FIW-Research Reports 2012/13 N° 01
October 2012

Foreign Trade and FDI in the Austrian Regions – A new methodology to estimate regional trade and an analysis of the crisis effects

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Abstract

Foreign trade and foreign direct investments (FDI) are key elements for economic development and growth of both a country and its regions. This paper focuses on foreign trade and FDI in Austrian regions (Bundesländer). Unfortunately, data on regional trade in Austria is only available on a very limited basis. The aim of this study is to develop new methodologies for the estimation of exports and imports of Austrian regions and analyse the data generated by this methodology. The basic idea is to disaggregate national foreign trade data to the regional level by using national input-output, regional employment and other supplemental data. This allows estimating Austrian regional foreign trade for the years 1999 to 2009. The study shows a large variation in trade among regions. Lower Austria, Upper Austria, Styria and Vorarlberg are the regions with the highest export share. The importance of regional trade increases between 1999 and 2008; the crisis in 2009 had a strong negative impact. Furthermore, the competitiveness of regions differs considerably. Only three regions, Upper Austria, Styria and Vorarlberg, show trade surplus.

Keywords: Austria, regions, Bundesländer, foreign trade, economic crisis

JEL-codes: C82, F10, F14, F16, R1, R12, R15

The FIW Research Reports 2012/13 show the results of the four topic areas "Micro data and foreign trade", "Modelling the impact of EU Free Trade Agreements", "The economic crisis and international macroeconomics", and "Environment, Environmental Technology and Foreign Trade" that were announced in 2011 by the Austrian Federal Ministry of Economics, Family and Youth (BMWFJ) within the framework of the "Research Centre International Economics" (FIW) and funded by the "Internationalisation Initiative".

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The study was commissioned by the Austrian Federal Ministry of Economy, Family and Youth (BMWFJ) within the scope of the Research Centre International Economics (FIW) and funded out of the Austrian Federal Government´s "internationalisation drive"

Vienna, October 2012

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1. Introduction

Foreign trade of countries and even more so of a country's regions is a key element for economic development and growth. For illustration, one can assume the economy of a region to be divided into two parts. The first part consists of those activities that mainly satisfy the demand from outside the region, i.e. the 'export base' of the region. This export base depends to a large extent on the region's characteristics and comparative advantages that in turn determine the pattern of industrial specialization of the region. The second type of activities is made up of those activities that are more or less common in all regions and basically supply goods and services to the region's inhabitants.

According to the 'base-multiplier' theory (see Fujita et al., 1999) the size and growth of the 'non-base' activities depend on the performance of the economic or export base activities, with a relatively small export base being able to support much larger activities in the non-base sectors (because of a multiplying effect). In this respect Fujita et al. (1999) give the example of California, where it was estimated that California's export sector employs only 25% of the state's employment, whereas 75% were employed in non-base activities.

The nexus between foreign trade, integration and economic growth has long been recognized in economic theory. Thus, in 'classical economic theory' foreign trade was a key element to understand why economies develop and why they might develop differently from each other. Specialization in the form of Adam Smith's 'division of labour' generates economies of scale and differences in productivity across nations or regions (Smith, 1776). David Ricardo (Ricardo, 1817) showed that gains from trade could be made when two countries or regions specialize in the production of goods for which they have a comparative advantage. Thus, differences in production technology across industries and across regions give rise to differences in comparative labour productivity, which is the basis of specialization and foreign trade as certain goods can be produced more efficiently (at a relatively lower price) in one region while other goods can be produced more efficiently in the other region.

By contrast, 'neo-classical theory' does not build on technological differences but assumes differences in the regions' initial comparative advantages (due to factor endowments, or the state of institutions etc.) to be the main source of trade. Following this theory there will be a continuous process of convergence, and economic activity will be spreading spatially. With respect to trade, the Heckscher-Ohlin (H-O) model builds on the assumption that comparative advantages arise because of differences in the (relative) abundance of factors of production (factor endowments) between two regions. Different industries use these factors in different proportions and as a consequence, regions tend to specialize in the production of those goods that use more intensively the factor with which they are more abundantly endowed. As in the case of the classical models, the move from

autarky to free trade provides an engine for economic growth (through gains in aggregate efficiency).

In new trade theory (Barro and Martin, 2004), increasing returns are a motive for specialization and trade and can lead to trade even when comparative advantage is of negligible importance. New trade theories can also be seen in terms of a switch in emphasis from exchange efficiency to productive efficiency, where the latter is influenced by factors such as labour force skills, level of technology, increasing returns to scale, agglomeration economies, and strategic actions of economic agents in technological and institutional innovations. We can see therefore that new trade theories suggest that a comparative advantage can be acquired as opposed to being 'natural' or 'endowed' as assumed by traditional theory. Moreover, the speed at which economies of scale can be achieved can influence comparative advantage – first-mover type advantage – so that factors that enable the quick realization of economies of scale can be important: skilled labour, specialized infrastructure, networks of suppliers, and localized technology that support industry.

Foreign trade is also a key element in the Keynesian framework, in which aggregate output is taken as the sum of consumption, investment, government spending, and net exports. The drivers of the system are the consumption function and the investment accelerator, together with export demand. The latter gives rise to an export multiplier, in which aggregate output can be expressed as a derived function of export demand. The export base of a national economy thus plays a key element in the basic Keynesian model.

Another important model with export-led growth elements is the circular and cumulative causation model. A region's output growth is assumed to be driven by export demand which is dependent on growth in world demand as well as the rate of increase in the region's product prices relative to world prices. The latter in turn depends on the rate of wage growth minus the rate of productivity growth (i.e. the change in wages per unit produced), which itself will be higher the faster the growth of regional output (the 'Verdoorn effect') (Greunz, 2003). The key element in this circular and cumulative process lies in the way in which increased output leads to increased productivity. This is the essence of the dynamic increasing returns assumption that underpins the model. Several different forms of dynamic increasing returns are postulated to follow from the (demand-led) expansion of output. Expansion of output is argued to induce technological change within and across firms in a region, both through the opportunities for increased task specialization within firms, and through the accumulation of specific types of fixed capital within which technological advances and innovations are embodied.

Where (neo-)classical economic theory presumes convergence in due time, core-periphery models provide an explanation for the persistent and growing international and inter-regional differences in development. Locations with good market access will inevitably become more attractive to firms which will push up wages. Skilled workers will be attracted to this expanding network which will

further increase market size and facilitate innovative activity through knowledge spillovers (Venables, 2006). From the production side, firms producing intermediate goods also relocate to the 'centre' to be closer to their customers. Clusters of industrial and economic activity thus form as a result of this reinforcing feedback. That the firms' location decision is determined by proximity to complementary activities is the underlying premise of the centre-periphery model.

Following these theories, foreign trade is an important source for regional economic development. It might be the source of rapid catching up of poorer regions, given they can make use of their comparative advantages, or it may be a source of the persistence or evening a widening of the gap between well-developed and less prosperous regions.

As a consequence regional foreign trade is an important variable in explaining the regions' past, current and future path of development. It is vital to analyse integration processes, notably within the EU or in smaller, locally confined areas like CENTROPE, to highlight the competitiveness of regions and thus derive conclusions for policy makers to take measures to improve the regions' economic situation and the situation of the people living in the regions.

The only problem is: data of foreign trade by regions are only available to a limited extent and those that are available are not published, most probably because of inherent problems of the data itself as well as confidentially issues. This seems to be case for Austria, where regional trade data tend not only to be available via a special compilation by the statistical office, but are evidently also prone to a couple of methodological weaknesses (see Kurzmann and Gstinig, 2010) like capital city and harbour ('Schwechat') effects that exert a considerable bias to the regional data on foreign trade.

Basically the same holds for data on regional foreign direct investment (FDI) in Austria. Data are available, but only at a highly aggregated level, without major details on e.g. the distribution of FDI across industries, thus impeding any more sophisticated and deep economic analysis.

To some extent this is quite surprising, as both trade – as demonstrated above – as well as FDI are key variables and determinants of economic development in an increasingly globalized world.

In the case of FDI, which can be seen as an alternative to foreign trade to supply a host country's market with goods and services, a recent study (EU Commission DG Regio, Study on FDI and regional development, Final Report, 2006) has found a number of effects exerted by FDI on the host region. Amongst the benefits from FDI were productivity spillovers from foreign firms to domestic firms, an increase in the labour demand in the host regions and quite general positive effects on economic growth. At the same time the study also postulates that the extent to which regions benefit from FDI depends on their attractiveness to FDI, i.e. whether they possess good infrastructure and accessibility, a highly educated workforce, a network of suppliers and clients etc. Thus, in practice – given the regions' differences in characteristics and hence attractiveness – FDI

is quite unevenly distributed across European regions, and consequently so are the positive effects from FDI.

Yet, though FDI has positive effects on the regions, it is not necessarily clear to which regions it actually flows. Following Dunning's OLI (ownership, location and internalization) framework the pattern of FDI may depend on the one hand on ownership-specific advantages of firms that determine their ability to service particular markets vis-à-vis their competitors. It may also depend on specific location advantages that make it profitable to produce in the host region rather than to engage in foreign trade, or also on advantages of internalizing transaction costs through owning a foreign affiliate.

On the other hand, following Helpman and Krugman (1985) FDI may be triggered through differences in relative factor prices, as is the case with labour-intensive FDI in low-wage countries, while if following Markusen (1995), and Markusen and Venables (1995, 1996a, 1996b) the amount of FDI that flows to a region, especially between countries with similar factor costs, is a function of transportation costs.

From a different angle, the amount of FDI that a region receives may also depend on the type of FDI and on the extent to which the region's characteristics correspond to the various types. In the case of so-called 'resource-seeking' as well as 'efficiency-seeking' FDI, foreign firms are interested in the host region's raw materials, or the availability of low-cost labour. Furthermore foreign firms might invest in a region because it has technological, innovatory and other firm specific assets (e.g. brand names) given an adequate physical infrastructure. By contrast, in the case of 'market-seeking' FDI firms target directly the host region's market. Hence the main determinants are the region's market size and per capita income as well as market growth, access to regional and global markets etc.

Summarizing, whether or not FDI locates in one region depends on how well the characteristics of the specific region meet the requirements of foreign firms. As regions tend to be quite different in their characteristics, also the distribution of FDI across regions is highly differentiated, in Austria as well as in any other country. At the same time, because of the positive economic effects that FDI exerts on the host regions, it is also one of the more important subjects in regional economic policy, as regions devise strategies, create institutions, improve their infrastructure etc. to attract foreign firms.

But still the lack of publicly available data largely impedes academic research in this field and thus does not allow linking scientific expertise with practical work and experience in order to improve economic policy making.

The lack of data with respect to regional FDI and also regional foreign trade is a quite unsatisfying situation. The purpose of the paper therefore is to improve this situation by firstly developing a

method to estimate regional trade and secondly to introduce an innovative data set on regional FDI. The paper is considered to be basic research aiming at improving our knowledge on the Austrian regions and especially improving the data availability. Both, with respect to foreign trade and FDI it should be seen as a first step in a process that may lead to more detailed analysis. This is also true for the method allocating exports and imports to the regions that is developed in the paper. Further analysis and some refinement and expansion could e.g. be done in linking foreign trade of Austrian regions with domestic trade between regions. Still, the method developed in this study should be seen as a valuable first step, and the use of it will be demonstrated not only by a description of the foreign trade of Austrian regions but also by an analysis of the crisis effects on the regions.

For this the paper is structured as follows: It starts with a detailed description of the newly developed method to estimate regional foreign trade, followed by a descriptive analysis of actual trade of Austrian regions in the period 1999-2009 and an analysis on how the changes in trade flows because of the economic crisis affected employment and output in the Austrian regions. The remainder of the paper deals with foreign direct investment, analysing the distribution of FDI across Austria as well as the performance of Austrian regions in attracting FDI compared to the other regions in the EU-27.

2. Regional trade

The description of the method to estimate foreign trade of Austrian regions is split into two parts, i.e. the estimation of regional exports and the estimation of regional imports. Despite some common features the methods to estimate exports as well as imports yield some differences as far as certain details in the methodology, their complexity, their features as well as their extensions are concerned. The basic idea behind the estimation method however, as well as the data set used, is the same.

The idea rests on the following line of reasoning: given that regional foreign trade data are not a priori available, it should be possible to derive reasonable estimates by: a) using foreign trade data at the national level, b) using national supply and use tables to identify the domestic producers and receivers of the traded goods and services, and c) combining this information with suitable data at the regional level to allocate national foreign trade to the individual regions.

The data set consists firstly of national trade data at the 2-digit NACE rev. 1.1 level from Eurostat's COMEXT database. To this we add national supply and use matrices from the WIOD project (World Input Output Database). Finally, we employ data on regional employment, regional consumption and investment expenditures from the EU Labour Force Survey (LFS) and Eurostat, respectively.

Together, the idea and the data build a framework for developing a method to estimate foreign trade of the Austrian regions. At the same time it is clear that such estimation relies on a number of more or less restrictive assumptions, so that the results of the analysis are expected to be plausible and reasonable, yet remain an approximation to reality. In turn, though, the proposed methodology potentially might be an improvement to the rare data that exist, as it tends to avoid some of the problems, like capital city and harbour effects, observed in the collection of statistical data on regional trade by statistical offices or other institutions.

The presentation of the methodology to estimate regional trade flows is split into three steps: the estimation of regional exports, the estimation of regional imports, and finally the presentation of the results.

One should note that the method presented in this study is only dealing with foreign trade of Austrian regions (i.e. exports and imports to/from foreign countries) but not with trade between the regions.

2.1. Regional exports

This section describes the methodology how national exports are broken down to the level of regions. The fundamental idea behind the methodology is that the regions' employment share in total country employment in a certain sector corresponds to the regions' output share in the same

sector. As a consequence this allows allocating the national output in each sector to the individual regions and since exports are part of the output, they can also be allocated to the regions.

Still there are a couple of restrictions behind this idea that diminish its accuracy. Firstly it assumed that output per worker, i.e. productivity in each sector is equal across regions. Secondly, sectors are assumed to produce the same product mix in each region, whereby the individual products are either identical or close substitutes.

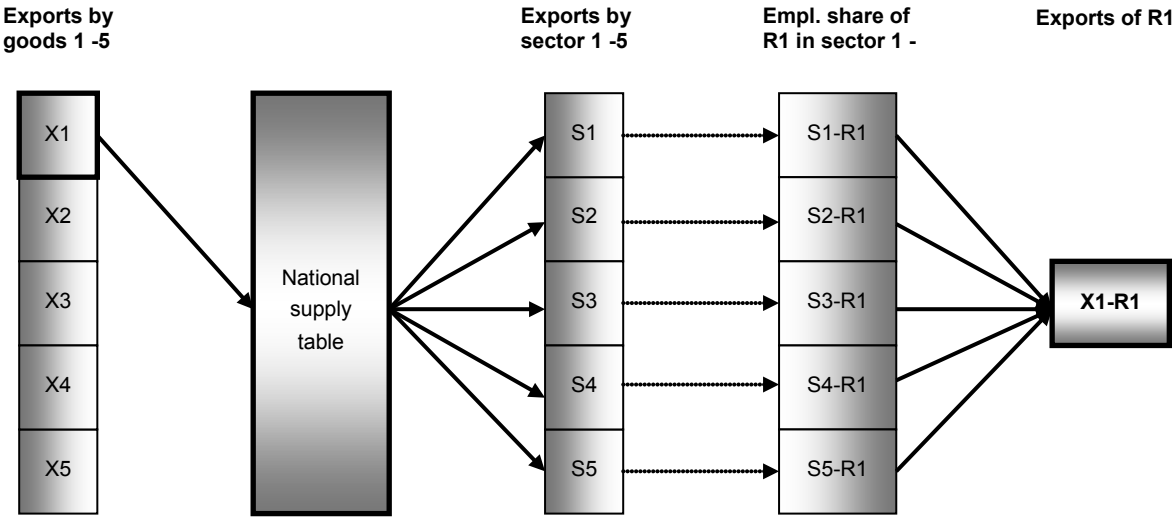
The first restriction can be relaxed to some extent by taking into account differences in regional productivity levels. Below we propose a methodology how this can be implemented in our framework, but still, because of data restrictions this adjustment remains limited.

The second restriction may be relieved by increasing the level of detail as far as the sectoral breakdown for national output and regional employment is concerned, given that actual output data by sectors and regions are missing. That is, the more disaggregated the output and employment data that are available for analysis, the higher will be the accuracy of the estimates. For this paper we use highly aggregated data, as the main focus is on developing the estimation methodology and to present the results in a concise way. That is, the results shown below are first estimates, to check whether the method works and delivers plausible results.

