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Future employment in transport

Analysis of labour supply and demand

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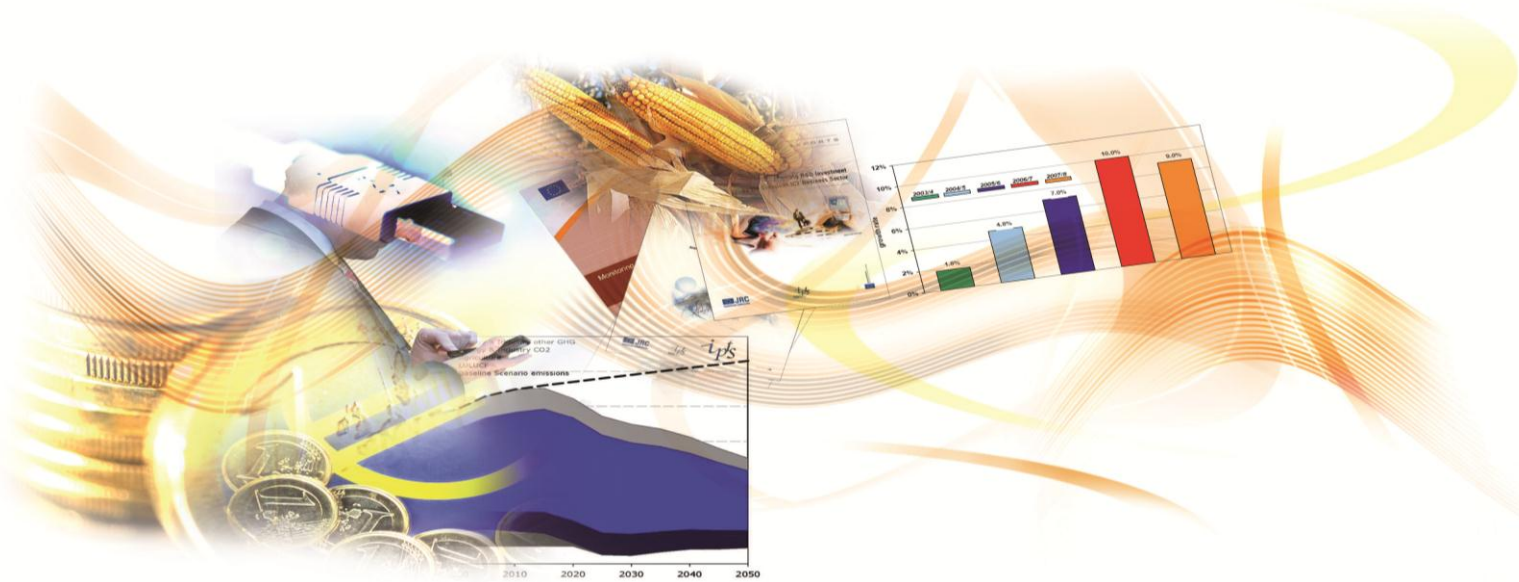

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Introduction

This report presents the results of the analysis carried out by the Joint Research Centre (JRC) in support of DG MOVE for the analysis of employment and skills issues in the EU transport sector, with the purpose of designing the policies targeting an increased competitiveness in the sector, and improving the labour productivity and job quality.

The project has been carried out through a combination of in-house analysis in the JRC with the input provided by an external study carried out Panteia/EIM and PwC Italy.

The overall objective of the project is to evaluate:

the quality of work in all transport modes, with respect to, notably, training, certification, working conditions and career development, with a view to creating quality jobs, developing the necessary skills and strengthening the competitiveness of EU transport operators.

In addition, the research activities address a number of specific questions:

- What will be the impact of *ageing* of the workforce in transport?
- Will there be *enough employees with the right skills* to replace the ones expected to retire from now to 2020?
- What is the impact of *productivity growth* in transport?
- How does future *labour demand* and working conditions in transport compare to that of other sectors?
- Will transport jobs be competitive/ attractive in the future?

The background study by PANTEIA/EIM and PwC Italy has gathered relevant literature and is carrying out consultations (notably with the market agents and social partners), establishes productivity measures, analyses the productive factor mix within the sector, and its dependence on technological progress, with the final scope of studying the relative attractiveness of transport jobs and the adequacy of the current and near future supply of labour and skills to the sector.

The part covered by JRC consists of the quantitative analysis of employment and skills in the transport sector, including a 'labour map' of transport as it is today and a tentative projection of how it may develop in the medium to long term (2015 and 2020 to 2030, depending on different assumptions).

Due to its high heterogeneity and broadness, transport is not a typical services sector. Depending on the transport mode considered, labour intensiveness can change significantly. Similarly, the training and skills profiles required can differ substantially between the different subsectors. These specificities are related to the overall cost structure of the transportation mode considered, the market organization and the different institutional and regulatory approaches made. Being as a whole a capital-intensive sector, all transportation modes require high capital investment.

As a result, some modes are closer to the traditional transport cost structure, and exhibit capital intensiveness, increasing returns to scale and all the characteristics of natural monopolies, whereas other transportation modes have a cost structure with increasing marginal costs and a free concurrence service market. Needless to say, the labour-demanding responses of each subsector depend, to a great extent, on the transport mode cost structure, as well as on the type of technological progress prevailing

As a consequence of the demographic trends, population ageing is going to be a key issue over the next years as large cohorts taking retirement will have to be replaced by younger generations. The challenge for the sector is whether enough employees with the right skills can be attracted to the transport sector given the conditions it offers. From the demand side, transport activity is foreseen to grow, even under pessimistic economic development scenarios. The growth is not expected to be, however, uniform among modes and market segments, creating local/temporal imbalances for some market segments. In addition, growing demand may increase the pressure on a workforce that is older than the average of the economy and where female workers constitute a small minority (with the exception of air transport in both cases). A main question for the sector is whether it can attract new employees with the needed skills given that the working conditions are (or are perceived to be) harder than in other sectors. At the same time, the prolonged economic crisis in Europe has seriously affected the job market characteristics across all economic sectors and has led to important changes as regards the overall number of jobs, wages and job stability. The need to adapt to technology changes notably in relation to the transition to a more knowledge-intensive sector can represent a barrier that may need public intervention.

This study analyses employment in the transport sector from different viewpoints, and by means of a variety of approaches. More precisely, a combination of four models has been applied:

- Labour force dynamics model
- Partial equilibrium sectoral analysis based on production functions
- Multisectoral analysis: Input-Output model (FIDELIO)
- Sector-wide bottom-up approach

Each model addresses some particular aspects which -when combined- can give a global picture of the trends and expected impacts.

Furthermore, scenarios about future working conditions will be sketched based on qualitative and quantitative projections and potential skill and labour shortages will be assessed. The quantitative work by JRC will be complemented with the results of an analysis carried out by PANTEIA and PwC that will provide qualitative insight, data collection, a literature review and interviews supporting the overall analysis.

1 Policy framework and overall methodological approach

As the White Paper "Roadmap to a Single Transport Area"[1] states, market opening needs to go in hand with quality jobs and working conditions within the transport sector. The White Paper also underlines that it will be important to reconcile inside the transport sector both the EU competitiveness policy and the social agenda, based on a well-founded social dialogue. Working conditions, productivity and salaries undergo a long-term parallel evolution[2], and therefore it is mandatory to address this issue in such a heterogeneous sector, which exhibits very different degrees of capital and labour intensiveness depending on modal and geographical conditions.

Transport faces the same challenges as all sectors of economic activity, with certain sector (and sub-sector) characteristics that make necessary a specific analysis of its employment issues. Demographics, trends in demand, availability of skills, working conditions and technological change are five main drivers of change that affect employment in the transport sector significantly.

As a result of the demographic trends, population ageing is going to be a key challenge over the next years as large cohorts taking retirement will have to be replaced by younger generations. The challenge for the sector is whether enough employees with the right skills can be attracted to the transport sector given the conditions it offers. From the demand side, transport activity is expected to demonstrate growth, even under pessimistic economic development scenarios. The growth is not expected to be, however, uniform among modes and market segments, creating local/temporal imbalances for some market segments. In addition, growing demand may increase the pressure on a workforce that is older than the average of the economy and where female workers constitute a small minority (with the exception of air transport in both cases). A main question for the sector is whether it can attract new employees with the needed skills given that the working conditions are (or are perceived to be) harder than in other sectors. At the same time, the prolonged economic crisis in Europe has seriously affected the job market characteristics across all economic sectors and has led to important changes as regards the overall number of jobs, wages and job stability. The need to adapt to technology changes notably in relation to the transition to a more knowledge-intensive sector can represent a barrier that may need public intervention.

This study analyses employment in the transport sector from different viewpoints, and by means of a variety of analytical approaches.

Sections 3 to 5 provide a profile of employment in transport, with an analysis of occupation in each sector, a quantitative description of the demographic trends of the labour force in each mode and a presentation of data concerning skills. Section 6 presents scenarios for the demographic development of transport employees. Sections 7 to 9 discuss three different analytical approaches that deal with the estimation of the future demand for labour (i.e., the number of employees required in order to meet the

[1] White Paper "Roadmap to a Single European Transport Area – Towards a competitive and resource efficient transport system" (COM(2011)144 final of 28 March 2011).

[2] In the short-term, wages can be higher in difficult jobs. Employment and productivity can also substitute for each other in the short-term

future transport activity). The analysis in Section 7 adopts a production-function-based approach, while the analyses in Sections 8 and 9 are based on the FIDELIO Input-Output model. Sections 10 and 11 combine the findings of the previous sections into a uniform model that allows the estimation of future labour demand in transport, using a bottom-up approach, i.e. projecting the specific needs in labour for each mode and EU Member State based on the estimates for future transport activity, growth in investment and productivity, and demographic evolution of the various occupational groups in transport.

The diversity in the approaches followed in all those chapters aims at capturing different aspects of the problem, and may therefore lead to confronting conclusions from different standpoints.

The partial equilibrium approach followed first relies on the quality of the data available to estimate labour demand functions as detailed as possible in terms of EU Member State, transport mode and occupational group or skill level. Activity in each subsector is given as exogenous, fully aligned with the EU Reference Scenario (the quantitative scenario used as a basis for the discussion of future EU transport policy). This aspect is an advantage in as much the central scenario will match (by definition) the Reference. A substantial drawback of this approach is that the analyses are limited to the transportation sectors, and the flows of capital and labour from/to other economic activities are not taken into consideration.

This inconveniency can be dealt with by incorporating in the analyses a multi-sectoral model which can theoretical replicate the mechanisms of a complex economic system. Bearing in mind that (a) a relatively rich sector disaggregation is advisable in order to capture the effects on different activity branches and (b) a time-dynamic formulation would be needed in order to address changes in a mid-term time scale, a first instrumental choice has been to use FIDELIO, a traditional input/output tool with a high degree of sectoral disaggregation, coupled with dynamic, econometric closure relationships *à la* Jorgenson. The main drawback of this is that, the baseline transport activity being endogenous, it is less directly comparable with the reference scenario in the White Paper. On the other hand, this approach enables to take into consideration the relative changes in other sectors' wages, which would have an impact in the labour supply to transport.

2 The context: Main factors and gaps in the transport labour market

The quantitative approach presented here was carried out in parallel with the study by PANTEIA that explored several of the driving factors that affect demand and supply for employment in transport. The framework of the PANTEIA analysis follows the structure of PESTLE factors (Political, Economic, Social, Technological, Legal, Environmental) which can be used to describe the context in which the transport labour market is placed. While the overall framework is described extensively in the report by PANTEIA, the quantitative analysis presented here did take the PESTLE structure into account in order to explain past trends and develop a more robust projection for the evolution of future labour demand in transport. The main aspects that can influence employment, skills and quality of work in transport that are relevant to the quantitative projections are summarized as follows:

Political factors

- EU Enlargement, the development of the Single Market and the general trend for market liberalisation have increased (and are expected to continue increasing) competition in all transport modes, helping reduce prices and increase quality of services. On the other hand, the single market has contributed in slowing the growth in the wages and raises several regulatory challenges, such as the need for better monitoring of the application of EU law. Within this context, labour demand in the sector is likely to become even more integrated at EU level and internationally, especially for mobile employees.
- Remaining protectionism in some Member States and/or transport sectors. In close connection with the above point, while progress has been significant in some parts of the transport system (notably aviation and road freight) there are still distortions that can be removed in order to improve the efficiency of the system as a whole.
- Integration of transport system. Integration of companies come as an opportunity of seeking synergies and as answer to the challenges made by new entrants. Vertical integration, interoperability and improved, more efficient logistics are also key aspects fostered by the policies adopted at EU at Member State level.
- Europe 2020 and ”flexicurity” The combination of "employment security" and "job flexibility" has become a labour cornerstone in the EU. Recognizing the need to improve the stiff market labour in the Union as a response to the competitiveness challenge of many important global competitors, but at the same to maintain the commitment with workers on labour stability, flexicurity is endorsed by the EU via four main recommendations: 1) developing of flexible and reliable contractual arrangements; 2) fostering comprehensive lifelong learning strategies to guarantee labour productivity; 3) implementing effective active labour market policies; and 4) improving social security systems providing adequate income support during employment transitions.

Economic factors

- General economic growth and the crisis. The present economic crisis has been the longest and more severe since the end of World War 2 and has produced changes that will last. The overall economic structure of the European economy has undergone significant transformations. For what concerns the transport sector, public expenditure cuts have affected the renewal of infrastructure, and the stiffening of the borrowing conditions in many EU Member States have hampered the renewal of cars, trucks, etc.
- Geopolitical changes and globalisation. The globalisation trend that boosted up to 2007 has changed its pace as a consequence of the global crisis. Trade patterns have shifted, and new commercial routes have been created whereas other have stagnated or withered as a consequence of the uneven distribution of crisis impacts. Emphasis on decarbonisation and, particularly in this context, energy security might lead to a modal shift.
- Regional differences in economic development & specialisation. At EU level, there have been also shifts in specialisation, economic activity, competitiveness and financial capability. Some of those changes have been consequence of the different vulnerability to the factors that originated the crisis first (real state and banking) and deepened it later (contraction of fiscal income, deficit, and debt). All those affect transport, its capital renewal as well as the job opportunities therein.
- Heterogeneous transport infrastructure and usage levels (incl. congestion). The above-mentioned factors have induced changes in the operation of the transport infrastructure. In some cases, as am early response to the crisis, Keynesian investments in additional transport infrastructure were made without having foreseen the actual potential demand (airports, highways etc.) In other cases, the crisis has provoked empty toll-paying highways and high congestion in parallel routes, with the corresponding high efficiency costs (unused infrastructure in one hand vs working time hours lost because of congestion in the other)

Social factors

- Demographic development. Demography will play a crucial role in determining the future demand for transport services, as it affects consumption patterns and, in turn, both freight and passenger transport demand characteristics. An ageing population would in principle make greater appeal of public transportation means, and this has to be taken in consideration when planning the main individual transportation scheme, i.e. road. The effect of an increasing immigration population is less clear: low qualified immigrants tend to use also prevailingly public transport, whereas long-term tourist and high-income settlers would primarily use individual cars. Demography also plays a role in the supply side, since the ageing of workforce in many transportation subsectors may have important impacts in costs and potential development/capacity expansion of certain modes.
- High level of unemployment in many EU countries. The unemployment impact on wages and productivity greatly differs between countries and sectors. Competitiveness gains via wage adjustment can indeed take place in those modes highly exposed to labour competition (domestic and international). Here,

the economic and institutional structure of the sector determines the outcome: railways workers, formerly highly unionized and powerful vis-à-vis public (or semi-public) railways companies are likely to see their market power deteriorated in a situation with high unemployment. On the other hand, road freight has experience a large degree of liberalisation. Wages have been adjusted to the marginal productivity and the room for competitive gains via salaries is much more limited. impact on wages and working conditions, structural unemployment)

- Gender balance in transport labour force. The participation of women in the transportation sector labour force has been substantially increasing over the last decades. This trend has been more intense in certain occupations (air transport) than in others (railways and navigation).
- Increased monitoring of employee performance. Parallel to the productivity gains, the ICT-based monitoring mechanisms have put at the disposal of managers and regulators a series of excellent tools to improve the overall efficiency. These mechanisms range from the digital tachograph, which guarantees resting times of drivers and is key to avoid stress and accidents, to fuel consumption monitoring, which also may provide incentives for a more efficient and cost-effective driving. Route optimizers, GPS trackers and other enabling technologies can substantially improve the workers performance, but, on the other hand, can lead also to perceived pressure and possibly create stress)
- Vandalism, violence in the public and organized crime have an impact on transport employees. Taxi drivers, bus drivers and other workers in public transport are exposed to this, the problem being exacerbated in urban environments at nigh time. Among other consequences, it deters female workers to enter in such markets niches.
- Increasing liability culture and responsibilities of transport employees. These represent increasing cost that affects the development of public transport modes. This trend is also having an impact in the sector. Insurances for liability in transportation are usually very high (viz. transport sector), and this is representing an)

Technological factors

- Technological innovation in infrastructure and moving equipment is a long-term trend that is likely to continue in the forthcoming years and will determine the future evolution of labour intensiveness of the different transportation modes.. Energy use in transport keeps improving in road, railway, aviation and waterways. Although the substitutability between energy and labour is limited, this trend is likely to have an impact in as much the gains in energy efficiency may be more important in the public transport sector (faster and larger transport means), where labour intensiveness is also greater.
- Increasing use of IT. Information technologies applied to transport are probably a crucial innovation cluster that will contribute to make the sector more innovation-friendly than it used to be during the last century. IT applications span from online monitoring of speed, consumption, optimal path, congestion avoidance, driving help and assistance, etc. Those technologies will require a higher degree of qualification and skills of the workers in the sector, at the same

time improving the service quality/cost balance and the overall sector competitiveness.
- Intermodality. As a particular, important subset of technological development, the general intermodality concept, combining information technologies, infrastructure and optimal planning will lead to efficiency & productivity gains, at the same time requiring more specialised jobs, more complex qualifications and skills.

Legal factors

- Different social regimes between Member States and transport modes. Broadly speaking, the railway sector, in which traditional state-owned companies prevail, and where the degree of unionization is quite high has thoroughly implemented a more benign set of policies with respect to the working conditions. Air aviation, which is the more internationalised transport mode in terms of staff flexibility and wage formation mechanism, has also undergone a substantial adjustment in labour conditions, motivated by the aggressive competition from low cost companies to traditional incumbents.
- Rights and legal regime of non-EU workers. Immigration labour force has a very different among the different subsector. In some of them (e.g. taxi), non-EU workers occupy a significant market share.
- Safety regulations (closely related to the above-discussed liability issues) would have an impact on costs first, but the associated improvement of the transport services reliability would also play a positive role in the overall sector demand and competitiveness. A key aspect is the harmonisation of the different safety regulations in place (Member-state-wise and transport-mode-wise) so that no distortions appear in the competition between companies due to their home base country.

Environmental factors

- Sustainability policies. Their implementation has affected the job requirements in the transport sector, as well as the balance between labour and other production factors, this latter impact being quite unequal between transportation modes. On the one hand, environmental-friendly regulation may foster alternative operational practices ("Eco-driving", forced reduced speed, etc.) that may require new skills, increase working hours etc. These may ask for increased wages to compensate for those changes. On the other hand, sustainability policies may involve accelerated capital stock renewal, both infrastructure (e.g. modal shift) and moving equipment (clean powered transport) that can rebalance the capital-labour ratio in the sector, which would become more capital-intensive.

The overall objective of the current study is to identify the quantitative and qualitative gaps between demand and supply in the labour markets of the various transport sectors.

Quantitative gaps

Quantitative discrepancies appear when there are not enough sufficiently qualified job seekers in (a subsector of) the transport sector as a whole (labour shortage) or where there are not enough vacancies to make use of the supply (labour surplus).

- *Current labour shortages/surpluses:* Many transport branches already report serious structural labour shortages, in particular for mobile jobs. As a result of the economic crisis, these shortages are temporarily mitigated.

- *Trends for the future:* In view of the ageing population in Europe and competition among transport branches and companies to attract (young) workers, labour shortages may cause problems for the transport sector in the future. The largest discrepancies are expected for aircraft staff, ship's deck officers and pilots, and drivers of high speed trains. This is in particular cumbersome for the transport sector's development because most of these specific occupations' employment is found in the transport sector itself (by way of comparison: many drivers do not actually work in the transport sector).

Qualitative gaps

Qualitative discrepancies occur where there is both sufficient supply of labour and a sufficient number of vacancies, but where the demands and wishes of employees and employers regarding level of qualification, content and organisation of the work diverge.

- *Current skills shortages and deficiencies in training and career opportunities:* Training employees is required in order to meet up with increasing requirements. Training opportunities for employees are limited (especially for low-educated and old workers), but improving.

- *Job quality*: Job quality contributes to the working image of a sector and/or profession and by that to the possibilities to recruit and retain personnel. A distinction can be made between employment and work quality.

    - Employment quality: Delocalisation of transport jobs and social regime competition practices occur. To cut costs, pension and early retirement schemes are being restructured. Working times are often irregular and in particular many mobile workers have to cope with regular and (very) long absences from home. Possibilities for part-time work are less than in other sectors.
    - Work quality: Work autonomy in transport is relatively low. Problems caused by heavy physical work have been replaced by stress derived from time-pressures and efficiency improvements, thereby shifting from physical to social or psychological problems. Transport is considered a dangerous activity (occurrence of accidents, public violence, organized crime/piracy). Work intensity has increased (due amongst others to increased traffic congestion and the use of 'lean' strategies or increasingly tight scheduled transport services.

3 The employment profile of the transport sector

The response of the labour force to the economic crisis, and particularly, the slow recovery in terms of employment, together with other trends, such as ageing, can produce bottlenecks in the transport labour market. Changes in the skill profiles needed (demand-side) or the perceived lack of job attractiveness (supply-side) might lead to labour market mismatches in the transport sector in the near future. In this context, an analysis of the available statistical evidence was considered in order to gain insight into the present situation and future evolution of the labour market in the EU transport sector. We have focused on the transport occupations, and have addressed overarching issues pertaining the characterisation of labour supply in this sector:

- demographics of the transport professions: average age evolution and age distribution, as well as female participation in these groups of professionals.

- educational background of the transport workforce, with a particular focus on the different occupations as well as the evolution in the last decade of skill profiles.

- reported working conditions by transport jobholders, assessing the degree of atypical working hours in these occupations, whether a typical working week comprises more than 40 hours, or the share of workers in these groups looking for another job.

The most reliable, harmonized source for labour data in the European Union is the Labour Force Survey (LFS). This database results from a quarterly survey based on a large sample providing results for the population in private households in the EU. The data by occupation follows the international standard classification of occupations (ISCO)[3]. This study makes use of the high level of detail of anonymised micro-data from the LFS (up to ISCO-3 digits, or 116 occupation sub-groups) and identifies the following definitions as representing the transport sector in terms of actual occupations:

- ISCO 314 "Ship and aircraft controllers and technicians"
- ISCO 511 "Travel attendants and related workers"
- ISCO 831 "Locomotive engine drivers and related workers"
- ISCO 832 "Motor vehicle drivers"
- ISCO 834 "Ships' deck crews and related workers"
- ISCO 933 "Transport labourers and freight handlers"

Some of these groups, notably ISCO 834 (Ship crews), and to some extent also ISCO 511 (Travel attendants), ISCO 831 (Railway workers) and ISCO 314 (Ship and aircraft controllers and technicians) present a relative low number of total

[3] This classification organises jobs into a defined set of occupation groups which allow aggregation for statistical purposes. It was last revised in 2008 (ISCO 08) and the LFS uses this revised classification (ISCO-08) since 2011; ISCO-88 (COM) was used until 2010. Therefore, due to comparability issues, our analysis is limited to the period 2000-2010.

responses due to the relative small sample size that this detailed breakdown entails.

Due to confidentiality considerations, Member States providing the micro-data of the LFS do not allow publication of direct estimates if the number of responses is lower than a given threshold to avoid any possibility of reconstructing the database or identifying the respondents in any way. In statistical terms we found that only the sample corresponding to Ship Crews was too low to fulfil the stringent reliability tests for the estimation of specific aspects addressed by in the section on working conditions. Consequently, we have not included this group in that part of the analysis.

In order to respect the confidentiality guidelines, the so-called small area estimation technique (Rao (2003)) has been adopted, which makes use of aggregate responses so that the prescribed threshold for the number of responses is observed. This methodology minimises variances and potential measurement errors inherent to the detailed breakdowns of the sample tackled in this study. In particular, we have adopted time series modelling in order to estimate the trends presented in this chapter following the approach initially proposed by Pfeffermann (1991), which takes advantage of the sample information observed in contiguous periods and identifies a trend component plus a random term. The latter is modelled as a white noise stochastic process that represents unexplained variations as a result of survey errors. This error term is specified taking the direct estimates for the design variances of the survey errors available from the micro-data (Binder and Dick (1989)). Both terms are estimated for the complete series, with lower standard errors for the identified trend than the estimates based in direct statistical inference from small samples. The chapter presents the results from this analysis, yielding a consistent outlook of the latest developments in the transport sector workforce and setting a context for discussion on how labour supply and demand match and which potential challenges may lie ahead.

The analysis of the EU labour market for the transport sector in the last years (2000-2010) is obviously conditioned by the global economic crisis. In relative terms, the percentage of the active population carrying out jobs defined as transport occupations[4] has decreased around 10 basis points during those years (see Figure 2). In spite of an increase of 3.9% of total transport workers over the period of study, employment in this group has witnessed a somewhat higher impact in terms of job losses during the economic slowdown, and the share of the transport professions in the overall occupations remains lower compared to pre-crisis levels, decreasing markedly in 2009. The recovery is still uncertain, and employment in these professions, which grew slightly in 2010, seems to have stagnated or even declined.

[4] Following the International standard classification of occupations (ISCO-88) (3 digits): ISCO 314 Ship and aircraft controllers and technicians, ISCO 511 Travel attendants and related workers, ISCO 831 Locomotive engine drivers and related workers, ISCO 832 Motor vehicle drivers, ISCO 834 Ships' deck crews and related workers, ISCO 933 Transport labourers and freight handlers.

The current relative composition of transport occupation employment (see Figure 1) evinces the significant share of road transport in terms of jobholder numbers. Focusing on the different sub-groups of transport occupations (see Figure 3), a more detailed analysis of the employment in these sub-groups shows the need to take into consideration this level of disaggregation. Occupations such as Vehicle Drivers, Freight Handlers and Ship and Aircraft Controllers and Technicians present an upward trend, which is decidedly more marked for the latter. Contrastingly, Railway Workers presents a decline which was more noticeable, interestingly, in the early years of the last decade (2000-2006)[5]. Finally, Travel Attendants or Ship Crews displayed a less discernible trend, with important variations throughout the series. The evolution of the transport employment by occupation shows therefore a rather differentiated response, although almost all professions considered remain below pre-crisis levels.

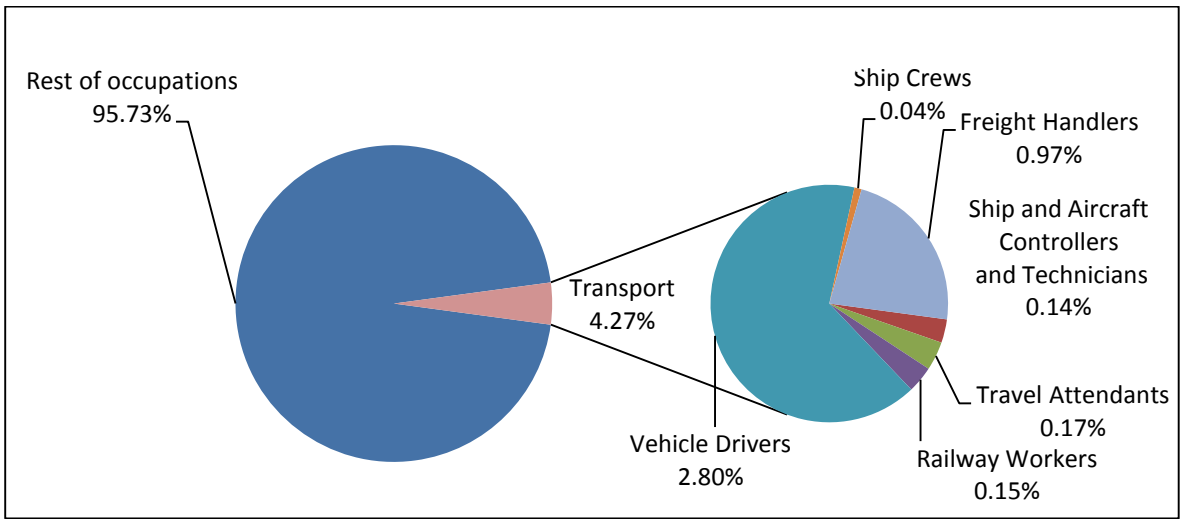


Figure 1: Share of employment by occupation, year 2010.

[5] Could be partly due to a reclassification of workers towards railway infrastructure managers as a result of the vertical separation promoted by the EU in this sector.

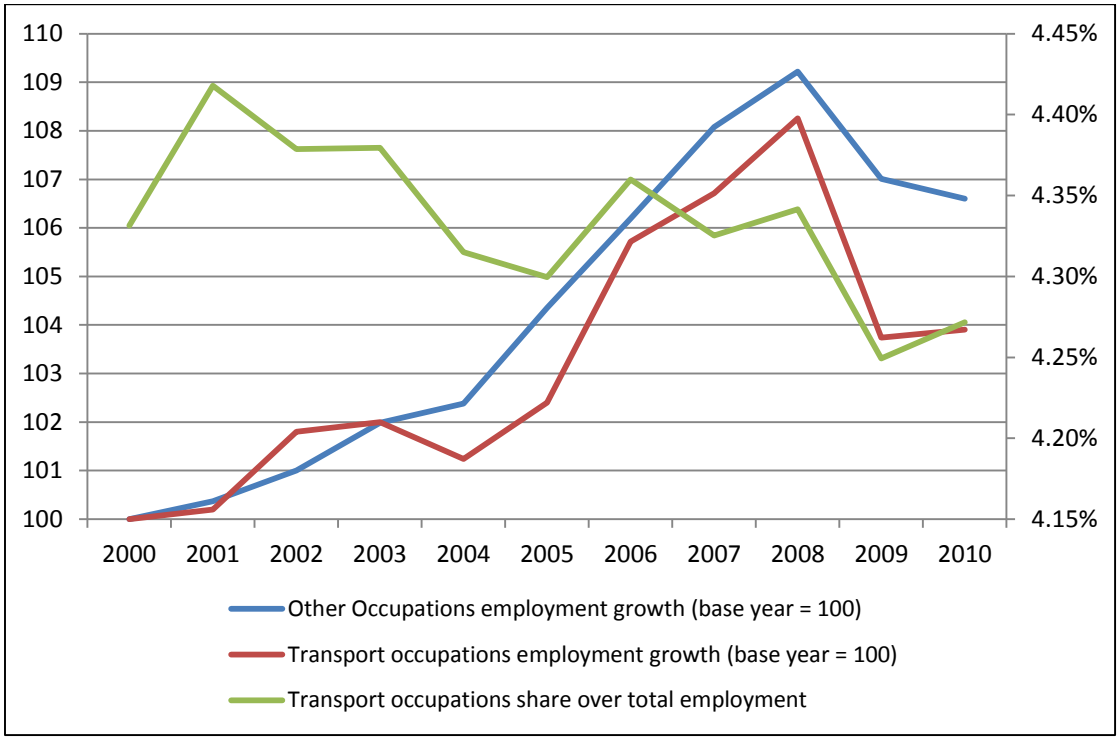


Figure 2: Evolution of employment for transport occupations

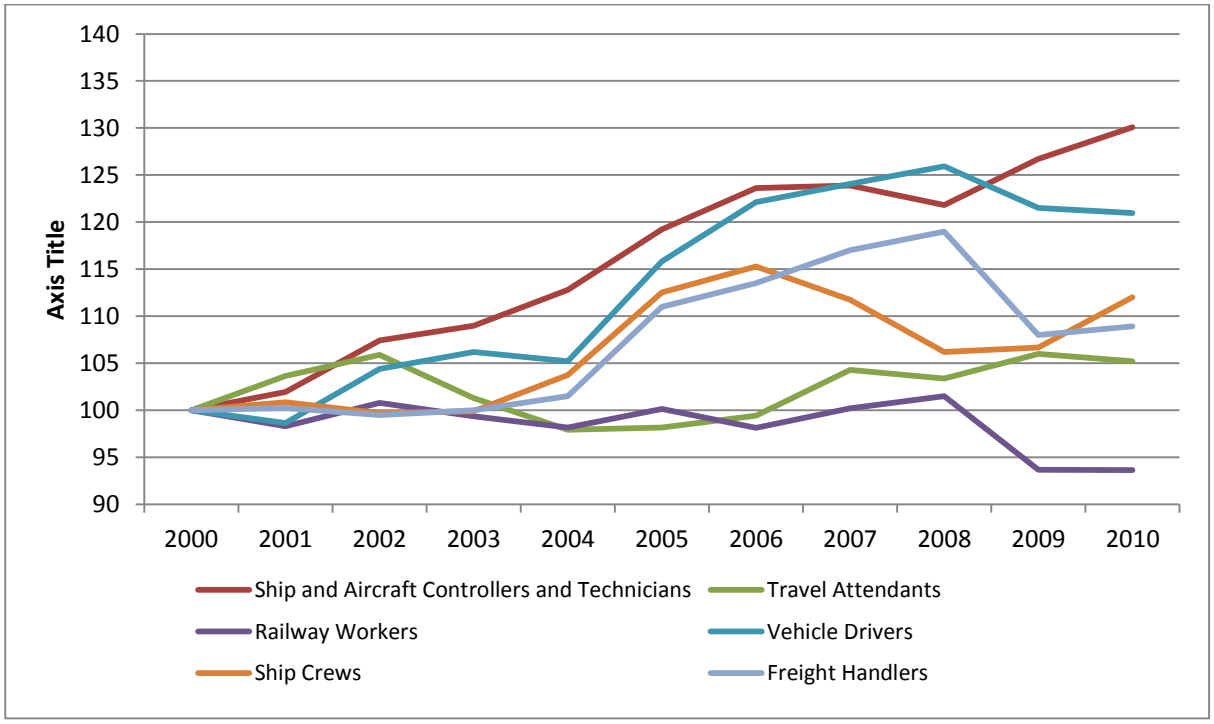


Figure 3: Trends in employment in the transport sector, relative to year 2000.

4 Demographic aspects

Transport occupations are considered particularly vulnerable to ageing and in this respect it is unclear that structural changes aimed at delaying retirement are going to alleviate the potential lack of labour supply in the sector. The analysis of the age distribution of the current labour force in the transport occupations shows (see Figure 4) a clear shift over the last decade towards older cohorts, as well as lower rates of entry into these professions.

This ageing trend is shared in any case by the overall European population, and when compared to the rest of occupations, the transport workforce presents an increasing average age very much aligned with the trend of the rest of the workforce (see Figure 5). Chapter 1 of this study, focusing on future demographic trends and based on sectoral classification rather than by occupation, presents a consistent view of the results obtained for occupations. Notwithstanding, a distinction can be drawn between a group comprised by Railway Workers, Vehicle Drivers and Ship and Air Controllers and Technicians, with a higher average age, and the Freight Handlers and Travel Attendants with a lower average age. In the light of the differentiated evolution of employment by occupation, it is worth noting the relative variations in the average age of job-holders by occupation, particularly in the case of Travel Attendants and Freight Handlers. In the case of the former group, the rise in number of workers has involved an increase in the average age of the group, whereas in the case of the latter, the higher number of jobholders has pushed down the average age, pointing at higher turnovers in this group.

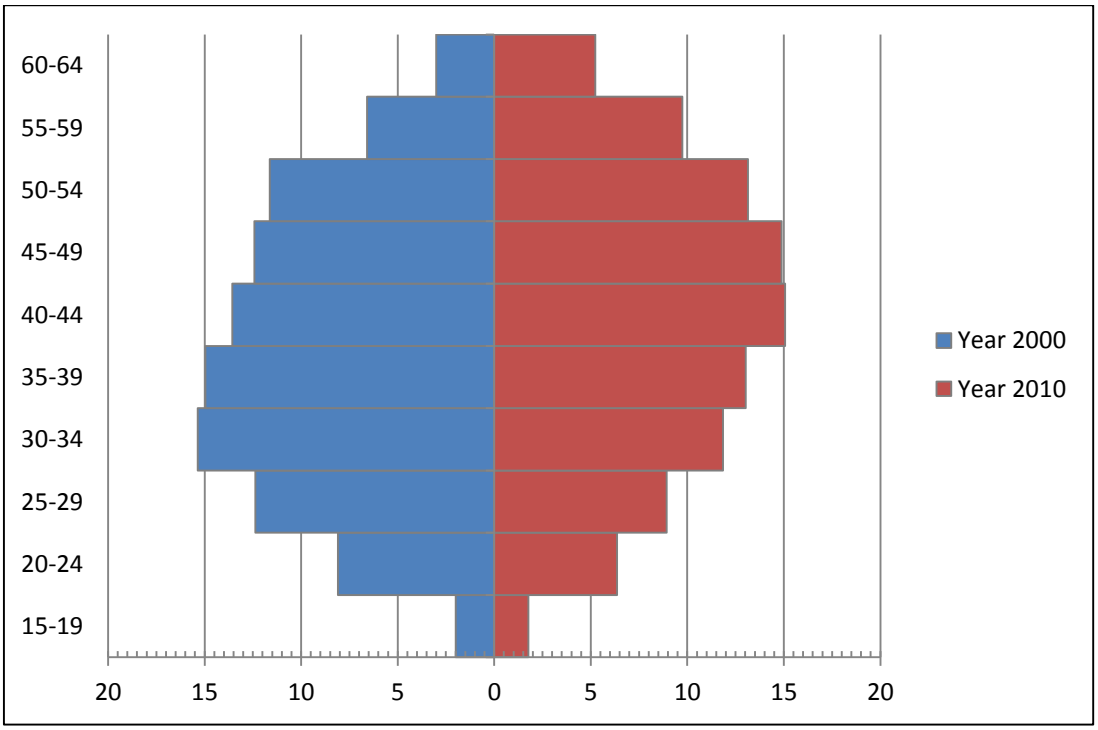


Figure 4: Evolution of workers distribution by age as a percentage of total transport workers (years 2000 and 2010).

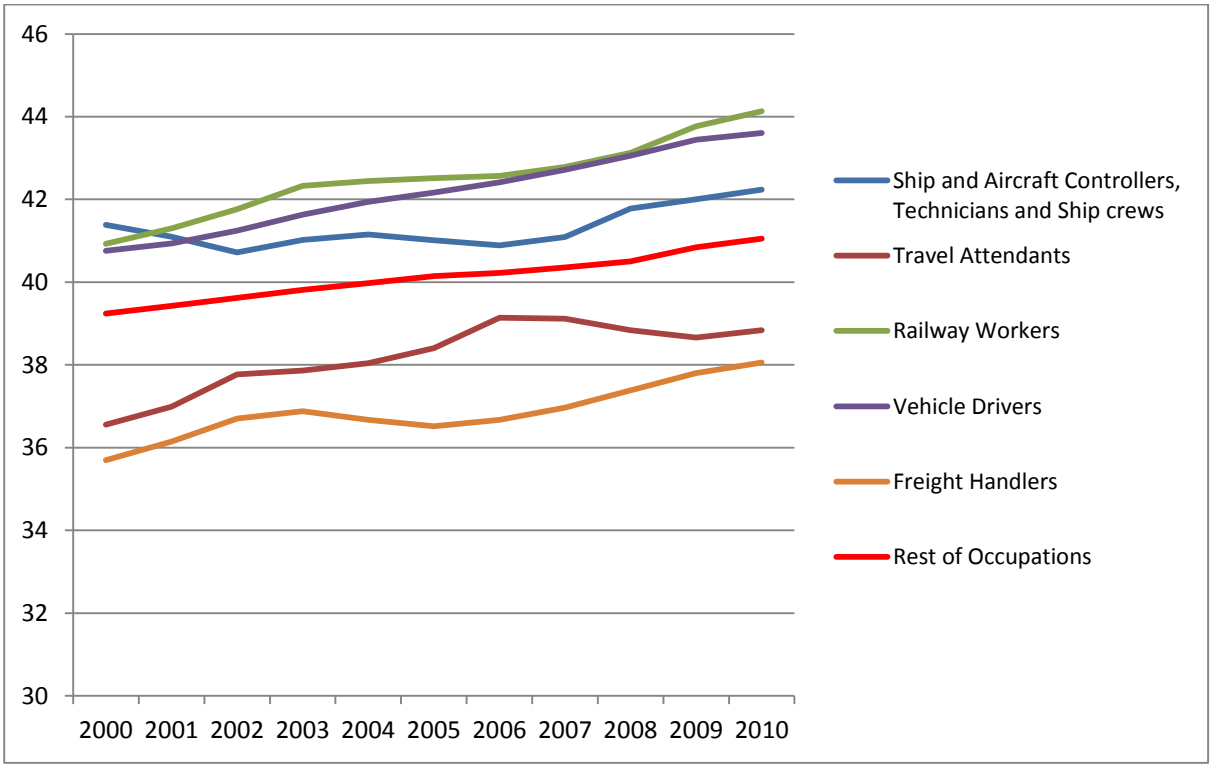


Figure 5: Average age by transport occupations.

Additionally, demographic data from the last decade show how younger cohorts are failing to join specific occupations in transport, with Railway Workers and Vehicle Drivers displaying a starker picture as can be seen in the following figures.

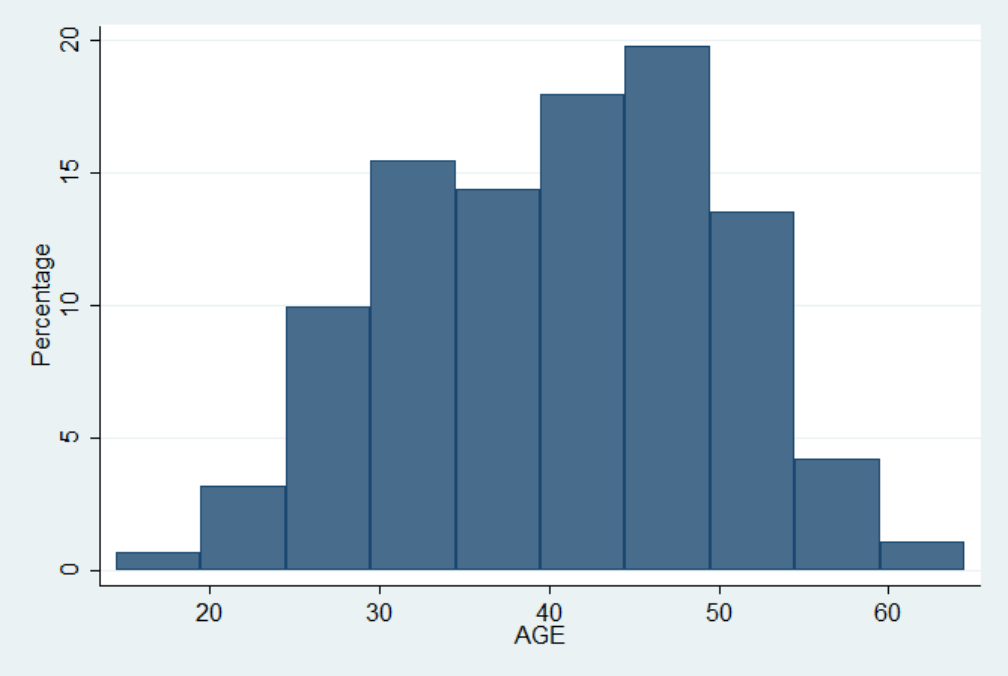


Figure 6: Age distribution of Railway workers in year 2000.

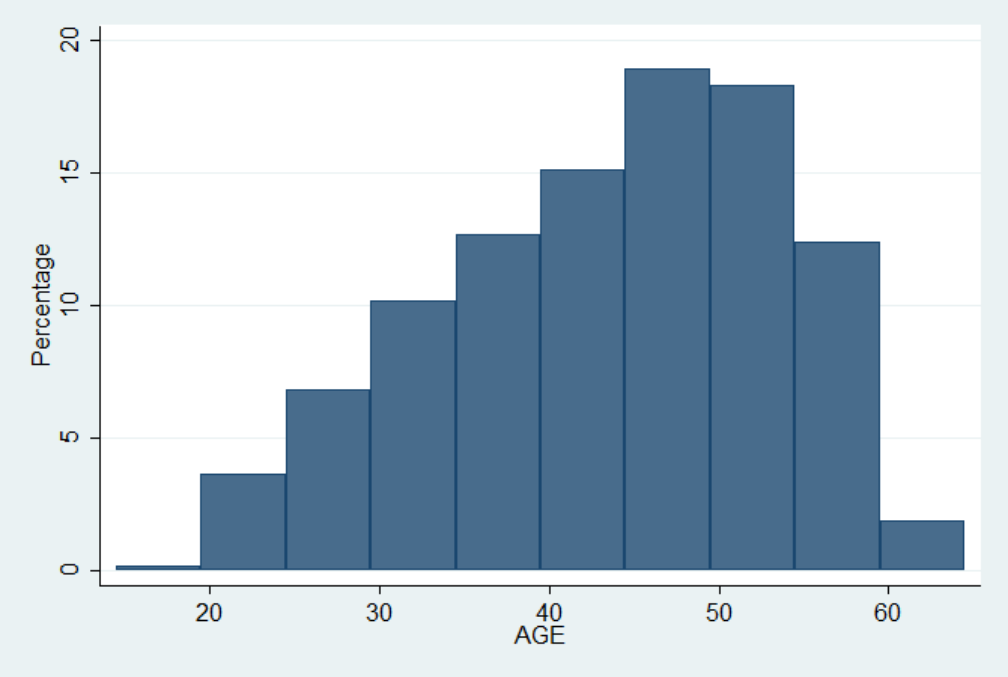


Figure 7: Age distribution of Railway workers in year 2010.

In the case of Railway workers (Figure 6 and Figure 7), the cohort between 50 and 60 years is now staying in their jobs rather than retiring as was the case a decade earlier. The lower proportion of younger workers points to a lower attractiveness of the profession (existence of dual-markets, lesser degree of opportunities to stay in the profession, etc.), or to younger job-holders exiting this occupation to pursue other career paths.

