational level the classifications of the BIBB occupational fields (Tiemann et al. 2009) are applied: they consist of 54 occupational fields which show comparable job characteristics and industry dominance when grouped at the level of occupational categories (3-digit codes from the official German classification of occupations 1992 (KldB 92)). On the qualification level a differentiation was made on four levels, in line with the ISCED classification. The data on occupational fields and qualifications is based on long time series from the micro census, which is a one per cent sample of the total population and which provides results for the entire range of employment (including the self-employed, assistants, civil servants and soldiers). However, only the respective structures (percentages) from the micro census are used for the final result, as the data on the employed from the IAB/INFORGE model which is taken as a starting point is based on the benchmark figures from the national accounts.

On the basis of data from the micro censuses from 1996 to 2008 it was ascertained how many people were employed in each occupational field in each industrial sector, and how many of those employed in each occupational field had which kind of qualification. This gives rise to shares which reflect the distribution of occupational fields in the economic sector for each year (share matrix P), and the configuration according to the highest qualification for each occupational field (share matrix Q).

To forecast the future labour demand, these shares are extrapolated in time as trends. The implicit assumption is that observable developments in the past can be transferred to the future. Variations from a long term monotone trend are considered as random. For each share $p_i(t)$ there will be a long term saturation level a*i which will be approached asymptotically by $p_i(t)$. However, it must be noted that (1.) a*i can only have a value between 0 and 1, and (2.) they must add up to 1 in every industrial sector or occupational field at all times. Thus, by taking the above restrictions into account, 54 trends are calculated for each of the 59 industrial sectors, and five trends for each of the 54 occupational fields.

After a series of analyses it was shown that logistic trend extrapolation delivered the most sustainable results for the problem area at hand:

[12] $$p_{ij,t} = \left(1 + exp\left(a_{ij} + b_{ij} * t\right)\right)^{-1} \Big/ \sum_{i=1}^{54} p_{ij,t}$$

Here p_{ij},t represents the share of labour in occupational field i (i = 1, ...,54) within industrial sector j (j = 1, ... , 59) at time t with a_{ij} and b_{ij} as the parameters to be estimated.

Accordingly, the formula for the qualification shares is as follows:

[13] $$q_{ki,t} = \left(1 + exp\left(a_{ki} + b_{ki} * t\right)\right)^{-1} \Big/ \sum_{k=1}^{5} q_{ki,t}$$

q_{ki},t represents the share of labour with qualification level k (k = 1, ... , 5) in occupational field i (i = 1, ...,54) at time t with a_{ki} and b_{ki} as the parameters to be estimated. With regard to logistic trend estimation it is assumed that the estimated shares asymptotically approach a saturation level. At the same time it is warranted that both conditions mentioned above are met by the selected estimation procedure.

2.2 Design of Analysis

The calculation of export-induced direct and indirect production and employment belongs to standard input-output-analysis (Holub & Schnabl 1994). Similar to equation [1], the determination of export-induced production (y^x) needs the Leontief-inverse $(I\text{-}A)^{-1}$ but instead of multiplying it with total final demand, only the export vector (x) of equation [11] is used.

[14] $$y_t^x = \left(I - A_t\right)^{-1} \cdot x_t$$

Export-induced employment (e^x) is retrieved by multiplying the employment coefficient (b) left-hand-sided with the Leontief-Inverse and the export vector.

[15] $$e_t^x = b * \left(I - A_t\right)^{-1} \cdot x_t$$

The total of export-induced production and employment can be separated into directly and indirectly induced effects. Indirect effects are initiated by inter-industrial production relations and are in general higher in those industries that function as component supplier for other industries. Direct effects are higher in those industries that produce final products for consumers. Direct effects of export-induced production and employment can be determined equal to equation [14] and [15] by using the diagonal elements of the Leontief-Inverse (Holub & Schnabl 1994).

In order to determine country specific impulses, total export (x) has to be replaced in equation [14] and [15] by country specific exports (x^{cc}).[7]

Country-specific, export-induced, direct and indirect effects on employment by occupational fields and qualification levels are elaborated after the effects on total employment and by industrial levels are generated according to equation [15]. Total effects on occupational level (e^{xp}) are measured by using employment effects by industrial levels (e^{x}) multiplied with the estimated share matrix P.[8]

[16] $$e_t^{xp} = e_t^x * P_{j,i,t} \qquad i \in [1,...,59],\ j \in [1,...,54]$$

Accordingly, employment effects on qualification levels (e^{xq}) are retrieved by applying the share matrix Q.