Figure 1 presents the complete method to estimate regional exports in a non-technical way. It starts on the left, showing actual exports as recorded in the trade statistics. Notably, at this stage exports are recorded by products, yet in order to derive regional exports it is needed to allocate the exported products to the sectors where they are produced first. Hence for each product we use the national supply matrix to calculate the share of each sector in the production of the respective good. (For simplicity reasons, this is shown for good 1 only in Figure 1). The implicit assumption is that the structure of total production, i.e. production for domestic use and exports, is identical to the production of exports. As a result of this procedure we get the exports by sectors.

In a second step, to regionalize exports, we use regional employment data by sector and given the assumption that employment is indicative of production, it allows calculating the shares of each region in the respective sectors. From this we finally estimate the export of each sector by regions.

Figure 1: Regionalization of national exports scheme



In practice to estimate regional exports we use the national supply table, which schematically is structured as in Table 1. The main elements of the supply table that are used for the estimation are the (product by industry) supply matrix S, as well as the domestic output vector (q-m), which will be further denoted as qm. The supply table we use further consist of a vector of imports m, the output vector g and the total supply vector q, which is the sum of (q-m) and m.

Table 1: Supply table

	Industries	Output	Imports	Supply
Products	S	q-m	m	q
Output	g			

Given this, we calculate the transformation matrix (for the estimation of exports) T_e , as

$$T_e = inv\big(diag(qm)\big) * S \qquad 2\text{-}1$$

As the individual elements in T_e show each sector's share in the total production of each good, it allows allocating actual exports by product to the sectors where they are produced. Total country exports by goods are given in vector form, with the rows corresponding to the individual goods. This vector is denoted *xtot*. Given this we calculate to get the matrix X:

$$X = diag(xtot) * T_e \qquad 2\text{-}2$$

X is the matrix of exports of products by industries. To regionalize the exports we use information on the employment by sectors and regions as illustrated in Table 2.

Table 2: Employment

	Regions	Total
Industries	E	tE

Matrix E simply represents employment by industries and regions, while the vector tE represents total (country) employment in each industry.

To allocate country trade flows to the regions the first step is to derive the regions' employment share in each sector, whereby the resulting matrix of regional employment shares is denoted by L:

$$L = inv\big(diag(tE)\big) * E \qquad 2\text{-}3$$

From this we finally derive the export matrix by regions and products *XR* by multiplying the matrix of sector contributions to exports X with L:

$$XR = X * L \qquad 2\text{-}4$$

2.1.1. Adjusting for differences in productivity

Notably this estimation method does not take into account differences in regional productivities that may alter the regions contribution to total production and exports. To incorporate region-specific productivity levels, we define a matrix *PR* of regional productivities, whereby each element in *PR* represents the productivity of a specific region in a specific sector. From this we derive a vector *minp*, where each row in *minp* corresponds to the lowest productivity level across the regions in the corresponding industry. Hence *minp* is defined as:

$$mp = \begin{bmatrix} min(pr_{1,n}) \\ min(pr_{2,n}) \\ \vdots \\ min(pr_{n,n}) \end{bmatrix} \quad 2\text{-}5$$

We use vector *minp* to scale the regions productivity in terms of the minimum productivity for each sector, so that the region with the lowest productivity level has a value of 1:

$$PS = diag(minp)^{-1} PR \quad 2\text{-}6$$

The matrix *PS* is used to adjust the regions employment for differences in regional productivity defining a modified employment matrix E^*:

$$E^* = \begin{bmatrix} e_{1,1}ps_{1,1} & \cdots & e_{1,m}ps_{1,m} \\ \vdots & \ddots & \vdots \\ e_{n,1}ps_{n,1} & \cdots & e_{n,m}ps_{n,m} \end{bmatrix} \quad 2\text{-}7$$

*E** might then be used instead of the original matrix *E* to calculate the regions contributions to the national exports.

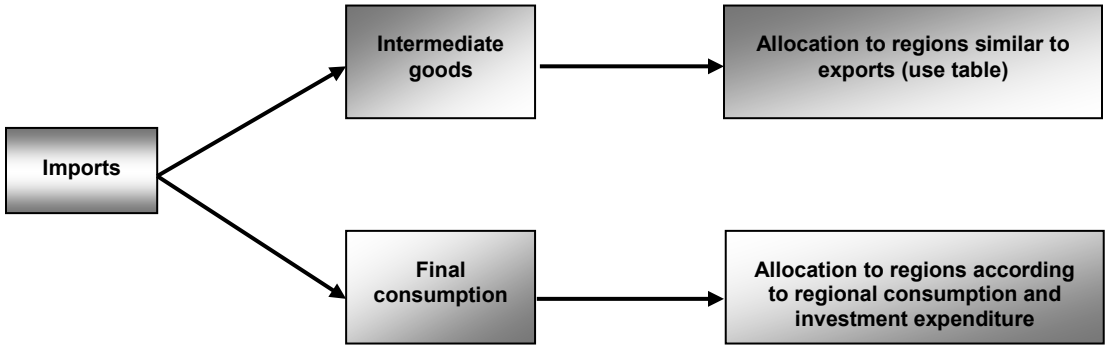
2.2. Regional imports

In contrast to the estimation of regional exports the estimation of regional imports is split into two parts (see Figure 2), 1) the imports of intermediate goods for production and 2) into imports of final goods for consumption and investment purposes[1]. While the estimation of intermediate goods imports follows more or less the rationale of the estimation of regional exports, except that we use the national supply instead of the use table, the estimation of final consumption differs to some extent.

The basic rationale behind it is that we first split total imports in intermediate and final consumption imports using the information of the use table. Moreover final demand is split into final consumption and investment demand, which, grossly speaking, is then allocated to the regions according to their consumption and investment expenditures, with the background assumption that spending patterns across regions are identical.

[1] Other purposes are export or the accumulation of valuables and inventories.

Figure 2: Estimation of regional imports scheme



For practical purposes we use the national use table as available through the WIOD project. The advantage of the WIOD use table is that it differentiates between domestic use and use of imported products, which not only facilitates the calculations but assumingly also increases the accuracy of the results. Schematically the use table is built as shown in Table 3.

The use table consists of two use matrices for domestic and imported products (U_d and U_m), two vectors for total intermediate demand (i_d and i_m), i.e. the sum of the columns of U_d and U_m respectively. Furthermore there are two matrices for final demand Y_d and Y_m, whereby the columns in both matrices correspond to final consumption and investment, respectively. Total final demand of either domestic or imported products is represented by the vectors f_d and f_m, and total use, i.e. the sum of intermediate and final demand is given by the vectors (q-m) and m. Furthermore there are a couple of matrices and vectors for value added and output, but they are less relevant for the estimation of regional imports.

Table 3: Use table scheme

	Industries	Intermediate demand	Consumption, Investment	Final demand	Use
Domestic products	U_d	i_d	Y_d	f_d	q-m
Imported products	U_m	i_m	Y_m	f_m	m
Value added	W	w			w
Output	g	i_t	y	f_t	

For the estimation of regional imports we mainly employ the matrices U_m and Y_m, as well as the vectors i_m , f_m and m.

In practice the first step in the estimation of regional imports is to split total imports into imports for intermediate and final consumptions. For this we calculate the shares of both final and intermediate use in total imports using the vectors i_s and f_s as $i_s = inv(diag(m)) * i_m$ and $f_s = inv(diag(m)) * f_m$. These vectors represent the share of intermediate and final consumption in total consumption by product. We can now calculate the imports for intermediate as well as final demand (mi and mf):

$$mi = diag(is) * mtot \quad \text{2-8}$$

$$mf = diag(fs) * mtot \quad \text{2-9}$$

These vectors are the basis to allocate both final consumption and intermediate imports to the individual regions in a country.

2.2.1. Final demand imports

The estimation of final demand imports by regions splits final demand into its two relevant components final consumption and investment, in order to allocate consumption imports according to the regions' disposable income of households and investment imports according to the level of regional investment. In a first step therefore we have to estimate the imports for final consumption and investment respectively:

$$I_c = diag(cs) * mf$$

$$I_{gcf} = diag(gcfs) * mf$$

With cs defined as: $cs = inv(diag(f_m)) * c$ and gcfs as $gcfs = inv(diag(f_m)) * gcf$

We split total consumption imports following the simple assumption that the amount of final consumption is a function of the households' disposable income in the regions. That is, final consumption imports are allocated according to the regions' share in total national disposable income of households. Investment imports are regionally split depending on the level of investment in the respective regions. For these we use the vectors shown in Table 4. The vector di is disposable income by region, while dit is a scalar with total country disposable income. Similar for investment, where inv is a vector of investment expenditures by region and invt a scalar of total country investment.

Table 4: Disposable income and investment expenditure vectors

	Regions	Total
Disposable income	di	dit
Gross fixed capital formation	gin	gint

On that basis we first define each region's share in the country's total of disposable income and investment through two vectors: $sdi = di * inv(dit)$ and $sinv = gin * inv(gint)$. To apply these vectors in order to split consumption and investment imports, both vectors have to be transposed and multiplied with a r×1 vector of ones, where r corresponds to the number of imported products. This results in two matrices, which are denoted DIS and INVS in our case. These can be employed to finally estimate regional imports for consumption and investment:

$$MRGCF = diag(I_{gcf}) * INVS$$

$$MRC = diag(I_c) * DIS$$

Regional final demand imports are then simply calculated as

$$IRC = MRGCF + MRC$$

2.2.2. Intermediate consumption

Like in the case of exports imports, too, have to be allocated to the sectors of production that use them as inputs. For this we employ the matrix U_m and calculate the transformation matrix T_i (for imports) as .

$$T_i = inv(diag(i_m)) * U_m \qquad 2\text{-}10$$

T_i has a similar interpretation to the transformation matrix T_e in the case of exports.

As a next step we can allocate the imports of goods to the sectors of production:

$$Ii = diag(mi) * T_i \qquad 2\text{-}11$$

To disaggregate imports to the level of regions we again use data on regional employment by sectors and regions given in matrix E. Using E we calculate firstly the regions' employment share in each industry (matrix L) as

$$L = inv\big(diag(tE)\big) * E \qquad 2\text{-}12$$

From this we may easily derive at an estimation of regional imports for intermediate use, i.e. (product by regions) matrix IRI_

$$IRI = Ii * L \qquad 2\text{-}13$$

Total imports *MR*, i.e. final consumption imports plus intermediate imports, follow directly as:

$$MR = IRI + IRF \qquad 2\text{-}14$$

Assumptions

The estimation of regional imports rests on a number of restrictive assumptions. Firstly, for all regions identical consumer preferences are assumed concerning final consumption imports. Secondly, investment behaviour is also assumed to be the same across regions. Furthermore firms are assumed to apply the same production technology regarding the split of the intermediate imports, while trade costs or distance are disregarded. Without more detailed data there is little to be done to relax these assumptions, so that the estimates are considered to be highly indicative but certainly not 100% accurately reflecting real trade flows. Hence there are number of issues left for future research to improve and expand the method and to increase the reliability of results.

2.3. Data analysis

2.3.1. Data

The estimation of regional trade flows draws on a number of different data sets.

Firstly we use Eurostat's COMEXT database on foreign trade that offers highly detailed data at the national level. Out of this we draw a sample of Austrian foreign trade at the 2-digit NACE rev. 1.1 product level vis-à-vis the EU-27 and the rest of the world (RoW).

Secondly, we use national supply and use tables for Austria from the WIOD database[2] at the 2-digit NACE rev. 1.1 level for both industries and products. This database has a number of favourable properties. Supply and use tables are not only available for all years from 1999 to 2009, but also for a large number of countries in- and outside the EU allowing to replicate our results quite easily for other countries. More technically, both supply and use tables are available at basic prices as well as producer prices, which facilitates work enormously. Furthermore, the use tables are split into domestic and imported inputs, whereby imported inputs are even disaggregated to the individual

[2] www.wiod.org

countries where they come from. For our analysis we aggregated the imported inputs from those countries to two groups, i.e. inputs from the EU-27 and inputs from RoW.

Thirdly, we use detailed employment data from the EU labour force survey, as it offers data at the NUTS-2 level of regions, which corresponds to the Austrian Bundesländer, and disaggregated to the 2-digit NACE rev. 1.1 industry level. This means that we have employment data for more than 60 industries.

Furthermore we draw upon Eurostat's regional database as far as data on regional productivity, disposable income, investment and GDP are concerned.

All in all this builds up to a quite comprehensive data set and thus is a good basis for the analysis and the testing of our method, even though, in the light of the restrictive assumptions that had to be made, one wished to have even more detailed data at the regional level.

The collected data allow an analysis for the years 1999-2009, thus covering also the first year of the economic crisis. Notably, original employment data only covers the years until 2008. These data are not extended to 2009 or later, at least not in their current form, due to a change in the NACE industry classification system from NACE rev. 1.1 to NACE rev. 2. This change brought a sudden break in the time series, and as the old and new industry classification do not correspond it is virtually impossible to have a continuous time series beyond 2008. Therefore in order to get 2009 we estimated 2009 according to the old classification by using the 2008-2009 employment growth rates from the new classification. However since industry classification do not perfectly correspond between the old and new classification the estimated 2009 provide only reasonable but probably not exact employment numbers.

A further limitation concerns the adjustments for regional productivity differences, as productivity data are less detailed than trade and employment data, especially as far as manufacturing industries are concerned. Thus, adjustments for productivity have been made, but under the assumption that the observed productivity differences in total manufacturing across the regions apply also to the individual manufacturing industries.

The whole estimation was programmed in STATA.

2.3.2. Results

In the following we present a short analysis to demonstrate the work of the estimation method. Despite the highly detailed data, results are presented in aggregated form. This concerns especially the level of industry detail, which for the sake of a concise presentation has been aggregated to six sectors only. These sectors are agriculture, mining and energy, low technology intensive manufacturing, medium and high technology intensive manufacturing, basic services and business

services[3]. A higher level of disaggregation, though easily possible, immediately increases the complexity of the analysis and especially the presentation of results, as already by now the analysis covers 11 years, 6 industries and 9 Austrian regions. A more detailed analysis at the detailed industry level is left for future analysis.

All results regarding exports take into account regional differences in productivity, while results disregarding these differences have been calculated but are not shown here.

To start the analysis of results we first look at the total imports and exports of Austrian regions over the periods 1999-2003, 2004-2008 and the year 2009. Table 5, that shows both in terms of the regions' GDP, reveals the following facts: firstly there is a wide variation in the import and export ratios of Austrian regions; in terms of imports the trade to GDP ratio range from around 27% (in the period 2004-2008) in Vienna to around 57% in Burgenland. As far as exports are concerned the gap is between 22% (Vienna) and around 55% to 57% in Upper Austria and Vorarlberg.

Secondly in all Austrian regions foreign trade expanded from the period 1999-2003 to the period 2004-2008 as both the regions' import and export ratios increased, though the size of trade expansion was different across regions – especially regarding exports. Thus, there are regions with only a little increase in export ratios such as Vienna and Burgenland, where the ratios increased by 1 and 4 percentage points respectively, yet there are also regions where there was a quasi-export boom, such as Vorarlberg and Styria, where exports increased by 12 and 9 percentage points of GDP respectively.

Thirdly, in the year 2009 the crisis was heavily affecting foreign trade of all Austrian regions as both exports and imports declined by 6 and 5 percentage points on average respectively.

Table 5: Imports and exports by Austrian regions, in % of regions' GDP

	Imports				Exports		
	avg. 99-03	avg. 04-08	2009		avg. 99-03	avg. 04-08	2009
Austria	36.9	41.4	36.3		34.6	40.6	34.4
Burgenland	49.7	56.8	48.2		35.5	39.5	27.9
Lower Austria	44.0	49.8	43.7		42.3	49.0	40.7
Vienna	26.2	27.6	23.7		21.2	22.2	17.4
Carinthia	42.0	47.1	40.9		38.4	44.6	34.7
Styria	42.9	48.6	43.6		40.8	50.1	45.5
Upper Austria	41.8	47.4	41.4		47.4	54.8	46.2
Salzburg	33.1	37.1	33.0		28.8	33.6	28.4
Tyrol	35.0	40.0	35.8		27.8	36.4	33.4
Vorarlberg	40.1	46.5	41.7		44.3	56.9	53.5

Source: Own calculations.