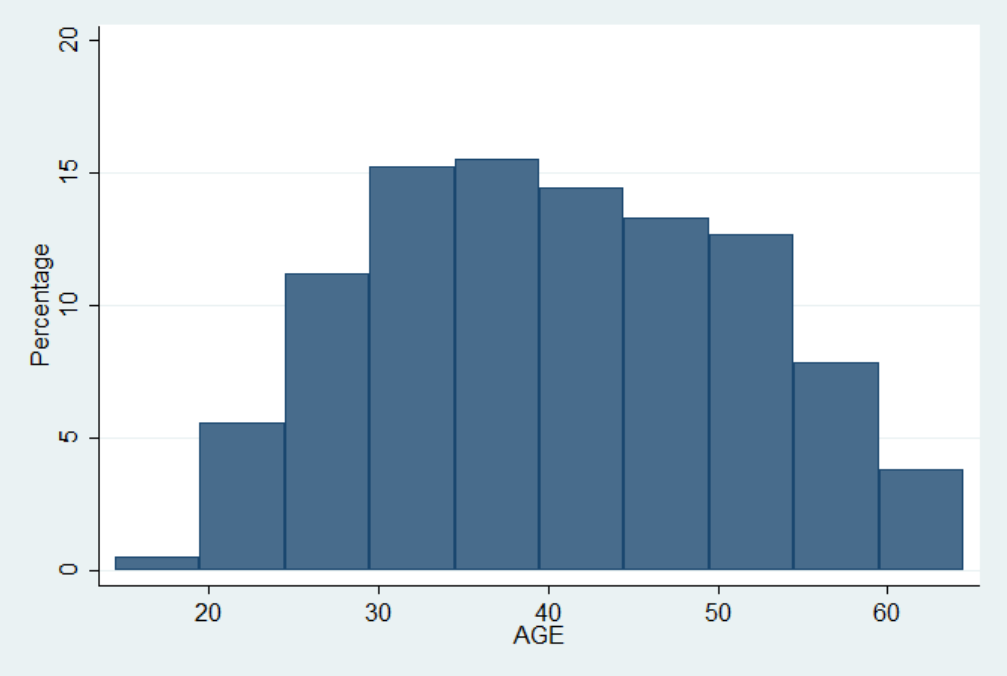


Figure 8: Age distribution of Vehicle Drivers in year 2000.

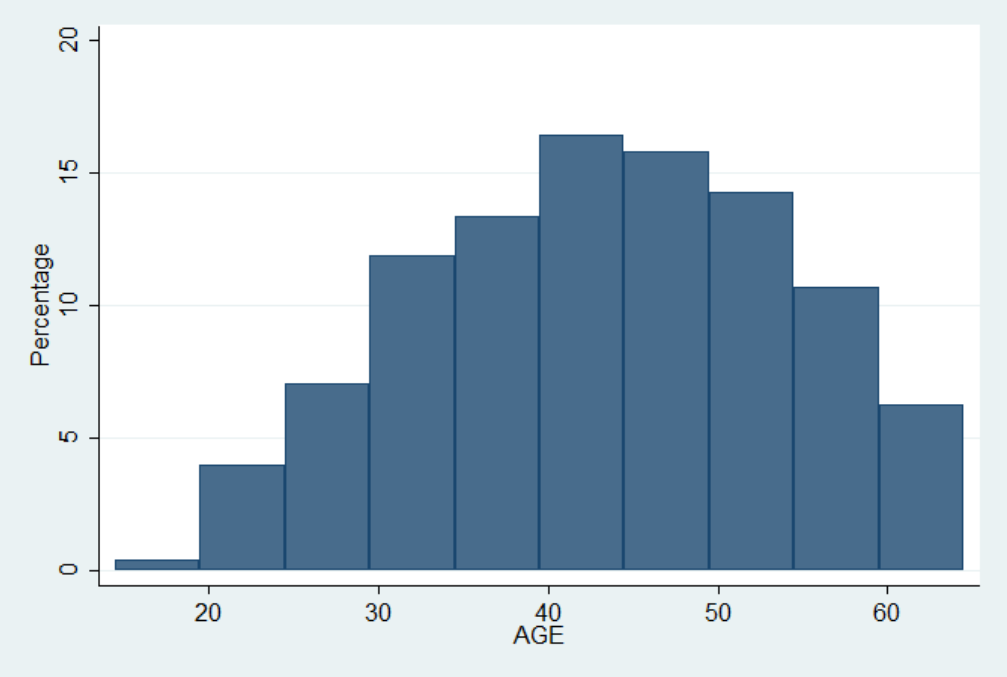


Figure 9: Age distribution of Vehicle Drivers in year 2010.

Vehicle drivers (Figure 8 and Figure 9) display as well a growing share of older workers, with lower rates of retirement than in 2000. The share of cohorts below 40 years incorporating to the profession and staying within it points to potential gaps in labour supply in the next years. The limited length of the available time series, in addition to the general purpose of the LFS precludes further analysis (see next chapter for a demographic analysis and dynamic forecast of age distribution evolution in the transport sector).

The educational path for these professions is another factor to consider when assessing potential gaps in labour supply. As we will show in the next section, skill requirements for these occupations vary significantly, making those professions with higher educational and training demands more vulnerable to labour shortages.

In terms of female participation (see Figure 10), these professional groups show a very low female employment rate, which stays below a 10% for the last years for all sub-groups except Freight Handlers and Travel Attendants, with a significant contrasting picture for the latter (women represented over a 60% of the total employed persons in this group in 2010). In general terms, the female participation in transport occupations displayed a modest growth, with the exception of Ship and Aircraft Controllers and Technicians, where the share of employed women has declined over 2% in the years 2005-2010.

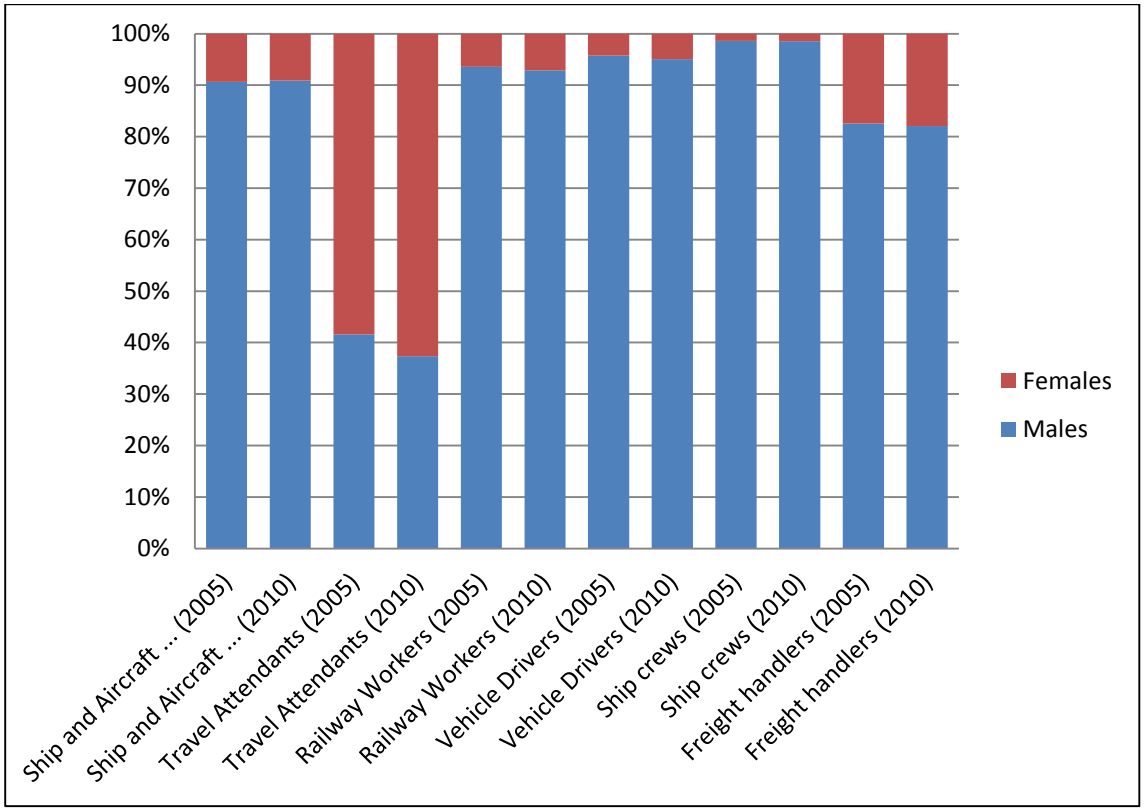


Figure 10: Gender share by transport occupation (2005 and 2010)

5 Skills profile and working conditions

The educational background of the labourers in the transport sector again calls for specific considerations by occupation. The educational classification used by the LFS is based on ISCED 1997 and reflects the highest level of education or training successfully completed by the respondent. Lower educational level corresponds to pre-primary, primary and lower secondary education, medium educational level is upper secondary and post-secondary non-tertiary education and upper educational level encompasses first and second stage of tertiary education. As expected, the skill profiles vary widely, with the highest share of upper educational attainment among ship and aircraft pilots and associated technicians, meanwhile freight handlers show the highest share of lower educational background (Figure 11).

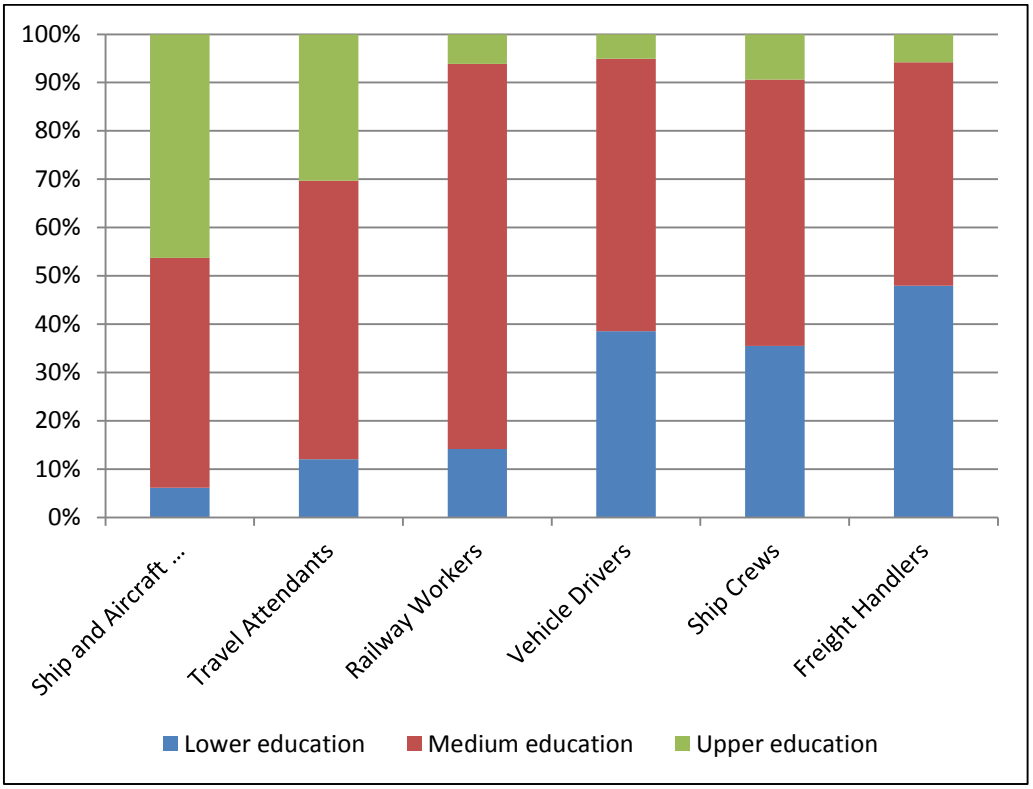


Figure 11: Educational background by transport occupations (year 2010)

It is particularly hard to identify trends in the skill profiles of the transport occupations as a whole, given the fact that many other drivers have a significant impact on the skill distribution by age group and occupation. Specifically, the lower entry rates of younger workers, as well as the impact of the crisis and changes in the business models of certain modes, together with the relatively short times series for this type of analysis, hinder a conclusive analysis of the empirical evidence. The evolution of the skills distribution by age group between years 2000 and 2010 can be seen in Figure 12.

In addition to demographic drivers and cohort effects (the fact that younger generations entering the workforce have higher qualifications on average than older workers currently retiring), skills acquisition alternative to formal education can also improve the qualifications of the working force. This can prove particularly relevant for the transport occupations, as job-holders with low- and medium-level education are a majority and where a higher penetration of technology is foreseen in the near future, adding to the many challenges faced by the transport labour force. In this respect, however, the lifelong learning trend has stagnated in recent years, perhaps as a side effect of the economic contraction (Cedefop (2010)). More importantly, it can be argued that in the case of the transport, training and qualifications are subject to the stricter regulations in place for many of these occupations and therefore, a closer involvement of employer and public bodies plays a relatively more significant role in the lifelong training of transport workers with respect to other occupations. The fact that the largest groups of transport workers (Vehicle Drivers and Freight Handlers) also display the highest share of low-skilled job-holders proves the relevance of such educative paths in the transport sector. Additionally, whereas vocational training is therefore a significant aspect of training and skill development in this sector, it is also the area where harmonisation at EU level needs further efforts, as recognised by the initiatives such as 'New Skills for New Jobs. Anticipating and matching labour market needs' (COM (2008) 868 Final) in order to build stronger bridges between the world of education and training and the world of work.

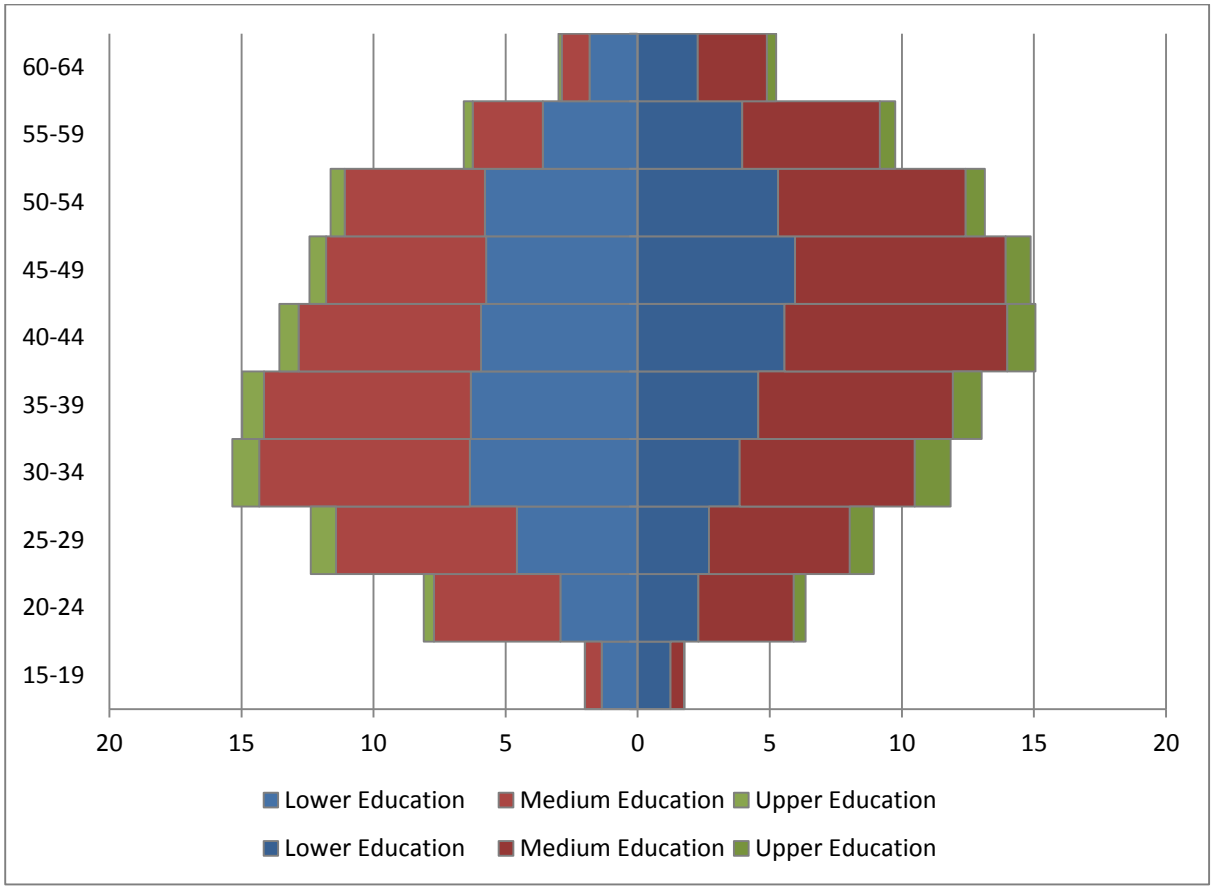


Figure 12: Distribution of skills (lower, medium and upper education) in transport workers by age group (years 2000, on the left hand side of the graph, and 2010).

The characterisation of some aspects of the working life of those in the transport professions has been based on respondents' answers to a series of questions regarding the overall working conditions in their jobs, such as of night or weekend shifts (atypical working hours), a typical working week comprising more than 40 hours, or the share of workers in these groups looking for another job. The results show an increasing demand for shifts outside typical working hours[6] (see Figure 13) with a clear reduction of these as the crisis hit in 2008, revealing how these working shifts outside normal hours can also serve as a flexibility mechanism to adapt to demand downturns.

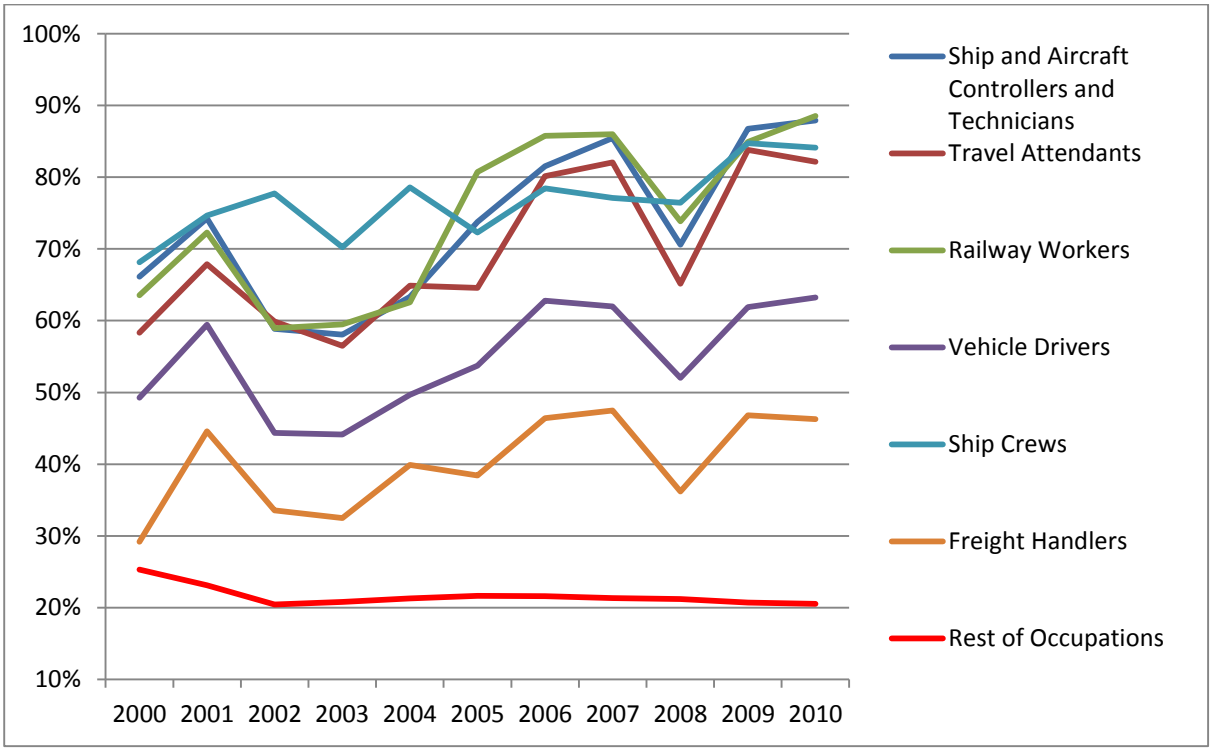


Figure 13: Share of workers with atypical working hours.

Regarding working weekly hours, we can see a different picture for the different sub-groups in the transport occupations, with Railway Workers, Travel Attendants and Freight Handlers showing a lower rate of weekly working hours above 40 compared to the EU average, whereas the rest of occupations in transport report a higher rate of working weeks above 40 hours. Interestingly, although the share of workers with weekly hours above 40 is rather stable, the increasing share of workers with atypical working hours, seems to point to worsening the overall working conditions, which is arguably a factor eroding the attractiveness of this sector.

[6] "Atypical" working hours are defined here as evening shifts and/or work on Saturdays or on Sundays.

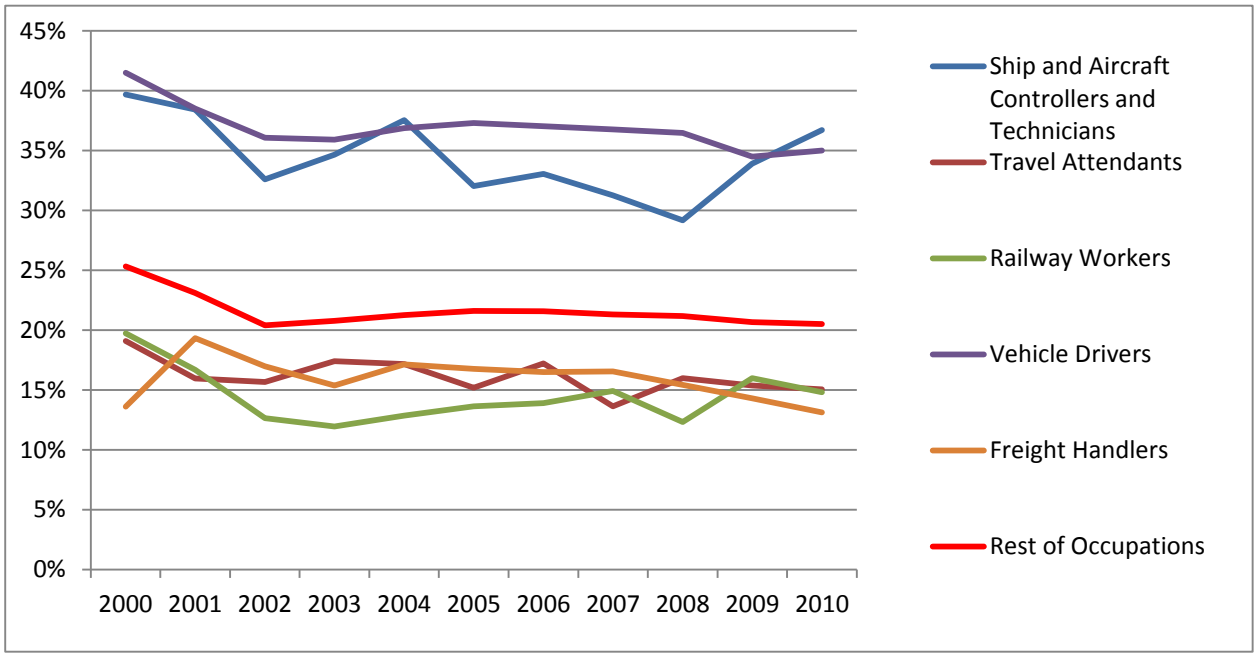


Figure 14: Share of workers with weekly hours above 40.

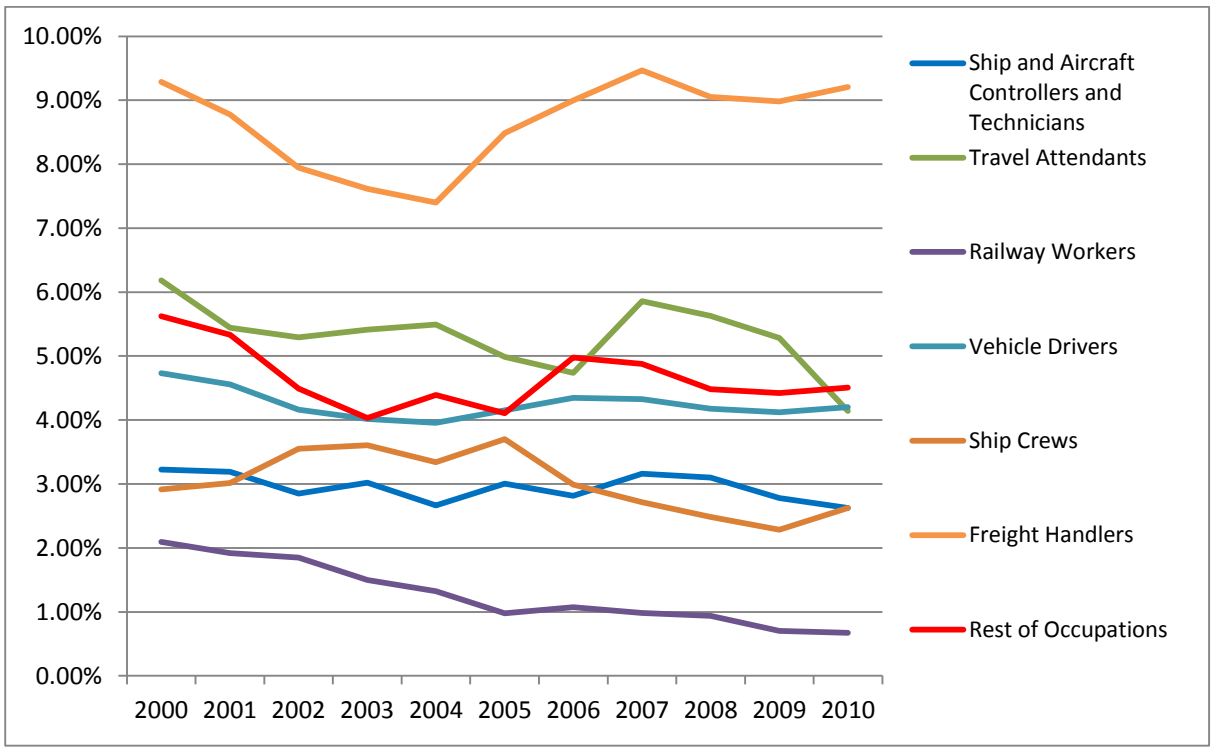


Figure 15: Share of workers looking for another job.

The share of workers looking for another job presents significant differences when taking into consideration the sub-groups within the transport occupations, with Freight Handlers as the sub-group with higher share of jobholders seeking a new position, very much in line with the high turnover implied in previous results, and Railway Workers displaying the lowest intention to change jobs.

These estimations of working conditions are meant to be a basis for further discussion. As mentioned earlier, many transport occupations, and notably those which are conformed by a higher share of workers with low to middle educational levels rely on vocational and lifelong training to develop their skills. On the other hand, these educational paths also tend to narrow the possibilities of these workers to seek opportunities outside their specific occupations, making them and indeed the whole sector vulnerable to structural changes or labour market developments such as, for example, technological change or migration.

It is challenging to draw conclusions from these results in terms of attractiveness of the sector. The crisis has affected transport employment aversely and recovery is still uncertain, in a sector highly dependent to structural change and business cycles, in as much transport activity follows economic activity. Ageing and gender imbalance are pressing issues and the transport workforce is particularly vulnerable to these, although results show however the relevance of mode- and occupation- specific analysis.

6 Analysis of future labour force demographics

This section consists of an estimation of the demographic development of the labour force in four transport sectors until 2020, with a special focus on its demographic composition in terms of age and gender. The analysis is based on historical data on the labour force dynamics and the quantification of the parameters that explain the natural ageing of the employees and the factors that affect entry to and exit from the transport sector labour force.

6.1 Data

The data used is taken from the EUROSTAT Labour Force survey, which provides annual data between 1992 and 2008 on the number of employees by sector and age category[7]. The analysis covers four transport sectors, i.e., land transport (including road, rail and pipelines), water transport (including sea/coastal and inland water), air transport and supporting and auxiliary transport activities.[8] Six age categories are covered: (15-24; 25-39; 40-49; 50-59; 60-64; >65).

Figure 16, as an example, shows in graphical form the data on four transport sectors in Germany. The data suggest that each transport mode has a different employee age profile which is influenced by the mode's working conditions and overall patterns of demand. In land transport, the decrease in total employment has meant mainly a decrease in the number of employees under 40 entering the workforce (and, as comparison with the overall EU data in Fig 4 will show, newcomers in the sector tend to be older than in other modes). At the other extreme, air transport draws most of its personnel from the 25-39 age group, which is however also the one absorbing most impacts from the fluctuation in overall demand. In water transport, fluctuations in demand are more frequent and they affect more the younger age groups. Auxiliary activities on the other hand show a rather uniform trend for all age groups. All four modes share the common characteristic of very low shares for employees over 60, which may suggest an accelerated exit from the transport professions compared to other economic sectors, probably as a result of the working conditions in the sector and the difficulty to continue working after a certain age.

[7] The dataset used is EUROSTAT table: "Employment by sex, age and economic activity (1983-2008, NACE Rev. 1.1)" (lfsa_egana).

[8] The four transport sectors covered correspond to the NACE rev 1.1. classification codes I60-I63. Land transport includes road, rail and pipelines, albeit the figures for this sector are heavily determined by road transport. Water transport includes sea/coastal and inland water. Air transport includes scheduled and non-scheduled air transport. Auxiliary transport includes cargo handling and storage, other supporting transport activities, activities of travel agencies and tour operators, and activities of other transport agencies.

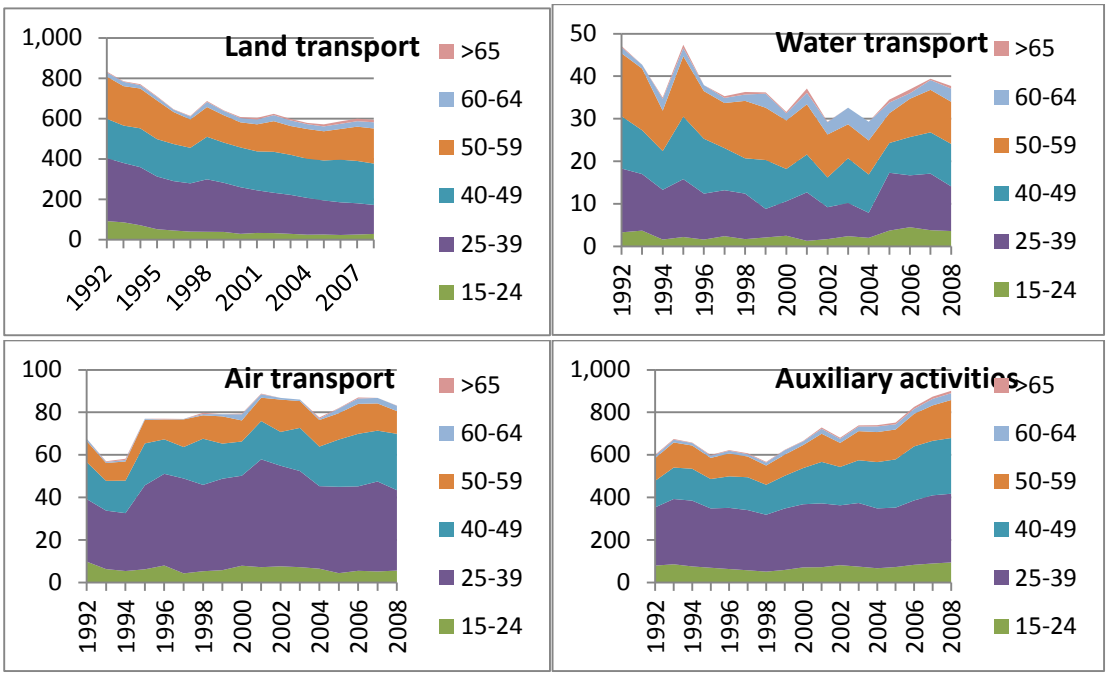


Figure 16: Employment in transport sub-sectors by age category for Germany, '000 jobs

6.2 The labour force dynamics model

The age structure of the workforce and the way it changes over time depends on several parameters that are not directly visible at aggregate level. As in all dynamic populations, the number of employees entering the workforce with the younger cohorts (i.e. newly hired) and the number exiting with the older ones (i.e. retiring) are certainly two of the main drivers. But what happens in between, and how the whole workforce is affected by external factors, are drivers that have a major influence and may be important for the transport sector. In particular, mid-career changes of sector are quite often in most transport modes, with relatively high mobility between transport and other sectors (in both directions). The fluctuations in overall transport demand and labour demand in transport also play an important role. Their impacts on the size of the labour force are not however concentrated on the entry (younger) cohorts, but can affect any age group depending on the specific situation. For example, a decrease in the demand for truck driver or airplane pilots does not necessarily mean that fewer young drivers or pilots are hired. It may well be that contracts for more experienced staff are not extended and that a higher share of transport activity is performed by younger staff.

As a first step for the development of a projection of the workforce in the future, we formulated a labour dynamics model based on the following assumptions. Each year a constant share of the workforce in each cohort shifts to the next age category. This share is assumed to be equal to the inverse of the size (in years) of the cohort. Furthermore, each year a certain share of the workforce in each cohort –depending on the cohort's age distance to average retirement age- retires or leaves the sector. The share of employees of a specific cohort entering the sector is also assumed to be a fixed ratio of the size of the existing labour force for that cohort.

The demographic dynamics are modelled as follows:

$$L_{t,1} = (1+\alpha_1)\left(L_{t-1,1} - L_{t-1,1}\left(\frac{1}{S_1}\right)\right)$$

$$L_{t,c} = (1+\alpha_c)\left(L_{t-1,c} - L_{t-1,c}\left(\frac{1}{S_c}\right)\right) + (1+\alpha_{c-1})\left(L_{t-1,c-1}\left(\frac{1}{S_{c-1}}\right)\right)$$

Where $L_{t,c}$ denotes the labour workforce in age category c in year t, and S_c is the size in years of age cohort c. The parameters α_1 to α_7 indicate per cohort the autonomous net flow of employees (those entering the sector minus those leaving or retiring) as a ratio of the total workforce. The parameters are calibrated based on historical data for the EU27 and for each of the thirteen Member States included in the analysis (a representative sample of Member States for which data was available). Table 1 shows the parameter estimates for each transport sector at the EU27 level.

Table 1: Estimated net flow ratio (α_c) per cohort

Cohort	Land	Water	Air	Auxiliary
15-24	0.100	0.161	0.030	0.149
25-39	0.060	0.055	0.042	0.068
40-49	0.045	0.011	- 0.008	0.036
50-59	- 0.004	- 0.020	- 0.028	0.006
60-64	- 0.278	- 0.242	- 0.459	- 0.235
65-74	- 0.308	- 0.401	- 0.669	- 0.308

Source: estimated model parameters

Across all transport sectors the following pattern can be observed. For the lower age cohorts the ratios are greater than zero, indicating a positive net flow. This suggests that for the class ages between 15 and 49 years, there are more people entering the sector than leaving it. The higher age cohorts, starting with the 50 to 59 cohort, show negative net flows, i.e., more people are retiring or leaving the sector than are entering. For the highest three age categories, it is reasonable to assume that the decrease in employees mainly reflects retirements. As such, the estimated coefficients for these three categories could be interpreted as proxies for retirement ratios.

When comparing the sectors, the results indicate that employees in the aviation sector start leaving the sector at a younger age than employees in the other three transport sectors. This explains the demographic composition of the relatively 'young' aviation sector. The other sectors are comparable in terms of their age composition and demographic dynamics.

6.3 Labour force projections (base scenario)

By using these estimated parameters in the model, an estimate of the future size of the workforce can derived. This would correspond to the hypothesis that the various transport modes continue demonstrating in the future the same dynamics they had in the past. Figure 17 shows the projections for the land, water, air and auxiliary activities sectors at the EU27 level (Annex A shows projections per Member State). For all sectors, except the aviation sector, the figures show an increase in the workforce size between 2000 and 2020. The demographic composition remains relatively stable for all sectors. The workforce in the land, air and auxiliary activities sector are ageing over time (i.e., the share of the three oldest cohorts increases by between -1 (water transport) and 8 (land transport) percentage point.

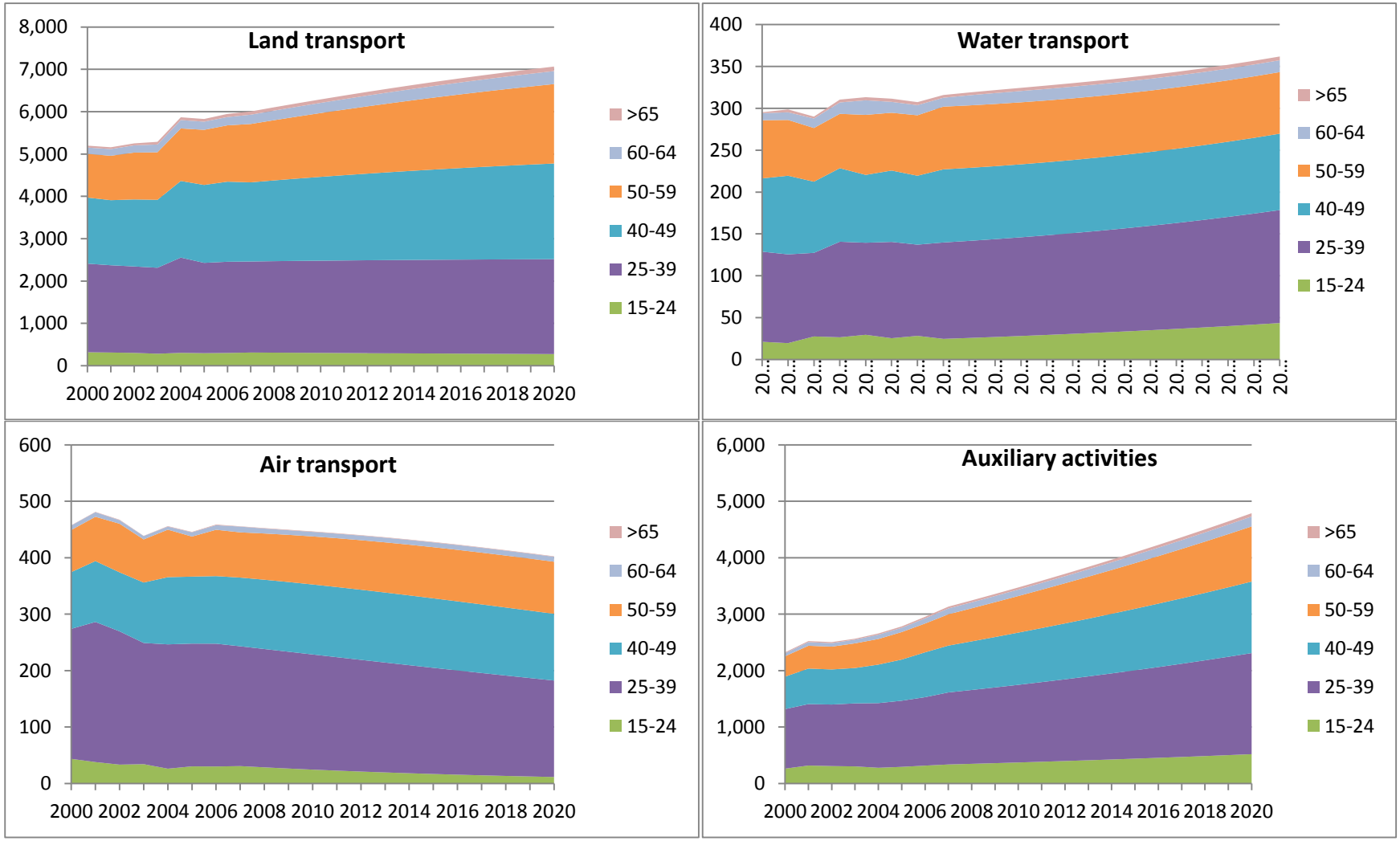


Figure 17: Projections of employment in transport sub-sectors by age category in EU27, '000 jobs.

It should be emphasized that these developments are based on the net flow ratios estimated in this section and as such reflect the labour force dynamics of the historical period (2000-2007). The model allows for the production of projections based on alternative scenarios concerning the labour force dynamics. Furthermore, the model could be used to address the changes in the labour force dynamics (i.e. the net flow ratios) that would be required in order for the future workforce capacity to match the future demand for labour. Updating the projections for the future level activity is a necessary step before finalizing the employment projections (see also Section 7).

Figure 18 shows the projection of employment split out by gender. The share of men in the workforce is about 80 percent during the entire period between 2000 and 2020. Projections of employment by gender for each of the transport sectors are given in the annexes.

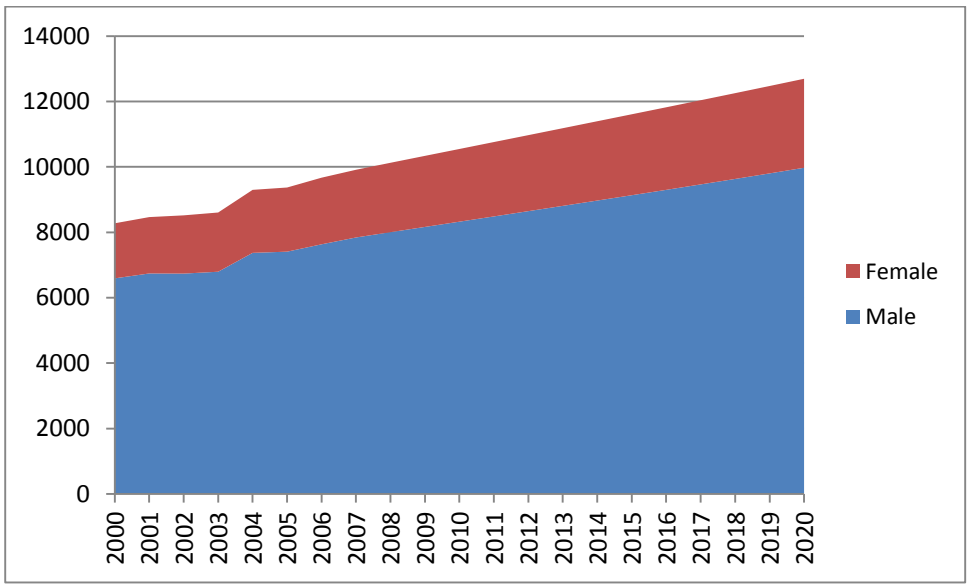


Figure 18: Projection of employment in the transport sector by gender in EU27, '000 jobs

Figure 19 compares the projection of the workforce of the four transport sectors.

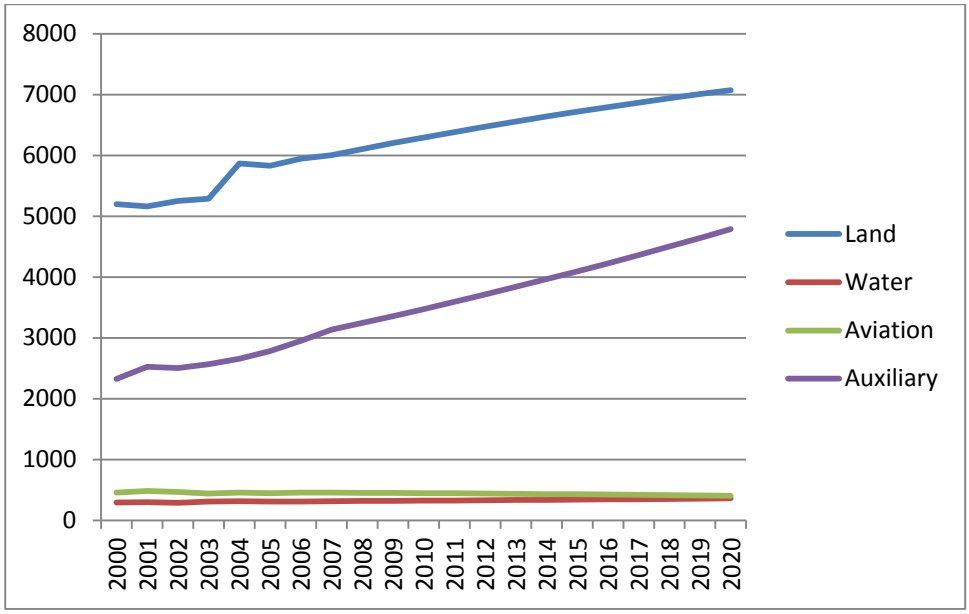


Figure 19: Projection of employment in land, water and air transport and auxiliary activities in EU27, '000 jobs

6.4 Labour force projection for a 'no replacement' scenario

The projections of the previous section constitute a base scenario which is based on the idea that the labour force dynamics in the future will remain essentially the same as during the historical period. This scenario assumes that the sector will remain attracting employees to the same degree as in the past. It would be interesting to know how many employees need to be attracted in order to maintain the trend as projected by the base scenario.

To this end, a second scenario is produced, which is based on the assumptions that no new employees are attracted and employees remain working in the sector until their retirement. Retirement ratios are as estimated in the previous subsection. All other assumptions remain the same as in the first scenario. In operational terms this means that the net flow ratio is zero for the three youngest cohorts and equal to the values in Table 1 for the three oldest cohorts.

While these assumptions are not realistic they constitute an extreme theoretical case which can help us assess how much additional employment would need to be attracted between now and 2020 in order to maintain the trend of the base scenario. Since it is assumed that no employees leave the sector until retirement, the projections actually form an upper bound of the current workforce capacity.

Figure 20 shows the labour force projections based on this scenario. Since in this scenario retiring employees are not replaced by younger employees, the workforce decreases rapidly in all sectors. Furthermore, the lack of young employees entering the sector results in an increase of the relative size of the older cohorts and thus an increase of the average age of the workforce in all sectors; the share of employees above 50 increases by 10 to 20 percentage point, depending on the sector. The increase is most

pronounced in the land transport and auxiliary activities sectors. For the purpose of comparison the projections of the total workforce under the base scenario are displayed by the black line. The no replacement scenario results in workforce projections which, for the land, water and auxiliary activities sectors, are 40 to 50 per cent lower than in the base scenario. For air transport the difference is only about 18 per cent.