[17] $$e_t^{xp} = e_t^x * X_{k,j,t} \qquad k \in [1,...,4],\ j \in [1,...,54]$$

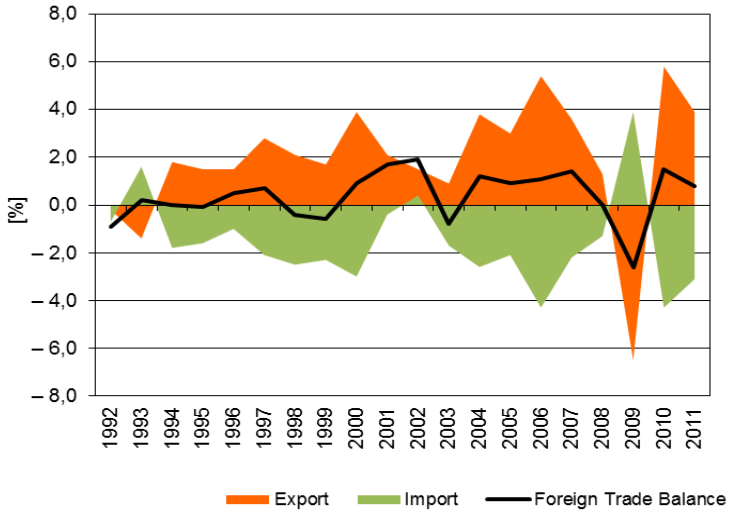
3 GERMANY'S FOREIGN TRADE

The growth impact of exports in Germany, as shown in Graph 2, was mostly positive and dominating to the other determinants of GDP in the past. But in 2009, the vulnerability of the German economy due to its strong exposure to foreign trade became more than evident with a decline in real GDP of -5.1%. The negative growth impact of exports reached the level of -6.5%. Within one year, the recovery process, initiated by worldwide stimulus packages of estimated 2,000 billion USD, let to a strong economic upswing that persisted until 2011. Again, the export channel was the major driving force to this development.

[7] Refer back to chapter 2.1.2 for the calculation and integration of German exports by 54 countries and 2 regions in INFORGE,

[8] The share matrix P and its forecasting approach were explained in chapter 2.1.3.

Graph 2: Growth impact to GDP



Source: Destatis

German foreign trade is strongly concentrated on certain regions and single economies. Latest available data from 2009 show that the greatest influence on Germany's trade balance with a share of 80% has the leading industrialised economies grouped in the OECD.[9] 63% alone is determined by the countries of European Union. By individual countries, France is the most important trading partner for Germany. The most important non-European economy in terms of exports is the United States with a share of 6.7% on Germany's exports. The fast developing economies of the BRICS-group ask for 9.6% of German products whereof half is solely due to demand from China.

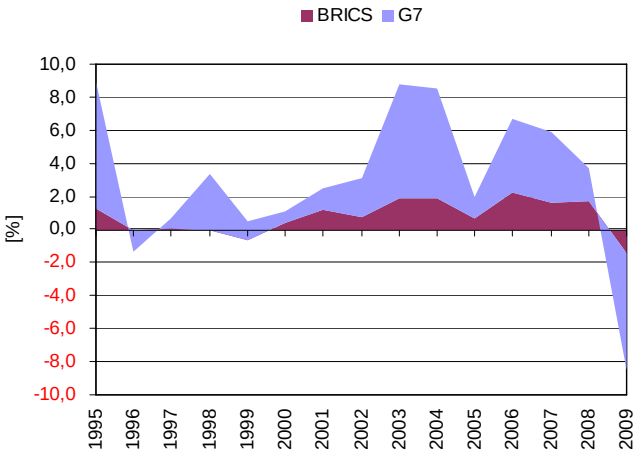
In Graph 3, the growth impact of the seven leading industrialised economies (G7) and the major developing economies (BRICS[10]) is shown for the period from 1995 to 2009. The G7[11] region holds a share of 40% on Germany's exports and was especially the reason for Germany's high export growth rates in early 2000. Its growth impact is declining since then, whereas the growth impact of the BRICS economies remains on a constant and steadily increasing path. The downswing in 2009 in foreign trade is mostly due to declining demand in industrialised nations.

[9] Bilateral trade matrices of the OECD.

[10] Brazil, Russia, India, China, South Africa

[11] The G7-group comprises besides Germany, the USA, Japan, UK, Canada, France and Italy.

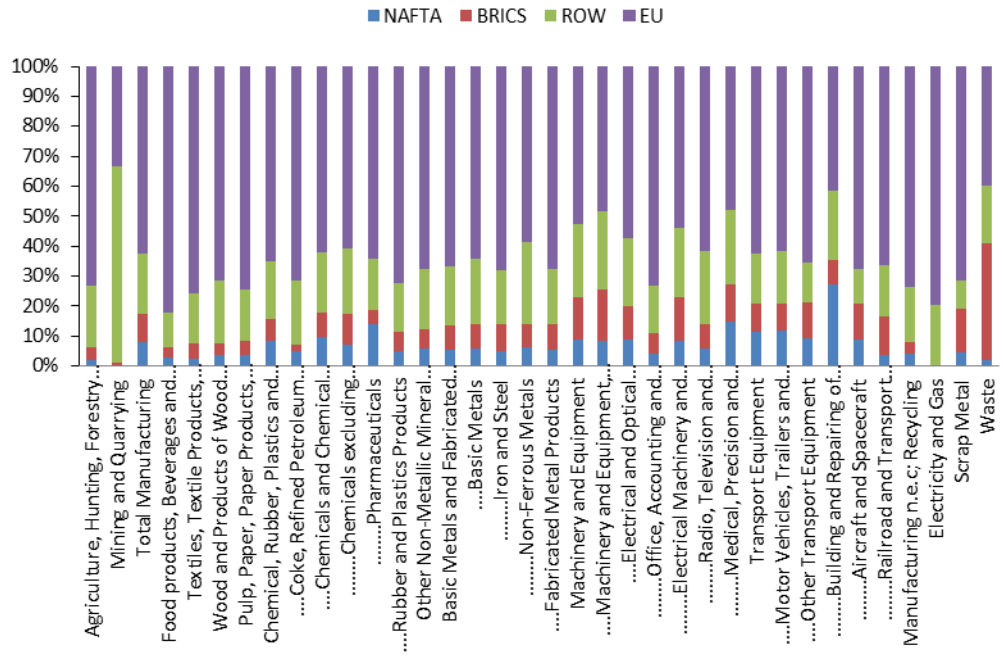
Graph 3: Growth impact of Germany's exports to G7 and BRICS, 1995-2009



Source: OECD Bilateral Trade Matrices – own calculation

On product level, the same dominant export structure is evident. Except for machinery equipment and waste, the demand from non-OECD economies exceeds 20% (compare Graph 4).