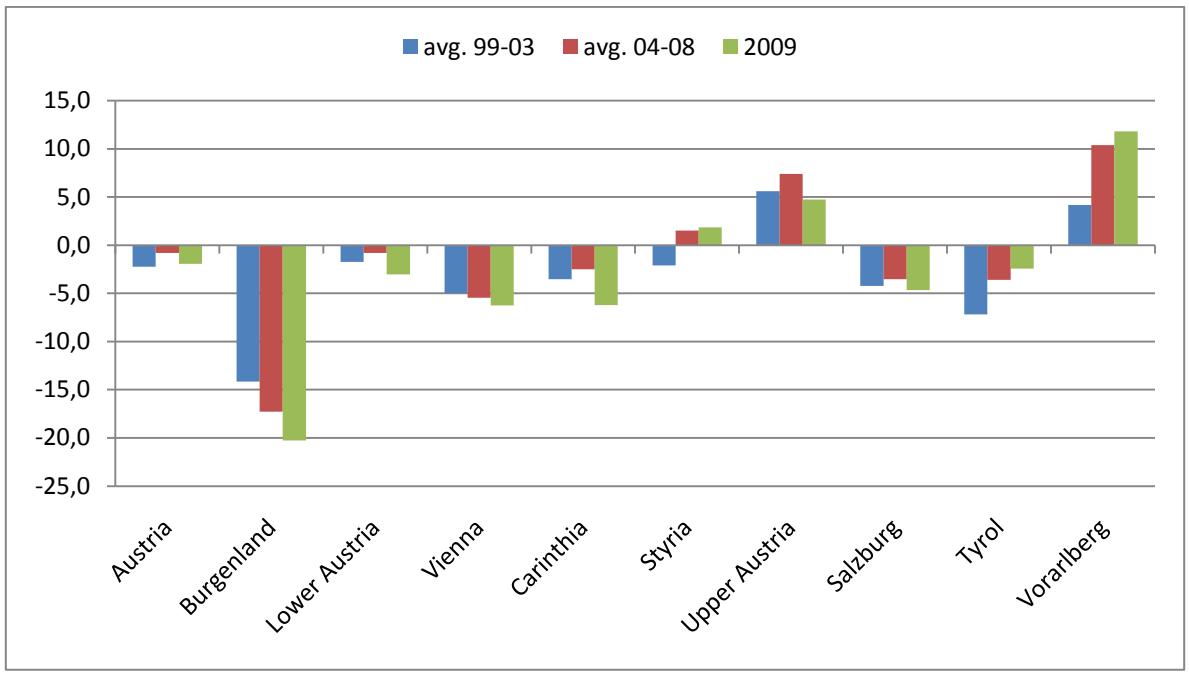
[3] For a definition of these sectors see the Appendix.

As far as net exports are concerned (see Figure 3), Austrian trade on average is nearly balanced. This however is not the case for individual Austrian regions. Out of the nine Austrian regions, only 3 show a net trade surplus (at least in the period 2004-2008), while the remaining 6 regions are net importers. This is most dramatic in Burgenland, where net imports steadily increased from around 14% of GDP in the period 1999-2003, to 17% in the period 2004-2008 and almost 19% in 2009. Net imports are lower in Vienna, Salzburg, Carinthia and Tyrol, but still reach around 2% to 5% of GDP (in 2004-2008). By contrast, Lower Austria has an almost balanced foreign trade.

The net trade surplus regions are Upper Austria, Vorarlberg and from the period 2004-2008 onwards also Styria, though in the latter net exports are considerably lower than in the first two regions.

The year 2009 generally brought a deterioration in the regions' trade balances as trade deficits grew larger while trade surpluses were shrinking; only Tyrol and Vorarlberg are an exception to this as the imports declined by more than the regions' exports in 2009.

Figure 3: Net exports by Austrian regions, in % of regions' GDP



Source: Own calculations.

As far as the structure of trade is concerned, Table 6 illustrates that the foreign trade of Austrian regions is (according to the Eurostat COMEXT database) dominated by trade in products from the manufacturing industries, as the cover 90% or more of total regional exports and imports. In terms

of GDP the size of sector trade varies depending on the size of overall trade. Hence in Burgenland imports from the low as well as medium to high technology manufacturing industries are higher than 50% of the region's GDP, while in Vienna these imports reach just 25% of Vienna's GDP. As far as exports from the manufacturing industries are concerned these are highest in Upper Austria and Vorarlberg, at around 53% to 55% of GDP.

In most Austrian regions exports from the medium to high technology industries tend to be higher than from the low technology industries (by 4%-8% of GDP), the exception being especially Vorarlberg and also Tyrol and Burgenland.

Table 6: Structure of regional foreign trade by Austrian regions, in % of GDP and % of total trade, 2004-2008 averages

in % of GDP										
	Austria	Burgenland	Lower Austria	Vienna	Carinthia	Styria	Upper Austria	Salzburg	Tyrol	Vorarlberg
	Imports									
Agriculture	1.0	1.5	1.4	0.5	1.2	1.3	1.2	0.9	1.0	1.2
Basic services	0.2	0.3	0.3	0.2	0.3	0.3	0.2	0.2	0.2	0.2
Business services	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Low tech manufacturing	16.7	24.0	20.5	10.4	19.0	19.8	19.3	14.8	16.3	19.7
Medium/high tech manufacturing	21.2	27.4	24.9	15.2	24.0	24.5	24.1	19.2	20.3	22.5
Mining&energy	2.2	3.5	2.7	1.2	2.6	2.7	2.5	1.9	2.1	2.8
	Exports									
Agriculture	0.4	0.7	0.8	0.1	0.4	0.5	0.5	0.3	0.2	0.2
Basic services	0.4	0.6	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Business services	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Low tech manufacturing	17.1	18.6	21.2	7.9	18.0	19.9	22.7	15.8	17.7	28.8
Medium/high tech manufacturing	21.9	18.5	25.6	13.2	24.9	28.3	30.6	16.5	17.4	26.8
Mining&energy	0.7	1.1	0.9	0.6	0.9	0.9	0.7	0.6	0.6	0.7

Table 6 continued: Structure of regional foreign trade by Austrian regions, in % of GDP and % of total trade, 2004-2008 averages

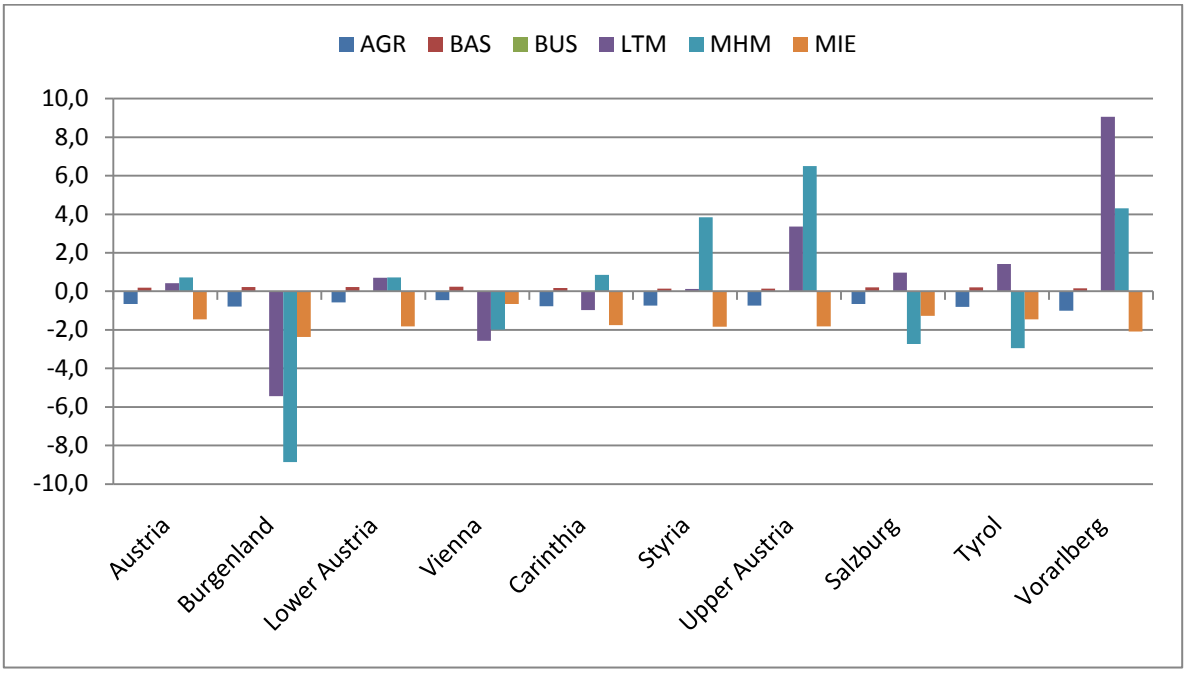
in % of total										
	Austria	Burgenland	Lower Austria	Vienna	Carinthia	Styria	Upper Austria	Salzburg	Tyrol	Vorarlberg
	Imports									
Agriculture	2.5	2.7	2.8	1.9	2.6	2.6	2.6	2.5	2.6	2.5
Basic services	0.5	0.6	0.6	0.6	0.5	0.5	0.5	0.6	0.5	0.5
Business services	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Low tech manufacturing	40.4	42.3	41.2	37.8	40.3	40.8	40.7	39.9	40.7	42.4
Medium/high tech manufacturing	51.2	48.2	49.9	55.2	51.0	50.4	50.8	51.9	50.8	48.5
Mining&energy	5.3	6.1	5.5	4.4	5.5	5.6	5.3	5.1	5.3	6.0
	Exports									
Agriculture	0.9	1.9	1.6	0.3	1.0	1.1	0.9	0.8	0.6	0.3
Basic services	1.0	1.4	1.0	1.8	0.9	0.8	0.7	1.2	1.2	0.7
Business services	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Low tech manufacturing	42.2	47.0	43.3	35.5	40.4	39.8	41.3	47.0	48.6	50.6
Medium/high tech manufacturing	54.0	46.9	52.2	59.7	55.8	56.6	55.8	49.2	47.7	47.2
Mining&energy	1.8	2.8	1.8	2.5	1.9	1.8	1.3	1.8	1.8	1.2

Source: Own calculations.

Looking at the net trade by industry products delivers highly differentiated results. On average (or for Austria in total) net trade in manufacturing products is slightly positive, led by high net export surpluses in medium to high technology industry products of Upper Austria, Styria and Vorarlberg, and the additional surpluses in trade in low tech industry products of Upper Austria and Vorarlberg. Additionally, Lower Austria, Salzburg, Tyrol and Carinthia show in one or the other manufacturing industry a net trade surplus. In total this outweighs the high net imports in both manufacturing sector by Burgenland and Vienna and also the trade deficits in the low technology industry products of Salzburg and Tyrol.

By contrast all Austrian regions are net importers of products from the mining and energy sector and also the agricultural sector.

Figure 4: Net exports by regions and sectors, in % of regions' GDP, 2004-2008 averages



Source: Own calculations.

In terms of the regions' contribution to total Austrian exports and imports the weight of the individual regions tend to vary greatly (see Table 7). For the period 2004-2008 it shows that the main foreign trade regions are Lower Austria, Vienna, Styria and Upper Austria – their share in Austrian imports is around 15% to 19% and around 15% to 22% in exports. Oppositely, the share of the other regions is low, especially in the case of Burgenland that contributes only 3% to Austrian imports and 2% to Austrian exports. The other regions contribute around 5% to 8% to exports and imports, respectively. With respect to the regions' contribution to the Austrian trade in individual sectors it shows that the distribution across regions more or less follows the distribution for overall trade. The exceptions being Vienna that has a particularly high share in Austrian trade in services (especially business services) and Lower Austria that contributes almost one third to Austrian trade in agriculture products.

Table 7: Regions' contributions to total Austrian in trade, in % of total trade, 2004-2008 averages

	Burgenland	Lower Austria	Vienna	Carinthia	Styria	Upper Austria	Salzburg	Tyrol	Vorarlberg	Total
Imports										
Total trade	***3.1***	***18.8***	***17.9***	***6.5***	***14.7***	***19.0***	***6.4***	***8.4***	***5.2***	***100.0***
Agriculture	3.3	20.7	13.8	6.7	15.5	19.5	6.5	8.7	5.3	100.0
Basic services	3.3	19.4	19.3	6.4	14.3	17.7	6.5	8.4	4.8	100.0
Business services	3.1	18.8	22.8	6.0	13.5	16.5	6.6	8.3	4.5	100.0
Low tech manufacturing	3.2	19.2	16.8	6.5	14.9	19.1	6.4	8.5	5.4	100.0
Medium/high tech manufacturing	2.9	18.3	19.3	6.5	14.5	18.8	6.5	8.4	4.9	100.0
Mining&energy	3.6	19.5	15.1	6.9	15.6	19.0	6.2	8.4	5.8	100.0
Exports										
Total trade	***2.2***	***18.8***	***14.7***	***6.3***	***15.5***	***22.4***	***6.0***	***7.8***	***6.4***	***100.0***
Agriculture	4.4	32.9	5.2	6.5	17.7	20.8	5.1	5.2	2.2	100.0
Basic services	3.0	18.5	26.2	5.7	11.8	14.8	7.0	8.8	4.2	100.0
Business services	2.9	19.2	29.8	5.0	11.2	13.6	6.2	7.7	4.5	100.0
Low tech manufacturing	2.5	19.3	12.3	6.0	14.6	21.9	6.6	9.0	7.7	100.0
Medium/high tech manufacturing	1.9	18.2	16.2	6.5	16.2	23.1	5.4	6.9	5.6	100.0
Mining&energy	3.2	19.5	21.9	7.2	14.8	15.5	6.1	7.4	4.4	100.0

Source: Own calculations.

The regions' contributions to total Austrian exports and imports depend to a large degree on the regions' size, as bigger regions' tend to have a bigger share in Austrian foreign trade. Hence these figures are not really indicative of the regions' strengths or comparative advantages (at least in the Austrian context). Focussing on the latter we put both the export and import shares of the Austrian regions in relation to each region's share in total Austrian population, in order to reveal their particular strengths. In other words, we measure the ratio (in percent) of each region's exports and imports per inhabitant to the Austrian average export and import share per inhabitant. A ratio (expressed in percent) of above 100 indicates that a region is more than proportional engages in either Austrian exporting or importing, which in the case of exporting is seen as a comparative advantage of the region – at least in comparison with the other Austrian regions. The results are shown in Table 8)

Table 8: Regions' import and export shares in % of regions' population share, 2004-2008 averages

	Burgenland	Lower Austria	Vienna	Carinthia	Styria	Upper Austria	**Salzburg**	Tyrol	**Vorarlberg**
Imports									
Total trade	**91.5**	**97.9**	**89.5**	**96.3**	**101.2**	**111.8**	**101.4**	**100.1**	**117.2**
Agriculture	*98.8*	*108.2*	*68.9*	*98.8*	*106.4*	*114.8*	*102.2*	*103.9*	*120.1*
Basic services	*96.7*	*101.2*	*96.4*	*93.9*	*98.1*	*104.5*	*102.4*	*99.7*	*109.2*
Business services	*90.5*	*98.0*	*113.8*	*88.8*	*92.8*	*97.3*	*103.6*	*98.2*	*102.8*
Low tech manufacturing	*95.7*	*99.9*	*83.9*	*96.2*	*102.2*	*112.9*	*100.3*	*101.0*	*123.3*
Medium/high tech manufacturing	*86.2*	*95.3*	*96.4*	*95.8*	*99.6*	*111.0*	*102.6*	*99.3*	*110.8*
Mining&energy	*106.4*	*101.5*	*75.2*	*101.3*	*107.4*	*111.9*	*98.1*	*99.8*	*132.2*
Exports									
Total trade	**65.1**	**98.2**	**73.2**	**93.1**	**106.4**	**131.8**	**93.6**	**92.8**	**146.2**
Agriculture	*130.8*	*171.7*	*25.8*	*96.3*	*121.4*	*122.8*	*80.1*	*62.3*	*49.4*
Basic services	*87.7*	*96.7*	*130.8*	*84.2*	*81.3*	*87.2*	*109.8*	*105.0*	*95.5*
Business services	*84.4*	*100.1*	*148.6*	*73.4*	*77.0*	*79.9*	*97.7*	*92.0*	*103.2*
Low tech manufacturing	*72.7*	*100.6*	*61.6*	*89.2*	*100.4*	*129.4*	*104.2*	*107.0*	*175.7*
Medium/high tech manufacturing	*56.5*	*94.8*	*80.9*	*96.0*	*111.4*	*136.2*	*85.1*	*82.0*	*127.7*
Mining&energy	*94.6*	*101.7*	*109.4*	*106.3*	*101.8*	*91.5*	*96.2*	*88.0*	*99.5*

Source: Own calculations.

The results indicate that the Austrian regions tend to be relatively similar in terms of import structure. Certainly the more industrial regions tend to have over-proportionate imports in both manufacturing sectors, while in the less industrialised regions like Burgenland and Vienna imports are lower than average. But the main differentiation of Austrian regions is on the export side. Here it shows that only two regions, Upper Austria and Vorarlberg, have particular strengths in both manufacturing sectors' exports, while in the majority of the remaining regions industry exports are below the Austrian average. This is especially the case in Burgenland, which in turn however exports a high per capita amount of agricultural goods, just as Lower Austria. Vienna is most competitive in services exports, quite in contrast to all other regions that especially in the field of business services tend to be underrepresented in services exports.

These differences in comparative advantages are rooted (also by the nature of the estimation method) in differences in the structure of economic activity between the regions. Upper Austria,

Vorarlberg und to some extent Styria are much more industrialised than the other regions in Austria, and thus also have a higher potential to engage in foreign trade in these sectors. Differently, Burgenland is highly rural with a comparatively low amount of manufacturing industry, and this not only determines its export structure, but in the end is also the explanation of Burgenland's high deficit in foreign trade.