The overall approach at the current stage was based on the analysis of the "own" dynamics of each mode, with overall levels of demand estimated endogenously. In the next phase of the project the updated total transport activity projections until 2020 will be incorporated, in combination with the productivity growth rates that the "bottom-up" approach will develop.

The projections on the labour force supply derived in this section do not take into consideration that differences in wage or working conditions with respect to other economic sectors may have an impact in transport labour offer. However, they can be considered a good first approximation to work supply, detailed by transport mode, and are therefore the appropriate counterpart to match labour demand estimates.

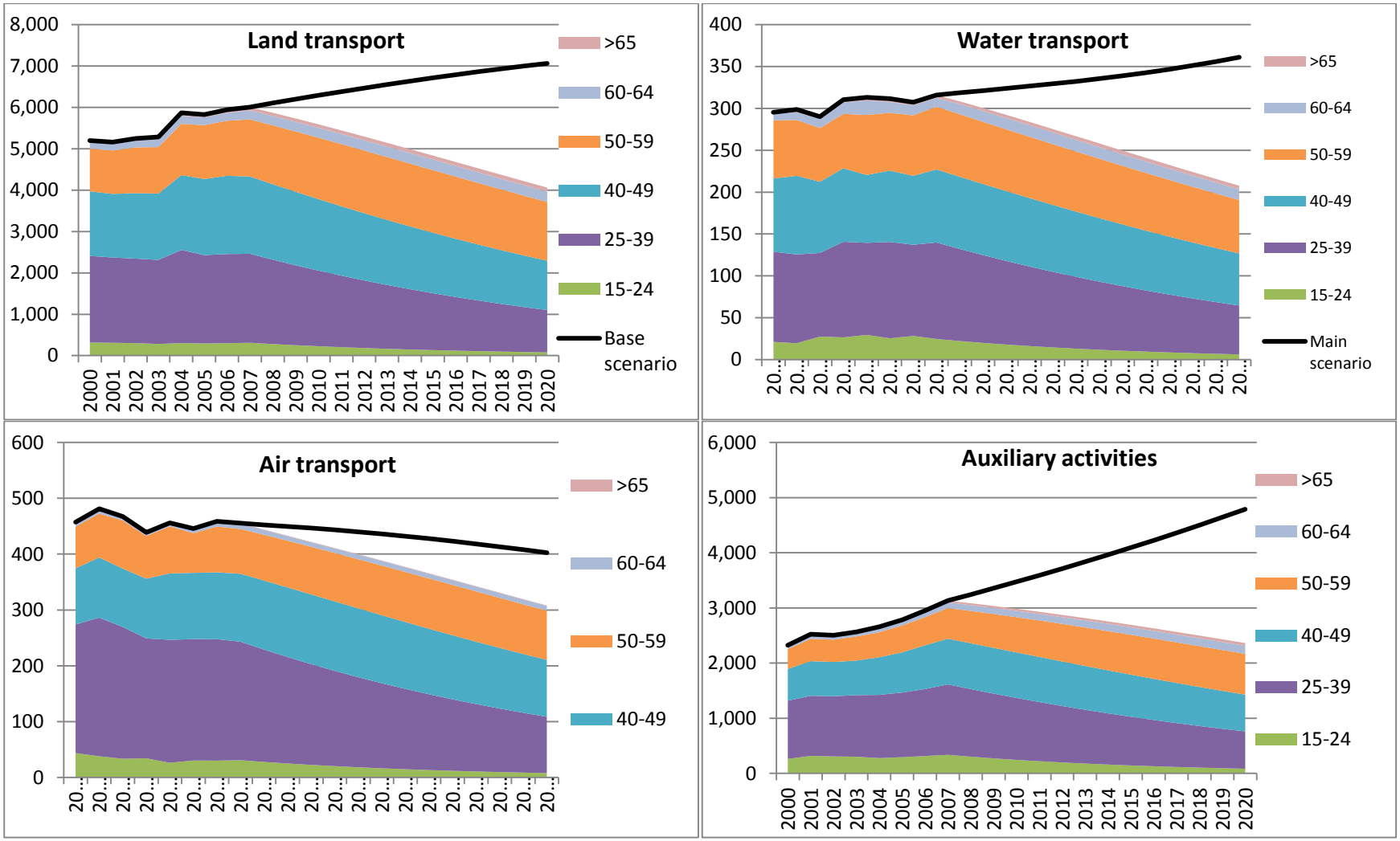


Figure 20: Projection of employment in transport sub-sectors by age category in EU27, '000 jobs (no replacement scenario).

7 Partial equilibrium analysis of labour demand using a production function approach

In this chapter we present partial equilibrium approach for the analysis of the potential future evolution of labour force demand in the transport sector under different assumptions. The key driver is to connect projections of future transport activity and economic indicators with the labour required to perform this transport activity, under certain assumptions as regards technological progress and the trends in labour and capital productivity. The objective is to develop a scenario analysis tool that can be readily used in combination with models providing projections on transport activity and allow an estimation of the potential impacts on employment in transport.

The theoretical stating point of the construction of a model of labour demand from a given economic sector would be the econometric specification of a production function in the sector, taking into consideration the production factors of interest. A production function is a mathematical function that describes the level of economic output as a function of the level of input factors as labour and capital. The precise relationship between the output and input variables is represented by a set of parameters within a given functional form. The values of these parameters can be estimated based on historical data on the output and input variables. Assuming a production function specification (Cobb-Douglas, translog, CES, etc..), and assuming also that the estimation of this production function can be made with the available statistical data, microeconomic theory would allow to obtain the indirect demand curve for each and every production function (including labour and its categories, if so specified). This the production function approach has been explored during the initial phases of the project.

In order to adequately capture substitutability between capital and labour, the constant elasticity of substitution specification was chosen to start the analyses. This production function assumes the following relationship between the production (or total added value of a given sector of the economy), and the labour and capital employed.

The analysis in this section can be split into the following four steps:
1. Analysis of the functional relationship between output, labour and capital by estimating a production function based on historical data
2. Derivation of the so-called inverse production function that expresses labour as a function of capital and output
3. Projection of capital and output values to 2020, based on transport activity
4. Projection of employment demand to 2020, based on the inverse production function and the projections of capital and output

7.1 Data

The analysis of this study focuses on the EU27 as a whole, as well as on its individual Member States. The required quality of the data is not available for all countries. Data are taken from the EUROSTAT database used in the previous section, i.e. EUROSTAT table: "Employment by sex, age and economic activity (1983-2008, NACE Rev. 1.1)".

As for age composition, Member States can also classified into three categories, based on the average age of the employee, which were labelled (i) young, (ii) medium and (iii) old (see Figure 21 and Figure 22).

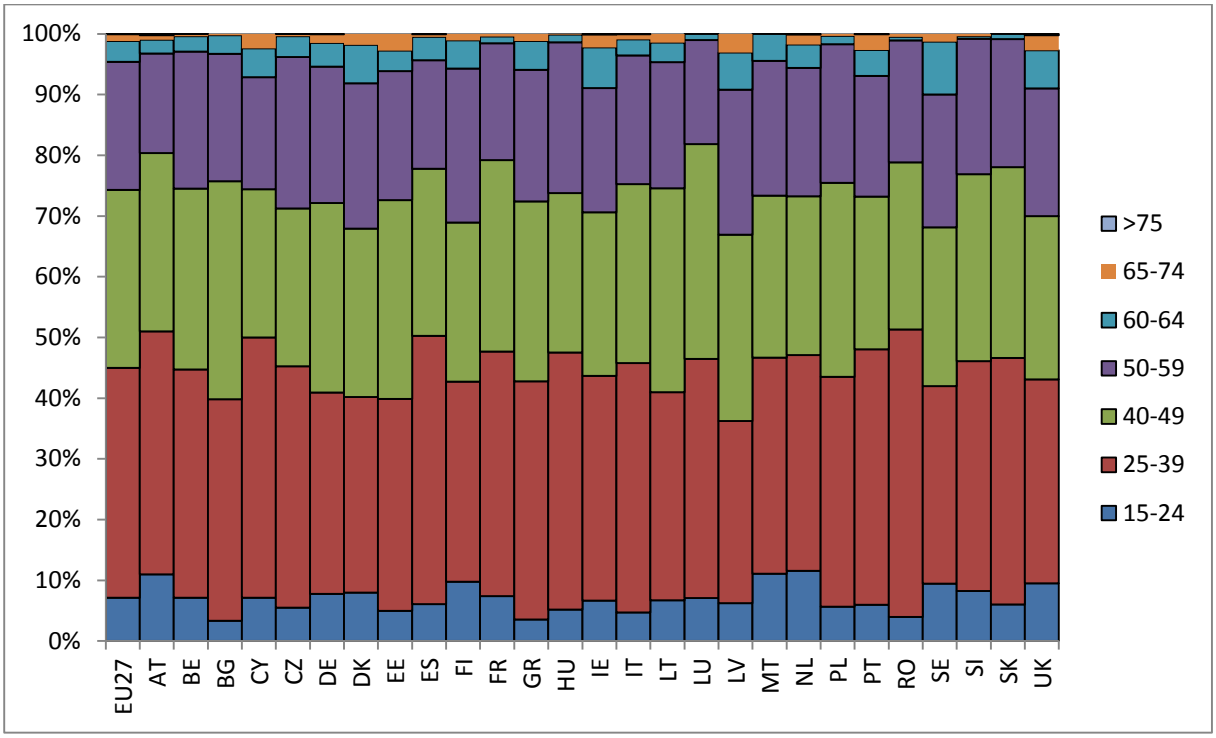


Figure 21: Age composition of employees in transport sector by Member State, year 2010

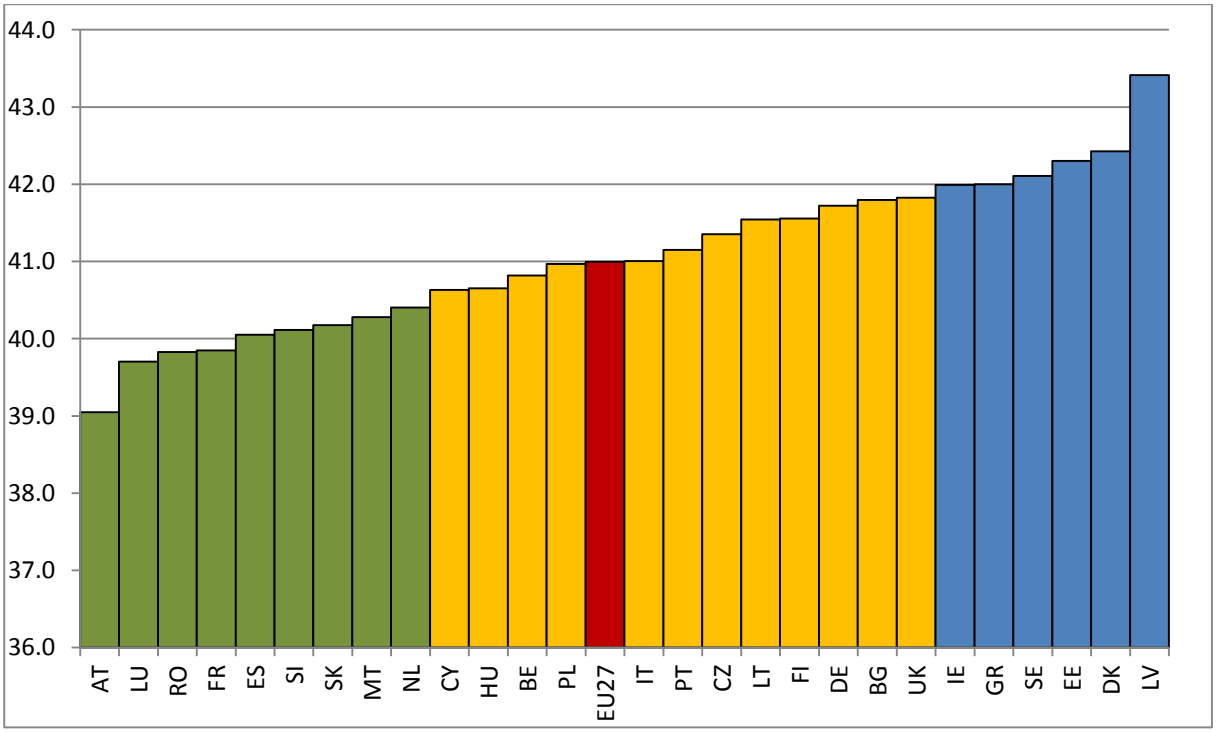


Figure 22: Average age of employees in transport sector by Member State, year 2010

Figure 22 shows that the average age of employees in the transport sector at the EU27 level is 41.0 years. For employees in all economic sectors this is 40.2: in transport, there

is a lower share of young people (15-24) and a higher share of employees in the 40-59 year age cohort.

Because of above-mentioned issue of data quality, the methodology proposed in this section will be applied only to the aggregate EU, and to a (broad) selection of Member States that has been chosen from the three geo-economic classes and according to the three age profiles.

Table 2 shows the set of Member States included in the analyses in terms of the geographic group and the age composition categories they represent. While not every cell in the table is accounted for, all age categories and main geographic groups are represented by the selected set.

Table 2: Member States included in the analyses

	East	South	West/North	Total number
Young	SI	ES	FR NL	4
Medium	PL HU CZ	IT	FI DE UK	7
Old	-	-	DK SE	2
Total number	4	2	7	13

The estimation of the production functions is based on historical data from the supply, use and input/output tables collected by EUROSTAT under the ESA95 regulation. These tables provide data on capital stock, output and labour at the Member State level for each of the four transport modes (land, water, aviation, and auxiliary services) corresponding to the NACE Rev 1.1. classification codes I60-I63.

Projections of transport activity are taken from the baseline scenario used for the 2011 White Paper of transport. These projections are available by Member State. However, due to the limitations on data availability (about capital stock per Member State and transport mode) the estimation of Member State-specific production functions (and labour demands) has not been feasible. A panel data approach has been followed (using measurements over time of several variables for each Member State), assuming the same parameterisation and functional form for each modal production function across Member States.

For the projection of employment we used EUROSTAT structural business statistics[9], which provide historical data on capital stock and output at the NACE two digit level.

9 The structural business statistics tables used are: "Annual detailed enterprise statistics for services" (NACE Rev. 2 H-N and S95) (sbs_na_1a_se_r2) and "Annual detailed enterprise statistics on services" (NACE Rev. 1.1 H-K) (sbs_na_1a_se)

7.2 Estimation of the production functions

For the subsequent steps insight is needed into the functional relationship between output, capital and labour. To this end we formulate and estimate a production function, i.e., a mathematical equation that expresses output (Q) as a function of labour (L) and capital (K); the relationship between these variables is represented by set of parameters.

A constant elasticity of substitution (CES) production function with factor-specific exogenous technical progress. The production function to be estimated has the following form:

$$Q = c \cdot \left[(1-\delta) L^{\rho} + \delta K^{\rho} \right]^{\frac{r}{\rho}} \cdot e^{\lambda t}$$

with variables: Q: output
L: labour
K: capital
And parameters: c: constant factor
δ: distribution parameter
ρ: elasticity of input factors
r: economies of scale
λ: exogenous technical progress
t: year of observation

Based on historical data for the variables output, labour and capital, we estimate the value of the parameters *c*, *δ*, *ρ*, r and *λ*.

The above methodology could potentially be extrapolated to consider a further split in the production factor structure, namely to consider for instance three labour categories (administrative staff, mobile staff and technically qualified staff) and one class of capital goods. This specification would yield a good deal of insight on the different evolution of these separated production factors.

The appropriate definition of the output variable in a production function can depend on the sector under consideration. Output can refer to Gross Value Added (GVA) or to total output value. Certain definitions are more appropriate for certain sectors from a theoretical point of view. From a pragmatic point of view, certain definitions may result in a better model fit for certain modes. On a similar note, the functional form of the production function can result in a better fit of the model. Table 3 shows the output measure and functional form used for each mode. For all modes, gross value added (GVA) resulted in the best model fit. For the land and water transport sector the aforementioned CES model is estimated. For air transport and auxiliary activities, a special case of this model with *ρ* approaching zero, i.e. the Cobb-Douglas model (CD) is used, since this resulted in more meaningful results.

Table 3: Output measure and functional form used per transport mode

Mode	Output measure	Functional form
Land	GVA	CES
Water	GVA	CES
Aviation	GVA	CD
Auxiliary	GVA	CD

Table 4 shows the results of the estimation of the parameter values. The parameter of most interest is $\boldsymbol{\lambda}$, representing the progress of total factor productivity. Higher values for this parameter indicate higher increases in productivity. The value is highest in the auxiliary activities sector and lowest for the water transport sector.

Table 4: Estimated values of the production function parameters

Mode	c	δ	ρ	r	λ
Land	0.916	0.553	0.000	1.000	0.0077
Water	0.717	0.153	0.845	1.266	0.0046
Aviation	0.911	0.434	0.000	0.938	0.0077
Auxiliary	0.843	0.333	0.504	1.170	0.0128

Source: own estimations based on data from Input/output tables, EUROSTAT

7.3 Derivation of labour demand functions

This step consists of an algebraic transformation of the production function into a function where labour is expressed as a function of the costs of productive factors (wages and interest rates), and the total sector output.

In order to simplify the analysis, *(r* could thoroughly be assumed to be 1, being transport a long-term mature economic activity with no substantial economies of scale). Assuming a competitive structure in the markets of production factors (in this simplified case capital K and labour L), where agents maximize their profit by combining those production factors to generate transport services, the demand for each of them can be proven to take this form:

$$L = \frac{w^{\frac{1}{\rho-1}}}{(1-\delta)^{\frac{\rho}{1-\rho}}}\left[\left[\frac{w}{(1-\delta)}\right]^{\frac{\rho}{\rho-1}} + \left[\frac{i}{(1-\delta)}\right]^{\frac{\rho}{\rho-1}}\right]Q$$

w being the cost of labour (salaries) and i being the cost of use of capital (interest rate), while the subscript t denotes the year of observation.

The value of the parameters c, δ, ρ and λ can be estimated based on historical data for the variables output, labour and capital.

By means of this inverse production function, based on projections of output and capital, and the estimated parameter values, estimates of the projection of labour can be calculated. The base case assumes that the wages are constant in real terms.

7.4 Projections of output and capital

Deriving a projection for labour demand based on equation would imply the need of having (or assuming) a long-term path to the gross added value of the sector *Q.* This would be given by a sectoral production equation, based not only on the (endogenous) evolution of labour but also on the exogenous assumption concerning the dynamics of the capital stock *K* (initial stock, investment dynamics, obsolescence and depreciation).

$$K_{t+1} = K_t(1-d) + I_t$$

where *d* = capital depreciation rate, *I* = investment and *t* denoting the time index.

In order to derive projections of capital (and therefore output) for 2015-2020 we use the baseline transport activity projections of the 2011 White Paper on transport as a basis. An overview of historical and projected transport activity at the EU27 level is provided in Table 5.

Table 5: Transport activity projections for EU27

Transport mode	1990	1995	2000	2005	2010	2015	2020
Passenger transport activity (Gpkm)	1379.5	1321.4	1464.1	1553.8	1645.2	1845.7	2037.6
Public road transport	544.0	504.0	517.6	526.0	545.0	575.5	602.9
Rail	472.5	421.7	447.9	461.0	482.5	525.4	566.7
Aviation	317.3	351.3	456.9	527.3	576.9	702.4	824.1
Inland navigation[10]	45.8	44.4	41.7	39.5	40.8	42.4	43.9
Freight transport activity (Gtkm)	1848.4	1942.4	2195.7	2494.6	2662.6	2972.7	3167.8
Trucks	1060.4	1288.7	1518.7	1800.3	1940.3	2184.8	2325.3
Rail	526.3	386.1	403.7	414.1	440.5	489.1	526.4
Inland navigation	261.6	267.6	273.3	280.2	281.9	298.8	316.1

Source: White Paper on transport (2011)

Table 6 gives the percentage change in transport activity in 2015 and 2020 compared to 2005.
Concerning passenger transport the large expected growth in the aviation sector draws attention. The road-based land modes, accounting altogether for 84 per cent of all passenger transport in 2005, increase less than average. In freight transport, the inland waterways sector is expected to increase less than road and rail.

[10] Inland navigation includes inland waterways and national maritime transport. International maritime transport is not covered by this category.

Table 6: Percentage change in transport activity compared to 2005 for EU27

Transport mode	2015	2020
Passenger transport	18.8%	31.1%
Public road transport	9.4%	14.6%
Rail	14.0%	22.9%
Tram/metro	12.9%	21.0%
Interurban	18.9%	31.5%
Aviation	33.2%	56.3%
Inland navigation	7.4%	11.1%
Freight transport	19.2%	27.0%
Trucks	21.4%	29.2%
Rail	18.1%	27.1%
Inland navigation	6.7%	12.8%

Source: own calculations based on data from the White Paper on transport (2011)

To derive projections of capital and output first, based on historical data (1995-2008) on capital, output and transport activity we estimate a pair of time-series equations for each Member State and transport submode. These equations associate the ratio of output to activity and capital to activity respectively, assuming a linear trend in time.

$$(Q/A)_t = \alpha_Q + \beta_Q t + \varepsilon \qquad (C/A)_t = \alpha_C + \beta_C t + \varepsilon$$

where A is transport activity, α and β are parameters to estimate and ε is a disturbance term. Next, based on the parameter estimates and projection of transport activity from the White Paper baseline scenario, projections of output and capital for 2020 (and analogously for 2015) can be derived as follows:

$$(Q/A)_{2020} = a_Q + b_Q(2020) \qquad Q_{2020} = A_{2020} \cdot (Q/A)_{2020}$$
$$(C/A)_{2020} = a_C + b_C(2020) \qquad C_{2020} = A_{2020} \cdot (C/A)_{2020}$$

Where a and b are the estimated values for α and β. A first scenario is based on the assumption that output measured in monetary terms increases proportionately with the transport activity projections as produced in the context of the 2011 White Paper on transport (i.e. $\beta_Q = 0$ and $\alpha_Q = (Q/A)_{2005}$) . Furthermore, we assume that the capital-to-output ratio will remain the same as in the last year for which we have data (generally 2008) (i.e. $\beta_C = 0$ and $\alpha_C = (C/A)_{2008}$).

Table **7** shows the average annual increase in output and capital for the period 2005-2015 and 2005-2020 under these assumptions[11].

[11] The annual increase of output is calculated as $(O_{2015}/O_{2005})^{1/15}$ and $(O_{2020}/C_{2005})^{1/20}$, and analogously for capital.

Table 7: Annual change in output and capital stock between 2005 and the indicated year

	Output		Capital	
Transport mode	**2015**	**2020**	**2015**	**2020**
Passenger transport	1.74%	1.82%	1.05%	1.36%
Buses and coaches	0.90%	0.91%	0.22%	0.46%
Rail	1.32%	1.38%	0.63%	0.93%
Tram/metro	1.22%	1.28%	0.53%	0.82%
Interurban	1.75%	1.84%	1.06%	1.38%
Aviation	2.91%	3.02%	2.36%	2.66%
Inland navigation	0.72%	0.70%	3.01%	2.23%
Freight transport	1.77%	1.61%	1.08%	1.15%
Road	1.95%	1.72%	1.26%	1.26%
Rail	1.68%	1.61%	0.99%	1.15%
Inland navigation	0.65%	0.81%	2.94%	2.33%

Source: own calculations

7.5 Estimation of labour projection

In order to develop projections for the future, it is assumed that the parameters estimated for the production function based on historical data remain constant. Future labour demand then depends on the future evolution of capital and output, which are themselves derived as described in paragraph 7.4. Table 8 shows the projected percentage change in the employment level in 2015 and 2020, as compared to 2005, for the EU27.

Table 8: Projected percentage change in employment levels in EU27 for 2015 and 2020 (compared to 2005)

Transport mode	**2015**	**2020**
Passenger transport	6.1%	9.1%
Buses and coaches	-4.4%	-8.1%
Rail	-0.4%	-1.5%
Tram/metro	-1.3%	-3.0%
Interurban	3.9%	5.4%
Aviation	20.8%	34.3%
Inland navigation	24.6%	25.0%
Freight transport	7.6%	5.8%
Road	6.1%	3.5%
Rail	3.2%	1.9%
Inland navigation	23.9%	26.5%

Source: own calculations

The results indicate that, despite the considerable increase in transport activity, the demand for employment for the road-based land transport submodes does not increase much. The increase in factor productivity compensates partly for the potential increase in employment resulting from the transport activity increase. The demand for employment in interurban rail sector increases faster than demand in the road-based transport sector.

In the aviation and inland navigation sectors the employment level grows more dramatically. For the aviation sector this is mainly the result of the high increase in transport activity. For the inland navigation sector this is caused by a modest increase in transport activity in combination with a relatively low value of the technical progress parameter in the water transport sector. This is a result of the model equations extrapolating from past trends in each mode, which in the case of inland waterways correspond to a decreasing overall productivity for the sector and lead to a disproportionate increase in projected labour.

Table 9 and Table 10 provide results for the complete set of Member States analysed in this section.

In general terms, the panel of EU Member States selected for the analysis show similar trends, although several outlaying figures emerge, whose explanation has to be found in the local market characteristics, or in the parameter estimation carried out with insufficient or statistically scattered data.

The expected decline in road passenger transport is found consistent almost everywhere, with the exception of CZ, ES.

The expected growth in aviation is however a bit more irregular: large countries in which this mode has already reached a high degree of maturity (DE, FR, FI, ES) range lower in the expected growth rate, whereas some new Easter Member States are expected to grow above average ((CZ, PL. SI). It should be noted though that since this modelling approach depends on the assumptions on investment and capital productivity, the results are very sensitive to the projected productivity growth rates that have been calibrated on past trends. While some general trends can be derived at EU and sector level, the irregularity in the projections makes the identification of trends at country level less certain. For this reason, additional modelling approaches were explored, as described in the following chapters, in order for other aspects of productivity in transport to be taken into account.

Table 9: Projected change in employment between 2005 and 2015

Submode	EU27	CZ	DE	DK	ES	FI	FR	HU	IT	NL	PL	SE	SI	UK
Passenger transport	6.1%	12.6%	6.1%	37.0%	13.4%	0.7%	-3.4%	1.3%	-2.2%	6.6%	6.8%	3.5%	5.7%	7.4%
Buses and coaches	-4.4%	5.0%	1.8%	-10.9%	7.1%	-12.4%	-7.9%	0.8%	-7.9%	-1.7%	-12.0%	-24.0%	0.2%	-2.9%
Rail	-0.4%	0.2%	2.8%	-5.9%	-0.9%	0.5%	-7.5%	-2.8%	-11.2%	3.7%	7.5%	-2.3%	3.7%	10.5%
Tram/metro	-1.3%	-13.7%	3.8%	-8.0%	-1.7%	1.7%	-6.8%	-9.7%	-14.1%	2.8%	5.8%	1.5%	-	13.0%
Interurban	3.9%	11.8%	-2.1%	72.5%	1.7%	-7.2%	-11.8%	26.0%	13.2%	13.0%	14.2%	-19.4%	-	-2.4%
Aviation	20.8%	42.7%	15.1%	110.0%	20.0%	-0.1%	3.9%	17.0%	20.5%	16.1%	117.7%	18.8%	56.7%	10.2%
Inland navigation	24.6%	-	26.5%	15.8%	26.9%	28.4%	30.5%	-	22.1%	24.4%	28.9%	20.9%	-	23.3%
Freight transport	7.6%	30.8%	12.7%	-16.1%	12.4%	-12.3%	-6.8%	49.7%	-10.9%	-1.1%	49.8%	-8.8%	82.7%	0.8%
Road	6.1%	33.7%	10.3%	-17.9%	12.3%	-15.4%	-7.7%	63.0%	-16.2%	-12.7%	65.4%	-12.3%	100.0%	-7.7%
Rail	3.2%	22.2%	10.7%	-19.5%	-11.9%	-3.1%	-9.7%	18.6%	-0.6%	16.3%	15.0%	-11.7%	23.9%	7.1%
Inland navigation	23.9%	45.7%	27.4%	12.5%	21.9%	30.9%	28.5%	24.3%	20.5%	19.8%	41.5%	19.1%	-	21.9%

Source: own calculations

Table 10: Projected change in employment between 2005 and 2020

Submode	EU27	CZ	DE	DK	ES	FI	FR	HU	IT	NL	PL	SE	SI	UK
Passenger transport	9.1%	17.7%	8.1%	44.7%	17.9%	2.6%	-1.6%	-0.1%	-3.0%	10.8%	7.6%	6.5%	5.3%	13.2%
Buses and coaches	-8.1%	0.7%	-1.8%	-15.4%	5.8%	-17.2%	-10.0%	-6.0%	-13.2%	-5.9%	-14.0%	-28.0%	-3.7%	-6.8%
Rail	-1.5%	-3.6%	1.3%	-7.6%	3.2%	-1.6%	-8.5%	-5.1%	-13.4%	2.7%	5.9%	-3.7%	4.3%	9.6%
tram/metro	-3.0%	-23.1%	2.5%	-10.8%	1.8%	-0.8%	-7.7%	-12.5%	-17.2%	1.2%	2.7%	2.2%	-	13.3%
Interurban	5.4%	12.8%	-4.4%	111.6%	8.2%	-6.8%	-13.5%	25.6%	17.8%	17.7%	19.2%	-29.6%	-	-9.8%
Aviation	34.3%	75.5%	28.3%	135.4%	27.5%	10.9%	12.7%	45.2%	32.2%	33.6%	146.4%	31.2%	84.5%	24.8%
Inland navigation	25.0%	-	27.4%	17.0%	30.4%	27.2%	31.6%	-	22.2%	24.1%	32.1%	20.7%	-	22.8%
Freight transport	5.8%	32.0%	8.4%	-18.4%	14.7%	-16.4%	-8.6%	45.9%	-12.2%	-3.7%	44.4%	-9.7%	95.8%	-3.0%
Road	3.5%	35.0%	4.2%	-20.5%	14.2%	-19.4%	-9.9%	57.9%	-17.5%	-17.0%	58.1%	-13.6%	113.1%	-13.1%
Rail	1.9%	23.2%	7.6%	-21.7%	-9.1%	-7.6%	-10.6%	16.5%	-4.9%	9.6%	13.7%	-13.4%	36.7%	1.8%
Inland navigation	26.5%	49.2%	29.8%	13.5%	27.3%	34.6%	30.9%	29.2%	21.9%	21.0%	46.6%	23.1%	-	22.7%

Source: own calculations

8 Projection of future employment, skill levels and wages using an Input-Output model approach

Apart from the overall size of labour demand and workforce capacity analysed in the preceding sections, trends in employment in transport employment are expected to affect wages and skills. The approach used so far assumes that changes in activity or productivity will have a direct impact on employment, everything else being constant. What was not taken into account, however, is that any shock in demand (activity) or supply (productivity) will be probably absorbed partially from a reaction in wages. For higher demand and/or higher productivity levels, wages tend to increase (the opposite is though not always the case where wage controls exist). An analysis of how wages in the transport sector evolve -and how a change in activity or productivity may influence their trends- is useful in order to have a better picture of the dynamics of labour markets in transport.

In addition, an analysis of the trends in employment and wages for a specific sector such as transport cannot be done in isolation. The evolution of labour related variables in the transport sector should be compared with those in the other sectors of the economy. The objective is threefold: to compare how the sector as a whole would evolve in comparison with the rest of the economy under the same socio-economic assumptions; to explore how the division in skill level groups changes inside the transport sub-sectors, as well as in comparison with the rest of the economy; and to compare projected wage levels for each skill level and mode, as well as with the rest of the economy.

The model applied in this section is the Full Inter-regional Dynamic Econometric Long-term Input-Output (FIDELIO), a dynamic econometric input-output model, whose calibration relies more on the most relevant and recent national accounts, using an empirical econometric closure rule, following the classical combined Leontieff-Jorgenson approach, rather than on given theoretical parameters.

This approach can also provide a projection of future employment levels and average wages (until 2030) for the three main transport subsectors (land, water, air) and for three skills levels. The work carried out with FIDELIO in the context of this project consists of two types of analysis. First, in the baseline scenario presented here, the growth in employment and the evolution of skills and wages will be compared to those of the other sectors. This will allow the analysis of the relative attractiveness of the sector for labour. At a second stage, the productivity improvements identified by the other activities of the study will be introduced into the model and the changes in the overall employment levels, skills and wages will be estimated.

8.1 Background

Data availability for macroeconomic models has increased significantly in the most recent years. The time series of Supply and Use tables (SUTs) published by EUROSTAT, the National Accounting Matrices including Environmental Accounts (NAMEA), the productivity satellite accounts developed in the course of the FP6 project EU KLEMS or the harmonized trade data and SUTs developed in the FP7 project WIOD, are only part of the data that have been recently made available and that have opened up the possibility of developing new macroeconomic models with a larger geographical scope and based on more coherent and detailed data. Even though a number of models with sectorial information already exist, both in the form of computable general equilibrium (CGE) models and in the form of Econometric Input-Output (EIO) models, the large availability of new data, often in the form of panel data, along with the recent development of new econometric and modelling techniques, represent a good reason and a solid foundation to develop a new model. In the course of 2010-2012 the IPTS has developed an Econometric Input-Output (EIO) model for the EU and its main trading partners, i.e. FIDELIO hereinafter, where both the empirical and methodological improvements that the new sets of data allow for are, or in some cases started to be, implemented.

FIDELIO is a predominantly demand-driven model of the 27 individual EU Member States plus Brazil, China, India, Japan, Russia, Turkey, USA and a macro region where the rest of the countries are included, i.e. Rest of the World (ROW). Countries are linked to each other via a detailed trade matrix.

The core data consists of detailed Supply and Use structures (derived from SUTs as provided by EUROSTAT) that distinguish between

- 58 commodities,
- 58 Sectors (2-digit NACE2003), and
- 6 categories of final demand (CP, CG, NPISH, I, Inventories and Export).

Data on trade and transport margins together with matrices that provide taxes less subsidies on products allow for a conversion of basic prices into purchaser prices at the country level, while for international trade, a similar treatment of the conversion of FOB into CIF prices is provided via matrices of international transport and trade costs as well as trade tariffs.

FIDELIO is an econometrically augmented IO model based on Supply-Use Tables (SUT). Therefore rather than using the (symmetric) Input-Output tables, FIDELIO utilizes the Supply and Use tables and find a solution via iteration instead of using the classical Leontief Inverse method. A full SUT framework is chopped in different blocks, i.e. matrices and vectors that correspond to intermediate demand, value added, final demand and import. These blocks are used to derive the sectorial structure of the mentioned components.

The multi country SUT framework is augmented with behavioural equations that make endogenous most part of the model rather than using fixed shares for input demand as defined by the structure calculated starting from the SUT.

8.2 Data

The primary sources for the SUTs are the EUROSTAT tables reported on an annual basis and starting 1995 in the case of most EU member countries. In addition to the SUT tables available at EUROSTAT, the Use tables in basic prices plus the Import and valuation matrices available as a result of another project conducted by Jörg Beutel and Jose Manuel Rueda-Cantuche at the IPTS are used (Rueda-Cantuche and J.M., Beutel J. 2010).

The data source for the trade data is the World Input Output Database (WIOD) (Marcel Timmer 2012), more specifically, WIOD's inter-regional Use tables. In FIDELIO, the trade matrix is used in a „demand-driven" way to trace the origin of the imported goods. The WIOD trade data form the starting values for the matrix of trade shares.

In order to have coherent trade matrices all imports must be accounted for, i.e. sum over all trading partners' shares must be equal to one and on the exporting partners' side, the sum of cif-imports by the trading partners, corrected for international "transport and trade margins", has to be equal to the export vector valued at FOB. To ensure that these two conditions are fulfilled, we use exports to and imports from ROW as a kind of "litter box".

The main data source for modelling the production block was the EUKLEMS database in different versions (dates of release) complemented with the WIOD database (van Ark B. 2005). The EUKLEMS database also contains capital stock data (at constant prices) by industry, so that for the time series 1980 to 2007 a link between capital 'services' and the capital stock in monetary units could be established. A further step consisted in estimating capital stock at the industry level of 2-digit NACE in FIDELIO from the 32 industry capital stock data in EUKLEMS. Given a classification correspondence, a constant capital/output ratio has been assumed as a starting value in each sub-sector and then the capital stock has been distributed.

The EUKLEMS data have been complemented by physical and monetary energy data, constructed from the WIOD energy accounts and the information in the OECD energy prices and taxes (IEA 2012). In a first step, the WIOD physical energy data by energy carrier from 1995 on have been combined with prices (per physical unit) by energy carrier from the OECD energy prices and taxes. Price information for certain energy carriers (district heating, biomass and fuelwood) had to be taken from other national data sources. From that nominal expenditure for energy and an aggregate energy price by industry can be calculated and compared to the energy data (price and quantity indices) from the 2007 release of the EUKLEMS database, which still contained energy as a separate input. Both sources have then been linked to calculate a full time series from 1980 to 2007 of expenditure for energy and an aggregate energy price by industry.

Starting from a bridge matrix between the classification of SUTs (CPA 2-digit) and COICOP, which is available for Austria, UK and Belgium, the bridge matrices for the other countries have been constructed by application of RAS.

Different releases of the EUKLEMS database have been combined with the WIOD database to obtain a data set that comprises Labour compensation of high, medium and low skilled employees, Hours worked by high, medium and low skilled employees and Number of high, medium and low skilled employees. Form those starting information the hourly wages for the three types of skill have been derived. The unemployment rates for the same three skill types as available from EUROSTAT complement the dataset used to estimate the wage function.

8.3 Baseline assumption

In the context of the analysis of employment in transport, several assumptions and inputs to FIDELIO were updated. These are mainly:

- GDP projections are consistent with the base scenario of the White Paper for transport.
- Exports to ROW grow according to their past trends (although not linearly, but dampened)
- Public consumption is growing about 1% p.a. (in nominal terms) given the tight fiscal policy in all countries
- Population growth is taken from EUROSTAT's population forecasting (EUROPOP2008)
- Interest rates are kept constant after 2010/11
- Liquidity constraints, i.e. the possibilities for the households to borrow, are tightening in a smooth manner to come back more or less to the pre-crisis level.

It should be noted that the activity levels of each transport subsector are now endogenous, and depend on FIDELIO's calibration based on the added value of each economic sector that it covers. While the latter are consistent with the hypotheses and macro-economic assumptions made in the White Paper, they nevertheless lead to different projections of transport activity growth.

8.4 Results

This section shows the results of the baseline projection for the time period 2010-2025. The observed variables are the main indicators for the status of the labour market plus the GDP.

Figure 23 shows the development of low, medium and high skill labour wages (€/hr) for three transport sectors and the rest of the economy. These labour categories have been formed based on the data from the EUROSTAT Labour Survey. Notice that the reported wages are nominal, so the reported growth rates net of inflation would be much lower. For each of the three skill levels, wages in the transport sector are higher than in the rest of the economy. Not surprisingly, the wage level in the aviation sector is the highest, even for low-skilled labour.

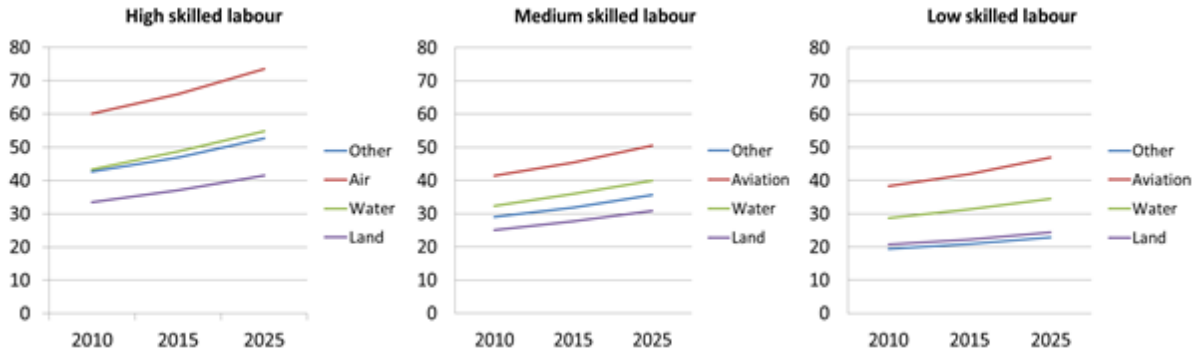


Figure 23: Wage levels for low, medium and highly skilled labour in three transport sectors and the rest of the economy.

These results are interesting because they provide an aspect only covered by FIDELIO, e.g, the disaggregation by type of work and transport subsector. Despite the fact that the overall labour demand does not correspond with the findings in the previous section (mainly due to the differences in the assumed level of activity), it seems that land transport is the worse remunerated transportation mode, especially for high- and medium-skilled workers, which are remunerated below the economy-wide average. On the other hand, air transport wages are much more attractive than average wages, especially for mid- and low-skilled jobs.

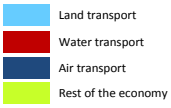


Figure 24 compares productivity growth, employment growth and GDP of the three main transport sectors and the rest of the economy (labelled 'other'). The results for the rest of the economy are calculated as the weighted average of the non-transport sectors. The weights are the shares in the overall GDP. Labour productivity is calculated as the ratio between total gross output in real term and total hours worked.

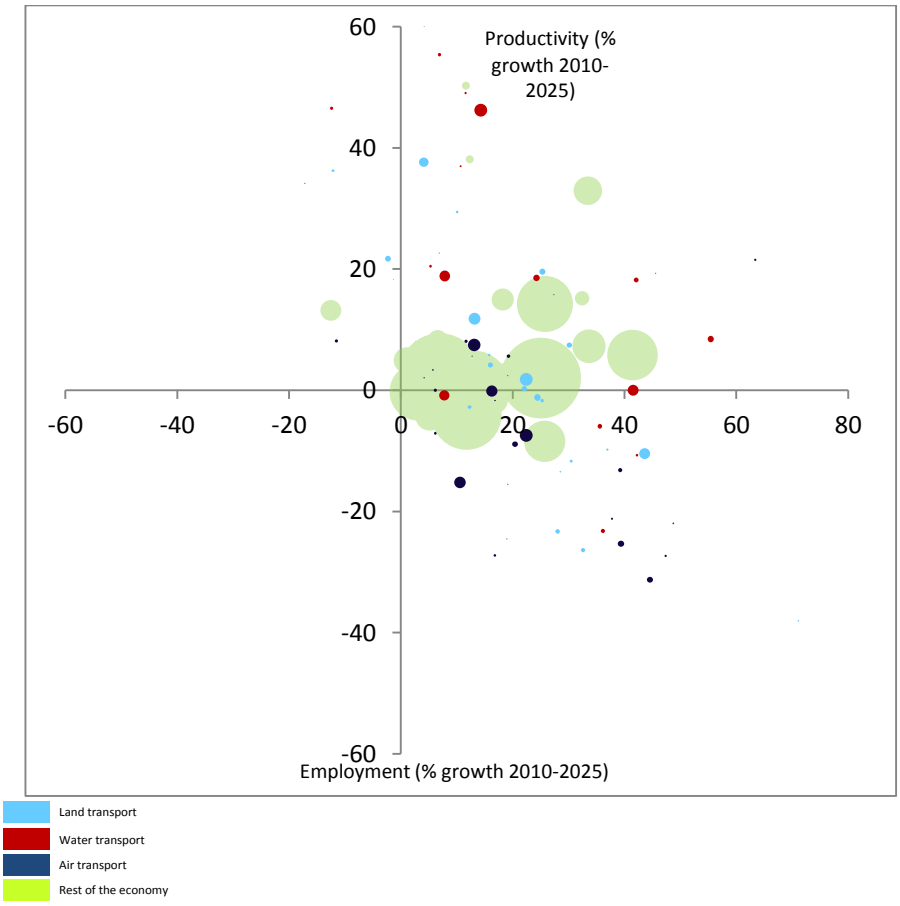
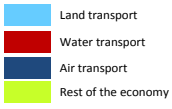


Figure 24: Comparison between growth in employment (x axis), growth in labour productivity (y axis) and GDP (bubble size)



The graph in
Figure 24 gives a mixed picture as regards the growth in productivity for the three transport modes the economies of Member States as a whole. Regardless of whether productivity is expected to increase or decrease, however, employment levels are expected to increase in the majority of Member States, either at transport mode level or as the whole economy.

Figure 25 shows the potential development between 2010 and 2025 of the employment in the EU27 for the three transport sectors (land, water and aviation) and for the rest of the economy, according to the FIDELIO results. Total employment increases for all sectors, with a small increase in the period 2010-2015 and a sharper increase in the period after 2015. The graphs furthermore show the composition of the total employment in terms of the skill level (i.e. high, medium and low skill labour). The figures demonstrate clearly that the skill level composition in the transport sectors differs somewhat from the rest of the economy in the sense that employment in the transport sectors requires a smaller share of highly skilled workers and a higher share of medium skilled workers. Across transport sectors, the workforce composition is comparable.