Graph 4: Exports by products and regions of destination 2009[12] [13]



Source: OECD Bilateral Trade Matrices – own calculation

[12] The NAFTA (North American Free Trade Agreement) is a trilateral trade bloc created by the USA, Canada and Mexico.

[13] ROW is the abbreviation for "rest of the world".

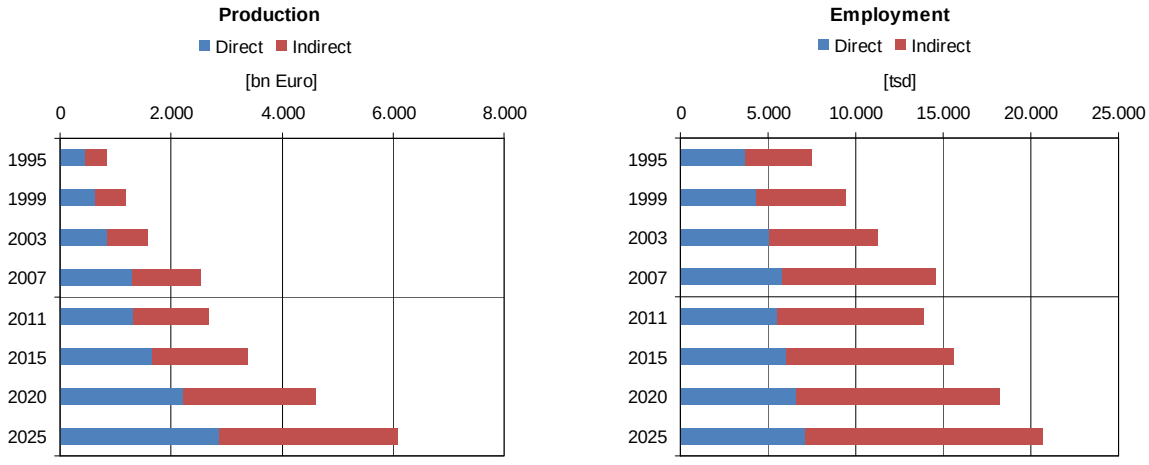
4 EXPORT-INDUCED PERFORMANCES – STATUS-QUO AND FORECAST UNTIL 2025

In the subsequent chapters, the results of the forecast are shown for a selected number of years. The results have to be interpreted according to their underlying methodology. The analysis described in chapter 2.2 is designed to only show the gross effects on production and employment. The net effects of the analysis are lower as the containing effects of imports are considered. Further, the analysis concentrates foremost on the disclosure of structural changes initiated by exports over time and less on the explicit figures within a certain year.

4.1 AGGREGATE EXPORT-INDUCED PRODUCTION AND EMPLOYMENT

Direct and indirect, export-induced production and employment in total and by regions are shown for a selected number of years in the following graphs. They illustrate, that export-induced production has nearly tripled from 1995 to 2007 and will further increase until 2025 albeit to a slightly slower extent. Direct effects on production have exceeded indirect effects in the past. The ratio will change at the latest in 2020 when indirect export-induced production will be predominant. The result indicates that on the one hand, export-induced production remains the leading factor for overall growth. And, on the other hand, intermediate production is gaining momentum as the indirect production effects are dominant in the future. The gross effects on employment also show a constant and strong upswing in directly and indirectly export-dependent workplaces. The development is slower compared to production in current prices. During 1995 and 2007, the number of export-induced employees has not even doubled. Within the next fifteen years, the development will slow down considerably but the total number of export-induced employees (gross effect) is still increasing. By the end of the projection horizon, the number of workplaces indirectly dependent on export is exceeding. The slower development on the labour market is explained by the dull labour market.

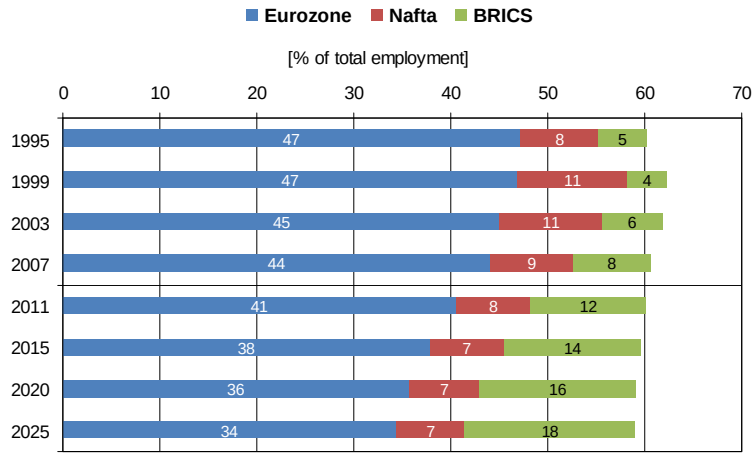
Graph 5: Export-induced production and employment (gross) – all countries