Finally, we again examine the total trade of the Austrian regions in the period 2004-2008, however this time we differentiate between trade with the EU-27 and extra-EU trade. Quite naturally it shows that the EU-27 is the far more important trading partner for Austria than the rest of the world (RoW). Still, there is some differentiation between the regions' imports and exports. In the case of the former, for all Austrian regions imports from the EU-27 outweigh imports from RoW by 4 to 1 or more (i.e. EU-27 are 4 times or more higher than RoW imports). In the case of exports however this ratio is only 3 to 1 or less, which emphasizes the important role of non-EU countries as export destinations.

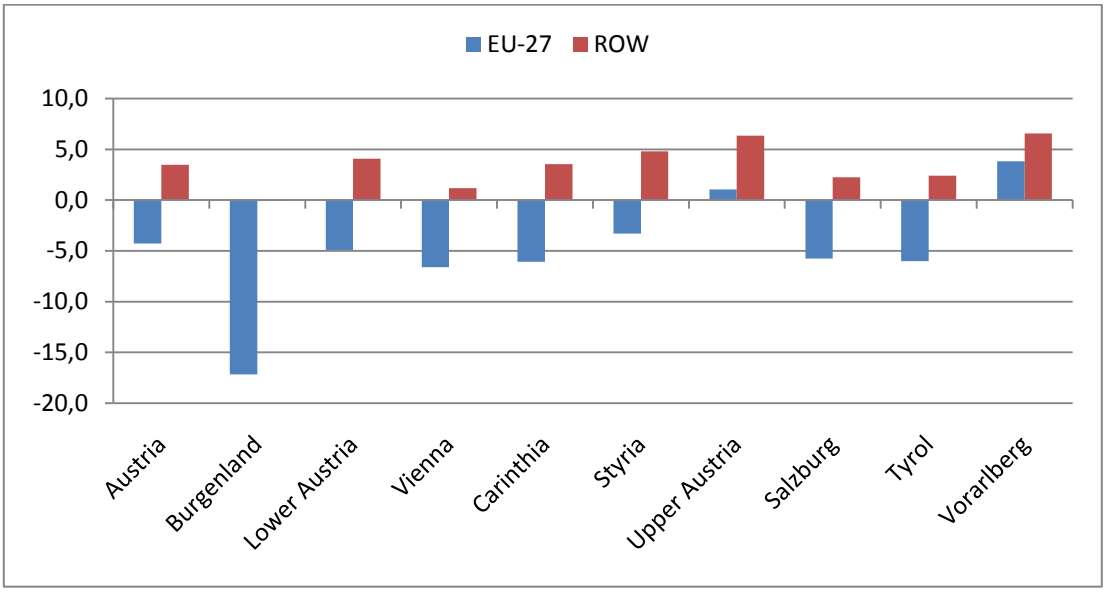
Table 9: Regions' exports and imports to the EU-27 and RoW, in % of regions' GDP, 2004-2008 averages

	Imports			Exports	
	EU-27	**RoW**		**EU-27**	**RoW**
Austria	33.7	7.6		29.4	11.1
Burgenland	46.2	10.6		29.0	10.5
Lower Austria	40.6	9.2		35.7	13.3
Vienna	22.6	5.0		16.0	6.1
Carinthia	38.4	8.7		32.3	12.3
Styria	39.6	9.0		36.3	13.8
Upper Austria	38.6	8.8		39.7	15.2
Salzburg	30.3	6.8		24.5	9.1
Tyrol	32.6	7.4		26.6	9.8
Vorarlberg	37.6	8.8		41.5	15.4

Source: Own calculations.

This fact is also reflected in the trade balance of the Austrian regions with the EU-27 and the RoW (see Figure 5), and leads to a split in Austrian trade. Whereas net trade with the EU-27 is mostly negative, all Austrian regions (except Burgenland) have a positive trade balance with the RoW. Importantly, Vorarlberg and Upper Austria are the only two regions that according to our results have a positive trade balance vis-à-vis the EU-27. Basically, this pattern is also replicated for the trade in low and medium to high technology industry goods as shown in Table 10).

Figure 5: Regions' net exports vis-à-vis the EU-27 and RoW, in % of regions' GDP, 2004-2008 averages



Source: Own calculations.

Table 10: Regions' net exports vis-à-vis the EU-27 and RoW – two manufacturing sectors, in % of regions' GDP, 2004-2008 averages

	Low tech manufacturing			Medium/high tech manufacturing	
	EU	RoW		EU	RoW
Austria	-1.3	1.7		-2.3	3.0
Burgenland	-6.5	1.0		-9.6	0.8
Lower Austria	-1.5	2.2		-2.7	3.4
Vienna	-3.0	0.4		-3.3	1.4
Carinthia	-2.6	1.6		-2.6	3.4
Styria	-1.8	1.9		-0.6	4.4
Upper Austria	0.7	2.7		1.3	5.2
Salzburg	-0.7	1.7		-4.4	1.6
Tyrol	-0.5	1.9		-4.7	1.7
Vorarlberg	5.0	4.0		0.0	4.3

Source: Own calculations.

2.4. CRISIS EFFECTS

In this section the analysis of foreign trade of Austrian regions will be extended to an analysis of the trade-related effects of the economic crisis in 2009. Apart from analysing changes in trade flows that were a consequence of the European and global economic downturn, special emphasis will be put on the employment and output related effects the decline in trade flows had on the regions. For this, not only the analysis will be expanded, but also a couple of new methodological steps are introduced.

As far as employment effects of the crisis are concerned two types of effects may be differentiated. Firstly, there are direct employment effects that are the results of the reduction of exports of the individual industries in the regions, and thus show how the decline in export production translates into a decline in employment in the respective industry.

Secondly, there are total effects that not only show the direct employment effects in the respective industry but also take into account the effects the reduction in intermediate demand due to the decline in exports. That is, the reduction of export demand in one industry spills over to other industries as the demand for intermediate inputs from them to produce export goods tends to decline pari passu with the decline in exports.

To estimate both direct and total employment effects we rely on the same data sources as for the analysis of trade flows, while the method needs to be expanded. Therefore in the following we will give a short description on how both effects may be estimated and continue afterwards with the analysis of the crisis related effects on regional foreign trade.

Notably, as far as the employment effects are concerned we only take into account the effects arising from a reduction or increase of exports of the Austria regions. We do not consider possible substitution effects that not only may cause a reduction of the regions' imports, but also may be connected to an increase in employment. In part this is because such analysis would go beyond the scope of the paper; more importantly, it is difficult to argue for substitution effects in times of crisis, when the reduction in imports and exports are mainly a reflection of a reduction in aggregate demand.

2.4.1. Direct effects

In contrast to the analysis of regional trade flows that gave results in terms of trade by goods and regions, the analysis of employment effects necessitates the estimation of trade by industries and regions. This allows firstly estimating the effects the crisis had on the industries and then break these effects down to the regional level – according to the employment share each region has in the respective industry.

To estimate trade by industry and regions we rely on the matrix X derived in equation 2.2. that shows country level exports by goods and industry. Schematically X looks like as shown in Table 11 with the rows of X representing the exports by products and the columns exports by industries for the whole country. Consequently the sum of each column, represented by the vector xind, gives total exports by industries.

Table 11: Country level exports by products and industries matrix, scheme

	Industries	Total exports by products
Products	X	xtot
Total exports by industries	xind	

To estimate foreign trade by industry and regions we use the vector xind, follow the methodology developed above and estimate exports by industry and regions, represented by the matrix XIR as:

$$XIR = diag(xind) * L \qquad 2\text{-}15$$

To translate export ouput by industry and regions into employment terms, we calculate the labour/output ratio, i.e. the amount of labour that is required to produce one unit of output by industry. This ratio can then be applied to estimate the labour embodied in the production of the exports in each industry and region.

To do this we first allocate total output of each industry to the regions, using the assumption that the regions' employment share (adjusted for productivity differences) in each industry is proportional to their share in the output of the respective industry. That is we estimate the matrix of regional output OR as:

$$OR = diag(g) * L \qquad 2\text{-}16$$

with the vector g is derived from the national use table (see Table 3) and represents gross output by industries. Matrix L (from equation 2-3) contains the employment share by industries and regions.

To calculate the labour embodied in one unit of regional output by industry, we then combine matrix OR with the matrix E, i.e. total employment by industries and regions to estimate the matrix LE.

$$LE = \begin{bmatrix} E_{1,1}/OR_{1,1} & \cdots & E_{1,n}/OR_{1,n} \\ \vdots & \ddots & \vdots \\ E_{n,1}/OR_{n,1} & \cdots & E_{n,n}/OR_{n,n} \end{bmatrix} \quad 2\text{-}17$$

Matrix LE contains for each region and industry the labour required to produce one unit of output. As a consequence matrix LE can now be combined with matrix XIR, i.e. trade by industry and regions to estimate the labour required to produce the exports of each region by individual industries. This results in the final matrix LT:

$$LT = \begin{bmatrix} LR_{1,1} * XIR_{1,1} & \cdots & LR_{1,1} * XIR_{1,1} \\ \vdots & \ddots & \vdots \\ LR_{1,1} * XIR_{1,1} & \cdots & LR_{1,1} * XIR_{1,1} \end{bmatrix} \quad 2\text{-}18$$

This matrix can will be calculated for each year, so that for each year the actual labour required in export production is estimated. The changes in these labour requirements over time then allow drawing conclusions on the employment effects of the regions' foreign trade, i.e. whether employment increased or decreased because of trade.

2.4.2. Total effects

To estimate the total employment effects of changes in exports, i.e. both direct effects and effects arising through a reduction in the demand of intermediate inputs, we draw on the WIOD supply and use tables used above and calculate, at the country level, the Leontief inverse matrix. This matrix allows calculating the total output required (by industry) to produce a certain amount of final demand, and hence can be used to calculate the output required to produce a country's exports. The Leontief inverse is defined as[4]:

$$LEO = (I - A)^{-1} \quad 2\text{-}19$$

[4] To calculate A the two steps are needed. First calculate the supply transformation matrix T as: $T = S' * inv(diag(q))$. Matrix T is then applied to calculate as: $A = T * U * inv(diag(g))$. Thereby S is the supply matrix, q the vector of final uses, U is the use table, a vector g represents gross output by industries. The property of the Leontief inverse is as such that using the vector of final demand y, the total output required to produce y can be calculated using: $g = (I - A)^{-1} * T * y$.

The Leontief inverse is used to calculate the output requirements needed to produce the exports by industry of Austria using:

$$tor = (I - A)^{-1} * T * xtot \qquad 2\text{-}20$$

The vector tor represents the total output requirements by industry needed to produce Austria's exports, i.e. vector xtot. As exports are given in goods and not by industries the supply transformation matrix T has to be used in order to get output at the level of industries.

Given this, the next step is to disaggregate the total country output requirements to the level of the regions. This is done under the already above used assumption that the regions' employment share in each industry is proportional to their share in the output of the respective industry. Hence we employ matrix L of regional employment shares to calculate the total output requirements for exports by regions as:

$$TOREG = diag(tor) * L \qquad 2\text{-}21$$

Finally, to estimate the labour embodied in this output we proceed as in estimation of direct effects and estimate the regional labour to output matrix LR to employ it to calculate the matrix TLT:

$$TLT = \begin{bmatrix} LR_{1,1} * TOREG_{1,1} & \cdots & LR_{1,1} * TOREG_{1,1} \\ \vdots & \ddots & \vdots \\ LR_{1,1} * TOREG_{1,1} & \cdots & LR_{1,1} * XIR_{1,1} \end{bmatrix} \qquad 2\text{-}22$$

Matrix TLT shows the total labour required by industry and regions to produce the regions' exports in a given year.

2.5. Results

Before analysing the trade related employment effects of the crisis on the Austrian regions, we briefly analyse the changes in the trade flows in 2009 compared to the five year period before. As Table 12 indicates the year 2009 was marked by a significant decline in foreign trade in the Austrian regions, as both exports and imports declined strongly. Thus, in terms of GDP, overall Austrian imports declined by around 5 percentage points and exports by 6 percentage points. Within Austria there was quite a strong differentiation however. Imports declined strongly especially in Burgenland, but also in Lower Austria, Carinthia, and Upper Austria, i.e. all regions with some strength in medium/high tech manufacturing, while they declined least in Vienna. As far as exports are concerned it is the same group of regions where they declined most. Hence exports shrank by more than 11 percentage points of GDP in the case of Burgenland, and around 8 to 10 percentage points in Carinthia, Lower and Upper Austria. However exports declined much less in Tyrol and Vorarlberg, i.e. only by around 3 percentage points of GDP.

As a consequence the net trade effects were even more differentiated across regions. The trade deficits increased most strongly in Carinthia and Burgenland, while Tyrol, Vorarlberg and to a small extent also Styria actually saw an improvement of their trade balance as imports declined by more than exports.

Table 12: Changes in imports, exports and net trade, average 2004-2008 and 2009, in % of GDP

	Imports	Exports	Net trade
Austria	-5.0	-6.2	-1.2
Burgenland	-8.6	-11.6	-3.0
Lower Austria	-6.1	-8.4	-2.2
Vienna	-3.9	-4.7	-0.8
Carinthia	-6.1	-9.8	-3.7
Styria	-5.0	-4.6	0.3
Upper Austria	-6.0	-8.6	-2.7
Salzburg	-4.0	-5.2	-1.1
Tyrol	-4.2	-3.0	1.2
Vorarlberg	-4.8	-3.4	1.4

Source: Own calculations.

Table 13 reveals the sources of the changes in net trade, as it shows the net trade developments by sector. The results in this table indicate that across all regions it were especially the low tech manufacturing goods that contributed to the worsening of the net trade balance, foremost in Burgenland, Carinthia and Upper Austria. As far as high tech manufacturing goods are concerned, they had a differentiated impact. In most regions they declined – most strongly in Lower Austria, at around 1.8 percentage points of GDP; yet in some regions net exports of these goods even increased, notably in Tyrol and Vorarlberg and to a lesser extent in Styria, too.

Throughout all regions, positive effects for the trade balance also came from the energy products, basically as imports declined more strongly than exports.

Table 13: Changes in net trade by industries, avg. 2004-2008 and 2009, in % of GDP

	Austria	Burgenland	Lower Austria	Vienna	Carinthia	Styria	Upper Austria	Salzburg	Tyrol	Vorarlberg
Agriculture	0.1	0.2	0.2	0.0	0.0	0.1	0.2	0.0	0.0	0.0
Basic services	0.0	-0.1	0.0	-0.1	0.0	0.0	0.0	-0.1	-0.1	-0.1
Business services	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Low tech manufacturing	-1.1	-3.0	-1.0	-0.2	-2.9	-0.7	-2.3	-1.4	-0.2	-1.0
Medium/high tech manufacturing	-0.5	-0.8	-1.8	-0.7	-1.3	0.5	-0.9	0.0	1.2	2.0
Mining & energy	0.3	0.7	0.5	0.2	0.4	0.4	0.4	0.3	0.3	0.4
TOTAL	**-1.2**	**-3.0**	**-2.2**	**-0.8**	**-3.7**	**0.3**	**-2.7**	**-1.1**	**1.2**	**1.4**

Source: Own calculations.

Looking at the 2009 trade developments in the Austrian regions vis-à-vis the EU27 and the RoW (Table 14) reveals that both imports as well as exports declined in all Austrian regions, with the exception of imports from RoW to Tyrol and Vorarlberg. The difference between EU27 and RoW trade is that the fluctuations tended to much higher in trade with the EU27, as both exports and imports tended to decline by around 5 percent of GDP on average across the regions. By contrast imports from RoW declined only little, while exports declined more, i.e. around 1.4 percent of GDP.