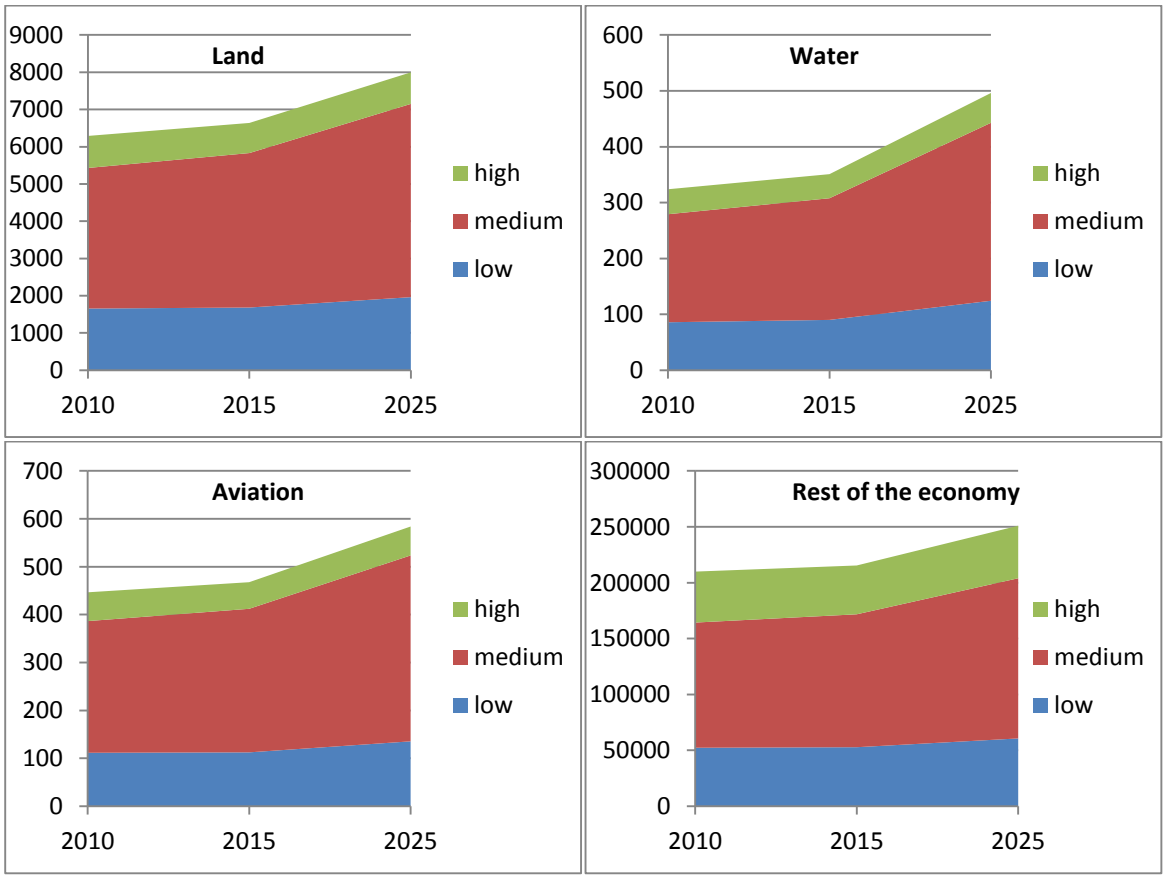


Figure 25: Employment in the EU27 in 2010, 2015 and 2025 by sector and skill level, '000 jobs

Figure 26 compares the growth in employment for the three transport sectors and the rest of the economy, both in index numbers and in absolute numbers. The figure shows that the waterborne transport sector grows fastest at 40 percent by 2025, which is about twice as much as the growth in the aviaton sector. The land sector and the rest of the economy grow by 15 percent by 2025. These results are to be put in context according to the evolution of the activity in the sector foreseen by FIDELIO, which departs from the reference scenario from the White Paper on Transport.

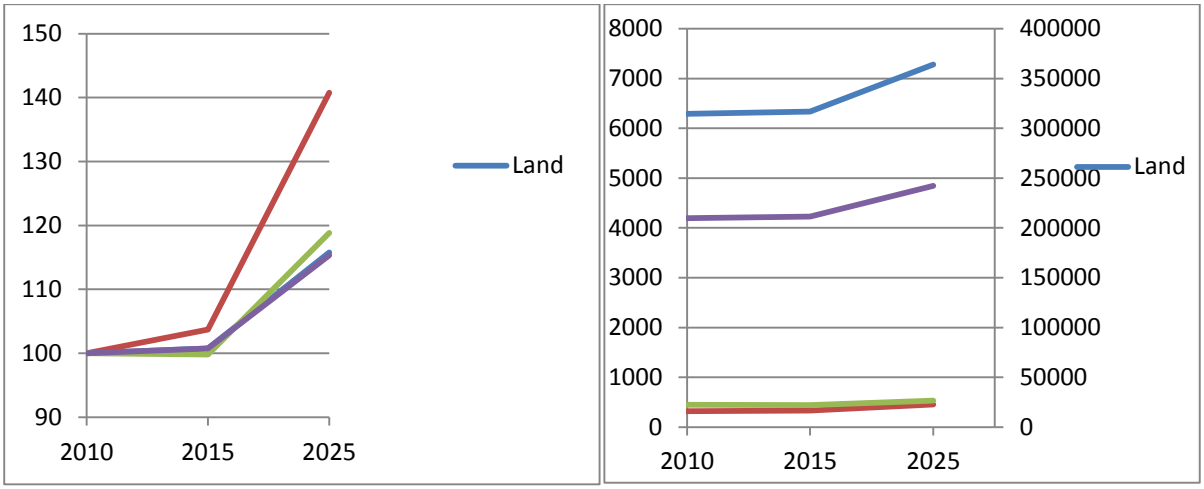


Figure 26: Change in employment in the EU27 for three transport sectors and the rest of the economy in index numbers (left-hand panel) and in absolute numbers, '000 jobs (right-hand panel)

Figure 27 to Figure 29 show the change in employment levels between 2015 and 2020 for the air, land and water transport sectors by Member State.

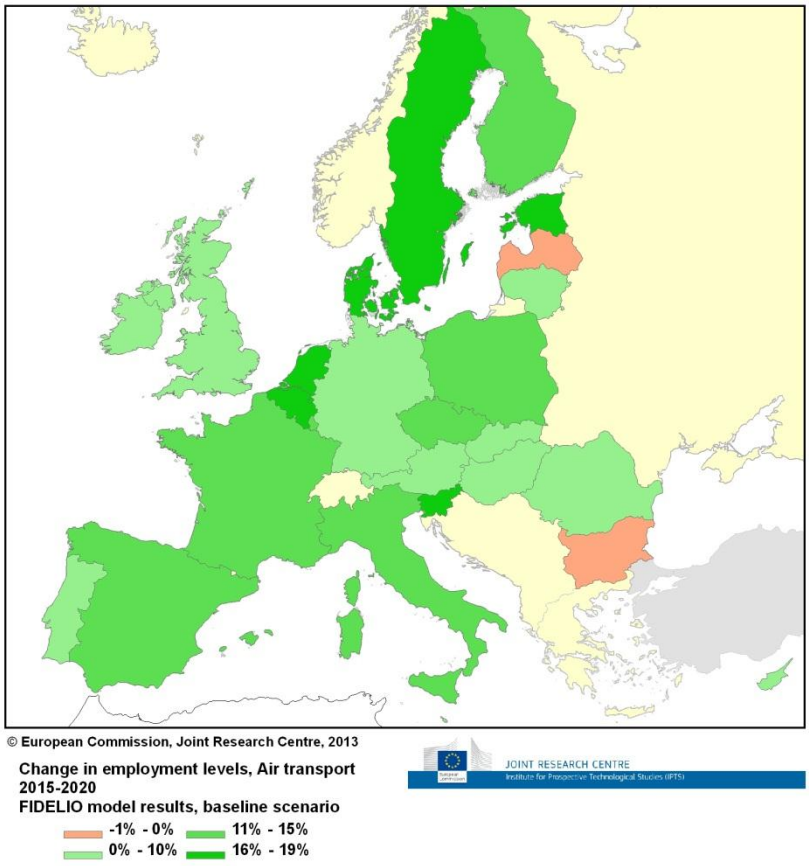


Figure 27: Change in employment levels in the air transport sector between 2015 and 2020

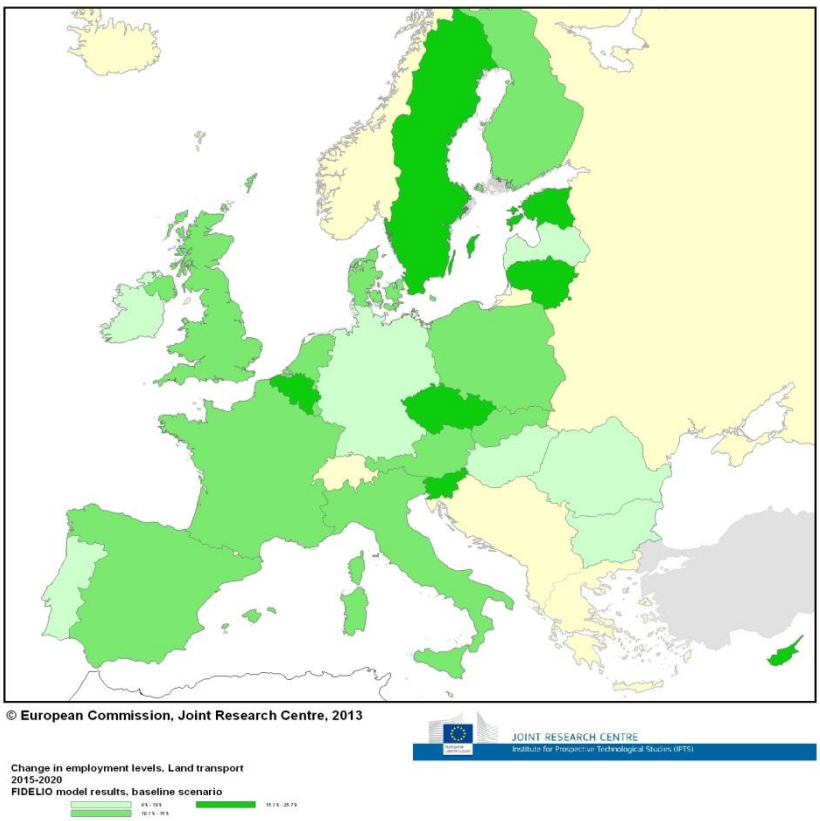


Figure 28: Change in employment levels in the land transport sector between 2015 and 2020

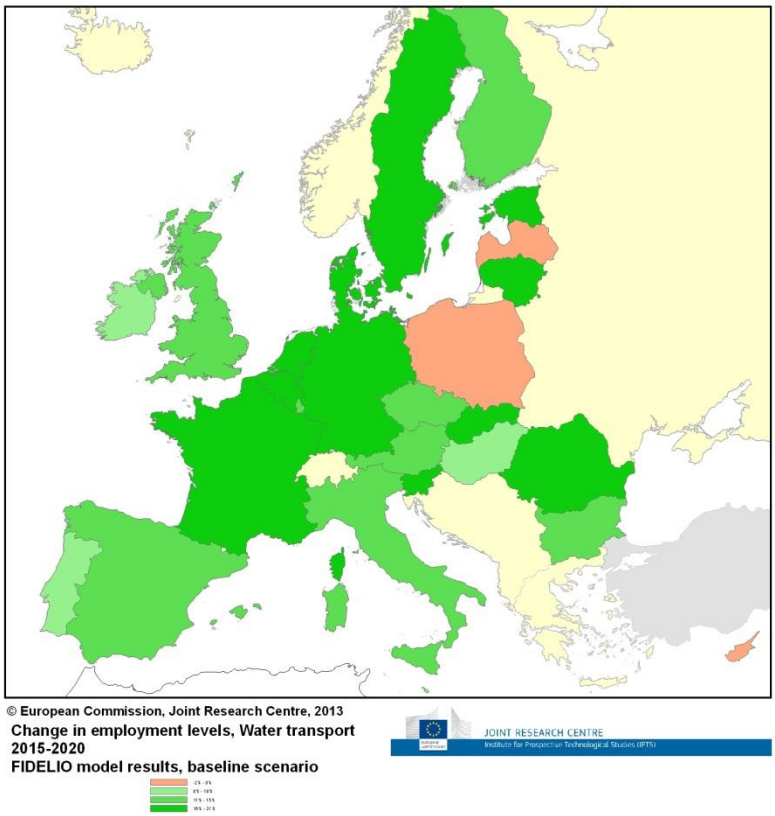


Figure 29: Change in employment levels in the water transport sector between 2015 and 2020

In order to address the sensitivity to a productivity shock, a scenario with a labour productivity increase of 10% upon the baseline has been run. Table 11 reports the results of the baseline and the scenario, for the overall EU and for the selected set of countries addressed previously (Table 9 and Table 10).

Table 11 Labour demand, land transport for baseline and high productivity scenario

	Change in jobs, land transport			
	Productivity baseline		High productivity scenario	
	2010-2015	2010-2025	2010-2015	2010-2025
Czech Republic	2.7%	24.4%	-0.3%	21.5%
Germany	0.3%	15.9%	-3.9%	11.7%
Denmark	5.8%	39.2%	1.9%	35.5%
Spain	0.2%	7.9%	-2.0%	6.1%
Finland	1.8%	18.8%	-2.2%	14.9%
France	1.2%	10.6%	-3.0%	6.5%
Hungary	-3.5%	9.1%	-6.9%	5.6%
Italy	-2.2%	2.6%	-5.3%	-0.2%
Netherlands	2.8%	20.7%	-0.9%	17.2%
Poland	-2.8%	6.9%	-4.7%	5.4%
Sweden	4.9%	32.3%	1.0%	28.6%
Slovenia	6.1%	35.4%	2.5%	31.9%
United Kingdom	1.0%	14.3%	-2.8%	10.5%
EU	0.7%	15.8%	-2.6%	12.5%

Table 12 Change in nominal wages, land transport

	Change in nominal average wages, land transport			
	Productivity baseline		High productivity scenario	
	2010-2015	2010-2025	2010-2015	2010-2025
Czech Republic	18.1%	42.4%	27.3%	51.8%
Germany	11.1%	28.3%	20.3%	37.6%
Denmark	7.3%	21.3%	16.4%	30.3%
Spain	8.6%	23.5%	17.8%	32.7%
Finland	9.2%	20.0%	18.4%	29.3%
France	6.6%	16.5%	15.9%	25.9%
Hungary	10.6%	36.6%	19.9%	46.1%
Italy	8.9%	23.2%	18.1%	32.5%
Netherlands	4.7%	11.6%	13.1%	20.1%
Poland	11.2%	30.3%	20.4%	39.6%
Sweden	17.7%	25.4%	26.9%	34.6%
Slovenia	17.7%	41.8%	26.9%	51.1%
United Kingdom	15.1%	24.4%	24.4%	33.7%
EU	9.1%	22.2%	17.9%	31.2%

Table 13 reports the same figures for the two considered scenarios for air transport. In general, the result that labour demand in air transport grows much faster than the one of land transport is confirmed by the FIDELIO results. Similarly to what happens with land transport, the expected labour demand would be substantially lower (about 8 to 5 points less) in the high productivity growth case (10% increase).
The corresponding figures for waterways transport are displayed in Table 14, which are broadly in line with the results obtained with the partial equilibrium approach. The first reporting period, however, being only 5 years long, delivers modest growth rates, but the growth rates for the horizon 2020 are consistent with the ones identified previously.

Table 13 Labour demand, air transport for baseline and high productivity scenarios

	Change in jobs, air transport			
	Productivity baseline		High productivity scenario	
	2010-2015	2010-2025	2010-2015	2010-2025
Czech Republic	18.1%	42.4%	12.4%	36.8%
Germany	11.1%	28.3%	6.4%	23.9%
Denmark	7.3%	21.3%	1.7%	15.9%
Spain	8.6%	23.5%	4.0%	19.3%
Finland	9.2%	20.0%	4.3%	15.5%
France	6.6%	16.5%	0.3%	10.2%
Hungary	10.6%	36.6%	7.0%	33.1%
Italy	8.9%	23.2%	4.3%	18.9%
Netherlands	4.7%	11.6%	-0.5%	6.5%
Poland	11.2%	30.3%	6.2%	25.6%
Sweden	17.7%	25.4%	13.0%	21.1%
Slovenia	17.7%	41.8%	12.5%	36.8%
United Kingdom	15.1%	24.4%	9.8%	19.1%
EU	10.3%	23.8%	5.1%	18.7%

Table 14 Labour demand, waterways transport for baseline and high productivity scenarios

	Change in jobs, waterways			
	Productivity baseline		High productivity scenario	
	2010-2015	2010-2025	2010-2015	2010-2025
Czech Republic	2.2%	30.3%	-6.6%	21.4%
Germany	1.6%	36.9%	6.6%	45.4%
Denmark	1.9%	38.0%	5.5%	46.2%
Spain	-3.9%	5.7%	-3.2%	8.0%
Finland	0.7%	28.5%	0.2%	29.2%
France	-0.4%	27.3%	3.2%	34.9%
Hungary	-0.8%	16.5%	-9.5%	7.6%
Italy	0.7%	22.4%	-0.5%	22.0%
Netherlands	6.2%	49.6%	5.6%	50.6%
Sweden	9.3%	62.0%	7.8%	61.6%
Slovenia	6.6%	51.1%	7.5%	53.3%
United Kingdom	9.8%	63.4%	8.2%	62.4%
EU	3.7%	40.8%	3.7%	42.2%

9 Attractiveness of jobs in transport

The study analysed the development of employment in various transport sectors from different viewpoints, and by means of a variety of analytical approaches. The approach addresses both the supply side (i.e. the workforce capacity) and the demand side (i.e., the number of employees required in order to meet the future transport activity). In doing so it aims to identify the gap between the supply and demand sides, and to provide some indications on the degree of change required in the labour force dynamics in order to close this gap. The goal is to identify the quantitative discrepancies between capacity and demand, but qualitative aspects related to the demographic composition of the workforce are also addressed.

The FIDELIO model used also allows the analysis of several factors affecting the dynamics of the transport labour market. The baseline projection already allows some main messages to be formulated:

The future demand for labour depends primarily on the future transport activity and the productivity growth in each transport sector. The quantitative projections use the 2013 EU reference scenario as a basis for the estimates. Productivity growth is modelled based on the existing trends in its underlying factors (capital investment, return on capital, labour productivity). Potential supply is assumed that initially will remain stable and will gradually adapt, with a lag, to increasing demand. The combination of the model parameters used corresponds to a situation of equilibrium in 2005. Based on these, the model implies that demand was lower than supply in 2010 (i.e. there was unemployment), a new equilibrium may be reached around 2015 and – if the supply part does not react in time – there may be not enough supply to cover demand by 2025. In practical terms, this can be interpreted as a need to ensure that potential employees with the right skills, education or certification will be available in order to cover the needs of retiring employees and increased transport activity by 2020.

9.1 Land transport, baseline scenario

The number of jobs in land transport (which due to the limited data availability includes road and rail, both for passenger and freight) is expected to remain almost constant at EU level between 2010 and 2015. But the expected recovery of the economy and, as a result, of transport activity after 2015 could lead to an increase by 12.8% of the total number of jobs by 2025 in the central scenario. Big differences are, however, expected at country level, since activity levels, investments, productivity growth rates and the share of rail transport show a very diverse picture across the EU. The big EU economies are also expected to follow different paths. Germany and the UK are expected to have a job growth rate higher than the EU average, while France, Italy and Spain are shown as generating proportionally fewer transport jobs than the EU average. Belgium and the Netherlands, both with important transport and logistics activities are also expected to demonstrate high land transport job growth rates, while the respective labour market in Poland will probably only grow slower than the average.

Table 15: Land transport, total number of jobs. Selected countries and EU27.

	2010	2015	2025	change 2010-15	change 2010-25
CZ	204.0	209	254	2.7%	24.4%
DE	764.8	767	887	0.3%	15.9%
ES	561.8	563	606	0.2%	7.9%
FR	789.1	798	872	1.2%	10.6%
UK	558.4	564	638	1.0%	14.3%
IT	551.1	539	566	-2.2%	2.6%
NL	203.5	209	246	2.8%	20.7%
PL	485.2	471	519	-2.8%	6.9%
RO	200.7	203	232	1.0%	15.7%
EU27	**5537.7**	**5544.6**	**6247.7**	**0.1%**	**12.8%**

Source: own calculations

It is important to note that of the three skill levels at which data is divided (high, medium, low), the high skill part is expected to grow the fastest in practically all Member States (table 2). While still only a small part of labour in land transport, high skill jobs are expected to grow by 34% between 2010 and 2025, corresponding to a significant part of overall growth. Medium skills jobs represent the highest share of jobs in most Member States and jobs at that level are expected to grow in line with overall labour demand (table 3). It is in the low skill level jobs (table 4) where most of the reductions are expected, with a 6.6% decrease between 2010 and 2015, that partially recovers to a 4.4% decrease by 2025 (as a result of increased activity). Table 5 gives a better picture of the qualitative changes that are expected, with clear increases in the share of high skill jobs and reductions in the share of low skill jobs for all Member States. This signifies a gradual up-scaling of the requirements of land transport jobs, following a trend that has been visible in statistics for more than 10 years. It should be also considered that there might be an even higher shift to higher skills than what these figures suggest. The changing work content of many land transport jobs may mean that the jobs defined as of medium and high skill level today requires higher skills than the jobs classified as such in the past.

Table 16: Land transport, number of high skill jobs. Selected countries and EU27.

	2010	2015	2025	change 2010-15	change 2010-25
CZ	16	18	25	14.2%	52.6%
DE	73	82	105	12.4%	44.2%
ES	111	120	137	7.4%	23.5%
FR	89	99	119	11.8%	33.9%
UK	74	81	100	10.2%	35.3%
IT	58	65	77	12.5%	33.6%
NL	33	37	47	11.6%	41.5%
PL	85	88	103	3.8%	21.7%
RO	26	29	35	8.8%	33.9%
EU27	**757**	**827**	**1015**	**9.2%**	**34.0%**

Source: own calculations

Table 17: Land transport, number of medium skill jobs. Selected countries and EU27.

	2010	2015	2025	change 2010-15	change 2010-25
CZ	183	186	223	1.6%	21.9%
DE	589	600	705	1.9%	19.8%
ES	228	231	253	1.7%	11.1%
FR	483	494	547	2.4%	13.3%
UK	349	358	411	2.6%	17.9%
IT	287	283	299	-1.6%	4.0%
NL	102	106	126	4.1%	23.6%
PL	388	371	402	-4.3%	3.6%
RO	51	53	62	3.5%	21.7%
EU27	**3322**	**3356**	**3834**	**1.0%**	**15.4%**

Source: own calculations

Table 18: Land transport, number of low skill jobs. Selected countries and EU27.

	2010	2015	2025	change 2010-15	change 2010-25
CZ	5	5	6	3.7%	27.0%
DE	103	85	77	-17.5%	-25.8%
ES	223	212	216	-4.9%	-3.2%
FR	218	205	207	-5.9%	-4.9%
UK	136	125	127	-8.0%	-6.3%
IT	206	191	190	-7.3%	-8.0%
NL	69	66	73	-3.3%	6.2%
PL	12	12	14	-2.0%	8.8%
RO	123	121	135	-1.8%	9.3%
EU27	**1458**	**1362**	**1399**	**-6.6%**	**-4.1%**

Source: own calculations

Share of high skills	2010	2015	2025
AT	7%	9%	10%
BE	11%	12%	14%
BG	13%	14%	15%
CY	24%	26%	27%
CZ	8%	9%	10%
DK	11%	12%	14%
DE	10%	11%	12%
ES	20%	21%	23%
EE	22%	24%	25%
FI	11%	12%	13%
FR	11%	12%	14%
UK	13%	14%	16%
EL	11%	12%	14%
HU	11%	12%	13%
IE	16%	17%	18%
IT	10%	12%	14%
LV	32%	33%	35%
LU	7%	8%	9%
LT	15%	16%	17%
MT	13%	14%	15%
NL	16%	18%	19%
PL	17%	19%	20%
PT	13%	14%	15%
RO	13%	14%	15%
SK	11%	12%	13%
SI	7%	8%	9%
SE	11%	13%	14%
EU27	**14%**	**15%**	**16%**

Share of medium skills	2010	2015	2025
AT	78%	79%	80%
BE	59%	60%	61%
BG	25%	26%	27%
CY	64%	65%	65%
CZ	90%	89%	88%
DK	55%	56%	57%
DE	77%	78%	79%
ES	40%	41%	42%
EE	75%	74%	72%
FI	64%	65%	66%
FR	61%	62%	63%
UK	62%	63%	64%
EL	59%	59%	60%
HU	78%	80%	80%
IE	52%	53%	53%
IT	52%	52%	53%
LV	66%	65%	63%
LU	57%	58%	59%
LT	77%	78%	77%
MT	25%	26%	27%
NL	50%	51%	51%
PL	80%	79%	78%
PT	25%	26%	27%
RO	25%	26%	27%
SK	87%	86%	85%
SI	88%	88%	87%
SE	72%	72%	73%
EU27	**60%**	**61%**	**61%**

Share of low skills	2010	2015	2025
AT	15%	13%	10%
BE	29%	27%	25%
BG	61%	60%	58%
CY	12%	10%	8%
CZ	2%	2%	2%
DK	34%	32%	30%
DE	13%	11%	9%
ES	40%	38%	36%
EE	3%	3%	3%
FI	25%	23%	21%
FR	28%	26%	24%
UK	24%	22%	20%
EL	30%	28%	26%
HU	11%	8%	7%
IE	33%	31%	28%
IT	37%	35%	34%
LV	2%	2%	2%
LU	36%	34%	32%
LT	8%	6%	6%
MT	61%	60%	58%
NL	34%	32%	30%
PL	3%	3%	3%
PT	61%	60%	58%
RO	61%	60%	58%
SK	2%	2%	2%
SI	5%	4%	4%
SE	17%	15%	13%
EU27	**26%**	**25%**	**22%**

Table 19: Change in share of each skill level, land transport.

Source: own calculations

The data and trends in wages for land transport jobs give an interesting picture. The weighted average at EU level suggests that salaries in transport jobs are lower than for similar jobs in the rest of the economy. Moreover, this comparison is expected to worsen in the future: while the average wage in land transport was 85% in 2010, it is projected to fall to 83% in 2025. From the wage point of view, this can be interpreted as a gradual loss of attractiveness in the long term, even before taking the issue of working conditions into account (covered by the study of PANTEIA/PwC). This seems to be an ongoing trend with historical routes, with land transport (especially rail and road freight) jobs being relatively highly paid in the past, but not as competitive as other jobs in the economy more recently.

There are however some important exceptions in some Member States: Bulgaria, Greece, Ireland, Italy, Portugal and Romania. Jobs in land transport in these countries are still better paid than the average job in the economy. Several factors may explain this trend: the market structure in rail (eg big state-owned rail companies that represent a high share of employment in land transport) and road freight (eg rules limiting entry into the profession), or the economy as a whole (lower skills and resulting wages across the economy compared to land transport jobs).

The trend of land transport jobs becoming gradually less attractive in terms of wage compared to other jobs is evident in almost all Member States, with a few exceptions that do not significantly change the overall picture.

Table 20: Land transport: comparison of wages compared to average wage in economy of Member State (average of economy = 100%)

	2010	2015	2025
Austria	91%	90%	88%
Belgium	97%	97%	96%
Bulgaria	159%	158%	155%
Czech Republic	95%	95%	95%
Denmark	96%	95%	95%
Germany	85%	85%	83%
Spain	82%	82%	82%
Estonia	93%	93%	92%
Finland	91%	91%	90%
France	91%	91%	91%
United Kingdom	81%	81%	81%
Greece	122%	123%	126%
Hungary	91%	90%	89%
Ireland	115%	114%	113%
Italy	168%	166%	163%
Lithuania	88%	88%	88%
Latvia	99%	98%	97%
Netherlands	97%	97%	97%
Poland	99%	99%	99%
Portugal	105%	105%	106%
Romania	100%	100%	101%
Slovakia	96%	95%	95%
Slovenia	91%	91%	91%
Sweden	93%	93%	92%
EU	85%	84%	83%

Source: own calculations

Table 21 makes the comparison of wages of land transport jobs in each Member State compared to the EU weighted average. This comparison suggests that the wage paid for similar jobs in land transport also varies significantly across the EU. It si not surprising that the economies with higher GDP per capita also have higher average wages in land transport, with a few notable exceptions like Greece and Ireland that appear to offer wages comparable to those of countries in a much better economic situation. It is also important to note the wide difference between Member States, with in general countries in new Member States having wages that are only a fraction of the ones in high income countries. There appears to be a marginal tendency for convergence in the long term, but the big distances in wages still seem to remain.

Table 21: Land transport: average wage for land transport in each Member State compared to weighted average of wages in land transport across the EU (EU= 100%)

AT	153%	141%	145%
BE	182%	163%	165%
BG	24%	23%	26%
CY	121%	124%	154%
CZ	59%	58%	63%
DK	186%	165%	167%
DE	126%	117%	120%
ES	73%	66%	67%
EE	49%	46%	48%
FI	153%	139%	136%
FR	163%	144%	141%
UK	110%	105%	102%
EL	130%	128%	152%
HU	45%	41%	45%
IE	177%	157%	171%
IT	248%	225%	227%
LV	33%	29%	30%
LU	194%	199%	265%
LT	42%	41%	42%
MT	43%	38%	41%
NL	158%	138%	131%
PL	38%	35%	37%
PT	86%	79%	80%
RO	12%	11%	12%
SK	40%	40%	43%
SI	86%	84%	90%
SE	162%	158%	151%
EU27	100%	100%	100%

Source: own calculations

The two indicators used as proxies for the attractiveness of land transport jobs can be combined in the form of a graph that can lead to additional insights. The x- axis represents how land transport jobs compare in terms of wages to jobs in the rest of the economy. Countries to the right have higher wages (i.e. at land transport jobs are attractive at national level) while to the left the wages for land transport are lower than for other jobs (i.e. jobs in land transport are relatively unattractive). On the y-axis, countries above pay higher wages for land transport than the EU average, while countries below pay lower. The bubble size represents the labour market for land transport and the colour unemployment rates (high or low). This graph suggests that countries like Germany and the UK have a large labour market for land transport, have wages that are higher than the EU average, but lower than other jobs in their economies and a relatively low unemployment rate. On the other hand, salaries for land transport in Spain for example are lower than both the average for land transport across the EU and the average for wages in the Spanish economy. Land transport jobs in Romania are not paid well compared to the EU average, but apparently they are close to the average of wages in Romania which, additionally, has a lower unemployment rate than the EU average.

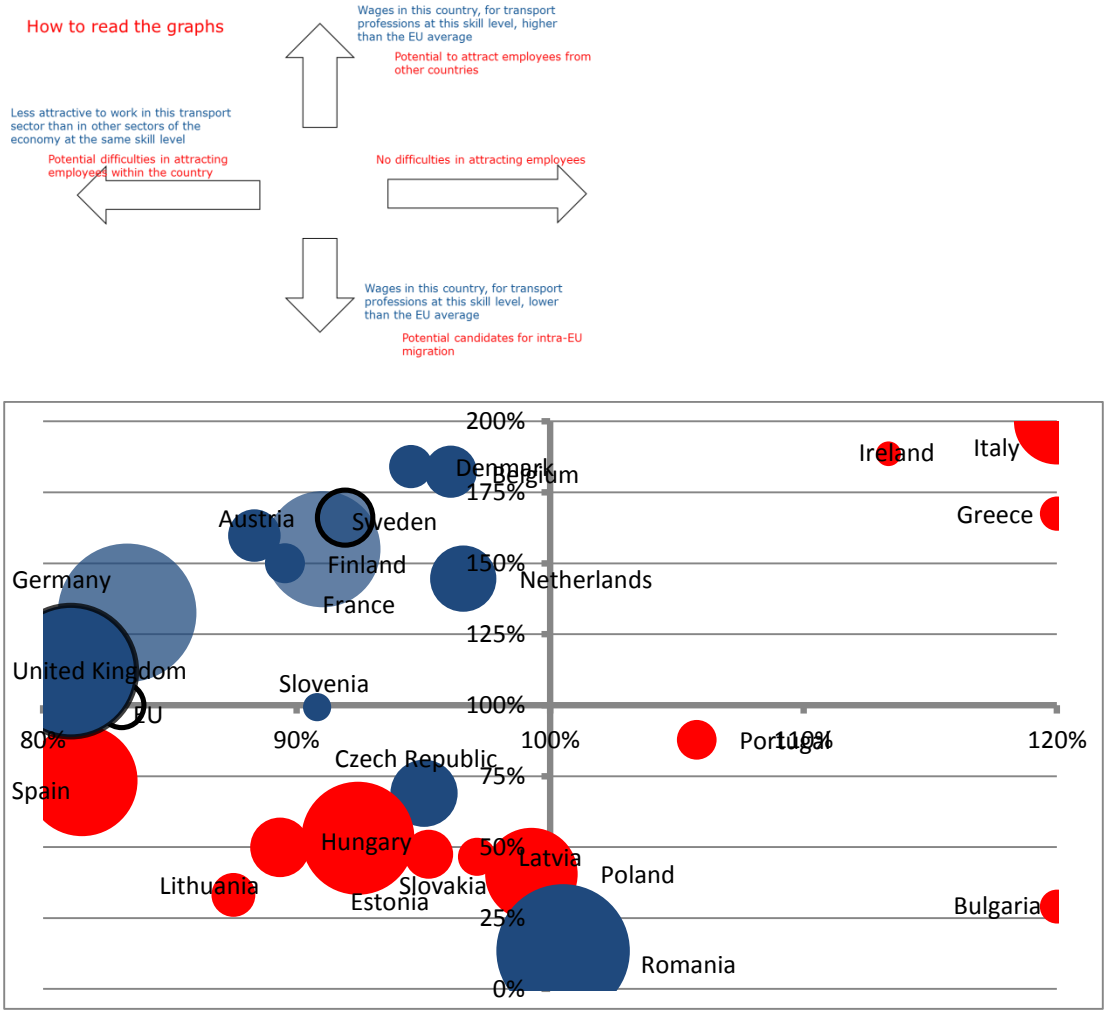


Figure 30: Graphical representation of job attractiveness indicators, land transport

Finally, in order to estimate the number of jobs vacancies for land transport, the projections for the total number of jobs are combined with the results of the demographic analysis. A part of the new demand is expected to be covered by increases in the productivity of the existing staff, but even so, the expected increase in transport activity will require a significant number of new employees, between half and one million by 2025 (table 8). But the retirement of employees active between 2005 and 2010 will have an even bigger impact, with between 1.7 and 2.1 million replacements necessary until 2025. This means that in total the new labour demand until 2025 may mean more than 3 million jobs.

Table 22: Projected number of jobs in land transport, EU-27

	2005	2010	2015	2020	2025
Number of total jobs (million)	**5.2**	**5.5**	**5.8**	**5.9 to 6.3**	**6.0 to 6.5**
Labour demand					
New jobs		0.2	0.3	0.4 to 0.8	0.5 to 1.0
Retirements		0.2 to 0.3	0.9 to 1.2	1.3 to 1.7	1.7 to 2.1
Total additional demand		**0.4 to 0.5**	**1.2 to 1.5**	**1.7 to 2.5**	**2.2 to 3.1**

Source: own calculations

9.2 Water transport, baseline scenario

An increase in jobs in EU water transport (which in this case covers inland waterways and short-sea shipping) is also expected until 2025, though at slower rates than the growth rate of economic and transport activity. Differences are expected at country level in this case too, not as pronounced however as in land transport. Most of the employment growth is driven by Germany, France, Denmark, Sweden, the Netherlands and United Kingdom, while the other two big countries in terms of water transport employment, Italy and Greece, show slower growth. Overall employment in the EU grows by 9.8%. It should be noted however, that the part of deep sea transport is not covered by the available statistics. While the overall trends may apply to a certain extent to that part of water transport, it is not feasible to develop a projection on employment which, in any case, would be distorted by the international character of sea transport activities, regulations and staffing policies.

Table 23: Water transport, total number of jobs. Selected countries and EU27.

Total	2010	2015	2025	change 2010-15	change 2010-25
AT	0.5	0.5	0.5	3.7%	3.1%
BE	2.5	2.4	2.4	-2.3%	-4.3%
BG	3.9	3.9	4.1	-0.8%	3.6%
DE	36.4	37.0	40.3	1.6%	11.0%
FR	18.1	18.0	21.0	-0.4%	16.3%
UK	26.4	28.0	30.2	6.0%	14.3%
HU	1.0	0.9	1.1	-0.8%	15.3%
IT	29.7	29.9	31.9	0.7%	7.4%
NL	23.3	24.7	26.4	6.2%	13.4%
PL	4.0	4.2	4.3	3.1%	5.5%
RO	3.3	3.4	3.5	3.1%	5.5%
SK	0.3	0.3	0.2	-1.7%	-8.8%
SI	0.7	0.7	0.8	6.6%	14.7%
EU27	224.1	228.9	246.0	**2.1%**	**9.8%**

Source: own calculations

Table 24: Water transport, average wages. Selected countries and EU27.

	2010	2015	2025
AT	40.2	44.7	51.1
BE	66.8	71.9	81.4
BG	5.9	7.0	9.1
DE	48.8	54.2	62.0
FR	46.8	49.8	53.7
UK	27.7	31.8	34.3
HU	5.9	6.5	8.0
IT	55.7	60.6	68.4
NL	51.1	53.5	57.1
PL	15.8	17.6	20.7
RO	3.1	3.4	4.4
SK	14.0	16.7	20.7
SI	38.9	45.7	55.1
SE	48.0	56.5	60.1
EU27	**32.9**	**36.8**	**41.1**

Table 25: Water transport: comparison of wages compared to average wage in economy of Member State (average of economy = 100%)

	2010	2015	2025
Austria	95%	94%	92%
Belgium	142%	120%	140%
Bulgaria	150%	120%	150%
Cyprus	80%	80%	80%
Czech Republic	77%	77%	76%
Denmark	102%	101%	100%
Germany	131%	120%	127%
Spain	112%	112%	111%
Estonia	93%	93%	93%
Finland	118%	118%	115%
France	105%	104%	103%
United Kingdom	81%	81%	81%
Greece	150%	150%	150%
Hungary	48%	47%	47%
Ireland	115%	114%	113%
Italy	150%	149%	146%
Lithuania	80%	80%	80%
Latvia	95%	95%	94%
Netherlands	124%	124%	124%
Poland	105%	104%	102%
Portugal	150%	150%	150%
Romania	105%	105%	108%
Slovakia	133%	133%	135%
Slovenia	150%	150%	150%
Sweden	110%	110%	108%
EU	111%	112%	111%

Source: own calculations

Table 26: Water transport: average wage for water transport in each Member State compared to weighted average of wages in water transport across the EU (EU= 100%)

	2010	2015	2025
Austria	122%	122%	124%
Belgium	200%	196%	198%
Bulgaria	18%	19%	22%
Cyprus	44%	48%	60%
Czech Republic	37%	39%	41%
Denmark	151%	145%	146%
Germany	148%	147%	151%
Spain	76%	74%	75%
Estonia	38%	38%	40%
Finland	151%	148%	144%
France	142%	135%	131%
United Kingdom	84%	87%	83%
Greece	122%	130%	154%
Hungary	18%	18%	19%
Ireland	135%	129%	140%
Italy	169%	165%	166%
Lithuania	18%	17%	18%
Latvia	85%	83%	84%
Netherlands	155%	145%	139%
Poland	85%	83%	81%
Portugal	117%	115%	115%
Romania	9%	9%	11%
Slovakia	43%	45%	50%
Slovenia	118%	124%	134%
Sweden	146%	154%	146%
EU	100%	100%	100%

Source: own calculations

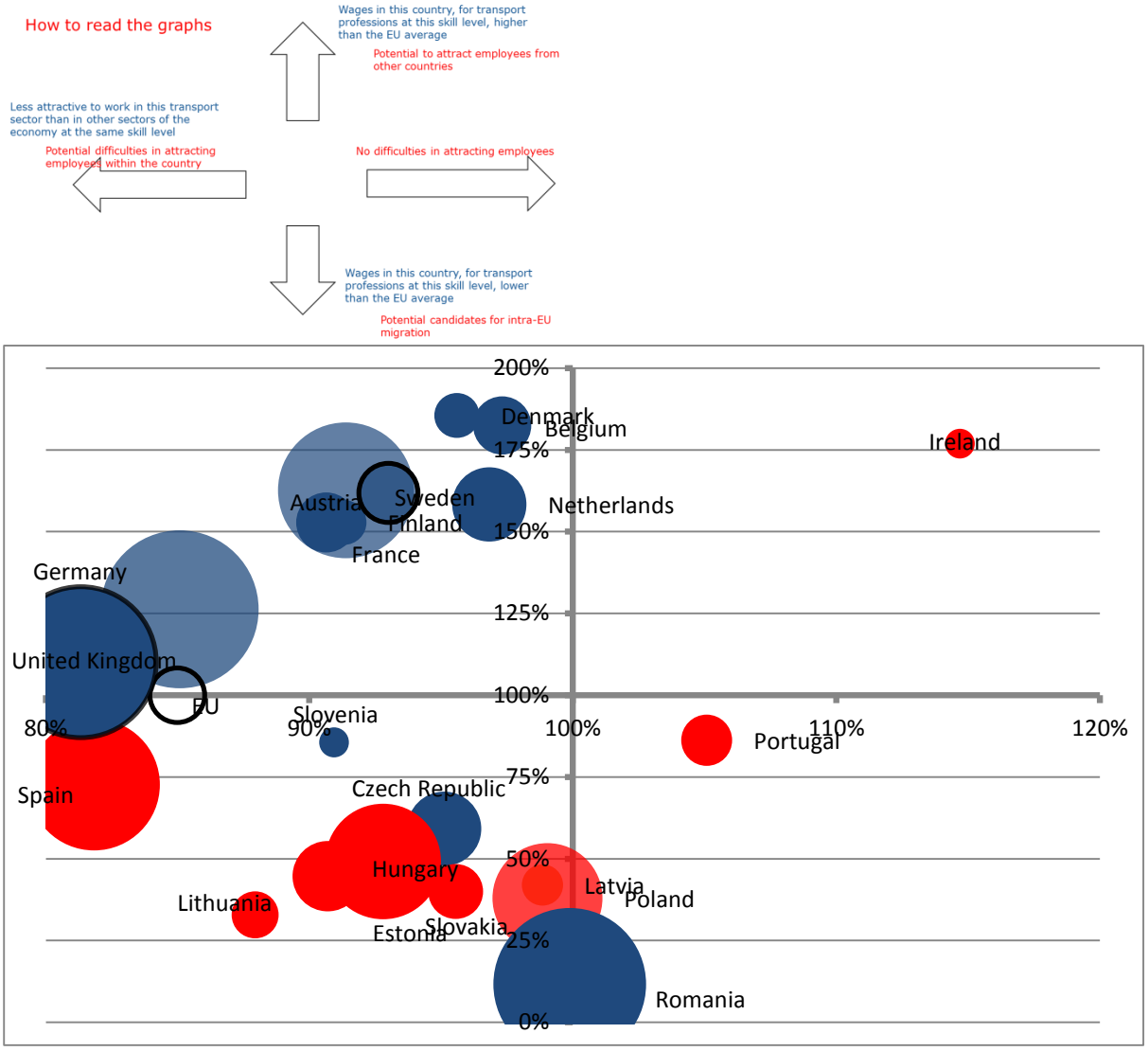


Figure 31: Graphical representation of job attractiveness indicators, land transport

Table 27: Projected number of jobs in water transport, EU-27

	2005	2010	2015	2020	2025
Number of total jobs (thousands)	**215.8**	**224.1**	**220 to 232**	**225 to 245**	**235 to 260**
Labour demand					
New jobs		8	4 to 16	9 to 30	20 to 45
Retirements		20	40 to 50	65 to 80	90 to 120
Total additional demand		**28**	**44 to 66**	**74 to 110**	**110 to 165**

Source: own calculations

9.3 Air transport, baseline scenario

According to the FIDELIO projections, jobs in air transport are expected to grow faster than in other modes. Wages are higher on average in air transport than in the other transport sectors. They are expected to remain high in comparison with the rest of the economy, but the relative difference is expected to decrease.

Table 28: Air transport, total number of jobs. Selected countries and EU27.

	2010	2015	2025	change 2010-15	change 2010-25
DE	63.7	60.9	76.0	-4.5%	19.2%
ES	32.6	31.7	39.0	-2.9%	19.6%
FR	69.2	72.2	86.0	4.3%	24.3%
UK	76.9	76.3	94.0	-0.7%	22.3%
IT	23.6	22.9	28.0	-2.9%	18.7%
NL	25.7	27.7	32.4	7.7%	25.8%
PT	10.8	10.3	11.3	-5.2%	3.9%
SE	24.9	25.1	31.2	0.8%	24.9%
EU27	**394.4**	**392.8**	**478.1**	**-0.4%**	**21.2%**

Source: own calculations

Table 29: Air transport, average wages. Selected countries and EU27.