Source: own calculation

With respect to different regions, the developments in the past and in the future differ considerably. The Eurozone, Nafta and BRICS encount for around 60% of total export-induced gross production and gross employment. The Eurozone with presently 40% contributes the strongest share on export-induced (gross) production and employment. Having already started in the past, the Eurozone faces a declining share on export-induced production and employment. The same is true for the NAFTA region with the USA, Canada and Mexico as leading economies. With currently 8% on total export-induced production and employment, this region experienced its greatest influence on Germany's production in the year 2000 with a share on export-induced production of 12% respectively 11% on employment. In contrast, the BRICS nations started in 1995 with a share in production and employment of 5%. Until the late 1990s, this ratio remained more or less constant over time but started to increase steadily in the early years of the 2nd century. By now, the export-induced production and employment share is at 12% respectivel 13%. With that, the impact of the BRICS nations has already exceeded the impact of the NAFTA region and is steadily closing-up to the Eurozone. By 2025, it is projected that around 18% of export-induced production and 19% of export-induced employment is due to increasing demand for German products in the BRICS countries.

Graph 6: Export-induced employment by regions (gross)

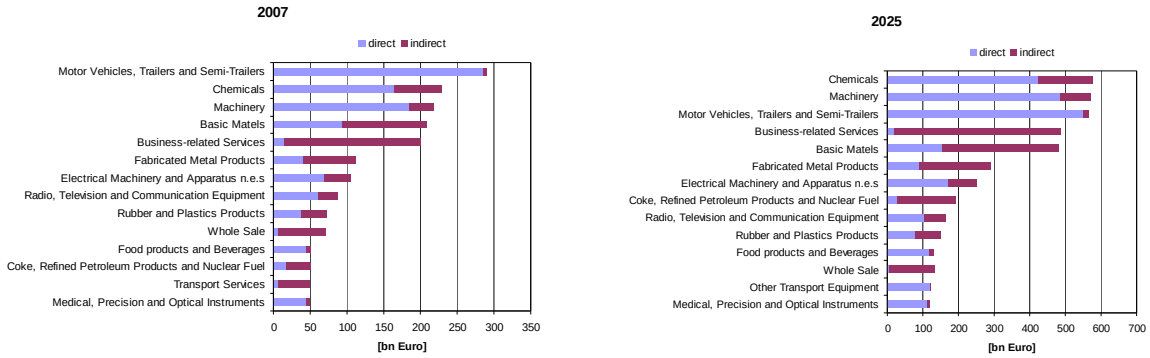


Source: own calculation

4.2 Export-induced Production and Employment on Industrial Level

Direct and indirect export-induced production for the year 2007 and 2025 is given for the fifteen largest industries in the following two pictures. Export-induced production is the largest for motor vehicles in 2007, followed by chemical products and machineries. Whereas the export-induced production is by majority directly generated, the export-induced production of chemical goods is also largely motivated by indirect export demand. The same holds to a little lesser extent for machinery products. But the largest indirect effect of export-induced production is focused on business-related services. Until 2025, the production of chemical products becomes the largest industry exposed to exports, followed by machineries. Motor vehicle production will reduce its export-dependency in comparison.

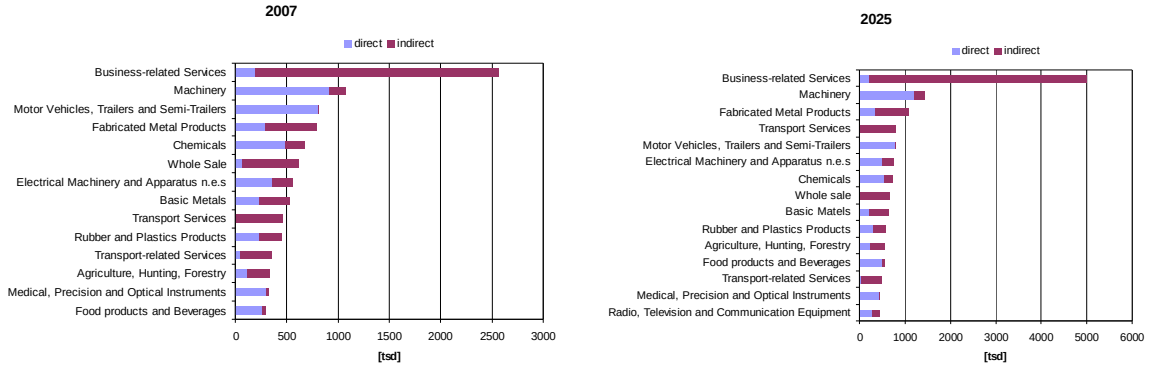
Graph 7: Export-induced production (gross) – by products



Source: own calculation

Direct and indirect export-induced employment for the year 2007 and 2025 is given for the fifteen largest industries in the following two pictures. Business-related services display the largest number of export-induced employees in 2007, followed by far by machinery and automobile industry. The large number of export-induced employees in the business-related service sector is mainly due to indirect effects which emphasises the dependency of this sector to other industries. This dependency can be directly linked to the importance of labour leasing for the manufacturing industries. Other industries that reflect a high indirect dependency on exports with respect to employment are the whole sale sector, the transport sector as well as the sector related to the production of crude oil and natural gas. The export-induced employment in the motor vehicle industry is mainly directly linked to the export channel. The same holds as well for the food producing industry and the industry for medical, precision and optical instruments. Until 2025, the business-related service sector remains the industry with the largest directly and indirectly dependent workplaces. The indirect effect is even enlarged.