Table 14: Imports and exports vis-à-vis the EU-27 and RoW, avg. 2004-08 and 2009, in % of GDP

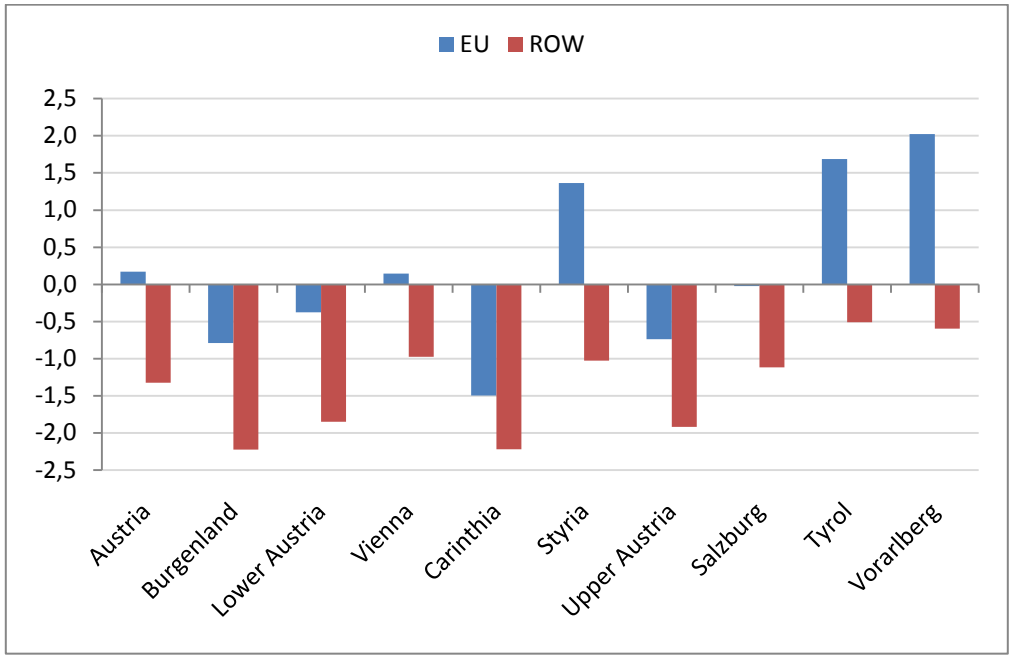
	EU			ROW		
	avg.2004-2008	2009	Difference	avg.2004-2008	2009	Difference
Imports						
Austria	33.7	28.8	-4.9	7.6	7.5	-0.1
Burgenland	46.2	38.3	-7.9	10.6	9.9	-0.7
Lower Austria	40.6	34.6	-6.0	9.2	9.1	-0.2
Vienna	22.6	19.0	-3.6	5.0	4.7	-0.2
Carinthia	38.4	32.4	-5.9	8.7	8.5	-0.2
Styria	39.6	34.5	-5.1	9.0	9.2	0.1
Upper Austria	38.6	32.7	-5.9	8.8	8.7	-0.1
Salzburg	30.3	26.3	-4.0	6.8	6.8	-0.1
Tyrol	32.6	28.4	-4.1	7.4	7.4	0.0
Vorarlberg	37.6	32.7	-5.0	8.8	9.0	0.2
Exports						
Austria	29.4	24.7	-4.7	11.1	9.7	-1.4
Burgenland	29.0	20.3	-8.7	10.5	7.6	-2.9
Lower Austria	35.7	29.4	-6.3	13.3	11.3	-2.0
Vienna	16.0	12.5	-3.5	6.1	4.9	-1.2
Carinthia	32.3	24.9	-7.4	12.3	9.8	-2.4
Styria	36.3	32.5	-3.7	13.8	12.9	-0.9
Upper Austria	39.7	33.0	-6.6	15.2	13.1	-2.0
Salzburg	24.5	20.5	-4.0	9.1	7.9	-1.2
Tyrol	26.6	24.1	-2.5	9.8	9.3	-0.5
Vorarlberg	41.5	38.5	-2.9	15.4	15.0	-0.4

Source: Own calculations.

Interestingly enough, the net trade effects of the crisis for the Austrian regions does not depend on the size of the reduction of imports and exports as Figure 6 suggests. Thus, in all Austrian regions the net trade balance worsened more in the trade with the RoW in 2009. On average trade balance decreased by around 1.3 percent of GDP, and most strongly in Burgenland, Lower and Upper Austria and in Carinthia (around 1.8 to 2 percent of GDP).

By contrast the trade balance vis-à-vis the EU-27 worsened by less than the RoW balance (e.g. again in Carinthia and Burgenland), or even improved, especially in the regions Styria, Tyrol and Vorarlberg.

Figure 6: Net trade vis-à-vis the EU-27 and RoW 2009, in % of GDP



Source: Own calculations.

Overall, therefore, the economic crisis led to a significant reduction in trade volumes of the Austrian regions. In most of them this was connected with a drop in regional GDP as exports tended to decline stronger than imports, especially in Burgenland, Carinthia and Upper Austria, where the net trade balance worsened by around 3 percentage point of GDP or more. Yet, there are also regions, notably Tyrol and Vorarlberg, where the net trade balance improved, largely because imports fell by more than exports, so that as a consequence the net trade effect of the crisis on these regions' GDP was even positive.

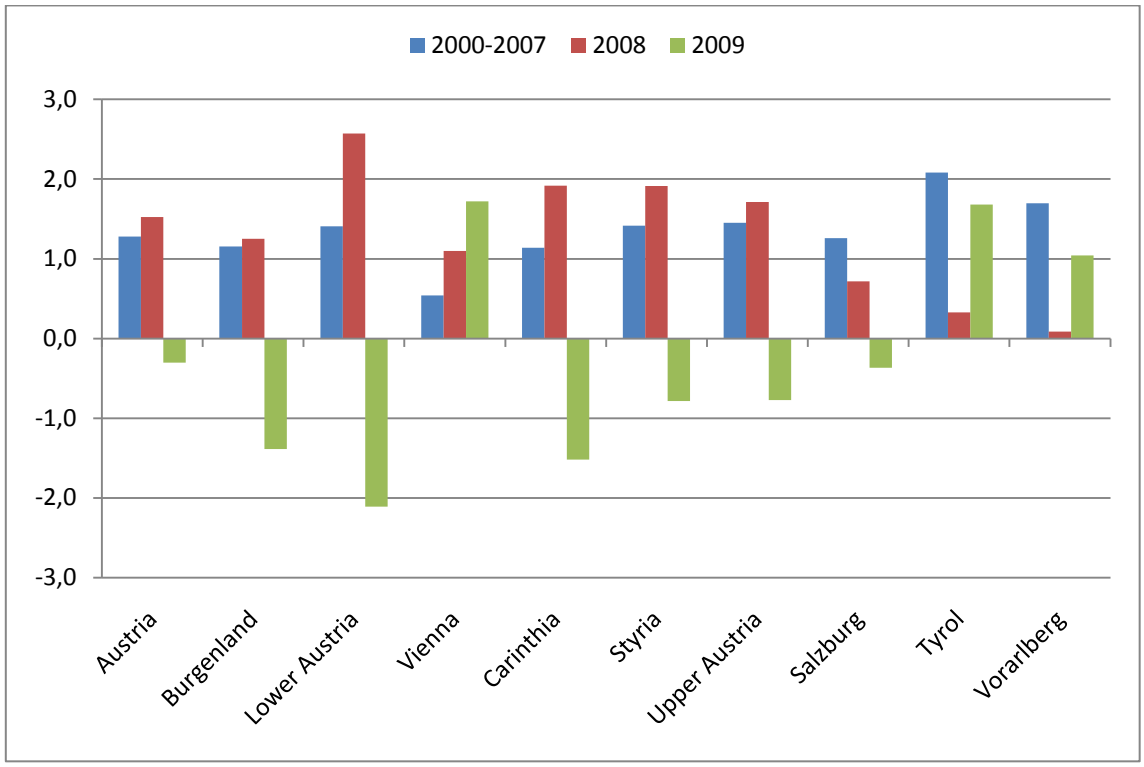
2.5.1. Direct employment effects

This section "translates" the changes in the regions' export demand into employment terms in order to analyse the direct trade related employment effects of the crisis on the Austrian regions. To put the trade effects in some perspective the analysis starts with a short description of the developments in total regional employment from 2000 to 2009 (see Figure 7).

As shown, total employment developed quite positively in most of Austrian regions. The average annual growth rate of employment in the period 2000-2007 was higher than 1 percent in all regions except Vienna, and even higher than 2 percent in Tyrol. Also in 2008 employment tended to grow quite strongly in most Austrian regions, especially in Lower Austria (around 2.6% in Lower Austria

and close to two percent in Carinthia and Styria). By contrast employment levels almost stagnated in Tyrol and Vorarlberg in 2008. The economic crisis in 2009 brought a sudden stop to the employment developments observed over a prolonged time in most regions. Thus employment levels tended to drop quite strongly in 6 of the Austrian regions, especially in Lower Austria (by slightly more than 2%), but also in Burgenland and Carinthia. Oppositely employment increased in Vienna, presumably due to its high share of services in employment that were less affected by the crisis, as well as in Tyrol and Vorarlberg, as they might have been hit be the main crisis shock already a bit earlier (in 2008), and also as they seem to be highly competitive regions within Europe in their field of specialisation.

Figure 7: Total employment growth rates, avg. 2000-2007, 2008 and 2009



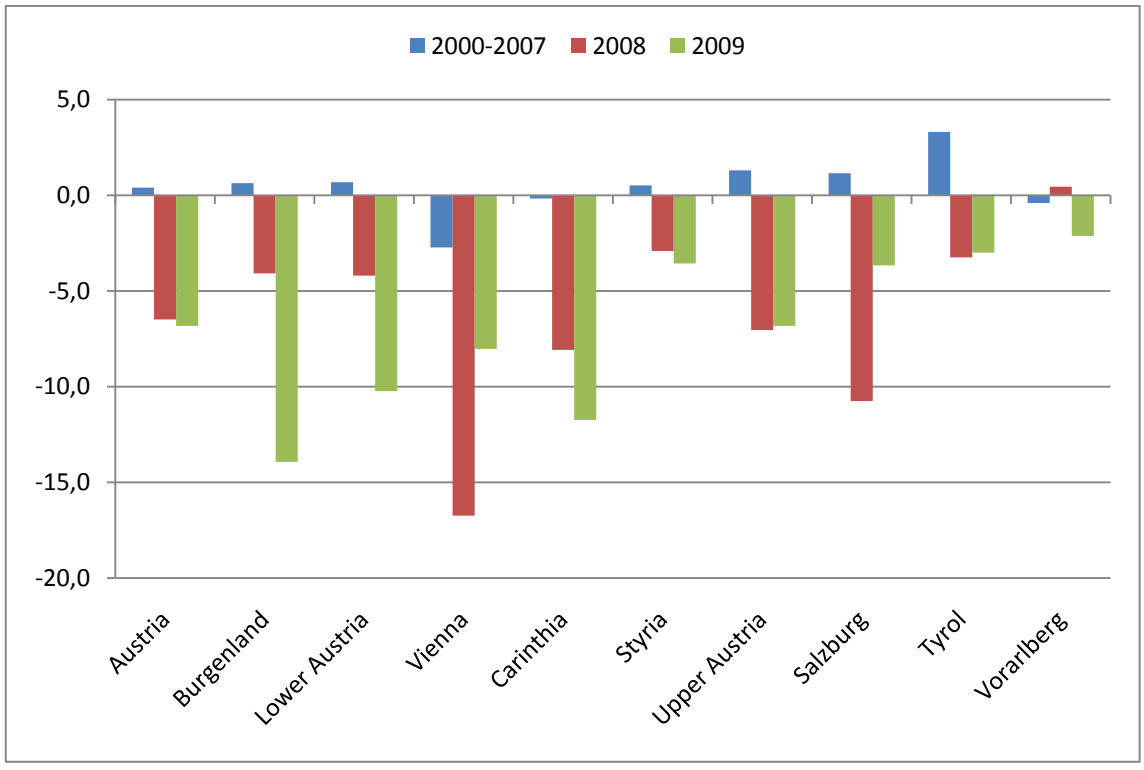
Source: Eurostat LFS, own calculations.

As far as the direct trade related employment effects are concerned the estimates suggest (Figure 8) that foreign trade contributed only little to employment growth in the regions. Looking at the development of the labour directly embodied in regional foreign trade indicates that in the period 2000 to 2007 the amount of labour to produce exports increased only slightly across most Austrian regions. On average trade related employment grew by around 0.4 percent per year in this period, though in Tyrol growth was much stronger at around 3% per year, and also Upper Austria and

Salzburg trade employment grew by over 1 percent per year. Contrastingly, in Vienna trade related employment decreased significantly at around 2.7 per year, and it also shrank in Carinthia and Vorarlberg, but to a much lesser extent.

The years 2008 and 2009 brought a massive change to mostly positive trade employment developments of the previous years. Hence already in 2008 the employment embodied in trade dropped quite dramatically, by more than 5% on average in Austria, and by around 16% and 11% in Vienna and Salzburg respectively. This might be an indications that the crisis hit the regions already a bit earlier than 2009, especially as in a number of regions the employment decline in 2008 was stronger than in the crisis year 2009, e.g. in Vienna, Upper Austria, Salzburg and Tyrol. Still the 2009 crisis had severe impacts on trade employment in the Austrian regions. Throughout all regions employment declined, and in many regions quite strongly (from 7% to 14%), as in Burgenland, Lower Austria, Vienna, Carinthia and Upper Austria. The least affected regions were Tyrol and Vorarlberg, but even here trade employment declined by 2% or more.

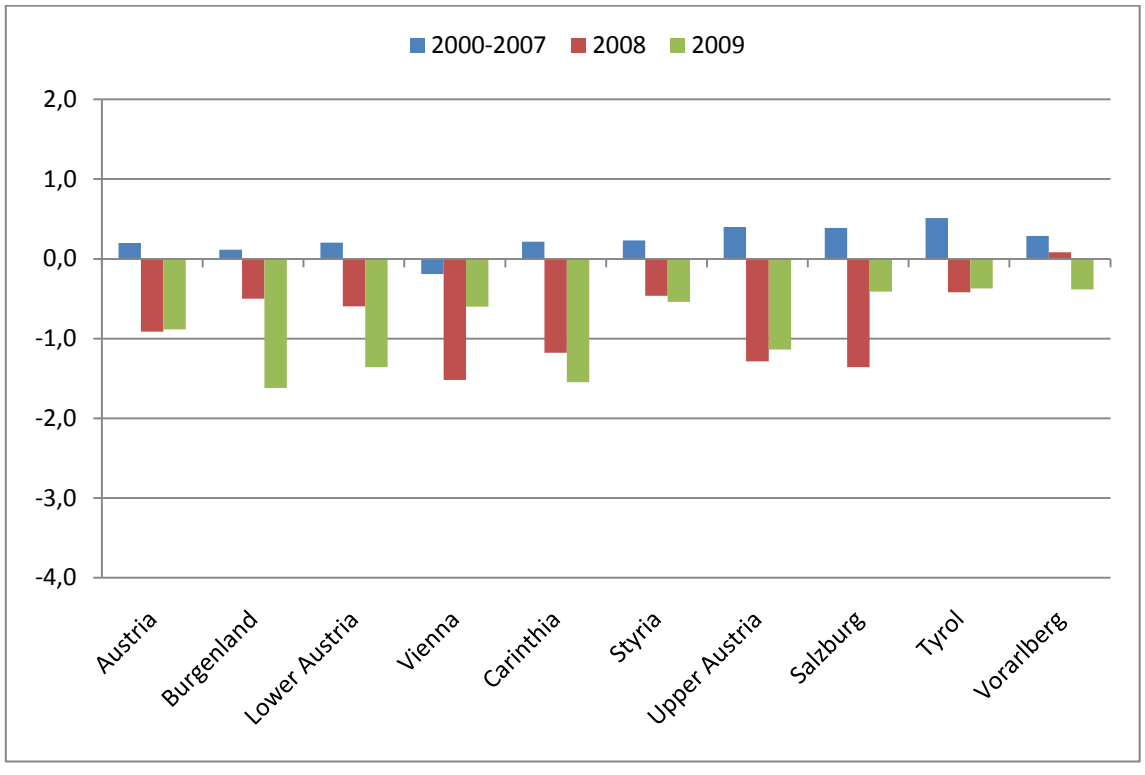
Figure 8: Growth in direct trade employment, avg. 2000-2007, 2008 and 2009



Source: Own calculations.

To evaluate the impact on the regional economy the changes in export related employment are put in relation to total regional employment (see Figure 9). This shows that in the period 2000-2007 the increasing exports led –ceteris paribus- to an increase in total employment in the regions of around 0.2 to 0.5 percent, except for Vienna where trade led to a reduction in overall employment. In correspondence with above results the development in exports however contributed negatively to total regional employment in 2008 and 2009. In both years, the exports developments caused trade related employment to decrease which in turn had negative consequences for total labour demand in the regions. Thus, all other things constant, the decline in exports caused overall employment to drop by around 0.5% to 1.6% in 2008 and 2009, with some regional differentiation as some regions (Vienna and Salzburg) were hit stronger already in 2008 while other regions felt the crisis effects fully in 2009. Nevertheless there is some differentiation across the regions on the severity of the effects. Amongst the regions that were more heavily affected by the crisis (i.e. had a trade related decrease in employment by 1% or more in 2008 or 2009), are Burgenland, Lower Austria, Vienna, Carinthia, Upper Austria and Salzburg, while Styria, Tyrol and Vorarlberg showed a somewhat higher resilience.

Figure 9: Growth of trade related employment in % of total regional employment (of previous year)



Source: Own calculations.