	2010	2015	2025
DE	71.5	79.4	91.7
ES	41.4	45.0	51.2
FR	49.2	52.5	57.3
UK	27.7	31.8	34.4
IT	71.5	77.9	88.1
NL	64.8	67.9	72.4
PT	55.9	61.5	69.5
SE	66.3	78.0	83.2
EU27	**43.2**	**47.7**	**53.5**

Source: own calculations

Table 30: Air transport: comparison of wages compared to average wage in economy of Member State (average of economy = 100%)

	2010	2015	2025
Austria	150%	149%	146%
Belgium	154%	154%	152%
Bulgaria	159%	158%	155%
Cyprus	114%	112%	108%
Czech Republic	>200%	>200%	>200%
Denmark	165%	164%	164%
Germany	192%	191%	188%
Spain	186%	186%	185%
Estonia	93%	93%	92%
Finland	163%	162%	160%
France	110%	110%	110%
United Kingdom	81%	81%	81%

	2010	2015	2025
Greece	>200%	>200%	>200%
Hungary	127%	126%	125%
Ireland	115%	114%	113%
Italy	193%	191%	188%
Lithuania	75%	75%	74%
Latvia	87%	87%	87%
Netherlands	158%	158%	157%
Poland	99%	99%	99%
Portugal	>200%	>200%	>200%
Romania	>200%	>200%	>200%
Slovakia	>200%	>200%	>200%
Slovenia	>200%	>200%	>200%
Sweden	152%	151%	150%
EU	146%	146%	145%

Table 31: Air transport: average wage for air transport in each Member State compared to weighted average of wages in air transport across the EU (EU= 100%)

	2010	2015	2025
Austria	147%	148%	152%
Belgium	168%	164%	165%
Bulgaria	14%	15%	17%
Cyprus	69%	77%	96%
Czech Republic	93%	100%	107%
Denmark	187%	181%	183%
Germany	165%	167%	172%
Spain	96%	94%	96%
Estonia	29%	29%	30%
Finland	158%	157%	153%
France	114%	110%	107%
United Kingdom	64%	67%	64%
Greece	127%	137%	163%
Hungary	36%	36%	40%
Ireland	103%	100%	108%
Italy	166%	163%	165%
Lithuania	16%	16%	16%
Latvia	19%	19%	20%
Netherlands	150%	142%	135%
Poland	22%	22%	23%
Portugal	129%	129%	130%
Romania	48%	49%	54%
Slovakia	55%	59%	64%
Slovenia	128%	136%	146%
Sweden	153%	164%	156%
EU	100%	100%	100%

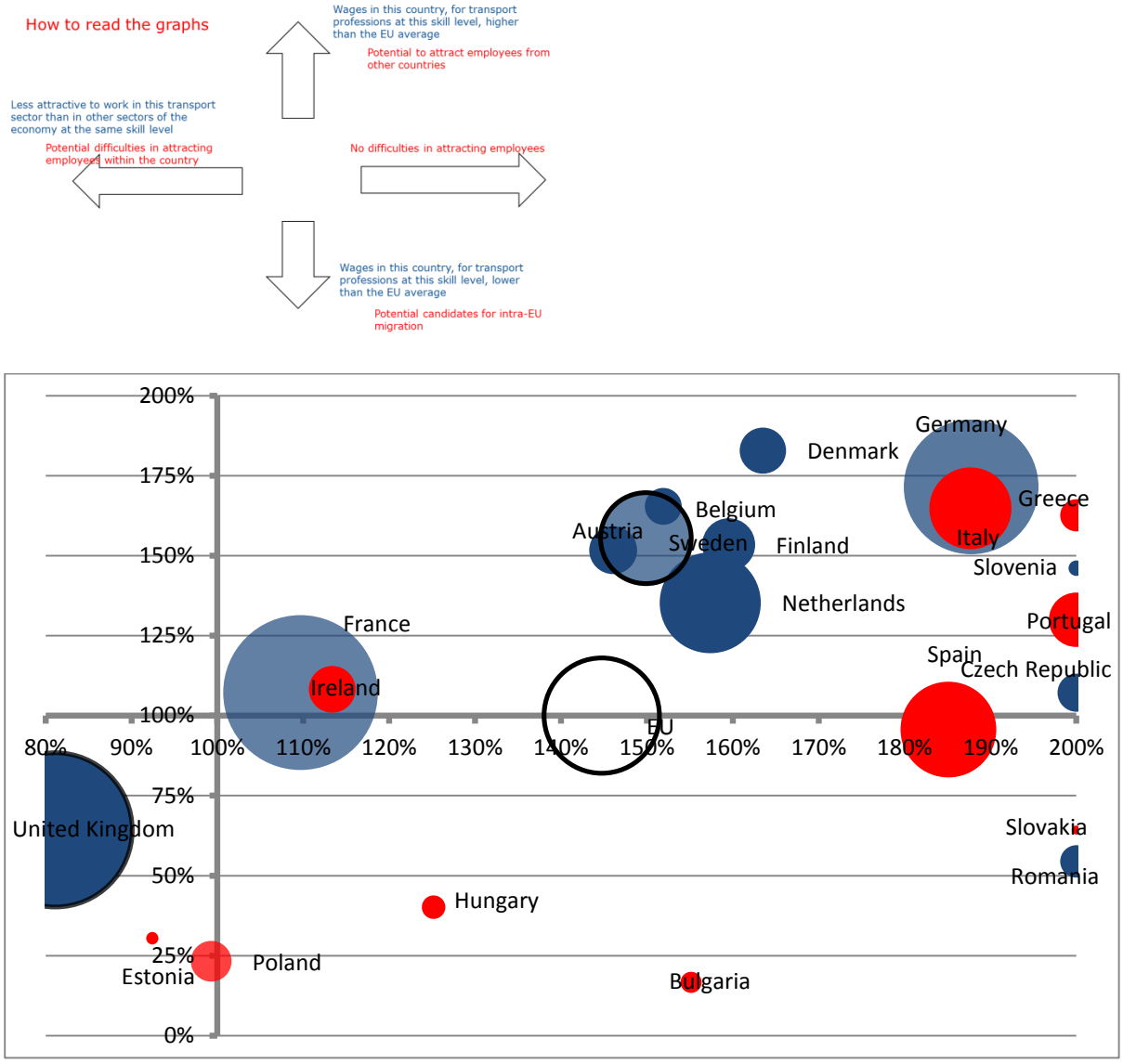


Figure 32: Graphical representation of job attractiveness indicators, air transport

Table 32: Projected number of jobs in air transport, EU27

	2005	2010	2015	2020	2025
Number of total jobs (thousands)	**390**	**394.4**	**390 to 400**	**420 to 460**	**450 to 500**
Labour demand					
New jobs		4	0 to 10	30 to 70	60 to 110
Retirements		30	50 to 80	80 to 120	100 to 150
Total additional demand		**34**	**50 to 90**	**100 to 190**	**160 to 260**

10 A bottom-up approach to address future scenarios on jobs in transport

A bottom-up approach for the analysis of the potential future evolution of labour force in the transport sector under different assumptions is presented hereafter. The key driver is to connect projections of future transport activity and economic indicators with the labour required to perform this transport activity, under certain assumptions as regards technological progress and the trends in labour and capital productivity. The objective is to develop a scenario analysis tool that can be readily used in combination with models providing projections on transport activity and allow an estimation of the potential impacts on employment in transport.

The theoretical stating point of the construction of a model of labour demand from a given economic sector would be the econometric specification of a production function in the sector, taking into consideration the production factors of interest. This approach (Chapter 7), although theoretically valid, resulted in not being practical for the use in a stand-alone tool. The data gathered on the different labour categories were not statistically good so that a robust estimation of the corresponding CES and labour demand function by category could be made. The main obstacle was the lack of data especially regarding capital investment. Consequently, the production function parameters could only be estimated at EU level (and with uncertain statistical significance), which meant that the same rates of labour and capital productivity would be assumed for all Member States. A second important weakness of this approach was the need to use projections of future capital stocks (or investments) disaggregated by transportation mode, an issue whose complexity would have required a deeper analysis of the existing NACE accounts and the assumption of reliable depreciation factors, which is something beyond the scope of this exercise.
Therefore, since only labour-aggregated datasets would be able to provide some insights on aggregated labour demand, an alternative methodology based on a non-marginalist approach has been adopted to address the desired level of labour categories diversification.

10.1 Model outline

For the operational scenario analysis tool that has been devised, it has been preferred to adopt a simplified approach for what concerns the rationale of labour demand by category, and at the same time take full advantage of the demographic structure of the (relatively well known) labour population structure. In order to circumvent the need to model the capital accumulation dynamics, a variable already available in the 2013 EU reference scenario was selected as a proxy: the ratio between sectoral GVA and GDP is used as an indicator on the capital available in the economy for investment. The analysis of past data shows that this variable is correlated to the overall investment, while independent from transport activity. It is, of course, also assumed that investment in transport is correlated with overall investment levels, an assumption that may not be completely precise but should be considered as valid for this type of model. The overall model was estimated through a combination of data-based and stochastic parameters.

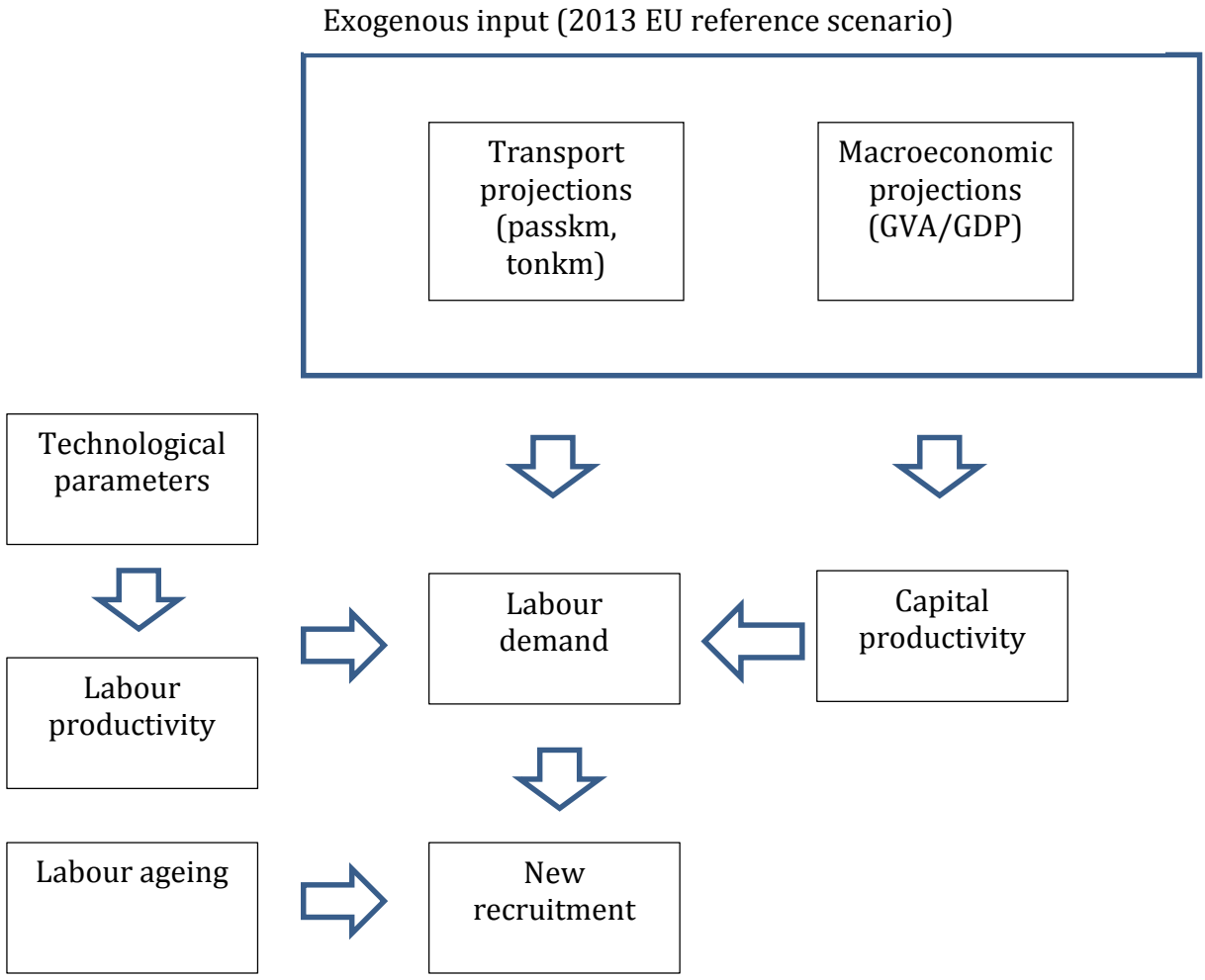


Figure 33: Schematic description of employment model

The diagram above summarises the main building blocks of the model. The main exogenous inputs are derived directly from the 2013 EU Reference Scenario, while the main output variables consist of total employment levels and new recruitment levels (per mode and type of occupation). The parameters affecting productivity are estimated based on the following sources:

- Employment in transport, by country, total and by mode (EUROSTAT and Pocketbook table 2.1.5)
- Transport performance data per mode, Pocketbook tables 2.2 and 2.3, three modes for passengers (public road transport, rail, aviation) and three for freight (road, rail, inland waterways)
- GDP and GVA values per country as reported in the 2013 EU reference scenario
- Breakdown of employment per mode into occupations (PANTEIA report)
- Age structure of labour force by mode (Labour Force Survey)

The sketched model rationale is stylized in the following.

Productivity indexes for the three labour categories (administration and management, mobile workers (drivers and operators) and logistic workers (dock staff) are introduced and referenced to a base year, as well as a general productivity for the sector. Rather

that assuming (or calculating) a dynamic path in labour and capital accumulation per mode and labour category and explain from them transport activity and factor demand, sectoral economic output is exogenously assumed from the EC reference, and based on it and other indicators (sectoral gross added value over GDP, etc), labour demand is obtained. Modal transport activity is reshaped with an overall trend on load factors (vehicle occupacy rates and average unit freight size). From this point, labour demand can be estimated using activity and the individual labour category productivity indexes

Productivity is assumed to be a key explanatory factor of output, but differences are made between labour categories. Administrative and management staff productivity is the main one correlated with output. The other two productivities are correlated with this one, taking into consideration the gross formation of fixed capital in the sector, which primarily affects the blue collar productivity (mobile and logistic workers).

The analysis is completed by studying the dynamics of labour supply, including elements like ageing, premature retiring, average recruiting age etc. This analysis has been carried out based on an *ad-hoc* Labour Force Survey.

10.2 Transport sector employment demand dynamics

In this study, labour demand is extrapolated, per mode and type of occupation, using a given level of transport activity (as input from the 2013 EU Reference scenario) and an estimate of the evolution of the productivity index. The overall productivity index depends in turn on labour productivity, capital productivity and technological progress. The model assumed three different labour categories in the sector (administrative staff, mobile staff/drivers, logistics/ technical), assuming essentially different skillsand levels of productivity for each category. Accordingly, the model uses three intermediate variables (productivity of administrative staff, productivity of mobile staff, productivity of logistic staff), as well as an underlying productivity growth in order to operationalize the three drivers of productivity, with suitable proxies that allow the estimation of the model parameters using available data. This formulation also avoids the technical obstacles encountered during the exploration of the production function approach, mainly the need to estimate parameters for the simulation of capital investment.

The productivity of administrative staff is considered to be correlated with overall sectoral output *Q*, which is the key exogenous activity variable in this exercise. In assuming this specification we admit the administrative staff productivity as main explanatory variable for *Q*. The productivity of administrative staff is an indexed variable with the value for 2010 equal to 100 that evolves asymmetrically with respect to the activity level in the sector. When *Qt>Qt-1*, a is higher than when *Qt<Qt-1*. The values of a used in the estimation of the model are around 0.40 and 0.24 respectively:

$$Pr_{adm^t} = Pr_{adm^{t-1}} + a\,(\frac{Q_t}{Q_{t-1}} - 1) \qquad (1)$$

The productivity of mobile operators depends on the GVA/GDP index (as a proxy for capital investment in the sector)as well as on the growth in productivity of administration. It is an indexed variable with the value for 2010 equal to 100:

$$Pr_{op^t} = \frac{100}{GVA/GDP} + b\left(Pr_{adm^t} - Pr_{adm^{t-1)}}\right) \quad (2)$$

b being a coefficient estimated to be around 0.5.

The underlying productivity index (UP) is assumed to have an autonomous increasing trend as a result of technological progress (whereas the two variables above were considered to depend on economies and capital investment). It is again represented by an indexed variable which changes according to an exogenous assumption as regards technological progress. When the productivity of administrative staff has grown, the underlying productivity also accelerates:

$$\begin{gathered} Pr_{gen^t} = Pr_{gen^{t-1}} + UP + \frac{Pr_{adm^t} - Pr_{adm^{t-1}}}{2} \text{ , if } (Pr_{adm^t} - Pr_{adm^{t-1}}) > 0 \\ Pr_{gen^t} = Pr_{gen^{t-1}} + UP \text{ , if } (Pr_{adm^t} - Pr_{adm^{t-1}}) < 0 \end{gathered} \quad (3)$$

Transport activity (in vehkms) estimates the number of required vehkms required in order to satisfy the demand for transport performance *Q*, given a load factor *LF,* whose evolution is also exogenous and upon which variant scenarios can be analysed:

$$V = \frac{Q}{LF} \quad (4)$$

The number of required operators/drivers is a function of transport activity *V* and the impact of productivity and operational factors:

$$D_{dr} = \frac{V}{Pr_{gen^t}\, Pr_{op^t}\, DO} \quad (5)$$

While the required logistics and administrative employees are estimated by similar functions using their own productivity parameters:

$$D_{log} = \frac{V}{Pr_{gen^t}\, Pr_{op^t}\, Pr_{adm^t}\, LP} \quad (6)$$

$$D_{adm} = \frac{V}{Pr_{gen^t}\, Pr_{adm^t}\, AP} \quad (7)$$

From the actual labour force side, the number of employees available in each period t equals the number in period *t-1,* minus the number of employees exiting the labour force (through retirement or other reasons), plus the number of employees recruited:

$$D = L - R + H \quad (8)$$

Where *D* is the number of required employees, *L* is the number of already available employees in the workforce, *R* the number of employees leaving the workforce and *H*

the number of new recruits. Solving for H allows the calculation of the necessary recruitments in each period in order to reach the size of the required workforce *D:*

$$H_{dr} = D_{dr} + R_{dr} - L_{dr}$$

$$H_{log} = D_{log} + R_{log} - L_{log} \quad (9)$$

$$H_{adm} = D_{adm} + R_{adm} - L_{adm}$$

The issue of the age structure and the overall dynamics of the labour force in transport were addressed in several parts of the overall study. The Labour Force Survey that has been carried out provides a representative sample of questionnaires with information about the employees' age profile. A model of the dynamics of the labour force demographics, including the expected number of retired employees was constructed based on this data. In addition, PANTEIA's report also included a chapter addressing labour demand and supply issues that confirm to a large extent the conclusions of the JRC part.
Some modifications were however necessary in order for an operative model to be constructed. The logic of modelling ageing is based on the simulation of four age cohorts in the labour force (under 35, 35-45, 45-60, over 60).

The average age of retirement is calculated as a weighted average of the age of the employees retired in each age group:

$$J_t = \frac{\sum R_{age,t} \overline{A_{age}}}{\sum R_{age,t}} \quad (10)$$

$\overline{A_{age}}$ values for past years were derived from the Labour Force Survey (LFS).
The average age of the workforce changes over time as a result of the retired staff leaving and new employees entering, while all remaining employees naturally grow older:

$$A_t = A_{t-1} - \frac{R_{dr}+R_{log}+R_{adm}}{D_{dr}+D_{log}+D_{adm}} J_t + \frac{H_{dr}+H_{log}+H_{adm}}{D_{dr}+D_{log}+D_{adm}} N_t + 1 \quad (11)$$

The LFS provides a time series for A_t, A_{t-1} and the model estimates the number of retired and newly hired staff. Solving for N_t allows an estimation of the average age of new recruitments, which is assumed as constant for the future.

10.3 Model estimation

Three of the model parameters (load factor LF, daily output DO and retirement parameter RP) correspond to data based estimates. The other four parameters used are estimated based on the least squares minimization of the difference between the modelled and the observed levels of employment for the period data is available (from 1995 to 2010):

Minimize

$$\sum_{t=1995}^{2010} (D_t^{model} - D_t^{observed})^2$$

Under the constraints
$OP, LP, AP \geq 0$
$-0.005 \leq UP \geq .05$

An additional constraint is added to ensure that the shares of the three types of occupation are within +/-10% of the data available for 2010.

Each mode and each country is optimised separately, resulting in 29x4 sets of parameters (27 Member States plus EU27 as a whole). The resulting match at EU level is reasonably good, with an adjusted R2 of 0.91-0.97 for the four modes. At Member State level the matching is acceptable when no constraints as regards the shares of types of occupation are used, which means that the model provides reliable estimates for the total employment in each transport mode and country, but not for the number of employees for each specific occupation type.

11 Estimating future labour demand based on a bottom-up approach

The employment model presented in the previous chapter covers four main sectors: road freight, public transport, rail and aviation which collectively represent 96% of employment in transport modes across the EU (the remaining coming from inland waterways and maritime transport), or 57% of all jobs in the wider transport field (if warehousing and postal services are also included)[12]. The model results suggest that the total number of jobs will increase by 1.25 million between 2010 and 2030, a 20.7% increase (Table 33). Most of the net increase is expected to come from the road freight sector (700 thousand jobs) and aviation (300 thousand jobs).

Table 33: Evolution of employment in main transport modes, EU-28, million jobs (2000-2010 data, 2015-2030 model projection

	2000	2005	2010	2015	2020	2025	2030
Road freight	2.50	2.66	2.80	3.11	3.26	3.39	3.50
Public road	1.96	1.90	1.91	1.99	2.06	2.11	2.15
Rail	1.35	1.07	0.91	0.90	0.90	0.92	0.96
Aviation	0.46	0.44	0.43	0.51	0.60	0.66	0.71
Total	6.27	6.07	6.06	6.51	6.82	7.08	7.31

There are three elements that mainly affect the model projections:

- The *future transport activity*, which in this case is given as exogenous input by the 2013 EU Reference scenario. It assumes a future growth in activity that is the baseline based on which transport policy at EU level is designed. The analysis of employment issues in transport should therefore be based also on it. An additional source of uncertainty as regards the activity projections is that they are based on further model projections on the development of the main macro-economic and demographic variables (some of which also influence the results of the employment model discussed here).
- Future *productivity growth*, which affects how many employees are needed in order to perform the projected future transport activity. Productivity depends in turn on several elements (technological progress, investment, skills evolution, etc) and estimating how it will evolve in the future entails a lot of uncertainty. The model has been estimated using parameters that allow the best match with past data on employment but if the real productivity growth in the future is higher, the model's projection would be overestimating total employment (and similarly, if the real future productivity growth results lower than estimated, the model will be underestimating future employment levels).
- *Retirement and overall turnover* depend on the age structure of the labour force (which can be projected to 2020-2030 with relative certainty), retirement rates

[12] According to the Statistical Pocketbook EU Transport in figures, total employment in pure transport modes was 6.2 million in 2010 with an additional 2.5 million jobs in warehousing & support activities and 1.8 million in postal and courier services.

(which is a source of uncertainty, but not as strong as the uncertainty of productivity growth) and the turnover not related to retirement (but depends instead on the attractiveness of the sector in terms of wages and other employment conditions).

Given that the future level of transport activity is exogenous, the number of recruitments depends on productivity growth (that influences the total number of jobs needed to satisfy the projected transport demand) and staff turnover (itself mainly influenced by the number of employees retired. The ways these two variables evolve affect the resulting number of employees to be recruited annually (and which corresponds to the sum of staff that needs to be replaced plus new jobs that are the result of increased transport activity).

The following diagram can help in discussing the results.

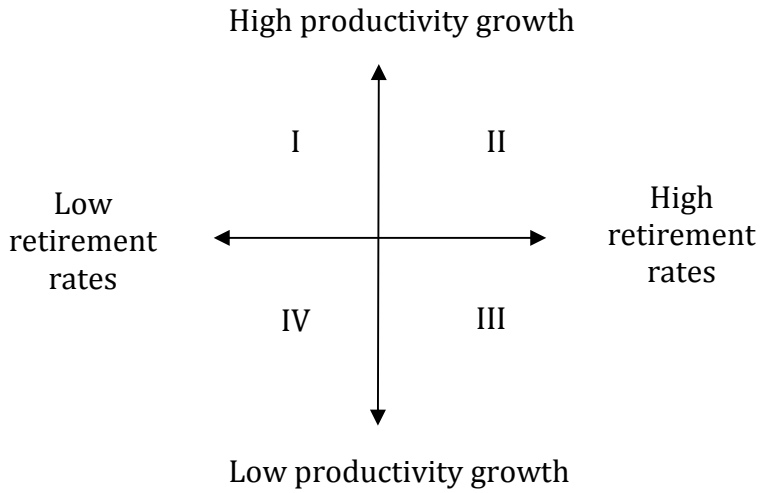


Figure 34: Quadrant representation of combinations of productivity growth and retirement rates

Quadrant I: High productivity growth, low retirement rates
Fewer employees needed for same level of activity, fewer employees leaving labour force due to retirement. Result: low levels of recruitment (few new jobs, few substitutions)
Quadrant II: High productivity growth, high retirement rates: total staff needed comparable to Quadrant I, but recruitment necessary to replace high number of retired staff. Result: medium levels of recruitment (few new jobs, many substitutions)
Quadrant III: Low productivity growth, high retirement rates: more staff needed compared to Quadrants I and II. Recruitment necessary to replace high number of retired staff. Result: high levels of recruitment (many new jobs, many substitutions)
Quadrant IV: Low productivity growth, low retirement rates: more staff needed compared to Quadrants I and II, fewer employees leaving labour force due to retirement. Result: medium levels of recruitment (many new jobs, few substitutions)

Each market segment in each Member State will follow a different trajectory as regards productivity growth and retirement/ staff turnover patters, within a general context of mode specific and demographic development. Table 34 summarizes the expected turnover at EU-28 level (which is further discussed at mode level in the following sections and at Member State level in the annexes).

Table 34: Estimates of staff turnover by mode, EU-28, full time equivalent jobs

	2010	2015	2020	2025	2030
Road freight	107,949	111,805	114,423	119,005	118,419
Public transport	69,067	72,057	70,824	69,973	71,219
Rail	39,255	34,941	33,835	33,031	32,176
Aviation	18,632	22,863	26,496	27,831	30,082
Total	**234,903**	**241,665**	**245,578**	**249,839**	**251,897**

A distinction is made, for each transport mode, between three occupational groups, each reacting in a different way depending on the mode characteristics, the age profile, the average retirement age and the sector attractiveness (Table 35). Mobile jobs present the highest turnover in both absolute terms and relative terms. This is due to the combination of the lower average retirement age of mobile staff in almost all transport modes and the high turnover of certain jobs in road freight transport (mainly long distance vehicle drivers).

Table 35: Estimates of staff turnover by occupational group, EU-28, sum of four main modes, full time equivalent jobs

	2010	2015	2020	2025	2030
Mobile	146,681	152,987	155,324	158,448	161,646
Technical	33,497	35,487	38,175	40,767	42,045
Administrative	54,726	53,191	52,080	50,624	48,206
Total	**234,903**	**241,665**	**245,578**	**249,839**	**251,897**

The annual recruitments necessary to reach the expected levels of employment per mode (Table 33) and replace the staff that left the labour force due to retirement and general turnover (Table 35) are summarized in Table 36. The total for the four modes covered by the model fluctuates considerably around 300 thousand job vacancies a year. Year 2010 corresponds to a dip in total labour demand (232 thousand job vacancies) mainly due to the lower demand in road freight transport as a result of the economic crisis. Overall figures tend to recover by 2015 and are expected to gradually stabilize around 300 thousand job vacancies a year by 2030.

Table 36: Estimates of annual recruitment levels by mode, EU-28, full time equivalent jobs

	2010	2015	2020	2025	2030
Road freight	136,012	173,720	144,900	144,958	139,624
Public transport	71,014	87,796	84,515	79,904	78,252
Rail	7,823	32,468	33,889	37,835	38,821
Aviation	17,287	39,604	42,805	39,681	40,689
Total	**232,135**	**333,587**	**306,109**	**302,378**	**297,385**

Table 37 presents the same information at occupational group level for the whole of the EU-28. Two thirds of the job openings are expected to correspond to mobile jobs by 2030, with the share of administrative recruitments gradually diminishing during the same period.

Table 37: Estimates of annual recruitment levels by occupational group, EU-28, sum of four main modes, full time equivalent jobs

	2010	2015	2020	2025	2030
Mobile	156,204	217,928	198,420	196,432	195,088
Technical	28,612	55,565	55,402	57,408	58,360
Administrative	47,319	60,094	52,287	48,538	43,937
Total	**232,135**	**333,587**	**306,109**	**302,378**	**297,385**

The following sections discuss the projections and trends of each mode in more detail.

11.1 Road freight transport

According to the Reference scenario, road freight transport activity is expected to recover part of its pre-crisis momentum and rise by about 32% between 2010 and 2030. The labour levels required to satisfy that activity depend on the evolution of the various factors that affect productivity in road freight transport. The impact of technological changes is expected to affect labour productivity and employment levels mainly through the improvement of efficiency on the administrative side of road freight transport, while the operational side is mostly affected by developments that affect load factors, shipment sizes and trip distances.

Several of the trends that influence the operational characteristics of freight transport often have a mixed impact on productivity. For example, the trend for longer trip distances leads to lower productivity levels (e.g.more drivers needed per tonkm), that is only partially balanced by higher load factors (more tons carried per trip), which in turn is limited by a higher share of empty trips (meaning more vehkms for the same level of transport activity). The model captures these effects indirectly, through the estimation – based on the historical trends- of the expected evolution of load factors, trip distances and the ratio of employees per unit of transport activity. Each Member State has a specific mix of road freight transport activity that results in different model parameters and a different estimate of future productivity levels. The picture at EU level is nevertheless quite coherent, allowing for some general conclusions to be drawn.

Employment in road freight across the EU-28 could reach almost 3.5 million in 2030, compared to about 2.8 million in 2010, a net increase of about 700 thousand jobs. This corresponds to a 25% increase of the total number of jobs, meaning that the ratio of growth in employment to growth in activity by 2030 is expected to be about 0.78 (24.9% to 32.1%). In other words, productivity in road freight transport at EU level is expected to increase by about 6% between 2010 and 2030, from 696 thousand tonkm per person to 737 thousand tonkm per person. In comparison, the average productivity in 1990 was 554 thousand tonkm per person, rising by 3.3% in the following 10 years and an additional 22% between 2000 and 2010 (driven by the drastic changes in the

new EU Member States but also disguising the impacts of the crisis). The model's projections suggest that while productivity will continue to grow, thus creating jobs slower than the expected growth in transport activity, its growth rate will be rather moderate, still allowing for a modest increase in the total number of jobs in freight transport.

Table 38: Evolution of employment, activity and productivity, road freight transport, EU-28 (data for 1990 to 2010, model projections for 2020-2030)

	1990	2000	2010	2020	2030
Employment (persons)	1,915,635	2,652,942	2,798,647	3,260,604	3,496,394
Activity (billion tonkm)	1062.2	1520.0	1949.0	2335.8	2575.3
Productivity (1000 tonkm/person)	554	573	696	716	737

	1990	2000	2010	2020	2030
Employment (year 2010= 100)	68.4	94.8	100.0	116.5	124.9
Activity (year 2010= 100)	54.5	78.0	100.0	119.8	132.1

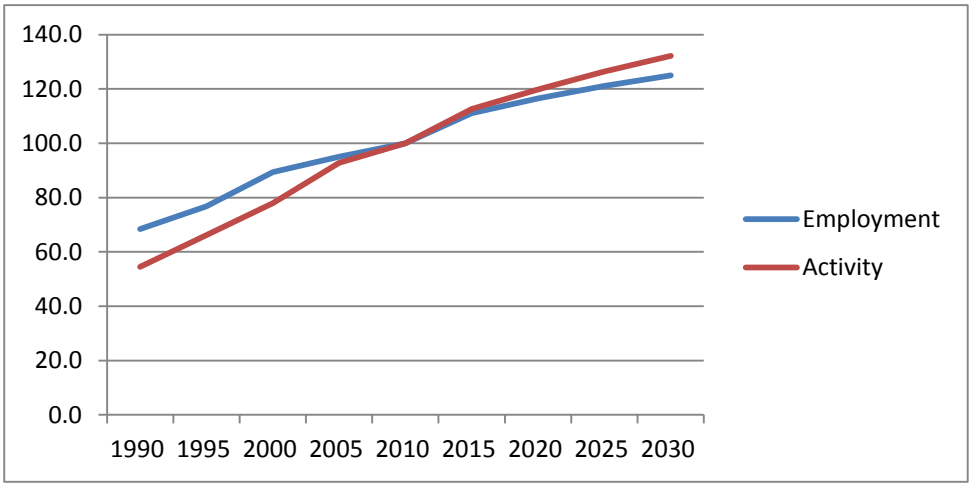


Figure 35: Evolution of employment and activity, road freight transport, EU-28 (data for 1990 to 2010, model projections for 2015-2030)

Table 39: Growth in activity, employment and productivity per EU Member State, road freight, 2010-2030, model projections

	growth in activity, 2010-2030	growth in employment, 2010-2030	productivity 2010 (1000 tonkm per person)	productivity growth 2010-30
Austria	25.8%	20.8%	738	4.2%
Belgium	30.7%	20.4%	683	8.5%
Bulgaria	55.1%	15.1%	339	34.8%
Croatia	33.7%	25.9%	474	6.2%
Czech Republic	44.6%	29.8%	462	11.4%
Denmark	27.9%	21.4%	737	5.4%
Estonia	57.4%	41.4%	508	11.3%
Finland	22.9%	16.1%	757	5.9%
France	34.5%	25.6%	577	7.1%
Germany	14.2%	12.2%	942	1.7%
Greece	42.2%	26.1%	633	12.8%

	growth in activity, 2010-2030	growth in employment, 2010-2030	productivity 2010 (1000 tonkm per person)	productivity growth 2010-30
Hungary	27.9%	20.8%	550	5.8%
Ireland	59.8%	51.2%	866	5.7%
Italy	37.6%	31.4%	823	4.7%
Latvia	38.0%	26.5%	646	9.0%
Lithuania	37.9%	27.9%	530	7.8%
Luxembourg	40.4%	32.9%	1118	5.7%
Netherlands	22.6%	15.2%	671	6.4%
Poland	31.1%	26.5%	634	3.6%
Portugal	32.8%	26.5%	682	5.0%
Romania	61.5%	43.8%	721	12.3%
Slovakia	26.6%	24.3%	1080	1.9%
Slovenia	89.5%	83.5%	900	3.3%
Spain	44.8%	36.1%	713	6.4%
Sweden	35.9%	22.2%	689	11.2%
United Kingdom	20.0%	13.2%	630	6.0%
EU28	**32.1%**	**24.9%**	**696**	**5.8%**

At Member State level, differences in the evolution of activity and employment can be observed, which mostly depend on the country-specific characteristics and the trajectory of the road freight sector in each case. The projected growth in activity (which is an exogenous input to this model) already describe different growth patterns for each Member State as a result of its macro-economic conditions and the development of its freight transport market. The employment model does take into account the growth of activity, both directly and indirectly. Directly, in the sense of allowing for economies of scale and saturation effects (in both cases having a dampening impact on productivity growth) and indirectly, as a result of the model estimation based on the correlation between activity growthactivity and employment growth that the sector demonstrated in each Member State in the past. The parameters estimated in the model correspond to different levels for the various parameters that describe productivity in each Member State.

Activity growth projections (2010-2030) range from as low as 14.2% for Germany and 20% for the United Kingdom, to 89.5% for Slovenia and about 60% for Romania, Ireland, Estonia and Bulgaria (Table 39). A similar range can be observed for the projections on employment growth, the main difference being that employment in Bulgaria is only expected to grow by 15.1%. The main reasons for a difference in the reaction of the labour market in each Member State are the existing level of productivity and its expected growth in the future. In most Member States, especially the ones in Western Europe, the road freight market is already mature and has already achieved important productivity improvements. As a result, the five large markets (Germany, France, UK, Italy, Spain) and the countries close to the economic centre of the EU (Belgium, the Netherlands, Austria, Denmark, Luxembourg) are expected to show only modest increases of productivity between 2010 and 2030 (between 1.7% for Germany and 8.5% for Belgium). Given the weight of these markets, the average at EU level is limited to 5.8%. Higher productivity growth rates are expected in smaller markets, in most cases still in a process of adapting their road haulage sector to become more competitive (Bulgaria, Romania, Estonia, Czech Republic, Lithuania, Latvia). Lower

productivity growth rates are expected in Slovakia, Slovenia and Ireland, where average productivity levels (activity per employee) is already very high. However, it should be kept into account that the absolute productivity levels are not directly comparable between countries since they depend on factors like size and geographic position, industry and transport mix or may simply be an issue of statistical definitions.

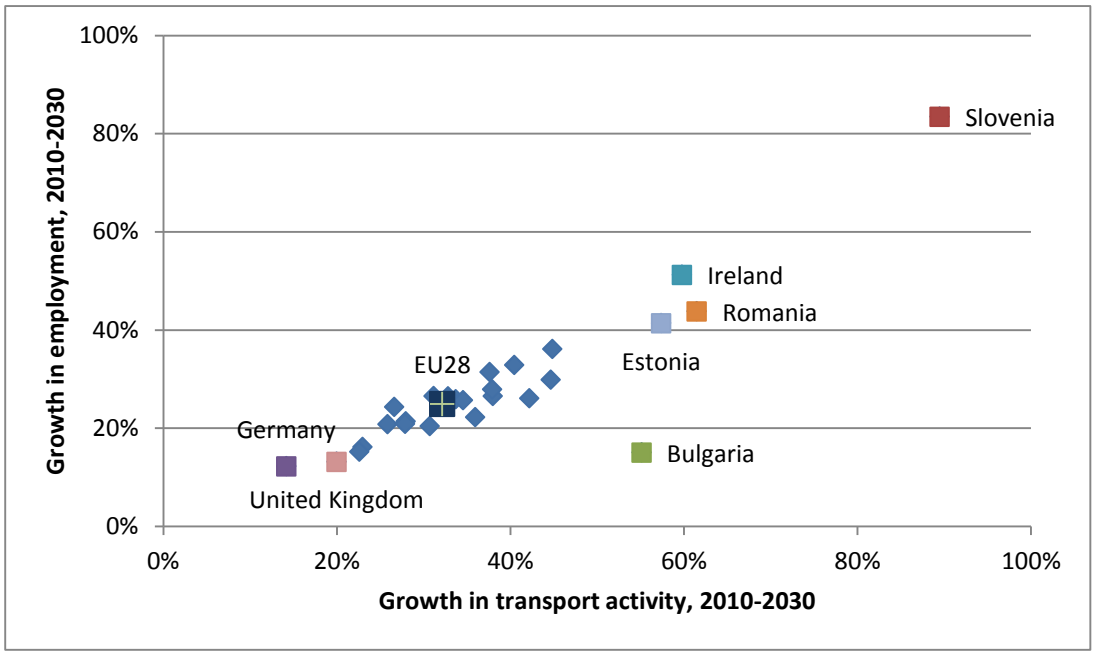


Figure 36: Correlation of growth in employment with growth in activity in each EU Member State, 2010-2030, road freight transport

The model allows the projection of employment levels per occupational group, based on the their breakdown according to year 2010 data (Table 40). For road freight transport, mobile staff corresponds to truck drivers of both long and short distances. Technical staff includes the part of freight handlers attributable to road freight transport, as well as the personnel involved in vehicle and installation maintenance (in both cases when reported in statistics as employees of enterprises in the road freight sector). Administrative staff includes office employees, managers and back office operations, as well as any non-mobile and non-technical staff employed by transport companies. The skill level profile of each occupational group differs already, with a small share of high skill employees present only in the administrative group (university graduates), while the majority of the employees in mobile or technical jobs currently has low skills. It is expected though that a higher share of medium skills (vocational training graduates) will be required for both technical and administrative jobs in the future.

In quantitative terms, mobile jobs are expected to increase by 27% between 2010 and 2030, adding more than ½ million jobs. An additional 100 thousand technical jobs are expected in the same period, a 32% increase. While the relative change for administrative staff is considerably lower (14%), it still represents 77 thousand new jobs. According to these projections, mobile jobs will correspond to 70.3% of the road freight transport jobs in 2030, up from 69.2% in 2010. At the same time, the share of administrative jobs is expected to fall from 19.6% in 2010 to 17.9% in 2030.

Table 40: Estimates on evolution of employment per occupational group, road freight transport, EU-28 (number of full-time equivalent jobs)

	2010	2015	2020	2025	2030
Total	**2,798,647**	**3,108,220**	**3,260,604**	**3,390,371**	**3,496,394**
Mobile	1,936,664	2,159,436	2,274,271	2,374,108	2,457,965
Technical	313,448	352,783	374,969	394,978	412,574
Administrative	548,535	596,001	611,363	621,286	625,854

The difference in the growth of jobs between the three occupational groups is explained by the differences in their expected future productivity (Table 41 and Table 42). Administrative jobs are expected to raise their productivity by 15.8% between 2010 and 2030 helped by the improved efficiency that new technologies and a more integrated EU freight market are expected to facilitate. This is in line with past trends on efficiency gains and may also signify a trend towards fewer and larger road freight companies that achieve higher levels of output per administrative employee. On the contrary, the operational and technical jobs are not expected to be affected by productivity growth significantly. The efficiency gains from better management will help in increasing load factors and reduce the number of trips required, but at the same time the expansion of the market may create diseconomies of scale, meaning that productivity falls as the volume of activity gets higher and the trade network served becomes wider. As a result, productivity of mobile jobs is expected to grow moderately, by 4.1%, while technical jobs are expected to demonstrate only a marginal gain in efficiency.

Table 41: Productivity estimates by occupational group, road freight transport, EU-28 (1000 tonkm per employee per year)

	2010	2015	2020	2025	2030
Mobile	1006	1016	1027	1037	1048
Technical	6218	6221	6229	6235	6242
Administrative	3553	3682	3821	3964	4115

Table 42: Index of productivity estimates by occupational group, road freight transport, EU-28 (1000 tonkm per employee per year, year 2010 value=100)

	2010	2015	2020	2025	2030
Mobile	100	101.0	102.1	103.1	104.1
Technical	100	100.1	100.2	100.3	100.4
Administrative	100	103.6	107.5	111.6	115.8

The turnover in the road freight sector is expected to grow in the future, as a result of the age profile of the current labour force but also because of the decreasing attractiveness of the sector, especially for mobile jobs involving long distance driving. With more than half of current vehicle drivers being over 45 years old, it is expected that a significant share of the current labour force will be retiring, even if the real average retirement age (which in practice is between 55 and 60 years) gets closer to 65. At the same time, working conditions for drivers are a serious reason for the sector attractiveness to decrease and itsturnover in younger age groups to increase. Especially for the long distance segment, the narrowing difference in wages between transport and

other sectors does not seem to compensate the prevailing working conditions and, in particular, the long absences from base. Empirical evidence suggests that there may be significant numbers of drivers shifting to other jobs not requiring long absences, either in other transport modes (public road transport, ports, distribution centres) or other industrial sectors requiring similar skills (construction, mining, manufacturing). Mobility in technical and administrative jobs is lower, since the conditions offered by road freight transport are comparable to the alternatives offered by other sectors for the same type of skills.

Table 43 summarizes the expected turnover by occupational group. For technical and administrative staff it is mainly driven by the number of employees who have reached retirement age, normally between 60 and 65 in most Member States (but with a tendency to increase). For mobile jobs the turnover is relatively higher, since the average driver usually retires earlier or has left the sector for another job. At aggregate level, about 110 to 120 thousand jobs would be needed annually to replace employees who have retired or left the sector, with more than 80 thousand corresponding to vehicle drivers.

Table 43: Estimates of annual turnover per occupational group, road freight transport, EU-28 (number of full-time equivalent jobs left vacant)

	2010	2015	2020	2025	2030
Mobile	77,467	79,899	81,874	85,468	86,029
Technical	11,284	11,642	12,374	13,034	13,615
Administrative	19,199	20,264	20,175	20,502	18,776
Total	**107,949**	**111,805**	**114,423**	**119,005**	**118,419**

Taking into account the net increase in jobs that are required to serve the expected transport activity (Table 40) and the turnover in the sector (Table 43), the expected annual recruitment in road freight transport fluctuates around 140 thousand employees at aggregated EU level. It is predominantly driven by the requirements to replace the staff that has retired or left the sector (Figure 37), but the rebounding freight transport activity is also expected to have created a minor peak during the 2010 to 2015 period. Three quarters of the recruitment needs correspond to mobile jobs, a share that is 5 percentage points higher than the share of mobile jobs in the sector. This is a result of the lower productivity growth (compared to administrative jobs) and the higher turnover (compared to both technical and administrative jobs) which means that proportionally, mobile jobs create both more new positions and more needs for replacement. It is also interesting to compare the number of recruitments to the turnover per occupational group in the previous table. While recruitment of administrative staff is only 5% higher than turnover for 2030, it is 19% and 26% higher for mobile and technical jobs respectively.

Table 44: Estimates of annual recruitments per occupational group, road freight transport, EU-28 (number of full-time equivalent jobs)

	2010	2015	2020	2025	2030
Mobile	96,886	124,453	104,841	105,435	102,800
Technical	14,427	19,509	16,811	17,036	17,134
Administrative	24,699	29,757	23,247	22,487	19,689
Total	**136,012**	**173,720**	**144,900**	**144,958**	**139,624**

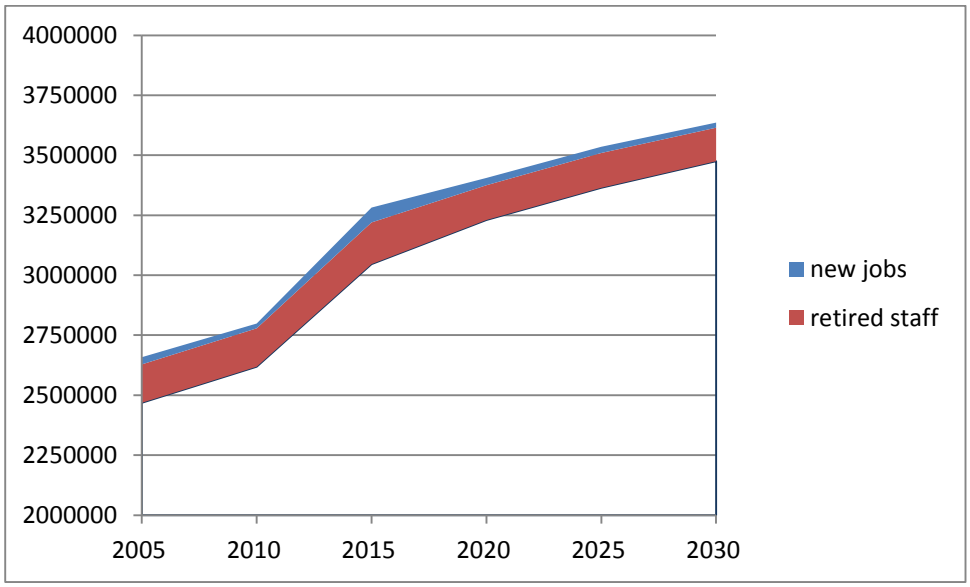


Figure 37: Projection of total employment level, annual recruitments and annual turnover, road freight transport, EU-28 (number of full-time equivalent jobs)

The balance between the number of employees that retire or leave the workforce and the ones that enter as new recruitments is expected to result in a small increase of the average age of the labour force in road freight transport from 38.1 years to 39.2 in 2030 (Table 45). This is mainly due to the general ageing of the working population and the inverted demographic pyramid that will still be visible by 2030. In addition, the specific characteristics of the sector, in terms of the turnover rates in mobile jobs and the growing average age of new entrants prevent the average age from stabilizing.

Table 45: Estimated average age of labour force, road freight transport, EU-28

	2010	2015	2020	2025	2030
Average age	38.1	38.6	38.8	39.0	39.2

11.2 Public transport

The definition of public transport in the employment model follows that of the Statistical Pocketbook EU Transport in Figures for (road) passenger transport: it includes all urban and suburban land modes (motor bus, tramway, streetcar, trolley bus, underground and elevated railways). The projections of the 2013 EU Reference scenario assume a growth of activity in the sector (in terms of annual passenger* kms) of 18.1% between 2010 and 2030. The employment model estimates that almost 70% of this growth in activity will be translated into growth in employment, resulting in a 12.1% increase in the total number of jobs. Public transport is a mature sector, with a rather stable level growth of investment and capital productivity. There are expected changes as regards the geographical coverage (extension of current networks, new metro lines or networks) and market share, but the main drivers for productivity growth still come from the change in the efficiency of existing operations. A key variable for efficiency is the occupancy rate of public transport vehicles (passenger per vehicle*km) which directly affects the number of mobile staff (drivers and operators). Technical and administrative staff is also affected by the operational efficiency gains, but in their case the impact of improvements in managing public transport through the use of new information and communication technologies has a more pronounced impact.