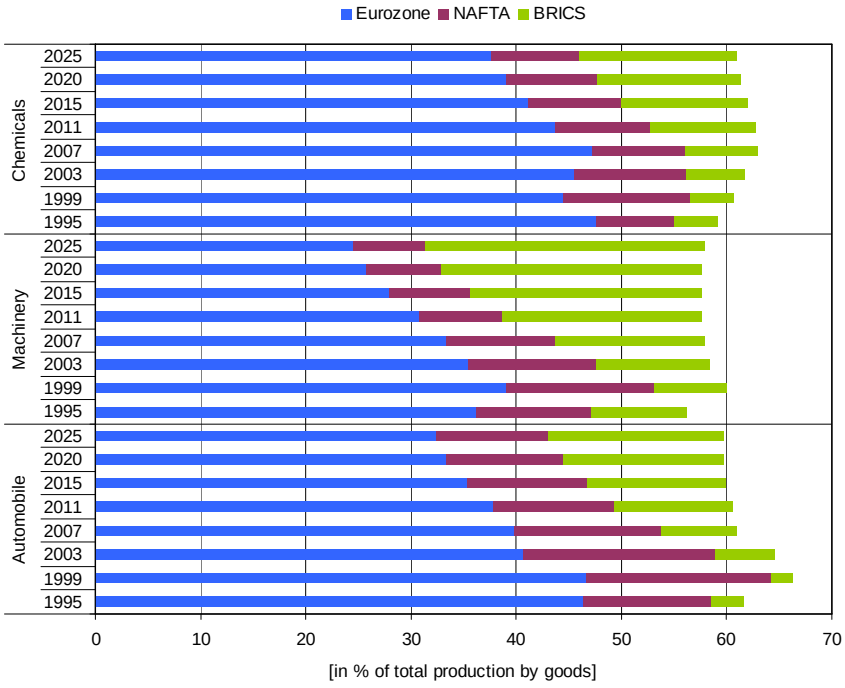
Graph 8: Export-induced employment (gross) – by products



Source: own calculation

The major export products of Germany are industrial products. The highest export shares hold automobiles, machinery and equipment and chemical products. The following graph illustrates the share of regions on export-induced production by products.[14] All three product categories illustrate the same tendency as outlined above: the share of export-dependent production to the Eurozone is declining, while the share of the BRICS's export-induced production is increasing. But apart from that, the three product groups differ considerably in detail. While the chemical industry shows the highest dependence on exports into the three regions and the highest share of export-induced production by the Eurozone, the machinery industry reveals a very strong dependence of export-induced production on the fast developing economies. The automobile industry instead shows a production dependency somewhere situated between both extremes. Already today the machinery industry relies exceptionally strong on exports bound to the BRICS nations. Until 2025, the share will increase to roughly 30%, whilst in the case of automobiles or chemical products the share will increase between 15% and 20%. The automobile industry illustrates its strong dependence on the two largest car markets of the world, the USA and China. The NAFTA region has the strongest impact on automobile production but the BRICS region is gaining momentum if only recently.

Graph 9: Export-induced production by regions and selected products



Source: own calculation

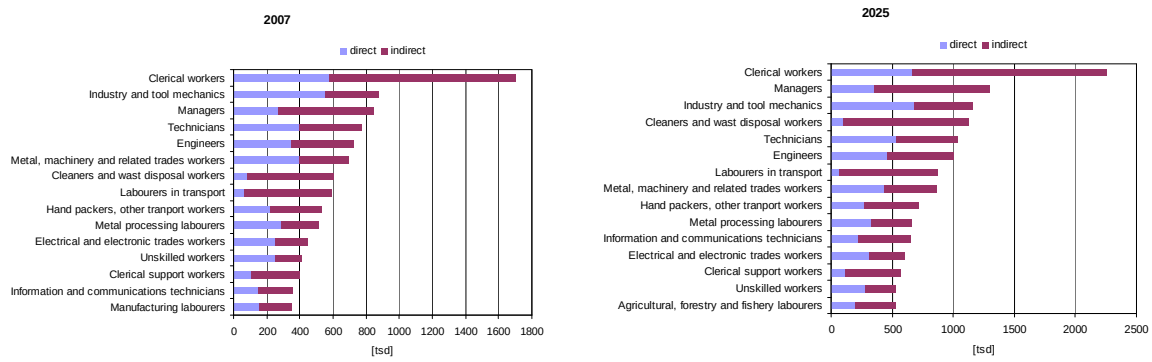
[14] The figures do not show the share on total export-induced production!