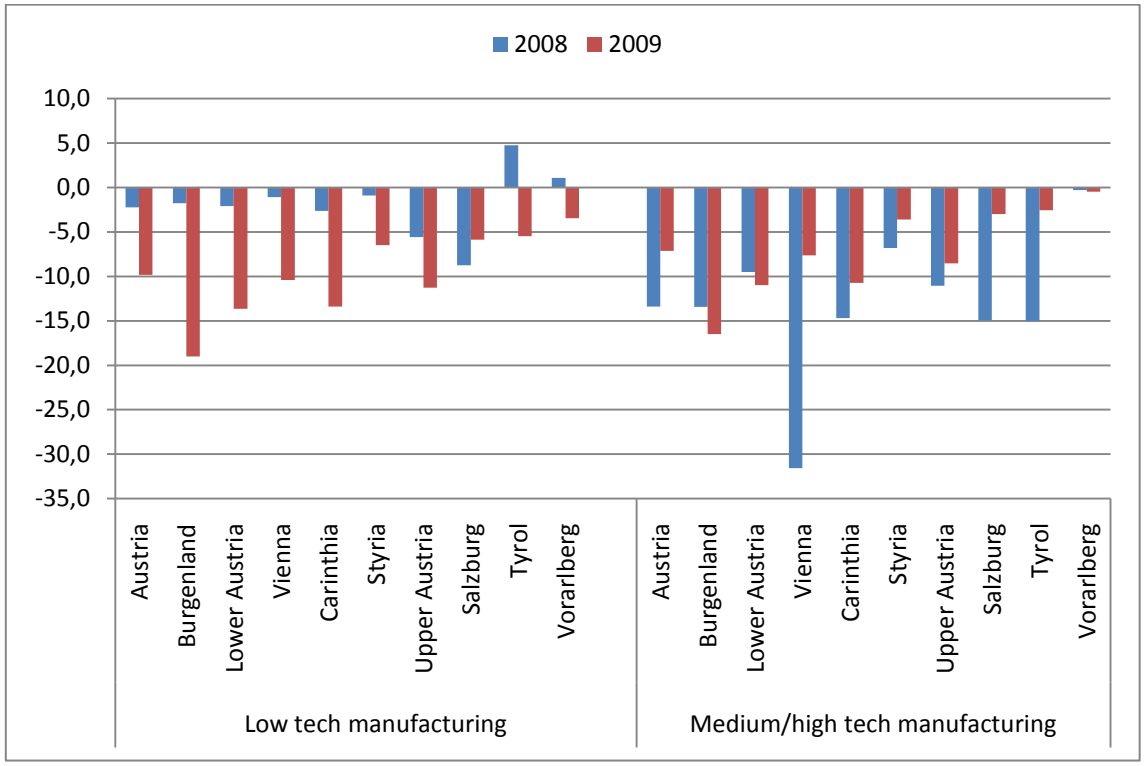
Looking briefly of the sectoral distribution of the trade related employment effects, we focus on the two manufacturing sectors only, as they are by far the most important exporting sectors. Figure 10shows the growth (decline) in the employment embodied in the production of low and medium/high tech industry goods for the Austrian regions and the years 2008 and 2009.

Interestingly enough the results suggest a strong differentiation between medium/high and low tech industry exports, at least as far as the effects of the crisis are concerned. Thus in 2008, in most regions the changes in low tech manufacturing exports only had relatively (!) little negative effects on employment. On average trade related employment decreased by slightly more than 2 percent. In Upper Austria and Salzburg the negative effects were much stronger, as in the former trade employment decreased by 5.6 percent and in the latter by more than 8 percent. Contrastingly, trade employment even increased in Tyrol and Vorarlberg.

As far as medium/high tech manufacturing exports are concerned, they affected employment negatively already in 2008, whereby the effects were quite dramatic, as on average trade related employment in this sector fell by around 14%. The most affected region in this respect was Vienna, were trade employment is estimated to have fallen by more than 30% in 2008, but also in all other regions the decline was very high (mostly above 10%).

The year 2009 brought negative employment developments in both industries and all Austrian regions. It was also the year when the crisis hit the low tech manufacturing sector fully, and trade related employment in this sector tended to decline strongly in most regions, especially in Burgenland, Lower Austria and Carinthia. With regards to the medium/high tech sector the negative employment effects were strong, but nevertheless to some extent weaker than the negative effects already encountered in 2008 (e.g. in Vienna, Salzburg and Tyrol).

Figure 10: Growth of direct trade related employment in manufacturing industries, 2008 and 2009



Source: Own calculations.

2.5.2. Total effects

The final step is to analyse the total effects arising from the regions' exporting activities on regional employment. As explained above the total employment effects due to regional exports are the sum of direct trade effects on the industries and of indirect employment effects as the exporting industries demand intermediate inputs from other industries to produce their export goods and hence thereby create additional demand for labour.

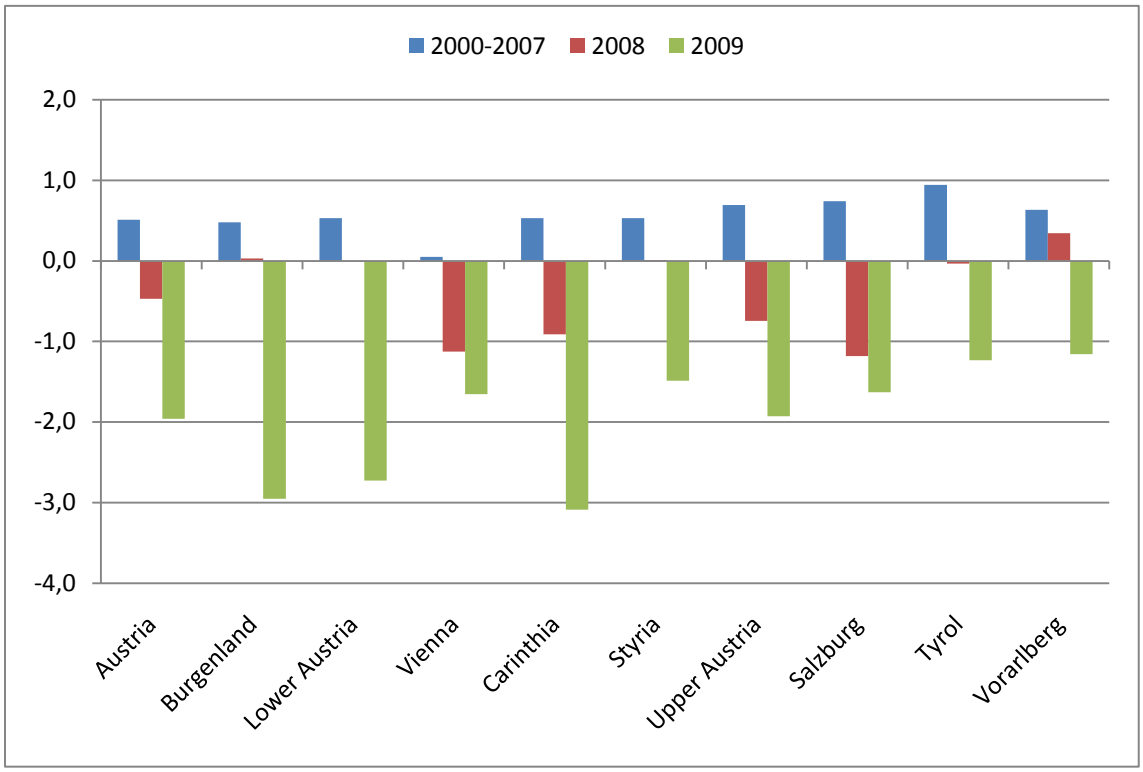
The brief analysis starts with Figure 11, which shows the total employment effects of exporting activities in relation to total regional employment (it thus compares to Figure 9 above). It shows that the expansion of exports in the period 2000-2007 had positive effects on total employment in the regions. On average trade related employment tended to grow by 0.5% per year in the Austrian regions, growth was lowest in Vienna (i.e. almost zero), and highest in Tyrol (close to 1%).

Notably, taking into account the employment generated by the demand for intermediate inputs almost doubles the positive effects from regional exports. This is indicated by the results for the period 2000-2007 if the direct effects and the total effects are compared. Even in Vienna, where directly trade related employment tended to have a negative impact on total Viennese employment, the jobs generated through intermediate inputs serving exports generated a small but still positive overall effect. For all other regions the employment gains from direct effects increased because of additional intermediate demand.

In 2008 the positive effects on total employment either vanished or turned to the opposite across the Austrian regions. The basic pattern of this change mirrors the effects of direct trade related employment, though, interestingly the total employment effects of the reduction in exports are a bit smaller than the direct effects alone. This may be attributed to the fact that not all sectors were equally hit by the reduction in exports, and hence while some sectors lost employment other sectors developed more positively and kept intermediate employment demand up, which tended to mitigate the direct employment losses a bit. In other words, this might be the gains from diversification.

In 2009 finally the crisis hit the Austrian regions fully in terms of employment. Thus, just as with direct effects, the large reduction in the regions' exports led to significant trade induced losses in total employment, from around 1.2% in Tyrol and Vorarlberg up to around 3% in Burgenland and Carinthia. In contrast to 2008, all major trading sectors suffered from export decline and hence direct employment losses in 2009, so that there were only little mitigating effects. As a consequence the total employment effects of the crisis are around twice to three times as high as the direct effects alone.

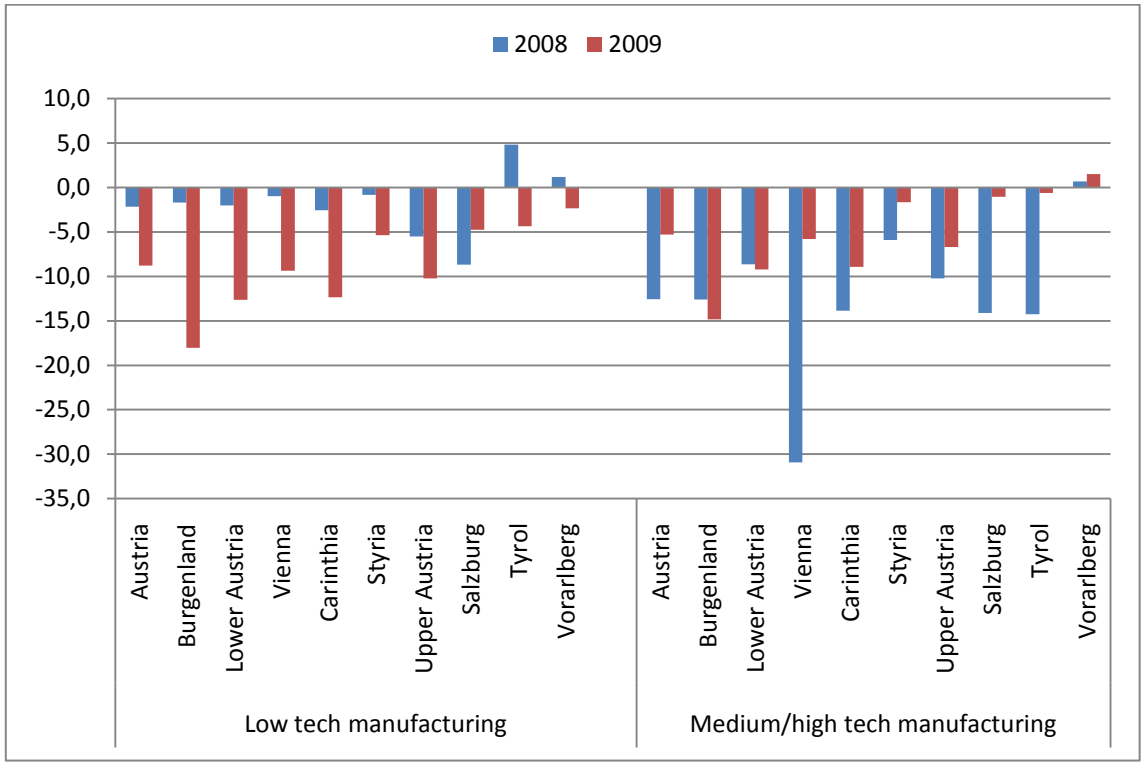
Figure 11: Growth of employment as effect of foreign exporting in % of total regional employment (of previous year)



Source: Own calculations.

As far as the sectoral distribution is concerned the analysis focusses again on the two manufacturing sectors only (see Figure 12). It shows that the results are quite similar to the results regarding direct effects only. The difference is, that the total employment effects for both manufacturing industries tend to be somewhat lower than the pure direct effects. This is attributed to the fact that there is some stabilising intermediate demand from other sectors, as well as that both manufacturing industry sectors mainly produce for exporting, so that most total effects are already covered by the direct effects and the negative effects exerted by the manufacturing industries tend to spill over relatively more to the services sector.

Figure 12: Growth of employment in manufacturing industries as a result of exporting, 2008 and 2009



Source: Own calculations.

2.6. Summary

In this chapter we introduced a method to estimate data on regional foreign trade. The main feature of this method is to disaggregate national foreign trade data via use and supply tables as well as regional employment and other supplementary data to the level of the nine Austrian regions.

The application of this method revealed a number of stylized facts:

- The importance of regional trade tends to differ greatly across Austrian regions, with Lower Austria, Upper Austria, Styria and Vorarlberg having import and export shares in GDP of around 45% to 50% and Burgenland's import share even reaching 57% (its export share however is only 40%) in the years 2004-2008. By contrast, in the same period Vienna's export and import shares in GDP were 22 and 28%, respectively.
- Over time, i.e. from 1999 to 2008 foreign trade relations became stronger in all Austrian regions, only to drop again when the crisis hit in 2009.
- Overall, competitiveness of foreign trade is unequal across regions. In fact, before the crisis, only three regions, Upper Austria, Vorarlberg and Styria have a net trade surplus, though in the case of the latter it is very low, while all other regions show trade deficits. This deficit is by far most pronounced in Burgenland at around 17% of the region's GDP on average over the period 2004-2008.
- Manufacturing trade by far dominates trade of other goods and services, though in part this may be explained in the data, which cover mainly manufacturing trade and exclude e.g. tourism, which for many regions is an important income coming from outside of Austria.
- Even if quite aggregated data were used, some Austrian regions show a distinct pattern of industrial and trade specialization, with the Eastern regions being stronger in exports of medium and high tech industry goods, while Tyrol and Vorarlberg showing some strength in the low technology industry goods.
- Interestingly enough, a number of regions and not only Upper Austria, Vorarlberg and Styria show a trade surplus in either low or high tech manufacturing (or both) such as Lower Austria (both), Carinthia (high tech), and Tyrol and Salzburg (low tech). By contrast, all Austrian regions are net importers of energy and agriculture. Services trade plays no major role.
- The main exporting regions of Austria are Upper Austria, Lower Austria, Vienna and Styria, which is due to the size of their overall economy. Their share in total Austrian exports and imports is around 15 to 22%.
- Austrian regions tend to differ in their comparative advantages that determine not only their trade pattern but also whether they are net importers or net exporters. it shows that only Upper Austria and Vorarlberg have particular strengths manufacturing industry exports,

while Burgenland and Lower Austria have advantages in the export of agricultural goods, just as Lower Austria. Vienna is most competitive in services exports.

- For all Austrian regions the main trading partner is the EU-27. Imports from the EU-27 are 4 times bigger than imports from RoW, while exports are three times bigger.
- Despite this, most Austrian regions have a trade deficit vis-à-vis the EU-27, except Upper Austria and Vorarlberg, in the period 2004-2008. By contrast all Austrian regions have a trade surplus against RoW, except Burgenland, but even here trade is almost balanced, i.e. the deficit was around -0.1% of GDP from 2004-2008.
- In the course of the crisis in 2009 both imports and exports declined strongly (in Burgenland, Lower Austria, Carinthia, and Upper Austria, while Tyrol and Vorarlberg were much less affected.
- In 2009 the trade deficits increased most strongly in Carinthia and Burgenland, while Tyrol, Vorarlberg and to a small extent also Styria actually saw an improvement of their trade balance as imports declined by more than exports.
- Mainly low tech manufacturing goods contributed to the worsening of the net trade balance in Austrian regions in 2009, especially in Burgenland, Carinthia and Upper Austria. By contrast net export of high tech manufacturing goods declined most strongly in Lower Austria they even increased in Tyrol and Vorarlberg and to a lesser extent in Styria, too.
- The absolute volume of both exports and imports decreased much stronger in the trade with the EU27, the net trade balance of all Austrian region worsened more in the trade with the RoW in 2009. By contrast in some Austrian regions (Styria, Tyrol and Vorarlberg) the trade balance vis-à-vis the EU-27 even improved
- The decline in exports as a result of the crisis caused overall employment to drop by around 0.5% to 1.6% in 2008 and 2009 if only direct effects are taken into account. Amongst the regions that were more heavily affected by the crisis are Burgenland, Lower Austria, Vienna, Carinthia, Upper Austria and Salzburg, while Styria, Tyrol and Vorarlberg showed a somewhat higher resilience.
- If total effects are considered (i.e. direct effects plus effects on the employment embodied in intermediate inputs), the employment losses in 2009 because of the crisis are twice to three times as high as the direct effects alone and range from 1.2% in Tyrol and Vorarlberg up to around 3% in Burgenland and Carinthia.