While increased public transport demand may increase average occupancy rates (the number of passengers carried per vehicle*km) and thus efficiency, it may also mean that higher frequencies, new destinations served or additions to the fleet may limit the gains. As a result, the marginal rate of productivity growth is negative (i.e. the productivity of the new services is lower than the average of the existing services). The decreasing rate of productivity growth is confirmed from the empirical data and is captured by the parameters used to estimate the model for most EU Member States.

Public transport employed 1.9 million persons in 2010, a figure that the employment model estimated that will rise to 2.1 million by 2030, with a net increase of 200 thousand jobs (Table 46). The productivity of the sector is expected to rise from 286 thousand passkm per employee to 301, an increase by 5.3% (or 0.3% a year, compared to 1% a year in the period 1990 to 2000 and 0.8% a year in the period 2000 to 2010).

Table 46: Evolution of employment, activity and productivity, public transport, EU-28 (data for 1990 to 2010, model projections for 2020-2030)

	1990	2000	2010	2020	2030
Employment (persons)	2,288,281	1,962,336	1,913,200	2,060,347	2,145,163
Activity (billion passkm)	549.7	519.4	546.7	604.4	645.4
Productivity (1000 passkm/person)	240	265	286	293	301

	1990	2000	2010	2020	2030
Employment (year 2010= 100)	119.6	102.6	100.0	107.7	112.1
Activity (year 2010= 100)	100.6	95.0	100.0	110.6	118.1

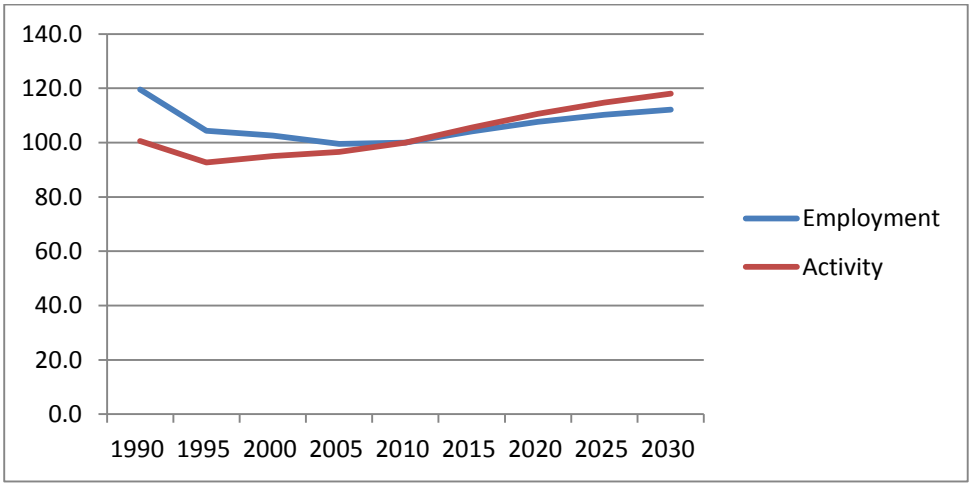


Figure 38: Evolution of employment and activity, public transport, EU-28 (data for 1990 to 2010, model projections for 2015-2030)

Table 47: Growth in activity, employment and productivity per EU Member State, public transport, 2010-2030, model projections

	growth in activity, 2010-2030	growth in employment, 2010-2030	productivity 2010 (1000 passkm per employee)	productivity growth 2010-30
Austria	23.0%	25.4%	185	-1.9%
Belgium	14.3%	22.0%	1514	-6.3%
Bulgaria	7.8%	-5.8%	318	14.4%
Croatia	4.3%	-1.8%	342	6.2%
Czech Republic	16.1%	-3.7%	203	20.6%
Denmark	15.0%	14.4%	281	0.5%
Estonia	7.0%	9.3%	504	-2.1%
Finland	9.3%	-3.0%	246	12.8%
France	29.4%	19.6%	195	8.2%
Germany	18.1%	19.7%	207	-1.3%
Greece	6.1%	-3.1%	410	9.4%
Hungary	6.4%	-3.1%	351	9.7%
Ireland	28.1%	29.1%	747	-0.8%
Italy	10.9%	10.1%	593	0.7%
Latvia	26.5%	6.0%	204	19.3%
Lithuania	18.2%	4.1%	235	13.5%
Luxembourg	23.1%	21.2%	260	1.6%
Netherlands	15.7%	20.7%	179	-4.2%
Poland	25.1%	0.1%	190	25.0%
Portugal	18.2%	17.1%	305	0.9%
Romania	33.9%	-2.7%	166	37.7%
Slovakia	8.1%	7.4%	476	0.6%
Slovenia	16.2%	18.9%	646	-2.3%
Spain	28.6%	23.7%	333	4.0%
Sweden	12.7%	3.2%	132	9.3%
United Kingdom	19.0%	11.9%	307	6.3%
EU28	**18.1%**	**12.1%**	**286**	**5.3%**

As shown in Figure 38, the high productivity growth in the period between 1990 and 2005 that was the result of the modernisation of public transport systems in most EU Member States led to a reduced labour demand in the context of the stagnant or falling demand for public transport. The White Paper projections of activity in public transport (from the 2013 EU Reference Scenario) suggest that the overall activity at EU level will recover and grow faster between 2010 and 2030 than it did between 1995 and 2010. According to the model's estimates for future productivity growth, the resulting total level of employment will allow the public transport sector to recover a large part of the jobs lost between 1990 and 2010. The total employment of 2.3 million in 1990 fell to 1.9 million in 2010 and is expected to rebound to 2.1 million by 2030. There will be however big differences between countries, specific public transport services and occupational groups as the analysis that follows will show.

First, public transport activity is expected to grow at different rates in each Member State, ranging from below 10% over the next 20 years in Croatia, Greece, Hungary, Bulgaria and Slovakia to about 30% in Romania, France, Spain and Ireland (Table 47). The expected productivity growth is also disperse, since it depends on several factors such as the existing level of productivity, urban concentration and land use, modal shares and the efficiency gains already achieved. In some Member States it is estimated that productivity has already reached a high level and further growth in activity will probably mean that the average productivity will fall (Austria, Germany and the Netherlands), while for others there seems to be a wide margin for further efficiency improvements (Romania, Bulgaria, Poland Czech Republic, Latvia). Smaller Member States like Estonia and Slovenia have already achieved high productivity rates due to their level of urbanisation. Belgium appears as an outlier as regards current levels of productivity (5 times higher than the EU average) and an increase in demand should normally mean that its average productivity will fall.

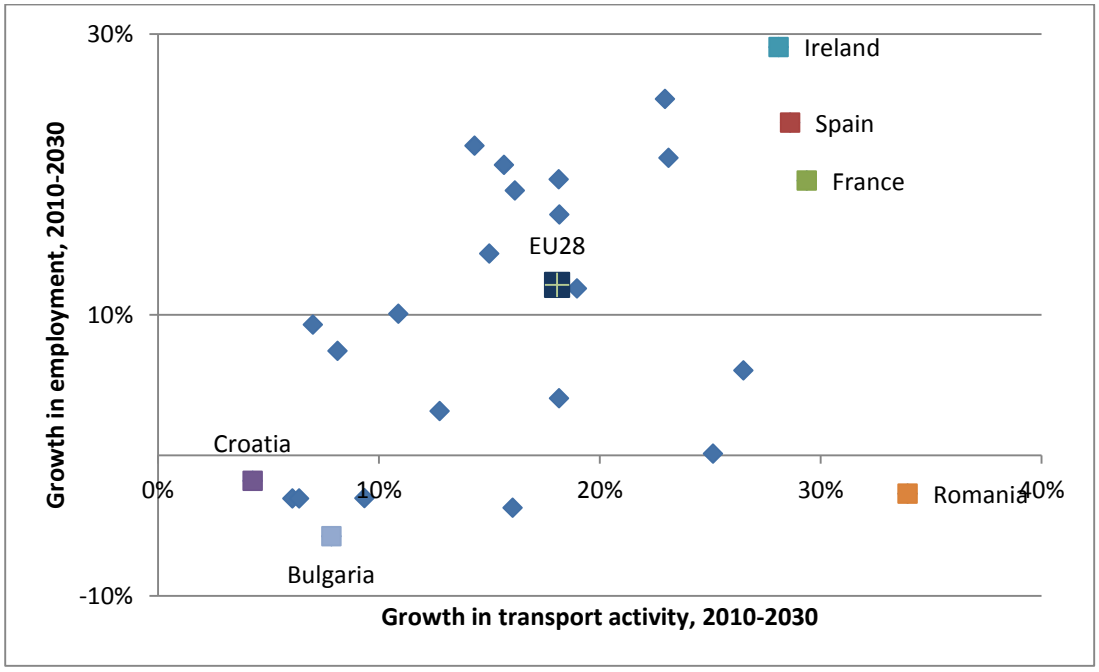


Figure 39: Correlation of growth in employment with growth in activity in each EU Member State, 2010-2030, public transport

The combination of varying rates of activity and productivity growth across the EU creates a mixed picture as regards the growth in employment in public transport at individual Member State level (Figure 39). While in principle there is a positive correlation (more activity = more jobs) that helps total employment in public transport grow by more than 10% in most countries, there is a number of Member States where the number of jobs is expected to drop (Bulgaria, Czech Republic, Greece, Hungary, Romania, Finland, Croatia) as a result of productivity growing faster than the rise in activity (Table 47).

Employment projections in public transport are further broken down into projections for employment per occupational group, using the same three groups as in the other transport modes covered.. In this case, mobile staff corresponds to drivers (of busses and other public transport road vehicles) and operators (for suburban rail and tram, including underground). Obviously, though jobs in public transport are mobile in physical terms, in almost all cases a driver or operator ends the shift at the same place it started, and the base of operations is in most cases stable. So, for modelling purposes they are considered as mobile, but they should not be considered as comparable to mobile jobs in road freight, rail or aviation. Other staff on-board the vehicle not directly involved in the operation of the vehicle (e.g. ticket controllers) are considered as administrative staff, together with all managerial, administrative, customer service, back-office and support staff. Technical staff includes employees responsible for vehicle, installation and infrastructure maintenance. Table 48 summarizes the estimates for the evolution of employment for each occupational group in public transport until 2030. While the total employment increases from 1.9 million to 2.1 million between 2010 and 2030 (a 12.1% increase), the number of administrative staff is expected to fall by 10.2% during the period (from 468 thousand to 440 thousand). Most of the increase in total employment is therefore expected to come from mobile jobs, which in fact are expected to grow proportionally to the growth in activity.

Table 48: Estimates on evolution of employment per occupational group, public transport, EU-28 (number of full-time equivalent jobs)

	2010	2015	2020	2025	2030
Total	**1,913,200**	**1,991,895**	**2,060,347**	**2,110,001**	**2,145,163**
Mobile	1,161,112	1,167,052	1,229,995	1,287,717	1,334,576
Technical	274,099	275,501	296,792	317,293	335,490
Administrative	468,252	470,647	465,107	455,337	439,935

The estimates on average productivity for each occupational group explain this trend (Table 49 and Table 50). Mobile jobs are expected to stay constant, or to demonstrate only a marginal improvement in efficiency. The situation in each Member State may be different to a certain extent, but on average for the EU these estimates reflect the fact that the efficiency of operations in public transport cannot grow spectacularly. Additional demand will require additional vehicles and timetable frequencies, often with lower vehicle occupation rates (passengers per vehicle) than the existing services have. Of course, demand can also help in increasing vehicle occupation rates for the existing services, and overall management of operations can increase productivity levels per individual driver. A larger share of mass public transport (such as underground/ metros) and the gradual introduction of automated driverless trains can also increase efficiency (however, given the still low share they have compared to total

public transport activity, the impact will only be marginal). All of the above result in a small net improvement of overall productivity levels.

On the other hand, productivity in administrative jobs is expected to grow by more than 30% in the period 2010 to 2030. New information and communication technologies will become even more ubiquitous in public transport and allow most of the ticketing, information, marketing, traffic and demand management and control functions to be carried out with much less staff. The trend for the average productivity of technical staff is a falling one. A potential reason for this is that more technical staff is needed to carry out the same level of activities if the increased demand is met with a higher number of (smaller) public transport vehicles that will need, proportionally, more maintenance and installations. The shift towards a more automated environment which is expected to lead to fewer administrative jobs, will also mean that more technical staff will be required for the operation and maintenance of these automated systems.

Table 49: Productivity estimates by occupational group, public transport, EU-28 (1000 passkm per employee per year)

Productivity	2010	2015	2020	2025	2030
Mobile	468	469	469	470	470
Technical	1984	1944	1905	1869	1835
Administrative	1162	1241	1327	1425	1535

Table 50: Index of productivity estimates by occupational group, public transport, EU-28 (1000 passkm per employee per year, year 2010 value=100)

Productivity 100	2010	2015	2020	2025	2030
Mobile	100	100.2	100.2	100.3	100.4
Technical	100	98.0	96.0	94.2	92.5
Administrative	100	106.8	114.3	122.7	132.2

In most EU Member States, jobs in public transport are considered as well paid and as offering good working conditions, at least compared to other jobs requiring a similar level of skills. The workload and job content allow most employees to retire at the same age as employees in other sectors of the economy (in contrast with other transport modes where the norm is that mobile employees retire significantly earlier). As a result, neither the retirement rate, nor the turnover rate is particularly high for any of the three occupational groups considered in public transport. The pattern of staff turnover is therefore expected to follow the natural ageing profile of the labour force in public transport, being rather stable for mobile jobs, gradually dropping in line with the decrease of its share for the administrative part, and growing with time for technical staff Table 51. For the whole of the public transport sector at EU level the total number for staff turnover is expected to be constant around 70 thousand employees a year.

Table 51: Estimates of annual turnover per occupational group, public transport, EU-28 (number of full-time equivalent jobs left vacant)

	2010	2015	2020	2025	2030
Mobile	46682	49200	47646	46710	48052
Technical	8265	8904	9519	10065	10554
Administrative	14119	13953	13660	13198	12614
Total	69067	72057	70824	69973	71219

There is however another underlying trend behind this aggregate figure, which can be noticed if we compare it with the figures for expected recruitment per occupational group (Table 52). They result from taking into account the changes in the required number of jobs (Table 48) including the needs for replacement (Table 51 above). The estimated recruitment needs for administrative jobs are rapidly decreasing and are lower than the expected turnover, meaning that many leavers will not be substituted. There is a marked tendency towards mobile and administrative job vacancies, which are estimated that will correspond to 71.2% and 17.1% of the total recruitment respectively in 2030. Nevertheless, new jobs (the difference between total recruitment and turnover) will still represent only 9% of overall recruitment in 2030, since the majority of vacancies will in practice replace retired staff (Figure 40).

Table 52: Estimates of annual recruitments per occupational group, public transport, EU-28 (number of full-time equivalent jobs)

	2010	2015	2020	2025	2030
Mobile	47870	61788	59190	56082	55717
Technical	8545	13162	13619	13704	13818
Administrative	14599	12845	11706	10118	8717
Total	71014	87796	84515	79904	78252

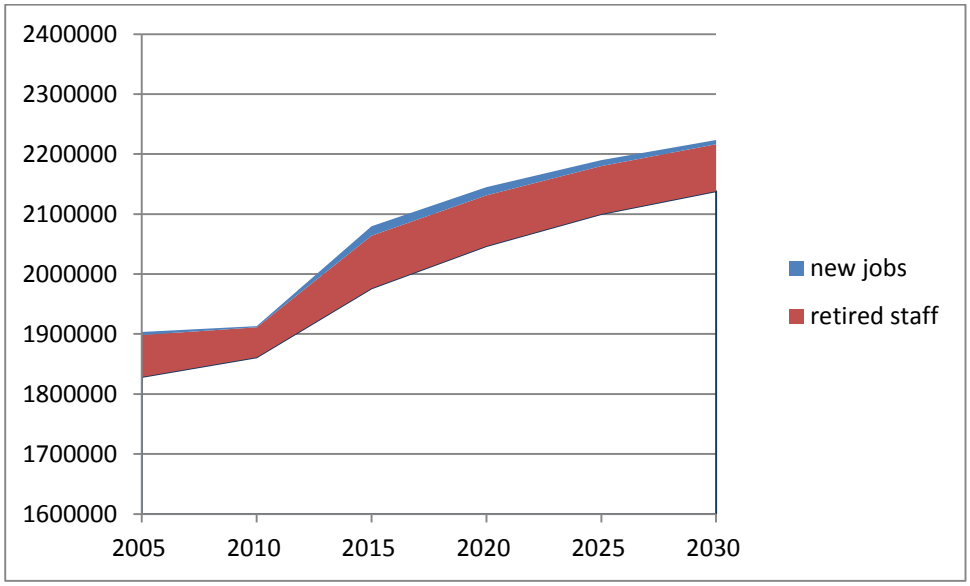


Figure 40: Projection of total employment level, annual recruitments and annual turnover, public transport, EU-28 (number of full-time equivalent jobs)

Being a more stable sector than the other modes covered, the balance between the number of employees that retire or leave the workforce and the ones that enter as new recruitments is not expected to affect the average age of the labour force in public transport significantly. The average age of the labour force is expected to grow marginally, from 37.6 years in 2010 to 38.0 in 2030 (Table 53). The demographic profile of public transport is more uniform than in other transport modes, at least partially because of the decrease through early retirement of employees in several

Member States in the period 2000 to 2010. Another specific characteristic of the sector is the low turnover rates in mobile jobs and the comparatively low average age of new entrants, both of which help the average age of the labour force in transport to stabilize.

Table 53: Estimated average age of labour force, public transport, EU-28

	2010	2015	2020	2025	2030
Average age	37.6	37.7	37.8	37.9	38.0

11.3 Rail transport

The projections for employment in rail transport cover both passenger and freight activities. In most EU Member States the part of infrastructure and administration is common for the two types of transport, while in the majority the operational part is also carried by the same organisation, usually a monopoly for the specific market. It is therefore difficult to acquire detailed data on employment that distinguishes between passenger and freight transport, with the exception of a small number of individual companies in some Member States that offer high speed services. The labour force in rail transport is therefore treated as a single group for each Member State.

Even though the growth in passenger and freight activities normally depends on different factors, the expected growth between 2010 and 2030 is expected to be comparable for the two types of rail transport according to the 2013 EU reference scenario, both increasing by about 48% in the period. However, the estimated growth in employment is significantly lower, only 4.9% in the same period. This low growth rate, only about 10% of the growth in activity, is due to the expected increase in productivity from the continued restructuring of rail operators across the EU and the impact of new technologies in all aspects of rail operations. More specifically, in several countries the process of privatisation of previously large public rail companies is still ongoing, with more cuts in both administrative and technical jobs in the horizon. This tendency is also maintained by the introduction of new technologies for traffic management, control, ticketing, maintenance and operation of rail services. In addition, the increased share of high speed rail in passenger services and the continuing electrification of the rail network will also contribute in the increase of the efficiency of operations.

These trends have already demonstrated an important impact on the number of jobs in the sector. Total employment amounted to 2 million in 1990, dropped to 1.35 million in year 2000, and continued the fall to about 900 thousand in 2010, according to EUROSTAT data[13]. The negative trend in employment was also a result of the decrease in activity, especially in freight transport, but also in passenger transport between 1990 and 2000. In some cases the causal relationship may be reverse, i.e. activity fell because the services were not provided any more, especially in new EU Member States where the efficiency and productivity levels were unsustainable.

The employment model expects the downward trend to continue until 2020, with the total number of jobs falling to 900 thousand. According to the model estimates, rail passenger demand is growing slower than productivity in the 2010-2020 period (18% and 21% respectively), a situation that doesn't allow the job numbers to recover, even though freight demand is expected to grow by 25% in the period. Employment is projected to grow again in the next 10 year period (2020 to 2030), when growth in passenger demand is expected to accelerate as a result of a higher penetration of high speed rail. Nevertheless, the overall picture for the sector in terms of employment is that of stagnation (Figure 41).

[13] It should be noted though that changes in definitions and inconsistencies in data reported by member states may exaggerate the trend in some cases.

Table 54: Evolution of employment, activity and productivity, rail transport, EU-28 (data for 1990 to 2010, model projections for 2020-2030)

	1990	2000	2010	2020	2030
Employment (persons)	2073444	1349412	912745	900650	957894
Freight activity (billion tonkm)	532.9	405.5	392.5	488.5	583.7
Passenger activity (billion passkm)	454.5	449.6	496.2	584.8	735.7
Mixed activity (billion passkm)[14]	474.1	438.6	470.3	560.7	697.7
Productivity (1000 passkm/person)	229	325	515	623	728

	1990	2000	2010	2020	2030
Employment (year 2010= 100)	227.2	147.8	100.0	98.7	104.9
Freight activity (year 2010= 100)	135.8	103.3	100.0	124.5	148.7
Passenger activity (year 2010= 100)	91.6	90.6	100.0	117.9	148.3

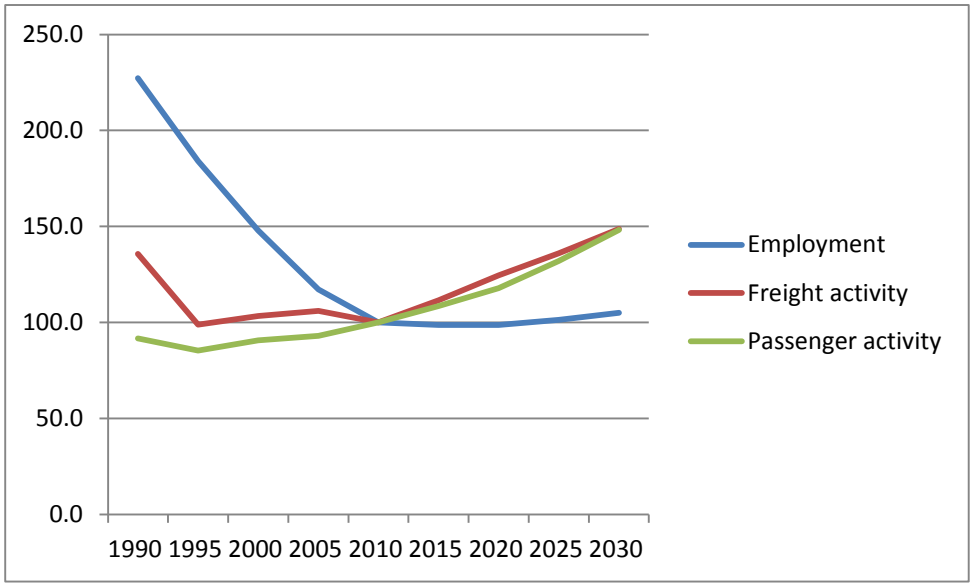


Figure 41: Evolution of employment and activity, rail transport, EU-28 (data for 1990 to 2010, model projections for 2015-2030)

The projections for activity (EU Reference scenario 2013), both passenger and freight, are rather optimistic, range from a 25% (Denmark) to a 100% (Spain) increase between 2010 and 2030 (Table 55). In most cases the projections take into account the development of the high speed rail network and the recovery of the share of rail in freight transport. The employment model builds on these projections, both in terms of the demand that has to be satisfied and in terms of the capital investment and productivity growth that they correspond to. Productivity is expected to grow slower in mature rail markets with high levels of efficiency like Austria (6.3%) and faster in new Member States where investments are expected in order to achieve the projected increase in rail activity (e.g. Romania and Poland). In Spain, the plans for an even more

[14] Mixed activity is the weighted average of passenger and freight activity, with weights of 0.75 and 0.25 respectively, and is used as an auxiliary variable for the estimation of the average productivity of rail transport.

extensive high speed network are translate into an impressively higher activity that would be accompanied by a relatively high productivity growth (compared to other western Europe Member States).

Table 55: Growth in activity, employment and productivity per EU Member State, rail transport, 2010-2030, model projections

	growth in activity, 2010-2030	growth in employment, 2010-2030	productivity 2010	productivity growth 2010-30
Austria	29.1%	14.7%	1288	6.3%
Belgium	45.3%	-10.2%	247	30.9%
Bulgaria	51.5%	20.9%	104	12.6%
Croatia	32.6%	-7.2%	189	21.4%
Czech Republic	45.9%	-8.8%	275	30.0%
Denmark	25.5%	11.4%	550	6.4%
Estonia	61.2%	39.6%	1212	7.8%
Finland	34.6%	11.4%	580	10.4%
France	49.1%	5.7%	497	20.5%
Germany	40.3%	12.3%	753	12.5%
Greece	24.8%	-7.9%	391	17.7%
Hungary	41.8%	-7.1%	282	26.3%
Ireland	41.8%	-24.2%	267	43.6%
Italy	53.4%	11.1%	565	19.0%
Latvia	48.5%	18.1%	1034	12.8%
Lithuania	49.7%	5.6%	353	20.9%
Luxembourg	42.8%	-12.7%	86	31.8%
Netherlands	29.8%	13.9%	1185	7.0%
Poland	88.3%	2.7%	278	41.7%
Portugal	58.3%	12.7%	591	20.3%
Romania	67.1%	-18.3%	298	52.3%
Slovakia	72.0%	7.5%	125	30.0%
Slovenia	72.1%	-3.7%	213	39.4%
Spain	99.7%	48.5%	1152	17.3%
Sweden	33.7%	15.7%	1107	7.8%
United Kingdom	29.2%	0.5%	934	14.3%
EU28	**48.4%**	**4.9%**	**515**	**20.8%**

The differences in growth in activity and productivity lead to a rather disperse picture as regards the expected change in the number of jobs in each Member State (Figure 42). Even though rail demand in Poland is expected to grow at twice the EU-28 average rate, the number of jobs will practically remain constant. Romania and Ireland are expected to decrease their labour force by about 20% despite an increase in activity by 67% and 42% respectively. Conversely, employment is expected to grow by more than 40% in Spain and Estonia.

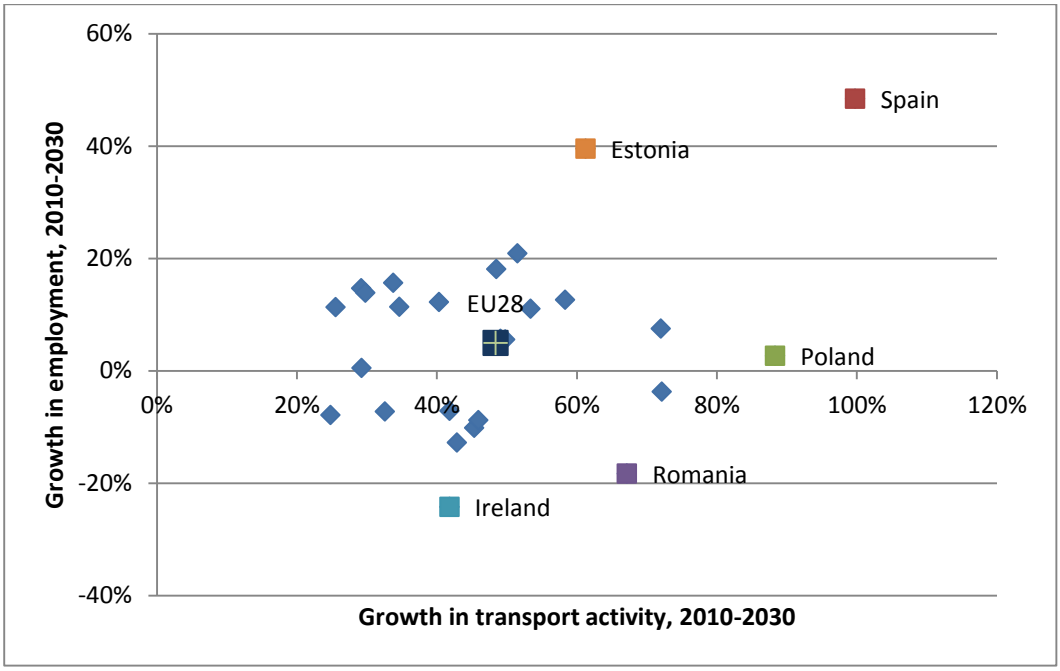


Figure 42: Correlation of growth in employment with growth in activity in each EU Member State, 2010-2030, rail transport

One of the main drivers of the change in the levels of employment in rail transport can be identified by analysing the estimated evolution by occupation group (Table 56). The number of administrative staff is expected to decrease by a further 23%, from 376 thousand in year 2010 down to 290 thousand in 2030. This group would represent just 30.3% of total staff by 2030, compared to 41.2% in 2010. The numbers of mobile and technical staff, on the other hand, are expected to grow more steadily, more in line with the growth in demand. It is indicative that productivity for administrative jobs is expected to almost double (a 92% increase between 2010 and 2030, Table 57 and Table 58), while productivity for mobile and technical jobs is expected to grow at comparable rates to those of activity (27% and 11% respectively).

Table 56: Estimates on evolution of employment per occupational group, rail transport, EU-28 (number of full-time equivalent jobs)

	2010	2015	2020	2025	2030
Total	**912,745**	**900381**	**900650**	**924672**	**957894**
Mobile	306612	311281	320199	337800	359322
Technical	230150	242671	258386	281337	308082
Administrative	375982	346429	322065	305535	290490

Table 57: Productivity estimates by occupational group, rail transport, EU-28 (1000 equivalent passkm per employee per year)

	2010	2015	2020	2025	2030
Mobile	1534	1649	1751	1850	1942
Technical	2043	2115	2170	2221	2265
Administrative	1251	1481	1741	2045	2402

Table 58: Index of productivity estimates by occupational group, rail transport, EU-28 (1000 equivalent passkm per employee per year, year 2010 value=100)

	2010	2015	2020	2025	2030
Mobile	100	107.5	114.2	120.6	126.6
Technical	100	103.5	106.2	108.7	110.8
Administrative	100	118.4	139.2	163.5	192.0

The trends for a reduction of administrative staff were already visible from the end of the 90's, but the negative impact on the number of jobs has been partially cushioned by the fact that most rail companies still belonged to the public sector and were less flexible in adapting the labour profiles. Restructuring is still ongoing in several operators and it will still take several years for the balance between turnover and recruitment to find a balance. As Table 59 and Table 60 show, a high turnover for administrative staff is expected until year 2020, either as a result of staff shifting to other sectors or –in the majority of cases- staff retiring. There will still be recruitment of administrative staff, but mainly in different Member States or with different profiles and skills than the ones leaving. The rate of substitution is expected be low (18% of turnover in 2010 up to 65% in 2030), leading to the low number for administrative jobs already shown in Table 56. Mobile and technical jobs on the contrary increase in numbers, since recruitment is higher than turnover from year 2015 onwards. The increase in recruitment of technical staff is noteworthy, being the result of the expected high growth in rail activity in combination with the low growth in productivity.

Table 59: Estimates of annual turnover per occupational group, rail transport, EU-28 (number of full-time equivalent jobs left vacant)

	2010	2015	2020	2025	2030
Mobile	13798	12763	12808	13174	13295
Technical	9666	9707	10077	10691	10167
Administrative	15791	12471	10950	9166	8715
Total	**39255**	**34941**	**33835**	**33031**	**32176**

Table 60: Estimates of annual recruitments per occupational group, rail transport, EU-28 (number of full-time equivalent jobs)

	2010	2015	2020	2025	2030
Mobile	3239	13696	14592	16694	17599
Technical	1741	12211	13220	15281	15516
Administrative	2843	6561	6077	5860	5706
Total	**7823**	**32468**	**33889**	**37835**	**38821**

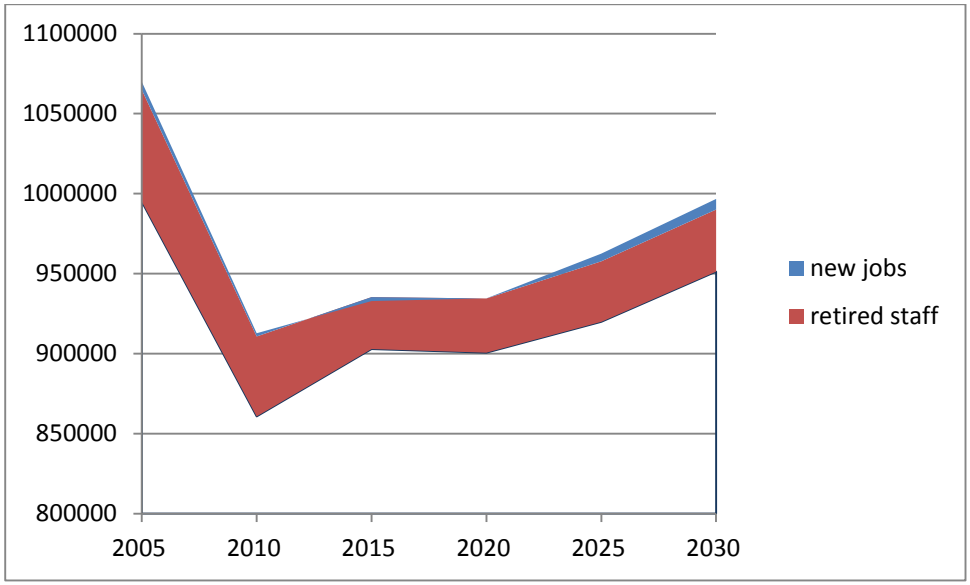


Figure 43: Projection of total employment level, annual recruitments and annual turnover, rail transport, EU-28 (number of full-time equivalent jobs)

Following the same patterns as the other transport sectors, the share of new jobs compared to total recruitment is expected to be very low (Figure 43), reaching 17% in 2030 but only after being marginal or even negative until 2020. This slow renewal of the labour force, is a main reason for the projected average age of staff in rail transport to continue to increase, from 44.1 years on average in 2010 to 46.7 years in 2030 (Table 61).

Table 61: Estimated average age of labour force, rail transport, EU-28

	2010	2015	2020	2025	2030
Average age	44.1	44.9	45.6	46.2	46.7

11.4 Aviation

Aviation is the mode where the highest growth rate in activity is expected according to the EU Reference Scenario. An increase of 85.3% is expected between 2010 and 2030, accelerating the speed of growth experienced in the past (activity increased by 76% in the previous 20-year period, from 1990 to 2010). These optimistic projections in the reference Scenario are probably based on the expectation of a continuation of the trend for low cost carriers, cheaper flights, air travel frequencies per capita and average growing average distance per trip, as well as an increase in demand at the newer EU Member States Table 62. Given these expectations, the projections on demand for labour in air transport need to share the assumption that productivity will grow in the future, but also need to take into account the potential for saturation in the air transport system and the limits to productivity growth that the maturity of the market will eventually lead to. According to the employment model, productivity is expected to grow by 13% between 2010 and 2030, since the actual average at EU level is already particularly high (1.3 million passenger km a year per employee in 2010). The model variables on which productivity depends the most in this case are the level of investment and the productivity of capital in air transport. Both are expected to grow slower than the growth in air transport demand in the future, keeping overall productivity growth at relatively low speeds. Therefore, while activity is expected to grow by 85.3%, the corresponding growth in employment would be 64.4%, which would mean that three quarters of the increase in demand would be translated into growth in employment. In this aspect, aviation is the mode with the highest rate of employment generation of all modes covered by the model. In absolute terms (270 thousand new jobs), the employment that aviation can generate is considerable is size.

Table 62: Evolution of employment, activity and productivity, air transport, EU-28 (data for 1990 to 2010, model projections for 2020-2030)

	1990	2000	2010	2020	2030
Employment (persons)	416698	460660	430701	595953	708235
Activity (billion passkm)	311.4	448.2	566.6	810.7	1049.9
Productivity (1000 passkm/person)	747	973	1316	1360	1482

	1990	2000	2010	2020	2030
Employment (year 2010= 100)	96.7	107.0	100.0	138.4	164.4
Activity (year 2010= 100)	54.9	79.1	100.0	143.1	185.3

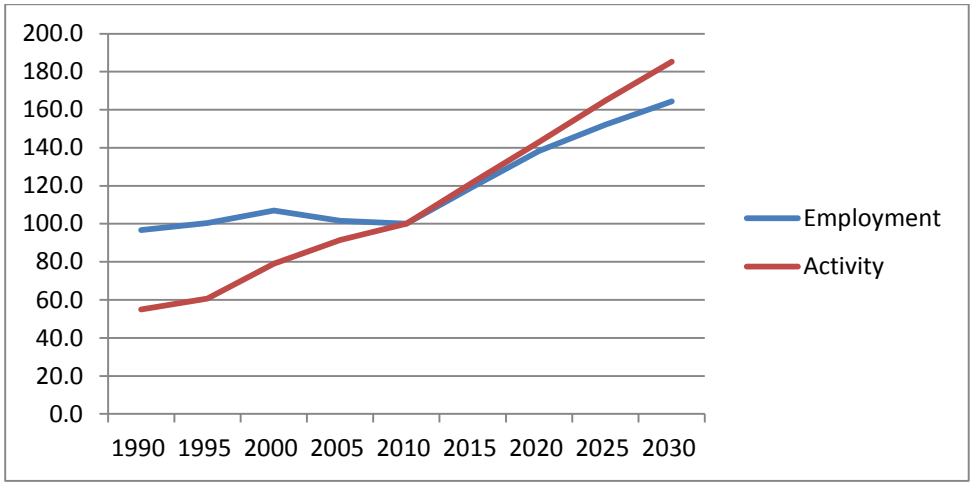


Figure 44: Evolution of employment and activity, air transport, EU-28 (data for 1990 to 2010, model projections for 2015-2030)

The data and projections at EU Member State level give a mixed picture, both as regards existing levels of productivity and expected impacts on future employment. There are important differences in the current levels of efficiency that depend on the structure of the local aviation market (including the size and competitive position of national carriers), the size and geographic position of each Member State as well as, for newer Member States up to a certain extent, their speed of integration (Table 63). The model expects a convergence at EU level to a level of productivity close to the one that western EU Member States currently have on average. In a small number of cases where particular market developments have caused serious restructuring of the labour force and an unnatural increase in apparent productivity levels (Greece, Belgium, Spain), the average productivity in the future is expected to decline to levels comparable with those of other aviation markets in the EU.

Table 63: Growth in activity, employment and productivity per EU Member State, air transport, 2010-2030, model projections

	growth in activity, 2010-2030	growth in employment, 2010-2030	productivity 2010	productivity growth 2010-30
Austria	104.3%	82.7%	924	11.8%
Belgium	79.2%	85.8%	1958	-3.6%
Bulgaria	168.2%	146.2%	1731	8.9%
Croatia	398.3%	165.6%	284	87.6%
Czech Republic	141.6%	127.0%	2314	6.4%
Denmark	84.2%	76.2%	2095	4.6%
Estonia	204.3%	182.4%	1050	7.8%
Finland	87.3%	69.3%	1471	10.6%
France	64.9%	44.0%	775	14.5%
Germany	84.3%	59.7%	1050	15.4%
Greece	107.1%	286.1%	6918	-46.4%
Hungary	150.1%	57.1%	496	59.2%
Ireland	81.5%	35.8%	501	33.7%
Italy	70.6%	59.1%	2669	7.3%
Latvia	207.7%	166.6%	859	15.4%
Lithuania	219.6%	172.1%	943	17.4%
Luxembourg	83.4%	35.2%	247	35.7%
Netherlands	88.5%	43.0%	510	31.8%

	growth in activity, 2010-2030	growth in employment, 2010-2030	productivity 2010	productivity growth 2010-30
Poland	171.1%	123.9%	1169	21.1%
Portugal	85.1%	70.8%	2226	8.4%
Romania	66.6%	46.6%	760	13.7%
Slovakia	168.8%	265.9%	5836	-26.6%
Slovenia	122.0%	31.6%	408	68.7%
Spain	79.5%	92.0%	3530	-6.5%
Sweden	97.7%	70.9%	762	15.7%
United Kingdom	75.0%	57.9%	1264	10.9%
EU28	85.3%	64.4%	1316	12.7%

Air transport demand is expected to grow fast across the whole of the EU, but in newer EU Member States the growth rate in many cases is more than double that of the rest of the EU. So, even though productivity growth is also expected to be high, employment in these Member States can more than double compared to year 2010 levels (Figure 45).

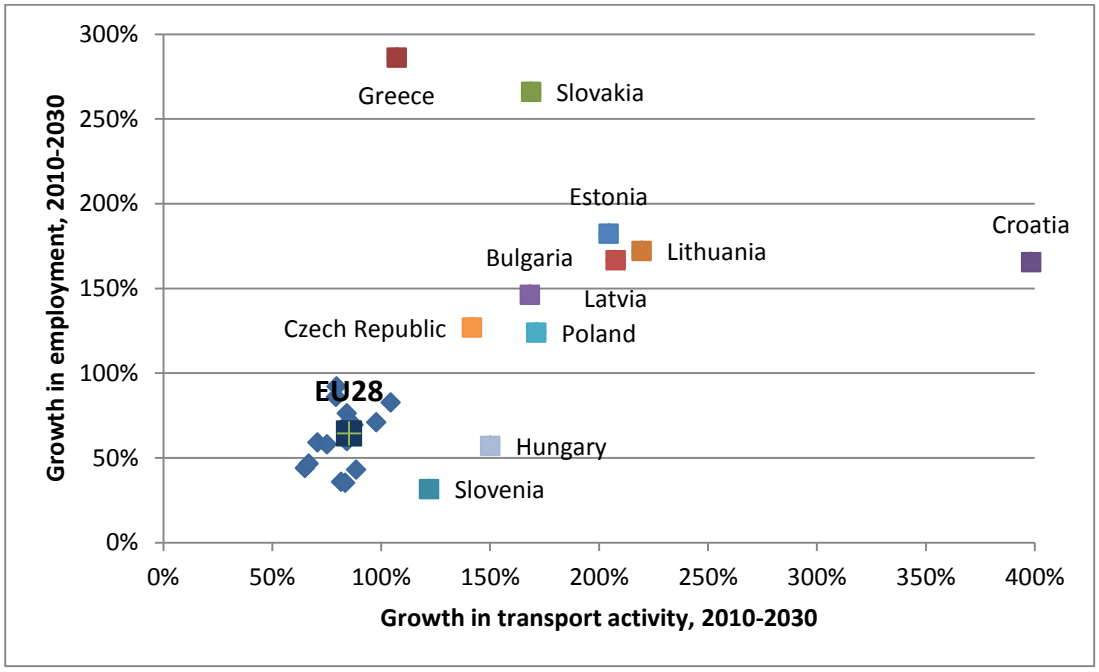


Figure 45: Correlation of growth in employment with growth in activity in each EU Member State, 2010-2030, air transport

Given the exogenous projections for activity and the model's estimation for future investment and productivity growth, the administrative staff is the only occupational group where significant increases in productivity are expected. This can be explained by the increased use of information and communication technologies with applications in ticket reservation and purchases, check-in and customer support already widely used, and the economies of scale that the higher level of activity may allow. Mobile staff (pilots and crews) are expected to achieve a 10% increase in average productivity since the extension of the network and the increased average trip distances can in fact decrease average productivity, an effect also seen in the other transport modes. Increases in productivity of technical staff are expected to be only marginal. On one hand new technology can limit the need for aircraft and airport maintenance, but the

expansion of the aircraft fleet would normally mean that diseconomies of scale may also develop.

Table 64: Estimates on evolution of employment per occupational group, air transport, EU-28 (number of full-time equivalent jobs)

	2010	2015	2020	2025	2030
Total	430,701	514,407	595,953	655,203	708,235
Mobile	167,973	202,291	236,295	261,917	285,419
Technical	122,319	149,564	177,296	199,345	220,261
Administrative	140,409	162,553	182,362	193,940	202,555

Table 65: Productivity estimates by occupational group, air transport, EU-28 (1000 passkm per employee per year)

	2010	2015	2020	2025	2030
Mobile	3373	3414	3431	3563	3679
Technical	4633	4617	4573	4681	4767
Administrative	4036	4248	4446	4812	5183

Table 66: Index of productivity estimates by occupational group, air transport, EU-28 (1000 passkm per employee per year, year 2010 value=100)

	2010	2015	2020	2025	2030
Mobile	100	101.2	101.7	105.6	109.0
Technical	100	99.7	98.7	101.1	102.9
Administrative	100	105.3	110.2	119.2	128.4

A unique characteristic of aviation compared to the other transport modes is the high turnover rate for both administrative and mobile staff (crews). While there is a shift from mobile to ground (administrative) staff, on aggregate there is a large number of staff in services that leaves the sector in their 30s. As Table 67 suggests, a high number of mobile and administrative staff is expected to leave the sector on an annual basis. Recruitment (Table 68) is higher than turnover for all three groups and all years in the future (which was not the case in 2010).

Table 67: Estimates of annual turnover per occupational group, air transport, EU-28 (number of full-time equivalent jobs left vacant)

	2010	2015	2020	2025	2030
Mobile	8735	11126	12996	13096	14271
Technical	4281	5235	6205	6977	7709
Administrative	5616	6502	7294	7758	8102
Total	18632	22863	26496	27831	30082

Table 68: Estimates of annual recruitments per occupational group, air transport, EU-28 (number of full-time equivalent jobs)

recruitment	2010	2015	2020	2025	2030
Mobile	8210	17989	19797	18220	18971
Technical	3899	10684	11752	11387	11892
Administrative	5178	10931	11256	10073	9825
Total	17287	39604	42805	39681	40689

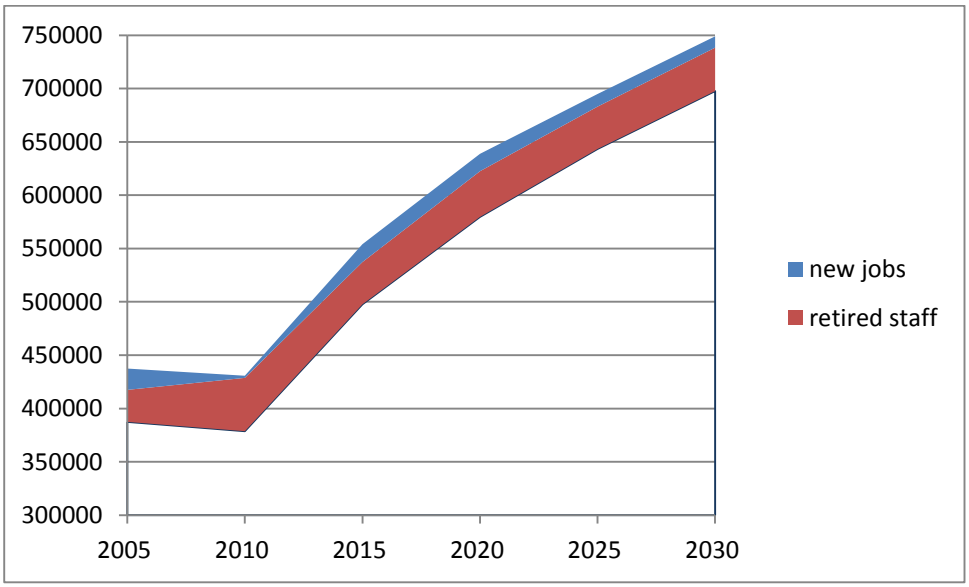


Figure 46: Projection of total employment level, annual recruitments and annual turnover, air transport, EU-28 (number of full-time equivalent jobs)

Figure 46 gives a picture of a relative renewal of staff in aviation, with the share of new jobs compared to turnover being much higher than in other modes. This allows the average age of employees in aviation to increase slower than in most other modes, but still rising form 38.3 years in 2010 to 39.7 years in 2030 Table 69. Young employees in their 20s-30s are expected to leave the sector faster than in the past, and older employees will probably retire later than before.