4.3 EXPORT-INDUCED EMPLOYMENT BY OCCUPATION

The effects of the transmission of export-induced employment by economic sectors to export-induced employment by occupational fields are displayed for the years 2007 and 2025 for the fifteen most affected occupations in the following graphs. By far, clerical work is the field which mostly relates to export flows. Although the direct and indirect channel is the strongest one compared to all other occupations, the indirect effects more than double the direct effects. This strong and mostly indirect exposure to export is linked to the observation made in the previous chapter: employment in the business-related service sector displays the strongest direct and indirect export-induced employment effect. The same holds for executive functions. The strong effects on technical occupations are the result of the high export-exposure of the manufacturing industry in total. Noticeable is the relatively strong indirect effect on labourers in transport. This accounts for the high indirect export-induced employment effects in the transport service sector.

Until 2025, export-induced employment effects by occupational fields are increasing, despite a shift in the structural composition. Occupations related to the business-related service sector and indirect effects are getting more prominent. Parallel, more service-oriented jobs are becoming more prominent like e.g. in the field of information and communication or of transport services.

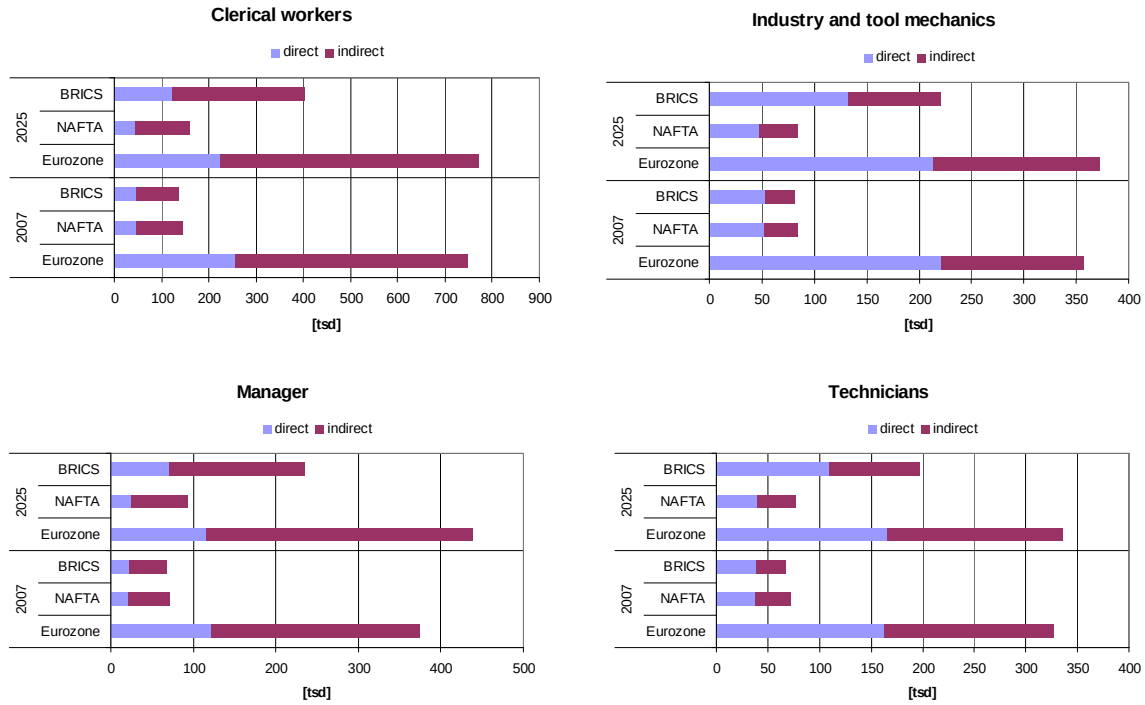
Graph 10: Export-induced employment (gross) – by occupation



Source: own calculation

Looking at the regional influence, the Eurozone is the most important factor in all occupational fields. The indirect effect is especially significant in the field of clerical workers and managers. In the case of industry and tool mechanics and technicians, the indirect effect is comparatively small but still prominent. The export-induced employment effects by the regions NAFTA and BRICS are equally high and significantly smaller than in Eurozone in 2007. By 2025, employment effects induced by the BRICS economies have grown much faster than the employment effects induced by the NAFTA countries.

Graph 11: Export-induced employment (gross) – by selected occupations



Source: own calculation

4.4 EXPORT-INDUCED EMPLOYMENT BY QUALIFICATION

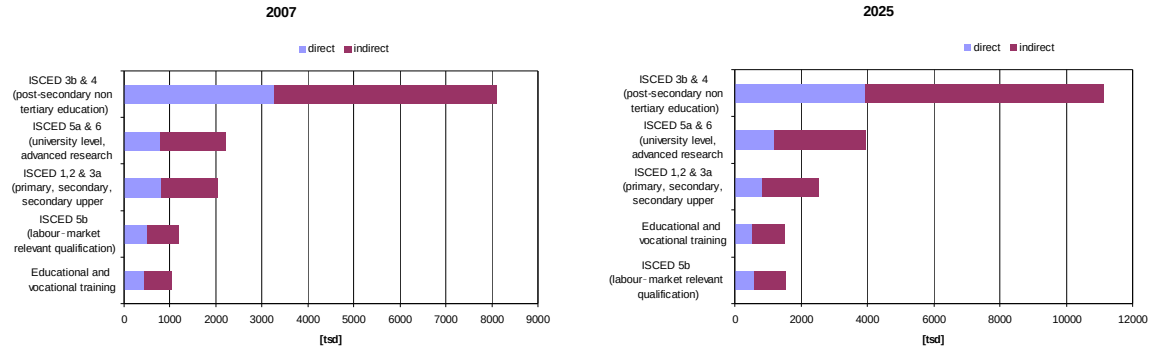
Export-induced employment by qualification levels is shown in the following graphs. The most important qualification needed to match export-induced employment demand is now and in future the ISCED level 3b and 4.[15] This qualification level is strongly practice-oriented with a focus on vocational training. The importance of this qualification level reflects the technical and industrial orientation of the employment fields mostly affected by exports. The education of clerical workers is also categorised in this qualification level. Higher or tertiary education (ISCED 5a and 6) is far less important than expected. Employees with university degree or higher are less strongly exposed to export-induced employment, although the indirect effects are relatively stronger than in ISCED level 3b