The results, raise a number of interesting issues and questions that may be followed up in further research.

- A first issue could be inherent differences in competitiveness across Austrian regions, as only three regions show trade surpluses while all other have foreign trade deficits. Thus one question arising is in how far the three regions are different from the rest. Certainly, the

regions in question are traditional industry regions and thus can are likely to possess some intrinsic comparative advantages. But the question is what these advantages are and whether they can be replicated by the other regions. Are these advantages due to differences in average firm size; the existence of regional 'champions', i.e. a small number of dominating firms that are mainly accountable for the trade surpluses; the existence of agglomeration externalities; the level of internationalization of firms, or are they due to FDI etc.

- Such analyses might become even more interesting if the differences in foreign trade with the EU-27 and the RoW are considered. It would be interesting to analyse why only two Austrian regions are competitive vis-à-vis the EU-27, but all regions vis-à-vis RoW. Is it because of different structures in trade? Is it because of individual trading partners, e.g. like Germany, that may distort the picture? Do the Austrian regions have comparative disadvantages against the EU countries, but comparative advantages against the Row? And if so what are these advantages and disadvantages and are they the same across the Austrian regions, or do Austrian regions have different comparative advantages?
- Other analysis might target individual Austrian regions, for example Burgenland, which is the worst performing Austrian region in terms of foreign trade. Certainly, Burgenland is a disfavoured region, as for a long time it was located next to the iron curtain with only a weak connection to potential markets in the West, without major urban agglomerations and a largely rural character, and – as soon as the iron curtain fell – facing an overwhelming competition from its Eastern neighbour regions. For this region it would be interesting to explore and develop its options and comparative advantages in foreign trade, to make it more competitive and generate jobs and income for the population living there.

To all such analysis the method introduced in this section can be a starting point. With only few extensions and modifications it can be tailored to provide a workable data basis to answer these questions and to scientifically support regional economic development policies and the work done in the ministries, regional government offices and the various institutions dealing with it in Austria.

3. FDI in the Austrian regions

3.1. Introduction

UNCTAD (1998) identifies three main spheres that determine a region's attractiveness for FDI, besides its climatic conditions and the geographic location.

Firstly, there is the policy framework, which comprises political stability, the rule of law, the functioning and structure of markets, FDI, tax and trade policies, etc.

Secondly, a region's attractiveness for FDI depends on business facilitation, i.e. measures such as investment promotion, investment incentives, costs related to corruption, administrative efficiency, social amenities etc.

Thirdly, there are economic determinants that can be separated according to three main motives for FDI, namely resource seeking, efficiency seeking and market seeking. Both, resource and efficiency seeking FDI aim at the host regions (relatively) low cost/high (marginal) productivity properties to exploit them within their production network. Contrastingly, with market seeking FDI multinational intend to sell their goods or services directly in the host region's market, thus exploiting the market size and market potential, the high income levels etc. of the host region.

For the Austrian regions it can be assumed that there is little difference between them as far as the first two spheres are concerned. However regarding the third sphere, i.e. the economic determinants, Austrian regions tend to differ greatly. This rests in the intrinsic differences in the regions' characteristics, as Austrian regions can be split quite roughly into urban and rural regions or regions with larger urban areas with a large rural hinterland. Alternatively Austrian regions differ with respect to their sectoral specialization, as some are more industrial, others more agricultural or also services oriented regions. Furthermore Austrian regions tend to differ in their market potential, their pool of educated workforce, just to mention a few of the factors on the list of factors that in one way or another determine a region's attractiveness for FDI.

The distribution of FDI across Austrian regions can be expected to be quite heterogeneous, not only as far as the amount of FDI per region is concerned, but also as far as the type of FDI is concerned.

At the same time data on regional FDI are scarce and, if available, often offer too little detail to allowing a precise analysis. The following section therefore, by using an innovative data set, is a kind of stock taking of regional FDI in Austria and its distribution across regions. However it does not contain any explanation why FDI flows into one region rather than in another. This is left for future analysis. Though the focus is on describing the FDI situation in the Austrian regions it already allows some preliminary conclusions on the regions' attractiveness for different forms of FDI, not

only in the Austrian but also in the European context. Thus, by preparing and introducing the data to a larger audience, the aim is also to use these data and stimulate further research in this area.

3.1.1. Data

For our analysis we make use of a unique and relatively new data set on FDI. These data are taken from fdimarkets.com, a commercial database tracking global cross border greenfield and expansion investments. Joint ventures are only included where they lead to a new physical operation. However, mergers & acquisitions (M&A) and other equity investments are not tracked. Foreign investments are recorded independently of the size of the project to be included.

One drawback of this database is that it does not include M&A investments. However this is compensated by the fact that the database offers up-to-date data at the European regional level including a sectoral breakdown. It is a very comprehensive data set, from which we extracted 31,547 individual FDI projects in the European Union for the period January 2003 to March 2010. 692 of these projects concerned Austrian regions.

The original data offer a rich sectoral breakdown, which however is prone to misinterpretations. To keep analysis manageable the sectoral breakdown was cleared and aggregated to five sectors of economic activity:

- Headquarters, business services, innovation. Business and innovation investments include investments into: design, development and testing, education and training, research and development;
- Retail trade and transport;
- Construction and other services. Other services include: customer contact centres, ICT and internet infrastructure, maintenance and servicing, sales, marketing and support, shared services centres and technical support services;
- High and medium technology intensive industries. They include: Aerospace, alternative/renewable energy, automotive components, automobile production, biotechnology, chemicals, consumer electronics, electronic components, industrial machinery, equipment and tools, medical devices, pharmaceuticals, semiconductors, space and defence industry;
- Low technology intensive industries and electricity. They include beverages, building and construction materials, ceramics and glass, coal, food and tobacco, metals, minerals, plastics, rubber, textiles and wood products; [5]

[5] For details about the aggregation of the initial, raw data contact: roemisch@wiiw.ac.at

Notably, the data are not straightforward to use. To compile our data set we collected over 30 thousand individual FDI projects for the period 2003 to March 2010. Since these projects are at the city level, much effort has been spent while preparing the data to allocate them to the respective NUTS-3 regions (for the analysis we aggregated the NUTS-3 level data to the NUTS-2 level). For this we devoted some effort to design a programme to allocate the FDI projects automatically. Through this programme around 90% of the observations were assigned to their respective region, while 10% of the observations had to be assigned manually in a time-consuming process. Additionally the database has a peculiar classification of industries that had to be adjusted in order to make it as comparable as possible to standard industry classifications.

Still once the data set is completed it allows highly detailed analysis at the regional or even city level, at the sectoral or even firm level (as individual FDI firms can be identified by their name and origin). It also allows analysis for individual regions, countries, comparative analysis etc. Thus it is a solid basis to analyse in more detail e.g. what the determinants of FDI are, why certain regions perform better than others in attracting FDI, what the economic effects of FDI are etc.

3.2. Regional FDI in Austria

We start our analysis by looking at the total number of new FDI projects in the Austrian regions from 2003 to March 2010 (see Table 15). It shows that out of the 692 FDI projects that were undertaken in Austria 284 projects went to Vienna, 58 to Upper Austria and 53 to Lower Austria; 123 FDI projects could not be allocated to a specific region because of data shortcomings. Taking this into account, approximately half of all FDI inflows to Austria went to Vienna, while the other regions each received 12% or less of the inflows to Austria. Still, the comparison of the absolute numbers of FDI projects per region somewhat disguises the importance of these projects for the individual regions, as the absolute number of FDI projects that went into one region depends – inter alia – on the size of the region concerned.

To improve the comparability of the FDI flows to the regions, the absolute number of FDI projects is set in relation to the size of the population and the GDP of the Austrian regions, respectively. Basically this correction does not change the dominant position of Vienna, as both in terms of FDI projects by population and by GDP it has a much higher FDI inflow ratio than the other Austrian regions. Certainly, this is only indicative of the true imbalances in FDI flows to the Austrian regions, as we just use the number of FDI projects, but have no reliable information on the size of the individual investment projects.

Table 15: Total FDI projects, 2003 – March 2010

	2003	2004	2005	2006	2007	2008	2009	2010*	Total
Austria	**79**	**100**	**104**	**90**	**109**	**111**	**74**	**25**	**692**
Burgenland	0	1	2	1	2	1	0	0	**7**
Lower Austria	6	13	5	8	10	6	4	1	**53**
Vienna	24	25	38	41	50	53	43	10	**284**
Carinthia	2	7	6	3	7	4	2	0	**31**
Styria	8	9	8	4	6	4	2	3	**44**
Upper Austria	7	11	13	12	9	7	9	0	**68**
Salzburg	2	8	3	3	2	6	4	1	**29**
Tyrol	6	12	6	4	1	6	2	1	**38**
Vorarlberg	3	1	3	3	3	0	2	0	**15**
not identified	21	13	20	11	19	24	6	9	**123**
% of total identified									
Austria	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Burgenland	0.0	1.1	2.4	1.3	2.2	1.1	0.0	0.0	**1.2**
Lower Austria	10.3	14.9	6.0	10.1	11.1	6.9	5.9	6.3	**9.3**
Vienna	41.4	28.7	45.2	51.9	55.6	60.9	63.2	62.5	**49.9**
Carinthia	3.4	8.0	7.1	3.8	7.8	4.6	2.9	0.0	**5.4**
Styria	13.8	10.3	9.5	5.1	6.7	4.6	2.9	18.8	**7.7**
Upper Austria	12.1	12.6	15.5	15.2	10.0	8.0	13.2	0.0	**12.0**
Salzburg	3.4	9.2	3.6	3.8	2.2	6.9	5.9	6.3	**5.1**
Tyrol	10.3	13.8	7.1	5.1	1.1	6.9	2.9	6.3	**6.7**
Vorarlberg	5.2	1.1	3.6	3.8	3.3	0.0	2.9	0.0	**2.6**
not identified	26.6	13.0	19.2	12.2	17.4	21.6	8.1	36.0	**17.8**

Source: fdimarkets.com, own calculations; *March 2010.

It might well be the case that Vienna is more attractive to smaller scale services FDI than other regions that in turn might attract more large scale industrial projects. But this is just speculation. What the present numbers suggest is a strong heterogeneity in the Austrian regions with respect to the number of FDI projects. This may be seen not only between Vienna and the rest, but also between on the one hand Upper Austria, Tyrol and Carinthia - as regions with a relatively high number of FDI projects - and on the other hand Burgenland, Lower Austria and Styria with a low number of projects.

To go a bit more into detail regarding potential differences in regional characteristics resulting in differences in FDI inflows we disaggregate the number of FDI projects by sector of economic activity. As indicated above there are different motives for multinationals to invest in a region. Some investments are undertaken to exploit the host regions market potential, other FDI makes use of the favourable production settings to export the goods produced in the host region to European or global markets. Though both forms of FDI might not in all cases separable from each other, each of them has its distinct needs regarding their location choice. Market seeking FDI prefers regions with

high market potential; efficiency seeking FDI is looking for relatively low land prices, wage costs, subsidies, transport connections etc. Certainly there is also a whole range of factors that may be important for both types of FDI like the availability of an adequate pool of skilled labour (for more skill intensive FDI), or communication infrastructure, networks of suppliers; the weight attached to the individual factors might be different between the types of FDI (or in fact may differ from project to project).

Table 16 Regional FDI 2003-2010 (March), in terms of regional population (number of projects per 1 mn inhabitants) and GDP (projects per 1 bn euro)

	per mn population	per bn. GDP
Austria	**83.9**	**2.9**
Burgenland	25.1	1.3
Lower Austria	33.6	1.4
Vienna	173.0	4.5
Carinthia	55.3	2.3
Styria	36.7	1.5
Upper Austria	48.6	1.8
Salzburg	55.0	1.7
Tyrol	54.7	1.9
Vorarlberg	41.4	1.4

Source: fdimarkets.com, own calculations.

Therefore expectations are that the geographic pattern of FDI in Austria depends strongly on the type of investment carried out. Our expectations are that market seeking FDI is likely to locate in or close to urban agglomerations (i.e. mostly Vienna), while FDI in manufacturing industry is expected to locate in more rural areas, that preferably are close enough to urban areas to benefit from agglomeration externalities.

Disaggregating total FDI projects in Austria by sector shows (see Table 17) that in Austria from 2003 to March 2010 the highest number of projects was recorded in the retail, trade and transport sector (189 projects) followed closely by the construction and services sector, as well as headquarter, business services and innovation projects. Contrastingly there was a lower number of manufacturing FDI projects (154 in total). Yet, within FDI the number of investments in the high technology sectors was twice as high as the investments in the low technology industries.

Still, the distribution of the sectoral investments was far from uniform across Austria. As expected, the vast majority (in absolute and relative terms) of FDI projects related to services went to Vienna. Hence Vienna was the destination for more than two thirds of the total Austrian FDI projects in the construction and basic services as well as the business services sectors.

Table 17: FDI projects by sector of activity, 2003-2010 (March)

	Construction & Services	HQ, business services, innovation	High and medium technology intensive industries	Low technology intensive industries and electricity	Retail trade and transport	Total
Austria	**182**	**167**	**102**	**52**	**189**	692
Burgenland	2	0	2	2	1	7
Lower Austria	10	5	13	9	16	53
Vienna	96	98	16	4	70	284
Carinthia	4	5	9	3	10	31
Styria	6	13	12	2	11	44
Upper Austria	8	12	19	10	19	68
Salzburg	7	1	5	2	14	29
Tyrol	6	5	13	4	10	38
Vorarlberg	4	2	1	5	3	15
not identified	39	26	12	11	35	123
in % of total identified						
Austria	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Burgenland	1.4	0.0	2.2	4.9	0.6	1.2
Lower Austria	7.0	3.5	14.4	22.0	10.4	9.3
Vienna	67.1	69.5	17.8	9.8	45.5	49.9
Carinthia	2.8	3.5	10.0	7.3	6.5	5.4
Styria	4.2	9.2	13.3	4.9	7.1	7.7
Upper Austria	5.6	8.5	21.1	24.4	12.3	12.0
Salzburg	4.9	0.7	5.6	4.9	9.1	5.1
Tyrol	4.2	3.5	14.4	9.8	6.5	6.7
Vorarlberg	2.8	1.4	1.1	12.2	1.9	2.6

Source: fdimarkets.com, own calculations.

Contrastingly manufacturing FDI projects were much more equally distributed across the regions, but with some differentiation across regions. The highest absolute number of manufacturing FDI projects went to Upper Austria, both in low and high technology manufacturing. Though not being known as an industrial city, Vienna still received the second biggest number of FDI projects in high tech manufacturing in Austria, followed by Tyrol, Lower Austria and Styria. By contrast, Burgenland and Vorarlberg were largely neglected by this type of FDI. Instead, Vorarlberg was one of the major locations of low tech industry FDI in Austria – following Upper and Lower Austria, while Vienna and the other regions just play a subordinate role.

Grosso modo these trends are also confirmed if FDI projects by sector and per inhabitant or per GDP are analysed (see Table 18 and Table 19) at least as far as services FDI is concerned. In manufacturing FDI the relative numbers show that the performance of some regions is not as bad

as suggested by the absolute numbers. This refers especially to Carinthia, which in terms of GDP has in fact the highest (relative) number of high tech manufacturing FDI projects (in terms of projects per inhabitant it ranks second behind Tyrol). It also shows that Burgenland is not performing as badly, once corrections for the size of regions are made.

Table 18: FDI by sector of activity, number of projects by regional population, 2003-2010 (March)

	Construction & Services	HQ, business services, innovation	High and medium technology intensive industries	Low technology intensive industries and electricity	Retail trade and transport
Austria	**22.1**	**20.3**	**12.4**	**6.3**	**22.9**
Burgenland	7.2	0.0	7.2	7.2	3.6
Lower Austria	6.3	3.2	8.2	5.7	10.1
Vienna	58.5	59.7	9.7	2.4	42.6
Carinthia	7.1	8.9	16.1	5.4	17.9
Styria	5.0	10.8	10.0	1.7	9.2
Upper Austria	5.7	8.6	13.6	7.1	13.6
Salzburg	13.3	1.9	9.5	3.8	26.6
Tyrol	8.6	7.2	18.7	5.8	14.4
Vorarlberg	11.0	5.5	2.8	13.8	8.3

Source: fdimarkets.com, own calculations.