Table 69: Estimated average age of labour force, air transport, EU-28

	2010	2015	2020	2025	2030
Average age	38.3	38.8	39.2	39.5	39.7

11.5 Summary of main projections

The following tables summarize the results for the four modes covered in terms of projected total employment levels and recruitment needs. The recruitment needs are further disaggregated into jobs resulting from the change in activity (new jobs), jobs to replace staff that will retire in the future and jobs to replace staff that has left the labour force for reasons other than retirement (turnover). All three drivers for recruitment are sizeable, indicating the importance of the main issues addressed by the analysis:

- Transport is expected to create new jobs, resulting from the increase in transport activity, even though productivity in the sector is expected to continue growing (in fact, as highlighted in the previous sections, productivity growth is a necessary condition for growth in activity and employment).
- The current workforce in transport has a high average employee age, which in most modes is expected to continue rising. As a result, high numbers of retirements are expected in all transport modes during the next at least 15 years. The majority of jobs that are expected to be created in transport, over 60%, will correspond to replacement of retired staff.
- The turnover in transport jobs, especially in mobile jobs, is particularly high. It is expected that more than 16% of recruitment will be due to job openings because of staff turnover.

Table 70: Summary of employment and recruitment projections, total of four modes, EU-28, (total employment; annual recruitments)

	2010	2015	2020	2025	2030
Total employment	6,055,293	6,514,903	6,817,554	7,080,247	7,307,686
New recruitment	232,135	333,587	306,109	302,378	297,385
Activity		91,922	60,530	52,538	45,488
Retired	174,695	185,439	195,343	203,336	210,309
Turnover	60,208	56,226	50,235	46,503	41,588

Table 71: Cumulative recruitment needs (next 5, 10 and 15 years), EU-28, sum of 4 transport modes

	next 5 years between 2015 and 2020		next 10 years (2015-2025)		next 15 years (2015-2030)	
New recruitment	1599240	100%	3120456	100%	4619863	100%
Activity	381131	24%	663802	21%	908868	20%
Retired	951957	60%	1948656	62%	2982768	65%
Turnover	266153	17%	507998	16%	728226	16%

Table 72: Summary of employment and recruitment projections, road freight, EU-28, (total employment; annual recruitments)

	2010	2015	2020	2025	2030
Total employment	2,798,647	3,108,220	3,260,604	3,390,371	3,496,394
New recruitment	136,012	173,720	144,900	144,958	139,624
Activity		61,915	30,477	25,953	21,204
Retired	79,879	88,035	93,471	97,362	100,703
Turnover	28,070	23,770	20,952	21,642	17,716

Table 73: Cumulative recruitment needs (next 5, 10 and 15 years), EU-28, road freight transport

	between 2015 and 2020		next 10 years (2015-2025)		next 15 years (2015-2030)	
New recruitment	796548	100%	1521192	100%	2232647	100%
Activity	230978	29%	372054	24%	489949	22%
Retired	453765	57%	930849	61%	1426013	64%
Turnover	111804	14%	218288	14%	316685	14%

Table 74: Summary of employment and recruitment projections, rail transport, EU-28, (total employment; annual recruitments)

	2010	2015	2020	2025	2030
Total employment	912,745	900,381	900,650	924,672	957,894
New recruitment	7,823	32,468	33,889	37,835	38,821
Activity		-2,473	54	4,804	6,644
Retired	27,148	26,037	26,003	26,605	27,572
Turnover	12,107	8,903	7,832	6,426	4,604

Table 75: Cumulative recruitment needs (next 5, 10 and 15 years), EU-28, rail transport

	between 2015 and 2020		next 10 years (2015-2025)		next 15 years (2015-2030)	
New recruitment	165893		345204	100%	536844	100%
Activity	-6047		6098	2%	34720	6%
Retired	130101		261620	76%	397064	74%
Turnover	41840		77485	22%	105061	20%

Table 76: Summary of employment and recruitment projections, public transport, EU-28, (total employment; annual recruitments)

	2010	2015	2020	2025	2030
Total employment	1,913,200	1,991,895	2,060,347	2,110,001	2,145,163
New recruitment	71,014	87,796	84,515	79,904	78,252
Activity		15,739	13,690	9,931	7,032
Retired	55,266	57,123	59,275	60,903	62,007
Turnover	13,801	14,934	11,549	9,070	9,212

Table 77: Cumulative recruitment needs (next 5, 10 and 15 years), EU-28, public transport

	between 2015 and 2020		next 10 years (2015-2025)		next 15 years (2015-2030)	
New recruitment	430777	100%	841823	100%	1237211	100%
Activity	73573	17%	132626	16%	175034	14%
Retired	290995	68%	591440	70%	898715	73%
Turnover	66208	15%	117757	14%	163462	13%

Table 78: Summary of employment and recruitment projections, aviation, EU-28, (total employment; annual recruitments)

	2010	2015	2020	2025	2030
Total employment	430,701	514,407	595,953	655,203	708,235
New recruitment	17,287	39,604	42,805	39,681	40,689
Activity		16,741	16,309	11,850	10,607
Retired	12,402	14,244	16,594	18,466	20,026
Turnover	6,230	8,619	9,902	9,365	10,056

Table 79: Cumulative recruitment needs (next 5, 10 and 15 years), EU-28, aviation transport

	between 2015 and 2020		next 10 years (2015-2025)		next 15 years (2015-2030)	
New recruitment	206023	100%	412238	100%	613161	100%
Activity	82626	40%	153024	37%	209165	34%
Retired	77096	37%	164747	40%	260977	43%
Turnover	46301	22%	94467	23%	143019	23%

12 Summary and Conclusions

This study analyses the development of employment in various transport sectors from different viewpoints, and by means of a variety of analytical approaches. The study addresses both the supply side (i.e. the workforce capacity) and the demand side (i.e., the number of employees required in order to meet the future transport activity). In doing so it aims at identifying the gap between labour supply and demand and to provide some indications on the degree of change required in the labour force dynamics in order to close this gap. The analysis mainly focuses on the quantitative discrepancies between capacity and demand, but also addresses relevant qualitative aspects including the demographic composition of the workforce.

The approach followed consisted of three different layers of complementary research activities:

- Evidence on the *trends in the transport labour force* was collected as regards the number of employees, the age distribution and the skill profile in each mode and EU Member State. The analysis provides a description of the current situation and an insight into the trends that may affect the labour force in the future.
- *Modelling of the future evolution of the factors that affect labour supply and demand in transport.* Three different models were developed or adapted: a demographic model that allowed the analysis of the different age cohorts in order to estimate future labour turnover for each mode; a model based on the production function approach in order to correlate future levels of activity and investment with productivity growth and labour demand; an Input-Output model (FIDELIO) to analyse the link between productivity growth, labour demand and wages.
- A final layer that encompasses the findings from the evidence-based and model-based analysis: *a bottom-up model that translates the projections of future transport activity into employment levels and recruitment needs* per EU Member State and mode.

While it is difficult to generalise for transport as a single labour market sector, since each mode, sub-sector and EU Member State is characterised by different conditions, there are indeed some common characteristics – mainly as regards the mobile nature, the atypical working hours and the safety aspects – that allow the identification of certain trends for employment in transport for the EU as a whole. Many of the observed trends in changing working conditions in transport are the result of general economic trends and are comparable to the trends in other economic sectors. The impacts of the economic crisis, globalization, liberalization and technological progress affect labour markets and working conditions in transport in a similar way as they affect most other economic sectors.

There are three elements that mainly affect the projections:

- The *future transport activity*, which in this case is taken as exogenous input by the 2013 EU Reference scenario. It assumes a future growth in activity that is the baseline based on which transport policy at EU level is designed. The analysis of employment

issues in transport should therefore be based also on it. An additional source of uncertainty as regards the activity projections is that they are based on further model projections on the development of the main macro-economic and demographic variables (some of which also influence the results of the employment model discussed here).

- *Future productivity growth*, which affects how many employees are needed in order to perform the projected future transport activity. Productivity depends in turn on several elements (technological progress, investment, etc) and estimating how it will evolve in the future entails a lot of uncertainty. In each case, an attempt has been made to find the parameters that allow the best match with past data on employment but if the real productivity growth in the future is higher than expected, the projections would be overestimating total employment (and similarly, if the real future productivity growth results lower than estimated, the models will be underestimating future employment levels).
- *Retirement and overall turnover* depend on the age structure of the labour force (which can be projected to 2020-2030 with relative certainty), retirement rates (which is a source of uncertainty, but not as strong as the uncertainty of productivity growth) and the turnover not related to retirement (but depends instead on the attractiveness of the sector in terms of wages and other employment conditions).

Given that the future level of transport activity is *exogenous*, recruitment crucially depends on productivity growth and staff turnover. The ways these two variables evolve affect the resulting number of employees to be recruited annually, and which corresponds to the sum of staff that needs to be replaced plus new jobs that are the result of increased transport activity.

Transport policy measures at EU level, as described in the 2011 White Paper on Transport, are expected to *increase the efficiency* of the transport system as a whole and lead to *increase the attractiveness of transport jobs* within each MS (wages and working conditions), possibly alleviating (indirectly) the problem of skill shortages. There is no indication however of the current EU transport policy contributing in the convergence of wages and working conditions between MS. There may be scope for specific policy intervention in the transport labour markets in order to address potential discrepancies that are due to the specific nature of transport activities. This mainly concerns mobile workers, working time and education/ certification systems. Legislation on minimum requirements at EU level already exists on most relevant issues – both specifically for transport and as part of the general labour law and health and safety legislation – but worries have been expressed by stakeholders as regards the degree of compliance and implementation.

The model-based analysis suggests that *productivity in all modes of transport will continue to increase* in the future, in most EU Member States. This is a combination of past trends in technological progress, the expected impact of policy measures at EU level and the impact of the investments in transport infrastructure and equipment that will be necessary in order to meet the expected levels of transport demand. The results also reveal that productivity growth is a necessary condition in order to maintain or increase the number of jobs and the wages in all transport sectors. The productivity increase in transport would lead to a decrease of employment in transport for the same level of transport activity, but would lead to an increase of wages for the whole of the

economy and all skill levels. Model results show that a hypothetical 10% increase in productivity may lead to a 3% decrease in jobs in surface transport, 5% decrease in air transport, but also to a marginal increase in sea transport jobs. It is important however to note that this increase in productivity may also lead to increases in average wages (9% on average) due to the shift to higher skill jobs. The increased level of transport activity compensates the difference in labour demand and, in the case of the expected transport demand in the EU Reference Scenario, leads to modestly higher total employment levels. As in any sector of economic activity, the net impact from the direct and indirect implications of productivity growth for employment is expected to be positive (more and better employment in total, with job losses in some parts of the transport sector being covered by increases in other transport sectors and the rest of the economy).

The future transport activity foreseen in the EU Reference Scenario in combination with the trends in productivity that this study has estimated would lead to an increase in total employment in transport by 20.6% between 2010 and 2030 and the addition of 1.25 million new jobs. Most of the growth in the number of jobs would come from road freight, while aviation would be the mode with the highest relative increase (60%).

Table 80: Employment in transport, million jobs in full time equivalent, EU-28 (data for 1990 to 2010, model projections for 2015-2030)

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Road freight	1.92	2.15	2.50	2.66	2.80	3.11	3.26	3.39	3.50
Public transport	2.29	2.00	1.96	1.90	1.91	1.99	2.06	2.11	2.15
Rail	2.07	1.68	1.35	1.07	0.91	0.90	0.90	0.92	0.96
Aviation	0.42	0.43	0.46	0.44	0.43	0.51	0.60	0.66	0.71
Sum of 4 modes	6.69	6.26	6.27	6.07	6.06	6.51	6.82	7.08	7.31

However, total employment is only one part of the issue. *Ageing* is another aspect affecting the whole labour force. Average age in transport occupations follows the overall trend, with a more marked increase in those transport occupations with an already higher average age (notably railway workers, vehicle drivers and ship and aircraft pilots and associated technicians). The importance this situation could have depends on the real age at which transport workers leave the transport workforce because of retirement or shifts to other sectors. The model projections suggest that about 250 thousand employees will be leaving the transport labour force annually and would need to be replaced. Two thirds of them (160 thousand) will probably correspond to mobile jobs, which tend to have lower average retirement ages and high turnover rates. Half of the jobs that need to be replaced would be in road freight transport (120 thousand a year, two thirds of which would be mobile jobs).

While in theory the retirement of older employees in transport will allow their substitution with younger, higher-skilled employees, the falling attractiveness of jobs in transport may be an obstacle in attracting sufficient employees with the appropriate skills. Although many transport jobs were considered as very attractive in the past,

there is a clear trend in the past 10 years that suggests that they are becoming less appealing. This is especially true for mobile jobs especially in long-distance transport, where the slow growth in wages combined with the working conditions that are becoming less compatible with modern lifestyles, result in transport jobs losing their appeal. There are big differences as regards attractiveness of jobs among the various modes and the EU Member States. Transport jobs are less attractive on average in the EU than other professions, only job-security seemed to make up for this handicap in the past. There are exceptions in countries with specific labour market structures (Italy, Ireland, Greece, Bulgaria) where transport professions earn higher wages than the average of the economy. At the same time, for big economies like Germany, France and the UK, transport jobs are not attractive within their economy. Combined with the high unemployment rates and lower wage levels of transport jobs in peripheral EU Member States, the imbalance of the attractiveness of transport jobs across the EU may cause a pressure for migration.

The modelled trends in the future imply that although some convergence between EU Member States is expected as regards working conditions and wages, the differences between the high and low wage countries will remain important in the next 10-15 years. Nevertheless, the differences in wage levels in transport are proportional to the differences in wages for the whole of the economy (with the above-mentioned exceptions). This means that, in general, the transport sector is expected to be affected by migration in a similar way with the rest of the economy. The models, however, cannot capture the effects of posted and international transport workers not considered as migrants.

Taking into account retirement and general turnover in transport, the future recruitment needs may raise important challenges. On average, 300 thousand employees need to be hired annually in transport services, to replace retired and exiting staff or to meet increased demand. Most of these vacancies, 200 thousand annually on average, would consist of mobile jobs.

Each market segment in each Member State will follow a specific trajectory as regards productivity growth and retirement/staff turnover patters, within a general context of mode specific and demographic development. A distinction is made, for each transport mode, between *three occupational groups*, each reacting in a different way depending on the *mode characteristics*, the *age profile*, *the average retirement age* and the sector *attractiveness*. Mobile jobs present the highest turnover in both absolute terms and relative terms. This is due to the combination of the lower average retirement age of mobile staff in almost all transport modes and the high turnover of certain jobs in road freight transport (mainly long distance vehicle drivers).

Table 81: Estimates of annual recruitment levels by mode, EU-28, full time equivalent jobs

	2010	2015	2020	2025	2030
Road freight	136,012	173,720	144,900	144,958	139,624
Public transport	71,014	87,796	84,515	79,904	78,252
Rail	7,823	32,468	33,889	37,835	38,821
Aviation	17,287	39,604	42,805	39,681	40,689
Total	232,135	333,587	306,109	302,378	297,385

Table 82: Estimates of annual recruitment levels by occupational group, EU-28, sum of four main modes, full time equivalent jobs

	2010	2015	2020	2025	2030
Mobile	156,204	217,928	198,420	196,432	195,088
Technical	28,612	55,565	55,402	57,408	58,360
Administrative	47,319	60,094	52,287	48,538	43,937
Total	232,135	333,587	306,109	302,378	297,385

Although labour force polarization (i.e. the creation of jobs requiring either very high or only low skills) is a major issue for the economy as a whole, transport seems to be an exception. In most transport modes, the demand for high and medium skill level employment in transport is expected to grow faster than demand for low skill level employment. The job content of low and medium skill work is also probably going to change upwards. Nevertheless, the model results suggest a mismatch, confirmed by the results of the stakeholder consultations. Many respondents suggest that staff shortages and redundancies are expected at the same time by the same firms, although the net effect favours the former in particular towards 2025. Shortages correspond mainly for high skill jobs (where transport jobs are not competitive to jobs requiring a similar skill level in other sectors of the economy), while redundancies are mainly concentrated in lower skill jobs (where the impact of technological change is higher and the labour pool is wider). Mismatches are also visible in the projections at occupational group level: a higher demand for mobile and technical staff is expected, while demand for administrative (low and medium skill level) staff is probably going to decrease.

The educational background varies widely between the different occupations in transport, with ship and aircraft pilots and associated technicians showing a higher share of upper studies. There is a growing relevance of specialised training and education as well as medium level studies over the majority of mid- and low skilled occupations in the sector, precisely in the educational area where there is a lesser degree of harmonization across the EU.

The analysis of the past trends and the extrapolation to the future using the models suggest that the issue of skills shortage has been present for the last at least 5 years but its impact has been hidden by the economic crisis and the overall reduction in

employment. It is expected that when economic activity and transport demand recover to pre-crisis levels the shortages will be more evident. Several segments of the transport markets already report that staff shortages are (or will soon be) a problem.

The main conclusions of the study can be summarized as follows:

- The current projections for future transport activity and productivity growth would correspond to a net increase in employment in all transport modes for the EU as a whole, taking into account the current trends in economic development and their projections for the future.
- According to the model projections, over the next 5 years 1.6 million workers will be recruited by the transport sector (waterborne excluded due to lack of data), of those some 950 000 to replace retiring workers (60%) but also some 266 000 (17%) to replace workers leaving the sector looking for jobs elsewhere, finally growth in activity will generate some 380 000 additional jobs (24% of total recruitment). From 2015 to 2025, 30% of the current transport workers will have retired which will rise to 46% by 2030.
- Meeting future transport demand needs entails an increase in capital investment and, as a result, productivity growth across all modes. Increased productivity may mean that fewer employees would be needed for the same level of activity, but would also attract higher activity levels that in turn would generate employment.
- Wages also depend on productivity growth. Although increased competition and fluctuations in economic activity can create downward pressures, increased productivity levels allow employees in transport to maintain or increase their income.
- Most transport professions, especially the mobile ones, are losing attractiveness compared to other sectors of economic activity. The wage premium for mobile transport jobs may be no longer sufficient (or does not exist anymore) to compensate for the specific working conditions in transport (especially longer working hours and the requirement to spend periods away from home). It may be more difficult in the future to recruit suitable candidates.
- There is a large disparity across the EU as regards the factors that influence job attractiveness of transport jobs, the acceptability of wages and working conditions being among the most important. These differences may stimulate migration of mobile transport employees within the EU and at global level, but may also give room for illegal practices that violate workers' rights.
- Ageing of the workforce is a main challenge that affects both the number of employees that need to be hired in order to replace retired staff and the average age of the workforce which will continue to rise.
- The analysis suggests that demand will grow at different rates among both occupational groups and skill levels. Mobile and technical staff on one hand, and high and medium skills on the other are expected to show higher demand than administrative and low skills respectively. In some cases this could result in mismatches between demand and supply for specific occupation and skill combinations in certain market segments with specialised job content and long education and training duration. But the main challenge would be the adaptation of existing staff with a specialisation that is not needed to the new requirements.

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Annex A: Methodological notes on statistical analysis of Labour Force Survey data

Data used for the estimations presented in this chapter correspond to the Labour Force Survey (EU-LFS), a quarterly, large sample survey providing results for the population in private households in the EU, EFTA and Candidate Countries (except Liechtenstein). EU-LFS is carried out by the reporting countries as a continuous quarterly survey.

All age groups are represented for all EU-27 participating countries. The average quarterly sample in 2011 in all participating countries was 1.835 million individuals (EU-27: 1.625 million), of which 1.421 million were in the age group 15-74 years (EU-27: 1.257 million). Therefore, the achieved sample in the EU-LFS is thus approximately 0.29 % of the total population. Sample design might vary significantly among the reporting countries, although most surveys are conducted following a multistaged stratified random sample design. Additionally, rotating schemes do not present a homogenous number of panels (waves) across the different national surveys. Regarding comparability over time, no breaks relevant to the study at hand took place during the period of reference (2000-2010).

Due to the anonymisation process applied to the micro-data in order to prevent identification of statistical reporting units (households), some variables are aggregated in the database. In our case, respondent's age was identified as an age band rather than the actual age and we have therefore reported many of results using histograms.

Estimation of standard errors and confidence intervals, presented here, have been calculated using a conservative approach as only reported stratification has been considered (territorial breakdowns). Other possible sample design features, particularly multistage design, have been ignored as they are not reported in detail in the EU-LFS. The following tables present the standard errors and confidence intervals for the relevant estimates:

Year	Mean	Std. Err.	[95% confidence interval]	
2000	0.6613	0.0207	0.6193	0.7005
2001	0.7427	0.0165	0.7088	0.7735
2002	0.5888	0.0192	0.5505	0.6258
2003	0.5806	0.0190	0.5428	0.6173
2004	0.6333	0.0190	0.5951	0.6696
2005	0.7378	0.0108	0.7159	0.7583
2006	0.8155	0.0204	0.7713	0.8517
2007	0.8547	0.0154	0.8211	0.8816
2008	0.7060	0.0246	0.6552	0.7516
2009	0.8677	0.0132	0.8391	0.8911
2010	0.8792	0.0122	0.8524	0.9006

Table 83: Standard errors and confidence intervals of the estimation of share of Ship and Aircraft Controllers and Technicians and Ship Crews working atypical hours in EU-27.

Year	Mean	Std. Err.	[95% confidence interval]	
2000	0.5835	0.0166	0.5505	0.6156
2001	0.6787	0.0151	0.6482	0.7074
2002	0.5989	0.0157	0.5678	0.6291
2003	0.5651	0.0179	0.5297	0.5997
2004	0.6487	0.0168	0.6150	0.6807
2005	0.6460	0.0130	0.6200	0.6709
2006	0.8015	0.0158	0.7685	0.8303
2007	0.8209	0.0158	0.7876	0.8495
2008	0.6515	0.0210	0.6092	0.6914
2009	0.8382	0.0150	0.8060	0.8650
2010	0.8218	0.0140	0.7918	0.8468

Table 84: Standard errors and confidence intervals of the estimation of share of Travel Attendants working atypical hours in EU-27.

Year	Mean	Std. Err.	[95% confidence interval]	
2000	0.6354	0.0147	0.6061	0.6635
2001	0.7230	0.0137	0.6952	0.7490
2002	0.5894	0.0140	0.5617	0.6165
2003	0.5948	0.0154	0.5642	0.6246
2004	0.6255	0.0156	0.5945	0.6555
2005	0.8073	0.0080	0.7912	0.8224
2006	0.8577	0.0129	0.8301	0.8809
2007	0.8598	0.0124	0.8332	0.8820
2008	0.7388	0.0184	0.7008	0.7728
2009	0.8494	0.0138	0.8193	0.8738
2010	0.8856	0.0141	0.8546	0.9101

Table 85: Standard errors and confidence intervals of the estimation of share of Railway Workers working atypical hours in EU-27.

Year	Mean	Std. Err.	[95% confidence interval]	
2000	0.4927	0.0044	0.4841	0.5012
2001	0.5943	0.0042	0.5861	0.6024
2002	0.4435	0.0039	0.4359	0.4512
2003	0.4412	0.0043	0.4328	0.4496
2004	0.4965	0.0044	0.4879	0.5051
2005	0.5373	0.0029	0.5316	0.5430
2006	0.6281	0.0048	0.6186	0.6375
2007	0.6199	0.0048	0.6103	0.6292
2008	0.5205	0.0053	0.5102	0.5308
2009	0.6190	0.0049	0.6093	0.6284
2010	0.6323	0.0050	0.6224	0.6420

Table 86: Standard errors and confidence intervals of the estimation of share of Vehicle Drivers working atypical hours in EU-27.

Year	Mean	Std. Err.	[95% confidence interval]	
2000	0.2918	0.0080	0.2762	0.3077
2001	0.4459	0.0076	0.4310	0.4609
2002	0.3355	0.0069	0.3222	0.3491
2003	0.3248	0.0075	0.3101	0.3397
2004	0.3991	0.0079	0.3838	0.4146
2005	0.3844	0.0056	0.3734	0.3955
2006	0.4641	0.0093	0.4459	0.4823
2007	0.4747	0.0089	0.4571	0.4921
2008	0.3619	0.0091	0.3442	0.3798
2009	0.4679	0.0096	0.4490	0.4867
2010	0.4625	0.0097	0.4435	0.4814

Table 87: Standard errors and confidence intervals of the estimation of share of Freight Handlers working atypical hours in EU-27.

Year	Mean	Std. Err.	[95% confidence interval]	
2000	0.3968	0.0224	0.3538	0.4414
2001	0.3842	0.0207	0.3445	0.4254
2002	0.3260	0.0184	0.2909	0.3631
2003	0.3467	0.0191	0.3103	0.3850
2004	0.3756	0.0212	0.3351	0.4179
2005	0.3204	0.0146	0.2925	0.3497
2006	0.3306	0.0241	0.2851	0.3794
2007	0.3125	0.0238	0.2678	0.3609
2008	0.2917	0.0240	0.2469	0.3410
2009	0.3391	0.0242	0.2934	0.3879
2010	0.3672	0.0262	0.3176	0.4199

Table 88: Standard errors and confidence intervals of the estimation of share of Ship and Aircraft Controllers and Technicians and Ship Crews working more than 40 weekly hours in EU-27.

Year	Mean	Std. Err.	[95% confidence interval]	
2000	0.1910	0.0134	0.1662	0.2186
2001	0.1598	0.0126	0.1366	0.1860
2002	0.1567	0.0060	0.1452	0.1686
2003	0.1740	0.0134	0.1494	0.2018
2004	0.1717	0.0148	0.1446	0.2027
2005	0.1519	0.0111	0.1315	0.1750
2006	0.1723	0.0161	0.1429	0.2062
2007	0.1363	0.0140	0.1112	0.1662
2008	0.1600	0.0151	0.1325	0.1919
2009	0.1537	0.0160	0.1249	0.1878
2010	0.1505	0.0169	0.1202	0.1867

Table 89: Standard errors and confidence intervals of the estimation of share of Travel Attendants working more than 40 weekly hours in EU-27.

Year	Mean	Std. Err.	[95% confidence interval]	
2000	0.1974	0.0127	0.1736	0.2236
2001	0.1669	0.0127	0.1434	0.1932
2002	0.1264	0.0100	0.1080	0.1474
2003	0.1196	0.0106	0.1003	0.1420
2004	0.1286	0.0114	0.1079	0.1525
2005	0.1363	0.0097	0.1184	0.1564
2006	0.1391	0.0154	0.1116	0.1720
2007	0.1491	0.0179	0.1173	0.1877
2008	0.1232	0.0139	0.0984	0.1533
2009	0.1598	0.0185	0.1268	0.1996
2010	0.1481	0.0194	0.1139	0.1903

Table 90: Standard errors and confidence intervals of the estimation of share of Railway Workers working more than 40 weekly hours in EU-27.

Year	Mean	Std. Err.	[95% confidence interval]	
2000	0.4151	0.0043	0.4066	0.4236
2001	0.3851	0.0043	0.3767	0.3936
2002	0.3608	0.0038	0.3534	0.3683
2003	0.3590	0.0042	0.3509	0.3672
2004	0.3687	0.0043	0.3602	0.3772
2005	0.3731	0.0030	0.3672	0.3790
2006	0.3704	0.0051	0.3604	0.3804
2007	0.3676	0.0051	0.3577	0.3776
2008	0.3647	0.0052	0.3547	0.3749
2009	0.3450	0.0052	0.3349	0.3552
2010	0.3502	0.0054	0.3397	0.3608

Table 91: Standard errors and confidence intervals of the estimation of share of Vehicle Drivers working more than 40 weekly hours in EU-27.

Year	Mean	Std. Err.	[95% confidence interval]	
2000	0.1362	0.0056	0.1256	0.1475
2001	0.1934	0.0062	0.1816	0.2058
2002	0.1697	0.0055	0.1592	0.1808
2003	0.1539	0.0058	0.1428	0.1656
2004	0.1715	0.0061	0.1599	0.1838
2005	0.1677	0.0049	0.1583	0.1776
2006	0.1650	0.0068	0.1522	0.1788
2007	0.1656	0.0065	0.1533	0.1786
2008	0.1544	0.0066	0.1419	0.1679
2009	0.1430	0.0069	0.1300	0.1570
2010	0.1314	0.0066	0.1191	0.1448

Table 92: Standard errors and confidence intervals of the estimation of share of Freight Handlers working more than 40 weekly hours in EU-27.

Year	Mean	Std. Err.	[95% confidence interval]	
2000	0.0322	0.0063	0.0222	0.0478
2001	0.0319	0.0066	0.0215	0.0480
2002	0.0285	0.0069	0.0175	0.0453
2003	0.0302	0.0061	0.0209	0.0459
2004	0.0266	0.0072	0.0151	0.0442
2005	0.0301	0.0038	0.0236	0.0388
2006	0.0282	0.0068	0.0173	0.0447
2007	0.0316	0.0078	0.0196	0.0512
2008	0.0310	0.0095	0.0170	0.0565
2009	0.0278	0.0082	0.0153	0.0486
2010	0.0262	0.0046	0.0189	0.0377

Table 93: Standard error and confidence intervals for estimation of share of Ship and Aircraft Controllers and Technicians and Ship Crews looking for another job in EU-27.

Year	Mean	Std. Err.	[95% confidence interval]	
2000	0.0618	0.0081	0.0478	0.0799
2001	0.0544	0.0077	0.0411	0.0715
2002	0.0529	0.0071	0.0411	0.0694
2003	0.0541	0.0092	0.0385	0.0750
2004	0.0549	0.0102	0.0377	0.0781
2005	0.0499	0.0068	0.0381	0.0652
2006	0.0474	0.0088	0.0331	0.0685
2007	0.0586	0.0083	0.0446	0.0775
2008	0.0563	0.0104	0.0387	0.0799
2009	0.0528	0.0084	0.0392	0.0728
2010	0.0414	0.0079	0.0281	0.0598

Table 94: Standard error and confidence intervals for estimation of share of Travel Attendants looking for another job in EU-27.

Year	Mean	Std. Err.	[95% confidence interval]	
2000	0.0210	0.0058	0.0116	0.0351
2001	0.0192	0.0055	0.0102	0.0324
2002	0.0185	0.0060	0.0091	0.0336
2003	0.0150	0.0058	0.0060	0.0298
2004	0.0133	0.0027	0.0092	0.0202
2005	0.0098	0.0026	0.0057	0.0161
2006	0.0107	0.0024	0.0073	0.0172
2007	0.0098	0.0041	0.0038	0.0205
2008	0.0094	0.0021	0.0063	0.0154
2009	0.0070	0.0023	0.0039	0.0136
2010	0.0067	0.0021	0.0037	0.0127

Table 95: Standard error and confidence intervals for estimation of share of Railway workers looking for another job in EU-27.

Year	Mean	Std. Err.	[95% confidence interval]	
2000	0.0473	0.0043	0.0395	0.0563
2001	0.0456	0.0033	0.0395	0.0525
2002	0.0416	0.0032	0.0357	0.0482
2003	0.0402	0.0029	0.0348	0.0463
2004	0.0396	0.0030	0.0341	0.0457
2005	0.0415	0.0025	0.0369	0.0466
2006	0.0434	0.0026	0.0386	0.0489
2007	0.0432	0.0025	0.0387	0.0484
2008	0.0418	0.0025	0.0372	0.0470
2009	0.0412	0.0023	0.0370	0.0460
2010	0.0420	0.0026	0.0372	0.0475

Table 96: Standard error and confidence intervals for estimation of share of Vehicle Drivers looking for another job in EU-27.

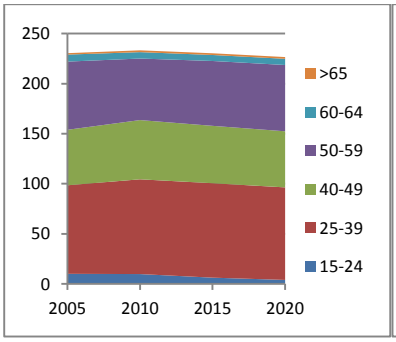
Year	Mean	Std. Err.	[95% confidence interval]	
2000	0.0929	0.0068	0.0803	0.1071
2001	0.0878	0.0059	0.0768	0.1001
2002	0.0795	0.0056	0.0691	0.0912
2003	0.0761	0.0055	0.0660	0.0878
2004	0.0740	0.0057	0.0635	0.0860
2005	0.0849	0.0047	0.0761	0.0947
2006	0.0900	0.0067	0.0776	0.1039
2007	0.0947	0.0060	0.0836	0.1071
2008	0.0905	0.0062	0.0792	0.1035
2009	0.0898	0.0067	0.0776	0.1038
2010	0.0920	0.0064	0.0803	0.1054

Table 97: Standard error and confidence intervals for estimation of share of Freight Handlers looking for another job in EU-27.

Annex B: Projections of workforce composition by EU Member State, '000 jobs

Land transport

CZ



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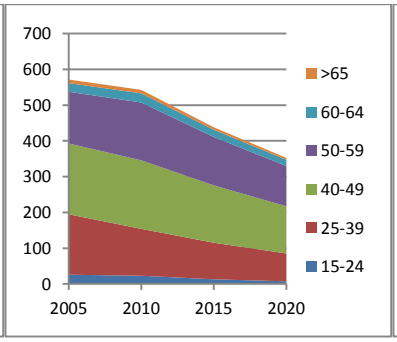

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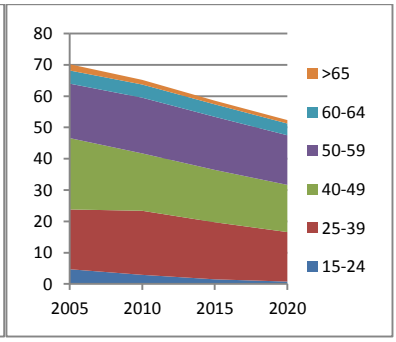

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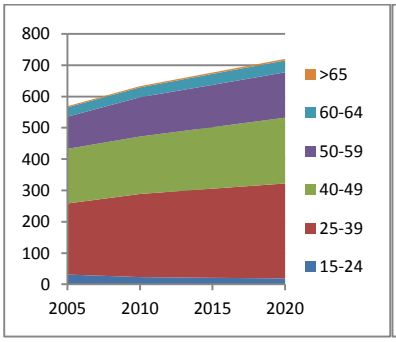

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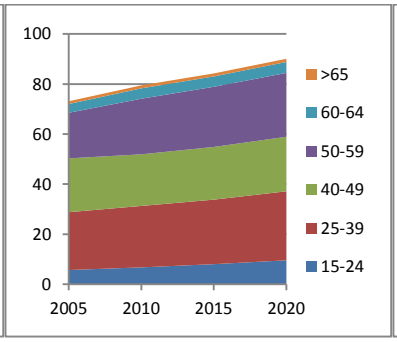

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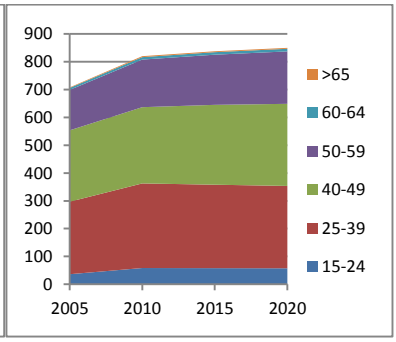

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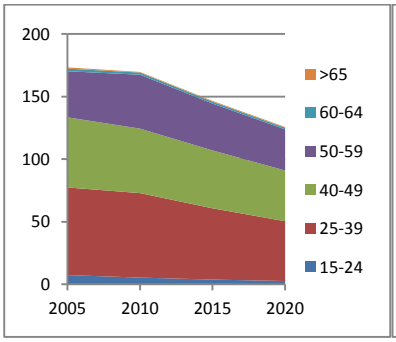

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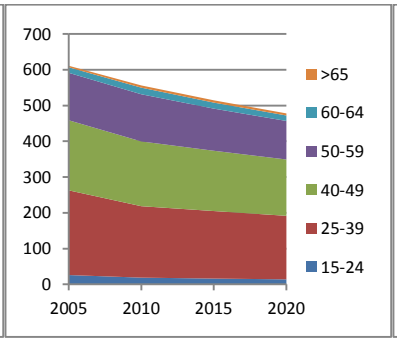

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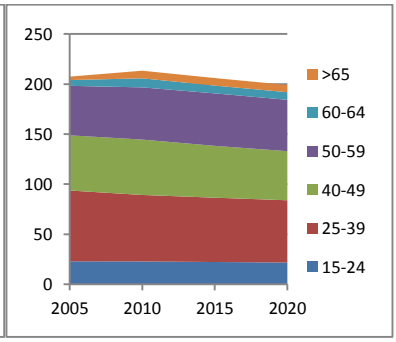

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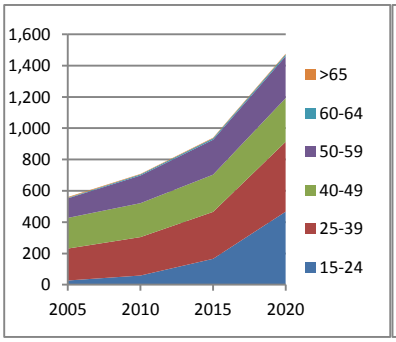

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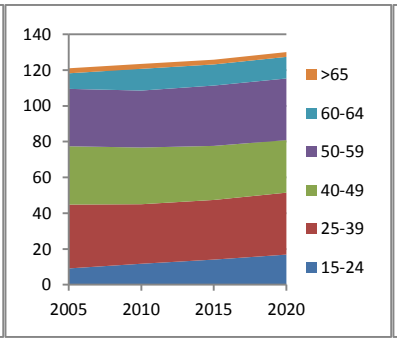

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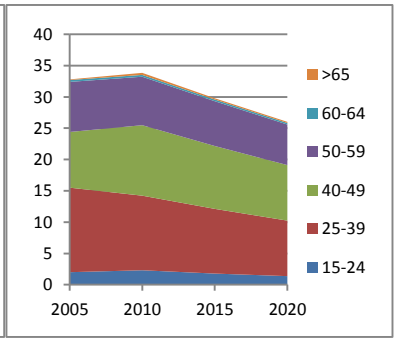

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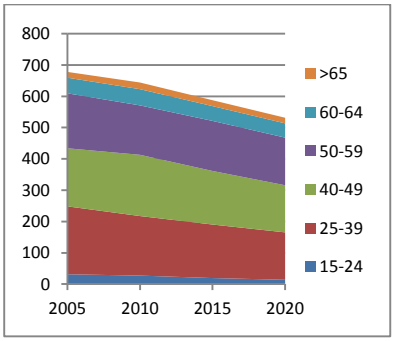
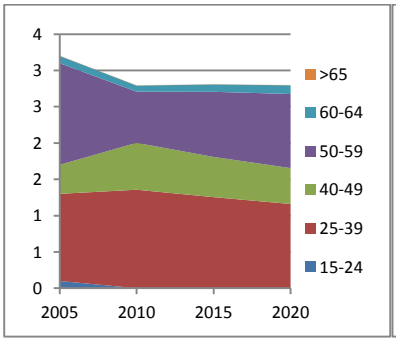


Water transport

CZ



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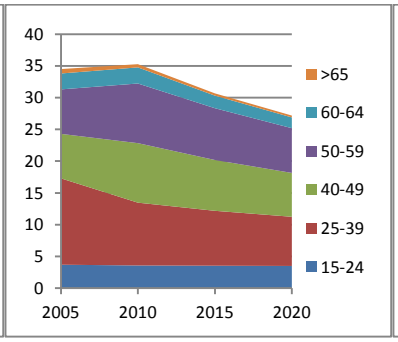

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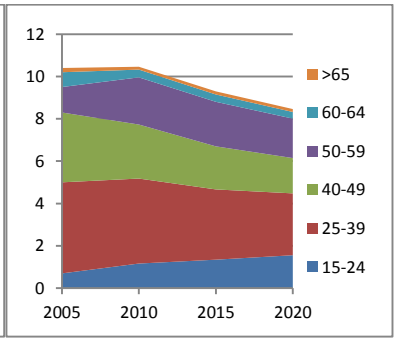

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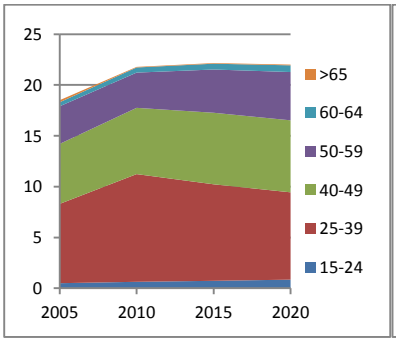

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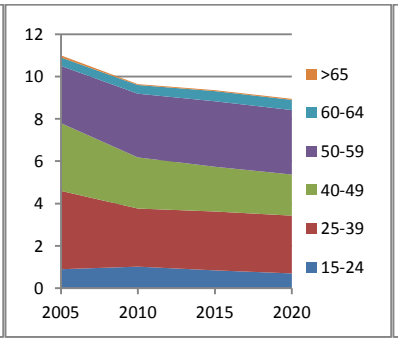

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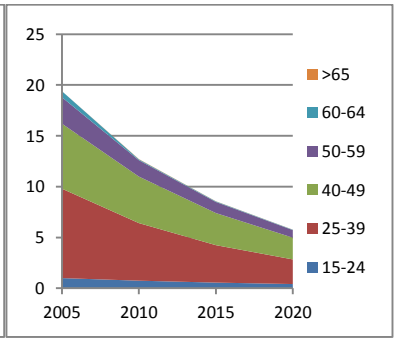

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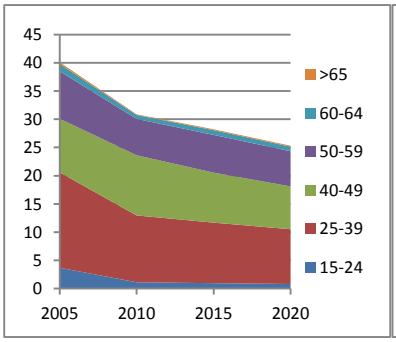

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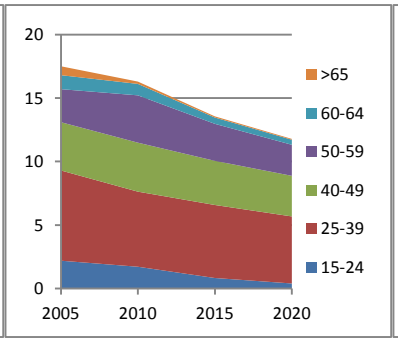

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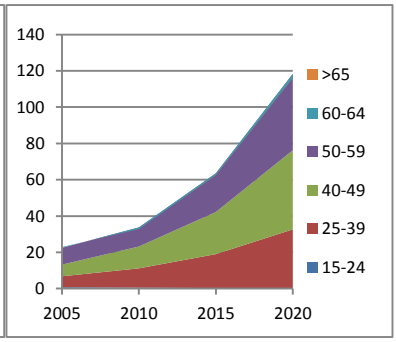

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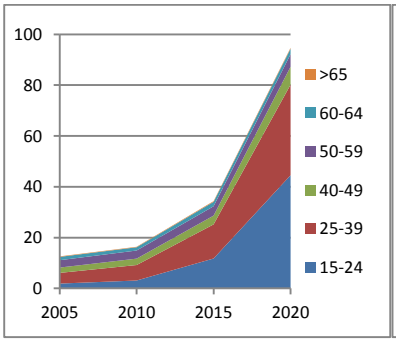

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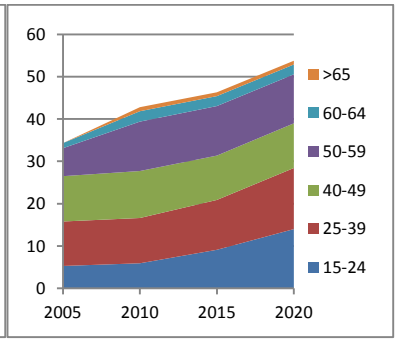

Aviation

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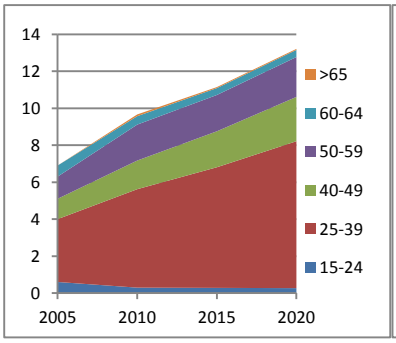

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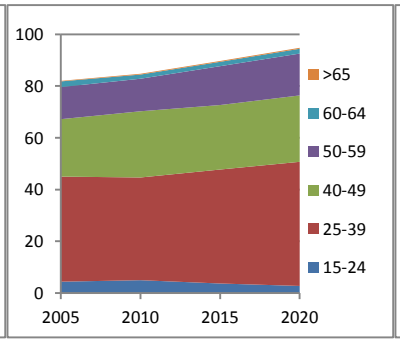

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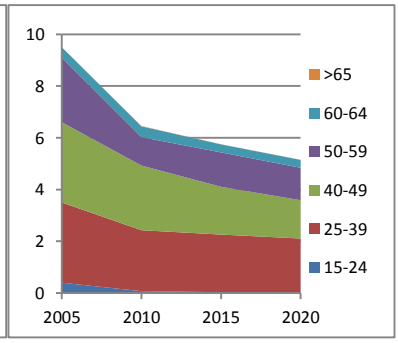