[15] Individuals grouped in the category ISCED 3b have either successfully completed a vocational training programme or finished dual education (e.g. *Berufsschule*). ISCED 3b programmes are designed to provide direct access to ISCED 5b (labour market relevant qualification) like vocational schools (*Fachschulen*) or universities of cooperative education (*Berufsakademien*). ISCED 4 qualifications describe post-secondary non tertiary education and are designed for those individuals who have completed ISCED 3.

and 4. Presently, the export-induced effects for primary, secondary and upper education (ISECD 1, 2 and 3a)[16] are similar to higher and tertiary education levels (ISCED 5a and 6).

The development until 2025 displays that qualification needs generally remain the same. But it becomes evident that higher qualification increasingly matters with respect to export-induced employment. Higher education increases faster than other ISCED levels.

Graph 12: Export-induced employment (gross) – by qualification

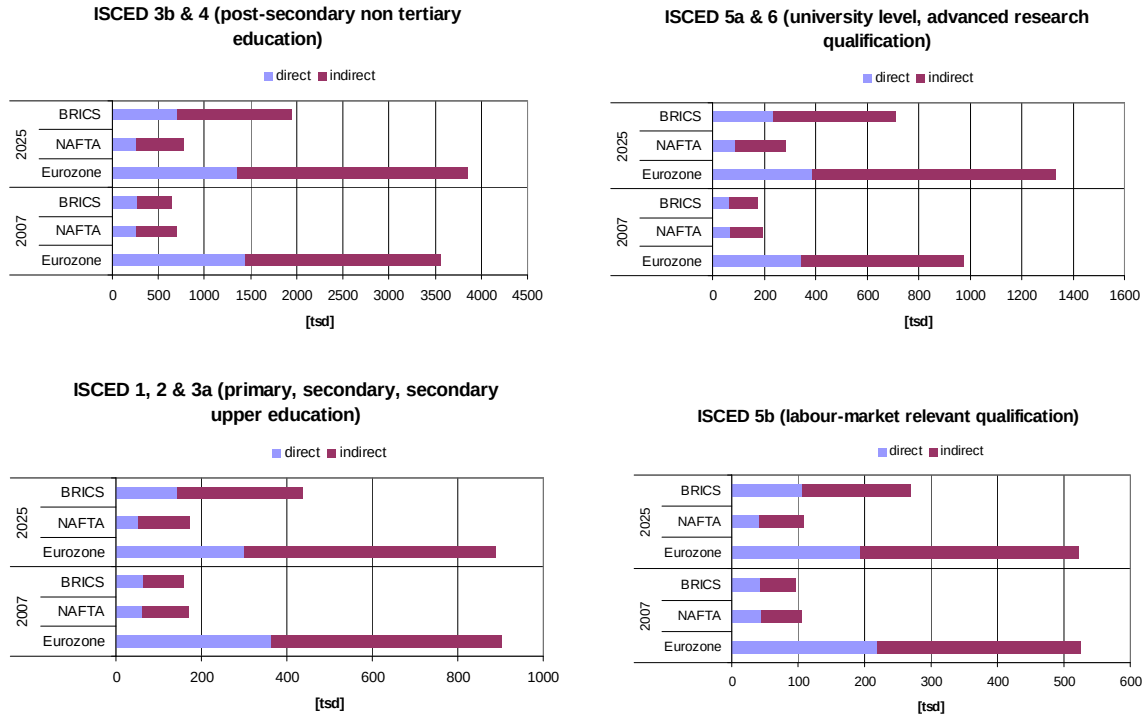


Source: own calculation

The regional effects by qualification levels are illustrated in the following graphs. Similar to the effects on occupational fields, the Eurozone is the dominant driver on all four displayed qualification levels. In the future, this prominent status remains. But it is interesting to notice, that the influence of the Eurozone on qualification levels increases especially in the more qualified ISCED levels 3b to 6 whereas the effects remain more or less constant for the lower qualification levels. In contrast, the influence arising from trade to the BRICS economies shows also impact on lower qualification levels.

[16] This category covers all steps of basic education until secondary level (ISCED 1 and 2) and includes programmes designed to provide direct access to ISCED 5a (programmes and professions with high skills requirements) like universities. The qualification remains below Phd level.