Table 19: FDI by sector of activity, number of projects by regional GDP, 2003-2010 (March)

	Construction & Services	HQ, business services, innovation	High and medium technology intensive industries	Low technology intensive industries and electricity	Retail trade and transport
Austria	**0.8**	**0.7**	**0.4**	**0.2**	**0.8**
Burgenland	0.4	0.0	0.4	0.4	0.2
Lower Austria	0.3	0.1	0.4	0.2	0.4
Vienna	1.5	1.5	0.3	0.1	1.1
Carinthia	0.3	0.4	0.7	0.2	0.7
Styria	0.2	0.4	0.4	0.1	0.4
Upper Austria	0.2	0.3	0.5	0.3	0.5
Salzburg	0.4	0.1	0.3	0.1	0.8
Tyrol	0.3	0.2	0.6	0.2	0.5
Vorarlberg	0.4	0.2	0.1	0.5	0.3

Source: fdimarkets.com, own calculations.

3.3. The European context

This part extends the analysis from the Austrian to the European context. It thus allows analysing how successful the Austrian regions are in attracting FDI compared to other similar regions in the EU-27. To account for size differences between the European regions, all FDI flows will be given as a proportion to the regions' population, i.e. FDI projects per 1 million inhabitants.

Taking into account that there are different types of regions, with different characteristics and thus attracting different types of FDI, we compare the attractiveness of Austrian regions to that of other EU-27 regions and take account of the regions' individual features.

Our analysis on regional development (Applica, Cambridge Econometrics and wiiw, 2012) has shown that location as well as the degree of urbanization are key determinants for economic development in general and for the location of firms and hence FDI in particular. It therefore makes sense to group the European regions according to these characteristics; the more so as highly urbanized regions tend to be more attractive for services FDI than other regions, while rural areas, especially if they are close to a larger city tend to be more attractive for manufacturing FDI. Controlling for such characteristics allows a more accurate comparison of the regions' attractiveness for FDI.

In practice we use the OECD classification of regions to group the regions by their degree of urbanization and their geographic location. The OECD classification identifies 5 types of regions (Dijkstra and Ruiz, 2010)[6]:

- Predominantly urban regions: the share of population living in local rural areas[7] is smaller than 15%, or the region contains an urban centre of more than 500,000 inhabitants representing at least 25% of the regional population.
- Intermediate rural, close to a city regions: the share of population living in local rural areas is between 15% and 50% AND the driving time of at least 50% of the regional population to the closest locality with more than 50,000 inhabitants is LESS than 60 minutes.
- Intermediate rural, remote regions: the share of population living in local rural areas is between 15% and 50% AND the driving time of at least 50% of the regional population to the closest locality with more than 50,000 inhabitants is MORE than 60 minutes.
- Predominantly rural, close to a city regions: the share of population living in local rural areas higher than 50% AND the driving time of at least 50% of the regional population to the closest locality with more than 50,000 inhabitants is LESS than 60 minutes.

[6] Originally these types of regions are defined at the NUTS3 level of EU regions. For the current analysis the typology has been aggregated to the NUTS2 level.
[7] A local unit is classified as 'rural' if the population density is smaller than 150 inhabitants per square kilometre. (OECD, 2010)

- Predominantly rural, remote regions: the share of population living in local rural areas higher than 50% AND the driving time of at least 50% of the regional population to the closest locality with more than 50,000 inhabitants is MORE than 60 minutes.

Predominantly rural regions are considered to be intermediate rural if they contain an urban centre of more than 200,000 inhabitants representing at least 25% of the regional population.

For the current analysis the intermediate rural, remote regions are included in the intermediate rural, close to a city regions, because there are only 4 regions that would fall under this category (none of them in Austria).

Analysing the average number of FDI projects (per inhabitant) for each type of region shows that the urban regions in the EU attracted the highest number of FDI projects from 2003 to early 2010. Moreover, they attracted a significantly higher share in all services sectors compared to other types of regions. On the other hand urban regions attracted less FDI projects in the manufacturing sectors. These were more prominent in the intermediate and predominantly rural close to a city regions. Overall the intermediate rural regions attracted marginally more FDI than the predominantly rural, close to a city regions, while the peripheral, predominantly rural, remote regions attracted the least FDI projects in the EU-27. All this suggests that there is indeed a certain hierarchy and specific pattern in the regions' attractiveness for FDI depending on their characteristics.

According to the OECD classification Austria consists of three types of regions – predominantly urban regions, i.e. Vienna; intermediate rural, close to a city regions, i.e. Carinthia, Styria, Salzburg and Tyrol; as well as predominantly rural, close to a city regions, i.e. Burgenland, Lower Austria, Upper Austria and Vorarlberg. There are no rural remote regions in Austria.

Comparing the Austrian regions to the EU regions of the same type gives a mixed picture as far as the total number of FDI projects by inhabitant is concerned. While some Austrian regions, foremost Vienna, but also Carinthia, Salzburg and Tyrol, received more FDI projects than the average corresponding region in the EU, other Austrian regions (especially Burgenland and Lower Austria) received relatively less FDI than regions of the same type in the EU.

Apart from Vienna, which in all sectors except low tech manufacturing received an over-proportional amount of FDI projects if compared to other urban regions in the EU, this mixed performance of Austrian regions regarding the attraction of FDI is partly explained through the fact that Austrian regions tend to specialize in certain types of FDI projects. Thus Carinthia seems to focus on high tech industry, retail trade and transport and also on business services FDI, Styria on business services only, Salzburg on basic services including transport and tourism, Tyrol and Upper Austria on high tech industry and Vorarlberg on low technology industry FDI. In all these areas the respective regions attract partly much more FDI project than the average EU region of the same

type. Only Burgenland and Lower Austria show a weaker performance than the average EU region in all sectors.

Table 20: FDI by sector of activity and OECD type of regions, number of projects per inhabitant, 2003-2010 (March)

	Construction & Services	HQ, business services, innovation	High and medium technology intensive industries	Low technology intensive industries and electricity	Retail trade and transport	TOTAL
EU-27 predominantly urban	23.7	17.8	4.5	3.8	14.3	64.1
EU-27 intermediate rural, close to a city	9.0	6.2	9.3	7.6	8.4	40.5
EU-27 predominantly rural, close to a city	9.6	10.5	9.0	8.0	13.3	50.4
EU-27 predominantly rural, remote regions	6.4	5.9	4.4	5.0	9.1	30.9
predominantly urban						
Vienna	58.0	59.2	9.7	2.4	42.3	171.5
intermediate rural, close to a city						
Carinthia	7.1	8.9	16.1	5.4	17.8	55.3
Styria	5.0	10.8	10.0	1.7	9.1	36.6
Salzburg	13.2	1.9	9.5	3.8	26.5	54.8
Tyrol	8.6	7.2	18.6	5.7	14.3	54.4
predominantly rural, close to a city						
Burgenland	7.1	0.0	7.1	7.1	3.6	25.0
Lower Austria	6.3	3.2	8.2	5.7	10.1	33.4
Upper Austria	5.7	8.6	13.5	7.1	13.5	48.5
Vorarlberg	11.0	5.5	2.7	13.7	8.2	41.2
% of average predominantly urban EU region						
Vienna	*245.0*	*332.7*	*214.9*	*63.6*	*295.3*	*267.7*
% of average intermediate rural, close to a city EU region						
Carinthia	*79.5*	*142.9*	*173.0*	*70.6*	*211.5*	*136.5*
Styria	*55.6*	*173.1*	*107.5*	*21.9*	*108.4*	*90.3*
Salzburg	*147.4*	*30.3*	*101.9*	*49.9*	*313.8*	*135.3*
Tyrol	*95.6*	*114.6*	*200.5*	*75.6*	*169.7*	*134.3*
% of average predominantly rural, close to a city EU region						
Burgenland	*74.3*	*0.0*	*79.6*	*89.2*	*26.9*	*49.7*
Lower Austria	*65.6*	*30.1*	*91.4*	*70.8*	*76.0*	*66.4*
Upper Austria	*59.3*	*81.6*	*150.9*	*88.9*	*101.9*	*96.2*
Vorarlberg	*114.2*	*52.4*	*30.6*	*171.3*	*62.0*	*81.8*

Source: fdimarkets.com, own calculations.

As an alternative to the regions' geographic and urban/rural characteristics we group the EU-27 NUTS2 regions also according to their income per capita levels (in PPS) (see Table 21). Thereby we identify four groups of regions, namely:

- a high income group with a GDP per capita level of above 125% of the EU-27 average
- a medium high income group with GDP between 100% and 125% of the EU average
- a medium low income group, where the regional GDP is between 75% and 100% of the EU average
- a low income group, where regional GDP is below 75% of the EU average, i.e. the group of regions eligible for funding under the 'Convergence' Objective through EU Structural Funds.

As far as Austria is concerned no region belongs to the low income group. Nevertheless this group is an important group for FDI as it comprises mostly regions of the EU-12 in Central and Eastern Europe that over the last decade or so were main recipients of manufacturing FDI within the EU. This is also visible in the number of average FDI projects per inhabitant by income groups, as the low income regions in the EU-27 got proportionally the most FDI projects in both the low technology as well as high technology industries. Thus, on average approximately 14 FDI projects in the high tech industries and 12 projects in the low tech industries went to each EU low income regions. In both sectors this is at least twice as much FDI as the average region in the other three groups got. Still as far as services FDI projects are concerned, they predominantly favoured the highest income regions.

In comparison with the EU averages the Austrian performance is - again - mixed. As above, a number of regions, foremost Vienna, but also Carinthia, Upper Austria and Tyrol, is relatively more attractive for FDI than the EU average region of the respective income group, while a couple of regions attract only a relatively low number of FDI projects if compared to their benchmarks. However, again the numbers suggest that there is quite a strong specialization of the Austrian regions in certain FDI sectors, like in the comparison with regions having similar geographic and settlement characteristics, only that in the case of regional GDP this specialization is more pronounced.

Table 21: FDI by sector of activity and income type of regions, number of projects per inhabitant, 2003-2010 (March)

	Construction & Services	HQ, business services, innovation	High and medium technology intensive industries	Low technology intensive industries and electricity	Retail trade and transport	TOTAL
above 125%	35.4	30.1	5.8	4.5	19.7	95.5
100% - 125%	9.6	7.6	5.1	4.1	8.2	34.6
75% - 100%	9.5	6.5	6.0	6.0	8.2	36.2
below 75%	8.4	4.5	13.7	11.6	12.4	50.6
high income regions						
Vienna	58.0	59.2	9.7	2.4	42.3	171.5
Salzburg	13.2	1.9	9.5	3.8	26.5	54.8
Tyrol	8.6	7.2	18.6	5.7	14.3	54.4
Vorarlberg	11.0	5.5	2.7	13.7	8.2	41.2
medium high income regions						
Lower Austria	6.3	3.2	8.2	5.7	10.1	33.4
Carinthia	7.1	8.9	16.1	5.4	17.8	55.3
Styria	5.0	10.8	10.0	1.7	9.1	36.6
Upper Austria	5.7	8.6	13.5	7.1	13.5	48.5
medium low income regions						
Burgenland	7.1	0.0	7.1	7.1	3.6	25.0
% of average high income EU region						
Vienna	163.6	196.5	165.6	54.2	214.6	179.5
Salzburg	37.4	6.3	162.1	84.9	134.4	57.4
Tyrol	24.2	23.8	319.1	128.5	72.7	56.9
Vorarlberg	31.0	18.2	47.1	308.3	41.8	43.1
% of average medium high income EU region						
Lower Austria	65.7	41.5	161.2	138.5	122.4	96.5
Carinthia	74.4	117.2	315.6	130.6	216.4	159.7
Styria	52.0	142.1	196.1	40.6	110.9	105.6
Upper Austria	59.4	112.4	266.1	173.8	164.2	139.9
% of average medium low income EU region						
Burgenland	75.5	0.0	119.2	119.2	43.7	69.2

Source: fdimarkets.com, own calculations.

3.4. Summary

The aim of this section was to introduce an innovative data set on regional FDI including a brief analysis of the regions' attractiveness for FDI in the Austrian and European context. The reason for this was that existing data on regional FDI in Austria, as well as in the EU, are highly unsatisfactory regarding their completeness, geographical breakdown and level of detail and thus are not really usable for economic research intending to be of some relevance for regional economic policy making.

The analysis of the data has revealed a number of stylized facts:

- FDI is distributed highly unequally across Austrian regions. Hence, in absolute as well relative terms (e.g. by number of population) most FDI projects being undertaken in Austria went to Vienna, which received around 3 to 5 times more FDI per head of population than all other regions in Austria. Among the remaining regions a relatively high amount of FDI went to Carinthia, Upper Austria, Salzburg and Tyrol, while Burgenland and Lower Austria received comparably little FDI.
- Austrian regions differ with respect to the type of FDI they attract. Vienna is overwhelmingly attracting FDI projects in all services areas (construction, business services, retail trade and transport), while Carinthia, Upper Austria and Tyrol receive over-proportional inflows of FDI in the medium and high technology intensive industries, and Salzburg is highly attractive for construction, general services as well as retail trade and transport.
- If the Austrian regions are compared with the regions in the EU-27 that are similar with respect to the degree of urbanization and/or rural character, Austrian regions are quite different in their attractiveness to foreign firms. If compared to EU regions of the same urban/rural type, a number of regions (Vienna, Carinthia, Tyrol and Upper Austria) seem to be highly competitive regarding the attraction of medium and high tech manufacturing as well as retail trade and transport firms; but Burgenland and Lower Austria are of little attractiveness compared to similar EU regions.
- If compared to EU regions with approximately the same level of income per head the situation is much more positive for all Austrian regions. With the exception of Burgenland, they tend to attract more than a proportional number of FDI projects as comparable EU regions. Though this does not hold for all sectors, it shows that each Austrian region has a particular strength or comparative advantage that makes it more attractive for one or more types of FDI than other EU regions with similar income levels.

These results are highly indicative of the regions' different capabilities to attract foreign firms, but certainly more detailed analysis is necessary to understand why certain regions in Austria attract

more FDI than others and what needs to be done in order to improve the attractiveness of the disfavoured regions.

The data that have been introduced might be a solid basis for this. Still the data are not optimal, as the reliability of the data source cannot be readily checked[8]. More importantly, although the data are to our knowledge the most comprehensive data set on regional FDI, a drawback is that they so far do not contain reliable information on the amount of money that has been invested in a region and also on the number of jobs that have been created. But, there is also no other database available with this information.

[8] This is because the data are supplied by a private company.

4. Literature

Applica, Cambridge Econometrics and wiiw, (2012), Analysis of the Main Factors of Regional Growth: An in-depth study of the best and worst performing regions - A final report for the European Commission, Directorate General Regional Policy

Barro, R.J. and Sala i Martin, X., (1990) Economic Growth and Convergence across the United States. National Bureau of Economic Research, working paper.

Barro, R., and X. Sala-I-Martin, (2004) Economic Growth, 2nd edition. MIT Press: Cambridge, MA.

Dijkstra, L., Ruiz, V.,(2010) Refinement of the OECD regional typology: Economic Performance of Remote Rural Regions, OECD, http://www.oecd.org/dataoecd/41/56/45511797.pdf.

European Commission, Directorate-General for Regional Policy, (2008) 'The impact of globalisation and increased trade liberalisation on European regions', Study for DG Regio Final report.

European Commission, Directorate-General for Regional Policy, (2009) Regions Benefiting from Globalisation and Increased Trade, Study for DG Regio Final Report Vol. I.

Fujita, Masahisa; Krugman, Paul; Venables, Anthony J., (1999) The Spatial Economy; MIT Press, Cambridge, Ma.

Greunz, L., (2003) The Technology Gap and European Regional Growth Dynamics. In Fingleton, B., ed. European regional growth. Advances in Spatial Science. Heidelberg and New York: Springer, 2003, 241-65.

Helpman, E., Krugman, P., (1985) Market Structure and Foreign Trade, MIT Press, Cambridge, Mass.

Kurzmann, R., Gstinig, K. (2010) 'Warenaußenhandel der österreichischen Bundesländer', Österreichs Außenwirtschaft 2010, p.106-115.

Nunnenkamp, P. and Spatz, J., (2005) FDI and economic growth in developing economies: how relevant are host-economy and industry characteristics, Transnational Corporations, Vol. 13, No. 3, Dec. 2004.

Ricardo, D., (1817) On the Principles of Political Economy and Taxation, Cambridge University Press.

Rozmahel P. et al, (2011) CENTROPE Regional Development Report 2010 – Return to growth, WIFO, Vienna.

Smith, A., (1776) An Inquiry into the Nature and Causes of the Wealth of Nations. New York Random House.

UNCTAD, (1998) World Investment Report 1998.

UNCTAD, (2003): 'World Investment Directory. Volume VIII, Central and Eastern Europe 2003' http://www.unctad.org/sections/dite_fdistat/docs/wid_ib_cz_en.pdf.

Venables, A.J., (2005) European Integration: A View from Geographical Economics. Swedish Economic Policy Review, 12, pp. 143-169.

Venables, A.J., (2006) Shifts in economic geography and their causes. Paper prepared for the 2006 Jackson Hole Symposium.