Graph 13: Export-induced employment (gross) – by selected qualifications



Source: own calculation

5 SUMMARY AND CONCLUSION

For Germany's economy, the trade channel is one of the major contributors to economic growth. More than ever foreign markets determine success and failure of those industries that have become reliant – directly and indirectly – on foreign demand. But world trade does not only affect the production structure of domestic industries, it also impairs the demand for employment. The number of employed persons that are directly or indirectly linked to export flows is increasing. When looking beyond labour market, this also invokes changes in occupational fields and qualification requirements. This paper has two major objectives. First, it aims to disclose the direct and indirect influence of major trading partners on Germany's production, employment, and qualification needs. Second, it projects the effects by using the dynamic macro-econometric input-output model INFORGE in combination with the demand side. The results show that industrialized economies are the most important determinants for employment especially in the manufacturing industries and indirect trade effects mostly affect the sector of business-related services. The growth impact of the industrialized nations is declining over time and the impact of the BRICS nations is gaining momentum. Also, a shift towards higher qualification needs can be observed.

6 REFERENCES

Ahlert, G. (2012) Analyse der exportinduzierten Wertschöpfung im europäischen Kontext. In: IWH (Hsg.) (2010) Neuere Anwendungsfelder der Input-Output-Analyse. Beiträge zum Halleschen Input-Output-Workshop 2010. IWH-Sonderheft 1/1012. Halle (Saale). Pp. 75-94.

Ahlert, G., Distelkamp, M., Lutz, C., Meyer, B., Mönnig, A. & Wolter, M.I. (2009) Das IAB/INFORGE-Modell. In: Schnur, P. & Zika, G. (eds.) Das IAB/INFORGE-Modell. Ein sektorales makroökonometrisches Projektions- und Simulationsmodell zur Vorausschätzung des längerfristigen Arbeitskräftebedarfs. Nuremberg. IAB-Bibliothek 318. Pp. 15-175.

Almon, C. (1991) The INFORUM Approach to Interindustry Modelling. In: Economic Systems Research. Vol 3. Pp. 1-7.

Barker, T., Lutz, C., Meyer, B., Pollitt, H. & Speck, S. (2011) Modelling an ETR for Europe. In: Ekins, P. & Speck, S. (eds.) Environmental Tax Reform (ETR) - A Policy for Green Growth. Oxford University Press. New York. Pp. 204-235.

Brautzsch, H.-U. & Ludwig, U. (2005) Ganz Westeuropa auf dem Weg in die 'Basarökonomie'? In: Wirtschaftsdienst. Vol. 85 No. 8. Pp. 513-517.

Deaton, A. & Muelbauer, J. (1980) An almost ideal demand system. In: American Economic Review. Vol 70 No. 3. Pp. 312-326.

Distelkamp, M., Hohmann, F., Lutz, C., Meyer, B. & Wolter, M. I. (2003) Das IAB/INFORGE-Modell: Ein neuer ökonometrischer Ansatz gesamtwirtschaftlicher und länderspezifischer Szenarien. Nuremberg. Beiträge zur Arbeitsmarkt - und Berufsforschung (BeitrAB) 275.

Holub, H.-W. & Schnabl, H. (1994) Input-Output-Rechnung: Input-Output-Analyse. R. Oldenbourg Verlag. München. Wien.

IMK (2008) Globalisierung und Beschäftigung – eine Untersuchung mit der Input-Output-Methode. Gutachten des Instituts für Wirtschaftsforschung Halle im Auftrag des Instituts für Makroökonmie und Konjunkturforschung (IMK) in der Hans-Böckler-Stiftung. Abschlussbericht. IMK-Studies 1/2008.

Kfw (2004) Wettbewerbsfähigkeit der deutschen Exportindustrie und die Theorie der Basarökonomie. Kfw-Research Nr. 15. November 2004. Frankfurt a.M.

Kratena, K. & Wüger, M. (2006) PROMETEUS: Ein multisektorale makroökonomisches Modell der österreichischen Wirtschaft. WIFO-Monatsbericht 3/2006. Pp. 187-205.

Lindenberger, D., Lutz, C. & Schlesinger, M. (2010) Szenarien für ein Energiekonzept der Bundesregierung. In: Energiewirtschaftliche Tagesfragen. Vol. 60 No. 11. Pp. 32-35.

Nelson, R. R. & Winter, S. G. (1982) An Evolutionary Theory of Economic Change Cambridge. Harvard University Press.

Prognos (2011) Globalisierungsreport 2011 – Welche Arbeitsplätze in Deutschland hängen von welchen Ländern ab? Basel.

Ricardo, D. (1817) On the principle of political economy and taxation.

Samuelson, P.A. (2004) Where Ricardo and Mill rebut and confirm arguments of mainstream economists supporting globalization. In: Journal of Economic Perspectives. Vol. 18 No. 3. Pp. 135-146.

Sinn, H.-W. (2005) Basar-Ökonomie. Deutschland. Exportweltmeister oder Schlusslicht? Berlin.

Tiemann, M., Schade, H.-J., Helmrich, R., Hall, A., Braun, U. & Bott, P. (2009) Berufsfeld-Definitionen des BIBB auf Basis der Klassifikation der Berufe 1992. Wissenschaftliche Diskussionspapiere des BIBB 105. Bonn.

Ulrich P., Distelkamp M. & Lehr U. (2012) Employment Effects of Renewable Energy Expansion on a Regional Level - First Results of a Model-Based Approach for Germany. In: Sustainability. Vol. 4 No. 2. Pp. 227-243.