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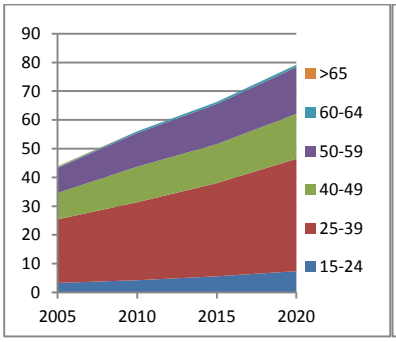

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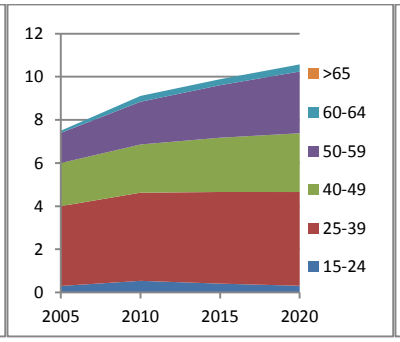

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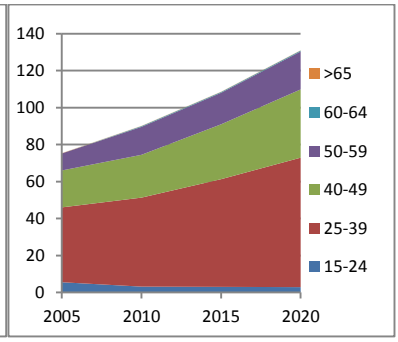

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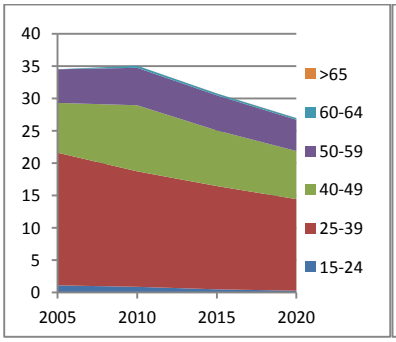

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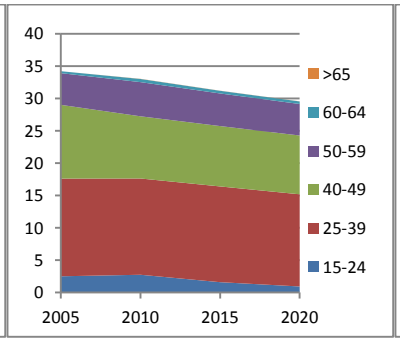

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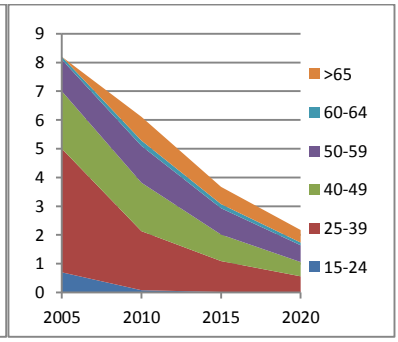

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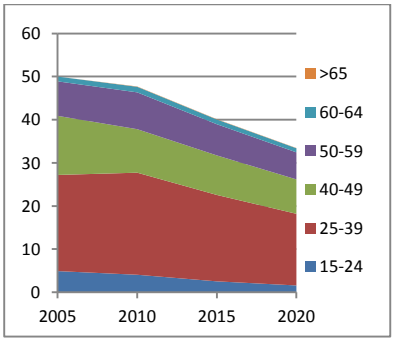

Auxiliary Transport

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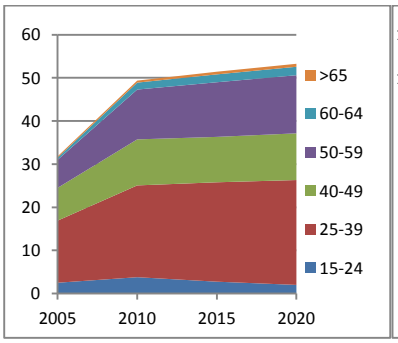

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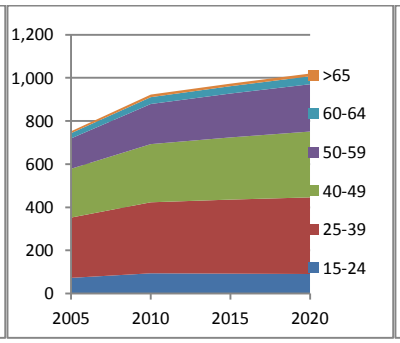

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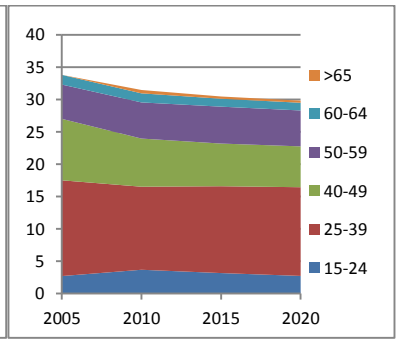

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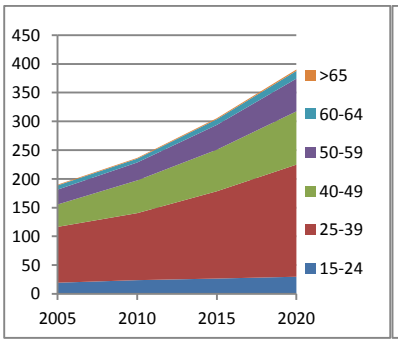

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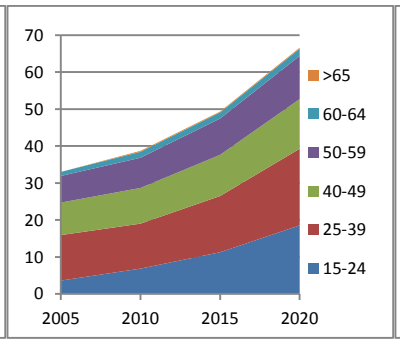

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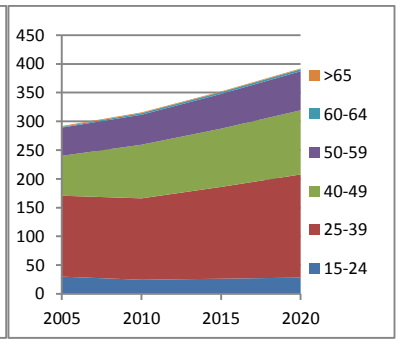

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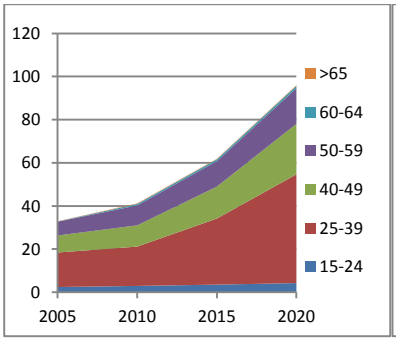
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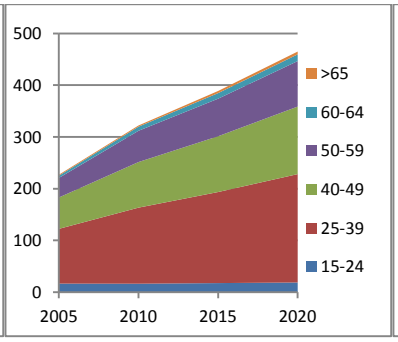
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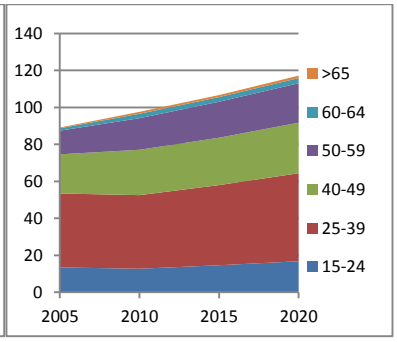
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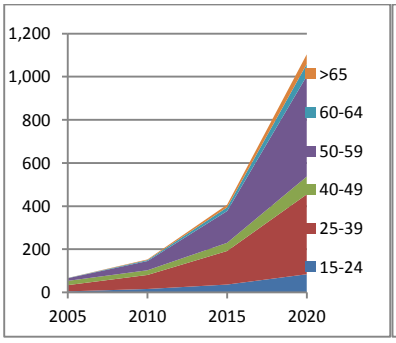
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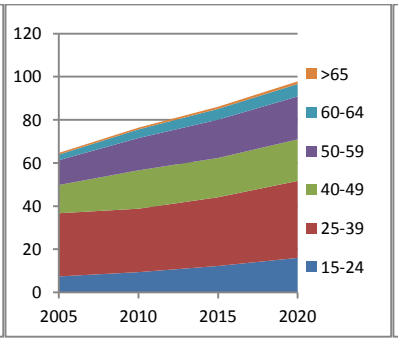
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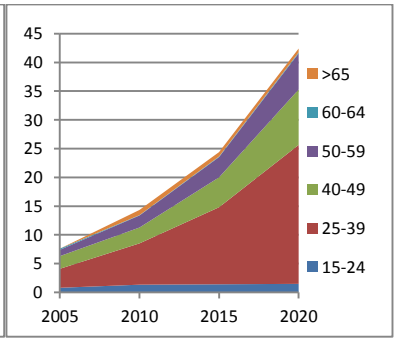
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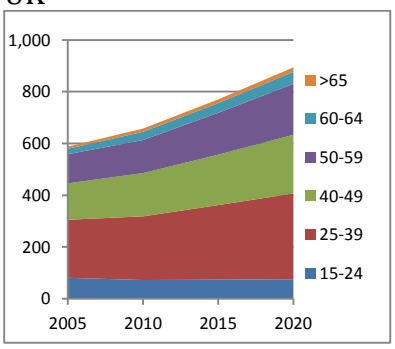
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Annex C: Gender composition by transport mode

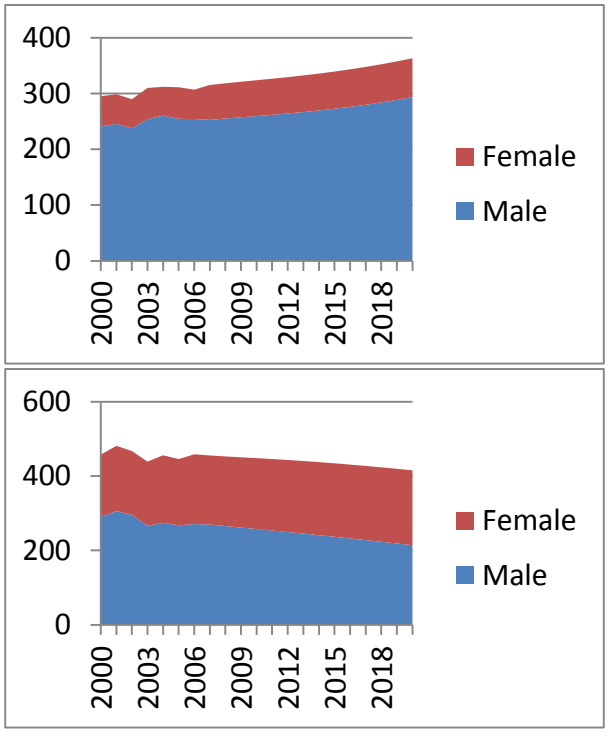


Figure 47 shows the share of male and female employees in the different transport sectors between 2000 and 2020. The share of female employees in the labour force is much lower than the share of males in all sectors, in particular in the land and water transport sectors (13 and 20 per cent, respectively). With a share of 37 per cent the aviation sector has the highest share of female employees. This share actually increases to almost 50 per cent in 2020. In the other sectors the shares are virtually constant over time.

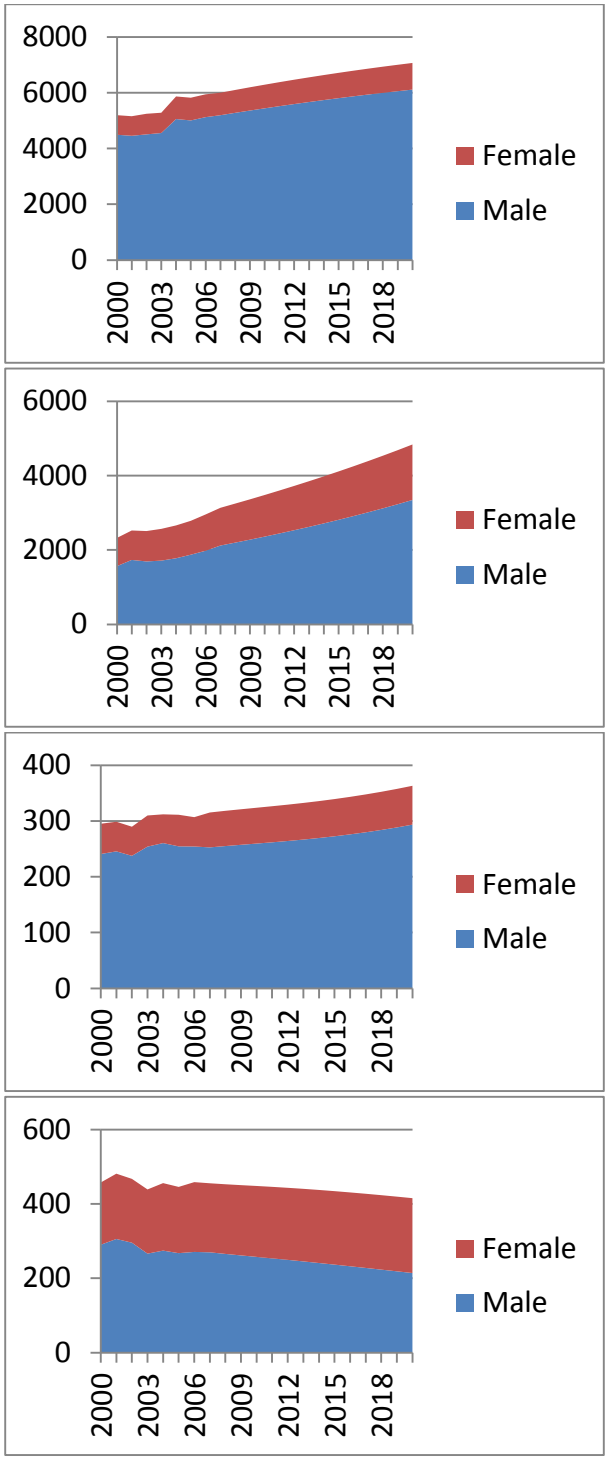


Figure 47: Composition of employment in transport sectors by gender in EU27, '000 jobs

Annex D: Input data for the production function estimation

The table below shows data on gross value added, capital stock and labour for the selection of 13 Member States collected from EUROSTAT input-output tables. The data points actually used for the estimation of the production function are in grey.

MS	Mode	Variable	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
CZ	Air	GVA	150	182	176	240	205	213	257	304	288	274	290	331	362
CZ	Air	Capital	3967	4187	4167	4112	4326	4460	5014	4928	4892	5124	5393	5636	6240
CZ	Air	Labour	3	3	3	4	4	4	4	4	4	6	5	6	6
CZ	Aux	GVA	1020	1023	1013	1004	1216	1248	1269	1521	1460	1740	1880	2063	2539
CZ	Aux	Capital	588	594	628	671	687	715	779	783	823	915	954	884	972
CZ	Aux	Labour	28	29	29	29	33	33	39	38	34	41	41	41	54
CZ	Land	GVA	2731	2784	2832	2951	2960	3309	3810	3826	3855	3895	4482	4686	4591
CZ	Land	Capital	3877	4957	6114	6760	7889	9003	9654	9353	9001	9348	9642	9785	9979
CZ	Land	Labour	237	243	235	245	233	237	236	233	233	221	224	227	212
CZ	Water	GVA	41	23	23	24	21	15	10	10	9	10	9	11	10
CZ	Water	Capital	398	417	431	465	499	546	647	667	771	888	1021	1118	1254
CZ	Water	Labour	4	2	2	2	2	1	1	1	1	1	1	1	1
DE	Air	GVA	-	8411	8597	8924	7316	5951	5430	5207	5708	5780	5806	5937	-
DE	Air	Capital	-	-	-	-	21374	22327	21866	21380	20479	19800	19902	20384	-
DE	Air	Labour	-	-	-	-	52	53	52	54	55	57	60	64	-
DE	Aux	GVA	-	21256	22464	23524	27835	28810	30860	31919	33394	34460	36493	37378	-
DE	Aux	Capital	-	-	-	-	228907	231201	232474	233641	235923	243030	247525	256859	-
DE	Aux	Labour	-	-	-	-	577	586	585	598	609	616	629	647	-
DE	Land	GVA	-	31789	31613	33557	31255	32795	31866	30674	28889	29140	30589	31153	-
DE	Land	Capital	-	-	-	-	122511	124049	123774	122573	120663	119060	116336	113122	-
DE	Land	Labour	-	-	-	-	947	946	938	924	920	905	913	935	-
DE	Water	GVA	-	3100	3138	3260	4751	5494	4612	4471	5729	6770	5363	6484	-
DE	Water	Capital	-	-	-	-	34794	36567	36803	36691	37594	38890	40982	46840	-
DE	Water	Labour	-	-	-	-	23	22	22	21	22	24	25	25	-
DK	Air	GVA	688	662	665	660	666	720	715	706	490	224	507	586	-
DK	Air	Capital	-	-	-	-	2155	1978	2508	3418	3268	2628	2660	2865	-
DK	Air	Labour	-	-	-	-	10	11	11	11	9	6	7	7	-
DK	Aux	GVA	1834	1726	1869	2207	2628	2617	2559	2681	2765	2621	2758	3156	-
DK	Aux	Capital	-	-	-	-	11682	12438	12453	12516	13097	13524	13763	14467	-
DK	Aux	Labour	-	-	-	-	32	32	32	31	32	34	34	36	-
DK	Land	GVA	3899	3904	3875	3981	4015	4176	4311	4222	4329	4198	4385	4458	-
DK	Land	Capital	-	-	-	-	12631	13584	13765	14064	14638	15167	15202	15518	-
DK	Land	Labour	-	-	-	-	73	74	74	74	74	74	75	78	-
DK	Water	GVA	1835	2318	1759	1710	2437	2277	2105	2274	3168	3950	2264	2418	-
DK	Water	Capital	-	-	-	-	11338	12736	13261	13059	14032	14379	14583	15368	-
DK	Water	Labour	-	-	-	-	16	15	15	14	14	15	16	18	-
ES	Air	GVA	2936	3124	3270	3486	2703	2832	2990	3097	3206	2974	3076	3171	-
ES	Air	Capital	-	-	-	-	-	-	-	-	-	-	-	-	-
ES	Air	Labour	-	-	-	-	-	-	-	-	-	-	-	-	-
ES	Aux	GVA	7154	7623	8131	8719	11080	12165	12822	13302	14008	14001	14512	15424	-
ES	Aux	Capital	-	-	-	-	-	-	-	-	-	-	-	-	-
ES	Aux	Labour	-	-	-	-	-	-	-	-	-	-	-	-	-
ES	Land	GVA	19974	20622	21953	22653	17775	19308	19087	19655	19939	19260	20245	20959	-
ES	Land	Capital	-	-	-	-	-	-	-	-	-	-	-	-	-
ES	Land	Labour	-	-	-	-	-	-	-	-	-	-	-	-	-
ES	Water	GVA	970	1009	1077	1147	865	817	852	872	909	981	988	1097	-
ES	Water	Capital	-	-	-	-	-	-	-	-	-	-	-	-	-
ES	Water	Labour	-	-	-	-	-	-	-	-	-	-	-	-	-
FI	Air	GVA	603	660	727	714	687	679	703	640	720	742	703	796	-
FI	Air	Capital	-	-	-	-	1317	1381	1280	1158	1137	1228	1357	1465	-
FI	Air	Labour	5	6	6	6	61	59	56	6	5	5	5	5	-
FI	Aux	GVA	2502	2664	2736	2805	2917	3048	2944	2956	3130	3240	3114	3314	-

FI	Aux	Capital	-	-	-	-	29800	29978	30045	30581	32001	33526	35196	36682	-
FI	Aux	Labour	25	26	26	26	267	264	259	26	27	28	30	32	-
FI	Land	GVA	3726	3900	4136	4333	3838	4123	4109	3980	3897	3904	3934	4058	-
FI	Land	Capital	-	-	-	-	4337	4356	4333	4348	4479	4609	4578	4533	-
FI	Land	Labour	74	76	79	81	805	806	831	83	85	83	86	87	-
FI	Water	GVA	619	702	789	809	814	814	811	873	933	904	876	961	-
FI	Water	Capital	-	-	-	-	3648	3586	3432	3127	3259	3139	3122	3234	-
FI	Water	Labour	11	11	11	11	110	112	108	11	11	11	10	10	-
FR	Air	GVA	-	4080	-	5306	4365	4165	5028	5158	5503	5937	6579	6499	-
FR	Air	Capital	-	-	-	22468	21797	25866	29692	27483	30450	32452	38926	21721	-
FR	Air	Labour	-	56	-	63	67	69	70	70	70	69	70	70	-
FR	Aux	GVA	-	20681	-	21386	22034	22222	23212	23391	23947	24206	24573	25732	-
FR	Aux	Capital	-	-	-	116857	121346	124289	121388	132072	137363	137273	123800	140637	-
FR	Aux	Labour	-	303	-	339	344	364	370	368	365	357	359	364	-
FR	Land	GVA	-	27413	-	29493	30957	33251	33568	33101	33442	34695	35228	37186	-
FR	Land	Capital	-	-	-	80245	83400	81641	85569	86566	85950	95573	101192	103837	-
FR	Land	Labour	-	582	-	589	625	640	649	650	652	647	655	672	-
FR	Water	GVA	-	173	-	890	974	1067	1084	1108	1862	2145	1843	2437	-
FR	Water	Capital	-	-	-	3856	4640	4911	7429	5758	6836	8422	22456	36931	-
FR	Water	Labour	-	18	-	16	16	16	18	19	18	18	18	19	-
HU	Air	GVA	-	-	91	85	60	47	91	96	93	61	38	51	-
HU	Air	Capital	-	-	-	-	-	-	-	-	596	598	576	581	-
HU	Air	Labour	-	-	-	-	-	-	10	7	8	10	9	7	-
HU	Aux	GVA	-	-	1231	1314	696	699	802	872	847	962	1024	1223	-
HU	Aux	Capital	-	-	-	-	-	-	-	-	5263	5934	6143	6560	-
HU	Aux	Labour	-	-	-	-	-	-	22	21	26	30	34	34	-
HU	Land	GVA	-	-	2260	2106	2043	2165	2246	2108	2251	2244	2283	2601	-
HU	Land	Capital	-	-	-	-	-	-	-	-	30110	29917	27988	28026	-
HU	Land	Labour	-	-	-	-	-	-	199	199	193	177	186	190	-
HU	Water	GVA	-	-	29	21	17	19	20	18	15	24	18	19	-
HU	Water	Capital	-	-	-	-	-	-	-	-	372	378	369	379	-
HU	Water	Labour	-	-	-	-	-	-	2	2	1	2	2	3	-
IT	Air	GVA	3484	3425	3281	2636	2232	2437	2107	2261	2132	1792	1570	1420	-
IT	Air	Capital	-	-	-	-	-	-	-	-	-	-	-	-	-
IT	Air	Labour	-	-	-	-	-	-	-	-	-	-	-	-	-
IT	Aux	GVA	12923	13814	13769	14244	17497	18725	19545	18460	18257	18877	18671	18819	-
IT	Aux	Capital	-	-	-	-	-	-	-	-	-	-	-	-	-
IT	Aux	Labour	-	-	-	-	-	-	-	-	-	-	-	-	-
IT	Land	GVA	40085	39767	43181	41614	41604	42433	44799	44708	46489	45516	45284	48101	-
IT	Land	Capital	-	-	-	-	-	-	-	-	-	-	-	-	-
IT	Land	Labour	-	-	-	-	-	-	-	-	-	-	-	-	-
IT	Water	GVA	2085	1979	2152	2218	2424	2109	1997	1952	2001	2002	1771	2230	-
IT	Water	Capital	-	-	-	-	-	-	-	-	-	-	-	-	-
IT	Water	Labour	-	-	-	-	-	-	-	-	-	-	-	-	-
NL	Air	GVA	2500	3080	3134	2915	3091	2371	2644	2633	1987	1891	1898	1642	-
NL	Air	Capital	-	-	-	-	-	-	-	-	-	-	-	-	-
NL	Air	Labour	-	-	-	-	-	-	-	-	-	-	-	-	-
NL	Aux	GVA	4865	5055	5355	5450	5580	5904	5886	5870	6504	6916	7154	7670	-
NL	Aux	Capital	-	-	-	-	-	-	-	-	-	-	-	-	-
NL	Aux	Labour	-	-	-	-	-	-	-	-	-	-	-	-	-
NL	Land	GVA	9116	9046	9604	9946	9909	10637	10387	9882	10013	9982	10318	10832	-
NL	Land	Capital	-	-	-	-	-	-	-	-	-	-	-	-	-
NL	Land	Labour	-	-	-	-	-	-	-	-	-	-	-	-	-
NL	Water	GVA	1466	1664	1895	1695	1671	1984	1721	1709	1855	1981	1868	1903	-
NL	Water	Capital	-	-	-	-	-	-	-	-	-	-	-	-	-
NL	Water	Labour	-	-	-	-	-	-	-	-	-	-	-	-	-
PL	Air	GVA	-	-	-	-	126	93	227	312	305	309	480	471	-
PL	Air	Capital	-	-	-	-	-	-	-	-	-	-	-	-	-
PL	Air	Labour	-	-	-	-	-	-	-	-	-	-	-	-	-
PL	Aux	GVA	-	-	-	-	1754	2221	1892	1753	1945	2086	2077	2451	-
PL	Aux	Capital	-	-	-	-	-	-	-	-	-	-	-	-	-

PL	Aux	Labour	-	-	-	-	-	-	-	-	-	-	-	-	-
PL	Land	GVA	-	-	-	-	6825	6967	7084	6241	5659	7066	8703	9262	-
PL	Land	Capital	-	-	-	-	-	-	-	-	-	-	-	-	-
PL	Land	Labour	-	-	-	-	-	-	-	-	-	-	-	-	-
PL	Water	GVA	-	-	-	-	-	-	-	-	-	-	-	-	-
PL	Water	Capital	-	-	-	-	-	-	-	-	-	-	-	-	-
PL	Water	Labour	-	-	-	-	-	-	-	-	-	-	-	-	-
SE	Air	GVA	966	1021	1037	950	1124	954	1080	1103	1070	716	728	710	694
SE	Air	Capital	-	-	-	-	2430	2200	2241	2298	2135	1979	1909	1861	1829
SE	Air	Labour	-	-	-	-	15	15	14	14	13	7	7	7	7
SE	Aux	GVA	4483	4650	4693	5042	5147	4916	4928	5059	5206	5676	5884	6123	5937
SE	Aux	Capital	-	-	-	-	39352	37160	38385	39400	41090	42410	44345	46050	46653
SE	Aux	Labour	-	-	-	-	67	70	68	66	67	72	71	73	73
SE	Land	GVA	5803	5921	6150	6669	7356	6659	6823	6930	6957	7063	7345	7893	7729
SE	Land	Capital	-	-	-	-	10550	9696	10068	10320	10831	10959	11805	12842	13062
SE	Land	Labour	-	-	-	-	127	120	122	119	118	119	121	127	131
SE	Water	GVA	1066	1145	879	1066	988	880	820	898	1048	1114	1113	1043	1021
SE	Water	Capital	-	-	-	-	2278	2065	2264	2651	2706	2981	3494	4019	4267
SE	Water	Labour	-	-	-	-	13	13	14	15	15	14	14	14	14
SI	Air	GVA	15	-	-	-	36	42	41	42	43	40	43	55	-
SI	Air	Capital	-	-	-	-	-	-	-	-	-	-	-	-	-
SI	Air	Labour	-	-	-	-	-	-	-	-	-	-	-	-	-
SI	Aux	GVA	311	-	-	-	335	329	303	310	386	408	457	518	-
SI	Aux	Capital	-	-	-	-	-	-	-	-	-	-	-	-	-
SI	Aux	Labour	-	-	-	-	-	-	-	-	-	-	-	-	-
SI	Land	GVA	521	-	-	-	607	603	609	642	686	704	755	826	-
SI	Land	Capital	-	-	-	-	-	-	-	-	-	-	-	-	-
SI	Land	Labour	-	-	-	-	-	-	-	-	-	-	-	-	-
SI	Water	GVA	-1	-	-	-	20	21	33	32	50	59	46	81	-
SI	Water	Capital	-	-	-	-	-	-	-	-	-	-	-	-	-
SI	Water	Labour	-	-	-	-	-	-	-	-	-	-	-	-	-
UK	Air	GVA	6681	8285	8529	8395	9843	8837	8731	8104	8842	8755	8850	8970	-
UK	Air	Capital	-	-	-	-	-	-	-	-	-	-	-	-	-
UK	Air	Labour	-	-	-	-	-	-	-	-	-	-	-	-	-
UK	Aux	GVA	17033	21122	23455	24881	28090	28289	28345	26560	26798	27033	29159	30149	-
UK	Aux	Capital	-	-	-	-	-	-	-	-	-	-	-	-	-
UK	Aux	Labour	-	-	-	-	-	-	-	-	-	-	-	-	-
UK	Land	GVA	22552	27646	29755	31356	35155	35094	34847	32641	32048	31848	32735	33171	-
UK	Land	Capital	-	-	-	-	-	-	-	-	-	-	-	-	-
UK	Land	Labour	-	-	-	-	-	-	-	-	-	-	-	-	-
UK	Water	GVA	2555	3018	2910	2727	2802	2900	3149	3584	5539	5784	5380	5680	-
UK	Water	Capital	-	-	-	-	-	-	-	-	-	-	-	-	-
UK	Water	Labour	-	-	-	-	-	-	-	-	-	-	-	-	-

Annex E: Data and projections of FIDELIO model

Table 1: Total employment and wages, land transport

	Total employment				Average wage		
	2010	**2015**	**2025**		**2010**	**2015**	**2025**
AUT	119.1	119.7	138.1		40.6	44.7	50.8
BEL	112.2	116.0	137.0		50.8	54.3	61.1
BGR	66.1	59.3	58.5		7.7	8.9	11.2
CYP	2.6	2.5	2.7		30.4	37.0	51.1
CZE	183.8	188.7	228.6		18.5	21.6	25.8
DEN	67.8	71.8	94.4		49.6	52.8	59.3
DEU	831.2	833.9	963.7		35.4	38.9	44.3
ESP	575.4	576.5	620.7		19.3	20.7	23.4
EST	444.8	472.8	638.8		12.8	14.2	16.6
FIN	67.2	68.4	79.8		42.4	46.0	50.2
FRA	613.4	620.5	678.2		46.0	48.7	52.8
GBR	760.1	767.9	868.7		30.8	35.1	37.5
GRC	50.1	51.1	59.1		34.3	40.7	53.9
HUN	164.4	158.6	179.4		14.5	15.8	19.3
IRL	29.4	29.3	31.2		48.2	51.0	61.6
ITA	362.1	354.1	371.7		63.1	68.6	77.5
LTU	73.8	76.3	97.2		8.3	8.9	10.2
LUX	14.8	15.2	18.2		63.4	77.3	113.9
LVA	56.1	57.1	72.8		11.7	13.5	15.6
MLT	2.2	2.2	2.4		13.9	14.7	17.3
NLD	183.5	188.7	221.5		41.8	43.5	46.0
POL	403.8	392.3	431.8		10.1	11.1	12.9
PRT	87.0	79.5	79.4		28.1	30.4	33.8
ROU	775.0	782.5	896.5		3.8	4.2	5.2
SVK	100.8	101.5	120.7		11.5	13.6	16.4
SVN	29.5	31.3	40.0		24.7	28.8	34.4
SWE	115.8	121.4	153.1		44.1	51.6	54.8
Total EU	**6291.7**	**6339.0**	**7284.1**		**29.8**	**33.2**	**39.1**

Table 2: Total employment and wages, water transport

	Total employment				Average wage		
	2010	**2015**	**2025**		**2010**	**2015**	**2025**
AUT	0.5	0.5	0.6		42.6	46.8	53.2
BEL	2.1	1.9	1.9		74.1	79.1	89.0
BGR	9.9	9.8	12.1		7.7	8.9	11.2
CYP	2.5	2.4	2.6		14.4	17.6	24.3
CZE	0.6	0.6	0.8		15.0	17.5	20.9
DEN	17.3	17.6	23.8		52.9	56.3	63.2
DEU	20.7	21.0	28.3		54.5	59.7	68.1
ESP	14.0	13.4	14.8		26.3	28.4	32.0
EST	28.4	26.4	30.6		12.8	14.2	16.6
FIN	10.7	10.7	13.7		55.0	59.6	65.1
FRA	17.1	17.0	21.8		52.6	55.7	60.4
GBR	130.7	143.6	213.7		30.8	35.1	37.5
GRC	13.0	12.6	16.2		42.3	50.1	66.4
HUN	2.9	2.9	3.4		7.6	8.3	10.1
IRL	2.8	2.7	3.1		48.2	51.0	61.6
ITA	26.9	27.1	33.0		56.4	61.3	69.2
LTU	6.4	6.7	9.2		6.0	6.4	7.3
LUX	0.1	0.1	0.1		72.1	87.8	129.5
MLT	0.8	0.8	1.0		18.1	19.2	22.6
NLD	13.5	14.3	20.1		53.7	55.8	59.1
PRT	2.9	2.8	3.0		49.7	53.8	59.8
ROU	11.7	12.1	15.3		4.0	4.4	5.4
SVK	0.9	0.8	1.0		16.1	19.0	22.9
SVN	0.5	0.5	0.8		44.7	52.1	62.2
SWE	14.5	15.9	23.5		52.1	61.0	64.7
Grand Total	**351.2**	**364.2**	**494.4**		**53.2**	**59.1**	**69.0**

Table 3: Total employment and wages, air transport

	Total employment				Average wage		
	2010	**2015**	**2025**		**2010**	**2015**	**2025**
AUT	8.2	7.9	8.6		67.2	73.9	84.0
BEL	4.9	4.9	5.8		80.4	85.9	96.5
BGR	4.4	3.4	2.9		7.7	8.9	11.2
CYP	1.4	1.3	1.2		29.9	36.4	50.3
CZE	5.7	5.5	6.4		50.1	58.5	69.8
DEN	7.3	8.3	12.6		85.9	91.4	102.6
DEU	61.9	59.1	66.2		79.9	87.6	99.9
ESP	47.1	45.8	49.9		43.7	47.1	53.1
EST	24.7	26.1	35.9		12.8	14.2	16.6
FIN	5.3	5.2	6.2		75.6	82.0	89.5
FRA	114.8	119.8	149.4		55.4	58.6	63.6
GBR	166.1	165.0	193.3		30.8	35.1	37.5
GRC	3.4	3.0	2.9		58.1	68.8	91.1
HUN	6.1	5.9	6.7		20.3	22.1	27.0
IRL	12.5	11.9	12.5		48.2	51.0	61.6
ITA	18.1	17.6	19.4		72.4	78.7	88.9
LTU	3.0	2.8	3.0		7.0	7.6	8.7
LUX	3.6	3.5	4.2		93.5	113.9	168.0
MLT	1.2	1.2	1.4		38.1	40.5	47.6
NLD	33.0	35.5	49.1		68.1	70.9	75.0
POL	24.4	23.3	26.5		10.1	11.1	12.9
PRT	9.0	8.5	9.3		72.4	78.4	87.2
ROU	3.2	3.0	3.1		26.9	29.5	36.5
SVK	1.1	1.0	1.1		27.2	32.1	38.7
SVN	0.7	0.7	0.9		63.4	73.8	88.3
SWE	7.1	7.1	8.9		71.9	84.2	89.3
Grand Total	**578.3**	**577.1**	**687.2**		**53.6**	**59.9**	**70.2**

Annex F: Variables used in bottom-up modelling approach

The following tables describe the main variables and parameters used in the model, including their interdependence.

Variable	Description	Unit	Source	Depends on	Affects
Q	Overall sector output	Tonkm for freight, passkm for passenger (per annum)	Exogenous (Reference scenario 2013)		Labour demand
GVA/GDP	Index of the Ratio of GVA to GDP	Dimension-less	Exogenous (Reference scenario 2013)		
TRint	Transport activity per unit of GDP	Tonkm/euro (freight modes), passkm/euro (passenger modes)	Exogenous (Reference scenario 2013)		Productivity (administrative staff)
Pr_{adm}	Productivity index for administrative staff	Dimension-less	Endogenous, estimation (intermediate variable)	Employment per transport mode, transport activity per unit of GDP	
Pr_{op}	Productivity index of mobile staff	Dimension-less	Endogenous, estimation (intermediate variable)	Employment per transport mode, GVA to GDP, productivity of administrative	
Pr_{gen}	Underlying productivity index	Dimension-less	Endogenous, estimation (intermediate variable)	Underlying productivity growth parameter	Productivity of mobile staff, Productivity of administrative staff
V	Transport activity (in vehkms)	Vehkms (per annum)	Model calculation	Transport performance, load factor	Required drivers
D_{dr}	Required operators/drivers	persons	Model calculation (output variable)	Transport activity (in vehkms), load factor, daily output, operator productivity parameter	
D_{log}	Required logistics	persons	Model calculation (output variable)	Transport activity (in vehkms), load factor, daily output, logistics productivity parameter	
D_{adm}	Required administrative	persons	Model calculation (output variable)	Transport activity (in vehkms), load factor, daily output, administration productivity parameter	
L_{dr}	Available	persons	Model	Available drivers in	

Variable	Description	Unit	Source	Depends on	Affects
	drivers in period t		calculation (intermediate variable)	period t-1, retired drivers	
L_{log}	Available logistics in period t	persons	Model calculation (intermediate variable)	Available logistics in period t-1, retired logistics	
L_{adm}	Available administrative in period t	persons	Model calculation (intermediate variable)	Available administrative in period t-1, retired administrative	
R_{dr}	Retired drivers	persons	Model calculation (intermediate variable)	Available drivers in period t-1, Share of employees per age range, average age, retirement parameter	
R_{log}	Retired logistics	persons	Model calculation (intermediate variable)	Available logistics in period t-1, Share of employees per age range, average age, retirement parameter	
R_{adm}	Retired administrative	persons	Model calculation (intermediate variable)	Available administrative in period t-1, Share of employees per age range, average age, retirement parameter	
Sh_{age}	Share of employees in age range	% (under 35, 35 to 45, 45-60, over 60)	Calibrated based on Labour Force Survey, calculated by model for projections		Retired drivers, Retired logistics, Retired administrative
A	Average age	years	Weighted average (number of employees in age range by average age in each age range)		Retired drivers, Retired logistics, Retired administrative
H_{dr}, H_{log}, H_{adm}	New recruitment (drivers, logistics, administrative)	persons	Model calculation (output variable)	Required – Available – Retired (drivers, logistics, administrative)	
R_{dr}, r_{log}, r_{adm}	Rotation indicator (drivers, logistics, administrative)	%	Model calculation (control variable)	New recruitment/ Available	
W_{dr}	Share of drivers in labour force	%	Model calculation (control variable)		

Parameter	Description	Unit	Range	Affects
UP	Underlying productivity index growth parameter	%	-0.5% to 5%	Labour demand
LF	Load factor	Ton/vehkm (freight), pass/vehkm (passenger)	From data, +/- 20% of 2010 average value	Transport activity (in vehkms)
DO	Daily output	Vehkm/day/person	Depends on mode, , +/- 20% of 2010 average value	Required drivers
OP	Operator productivity parameter	Dimensionless	Estimation parameter	Number of required drivers/ operators/ mobile staff
LP	Logistics productivity parameter	Dimensionless	Estimation parameter	Number of required technical and administrative staff
AP	Administration productivity parameter	Dimensionless	Estimation parameter	Number of required technical and administrative staff
RP	Retirement parameter	%	Estimation parameter	Staff turnover/ number of retired staff

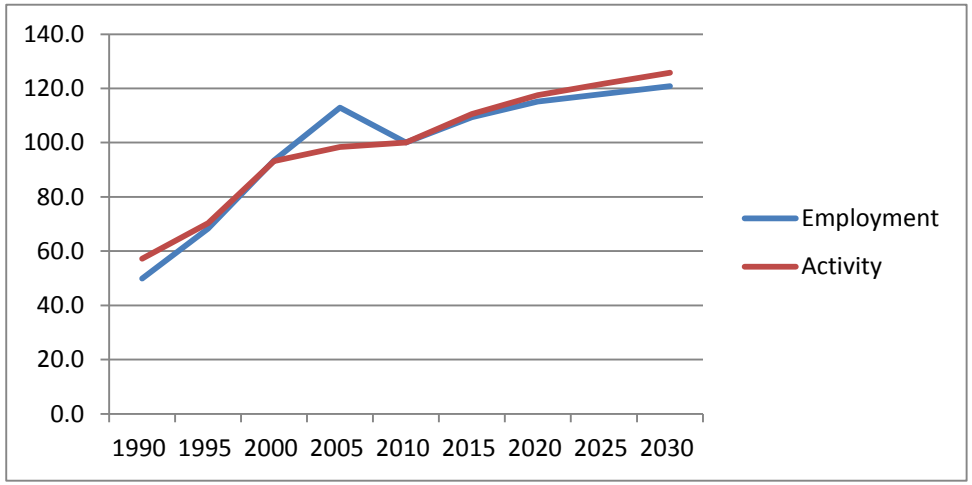
Annex G: Projections by EU Member State

Austria

Road freight transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment (persons)	25453	34826	47650	57576	51012	55793	58734	60213	61611
Activity (billion tonkm)	21.6	**26.5**	35.1	37.0	37.7	41.6	44.3	45.8	47.4
Productivity (1000 tonkm/person)	847	761	737	643	738	746	754	761	769

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment (year 2010= 100)	49.9	68.3	93.4	112.9	100.0	109.4	115.1	118.0	120.8
Activity (year 2010= 100)	57.2	70.4	93.3	98.4	100.0	110.5	117.5	121.7	125.8

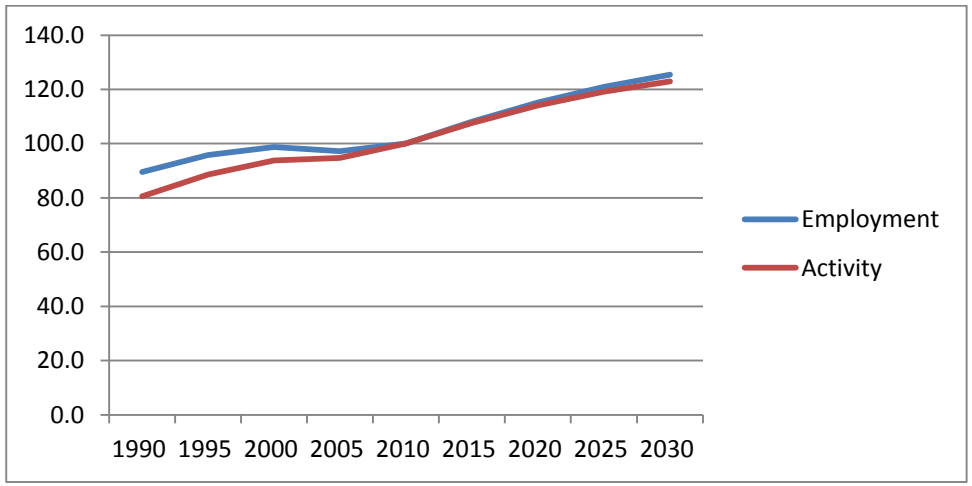


Austria

Public transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	47791	51174	52747	51894	53400	57739	61524	64592	66955
Activity	7.9	8.7	9.2	9.3	9.9	10.6	11.2	11.7	12.1
Productivity	166	171	175	180	185	184	183	182	181

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	89.5	95.8	98.8	97.2	100.0	108.1	115.2	121.0	125.4
Activity	80.5	88.6	93.8	94.8	100.0	107.6	114.1	119.2	123.0

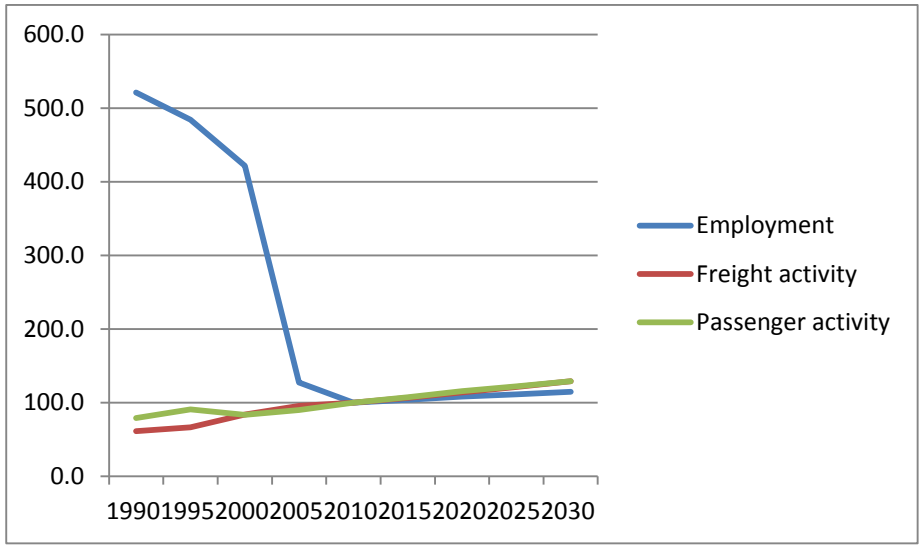


Austria

Rail transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	65000	60352	52554	15897	12468	12957	13479	13877	14300
Freight activity	12.2	13.2	16.6	19.0	19.8	21.1	22.5	24.0	25.6
Passenger activity	11.7	13.4	12.3	13.3	14.8	15.9	17.1	18.1	19.1
Mixed activity	11.8	13.4	13.4	14.7	16.1	17.2	18.5	19.6	20.7
Productivity	182	222	255	925	1288	1328	1369	1409	1450

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	521.3	484.1	421.5	127.5	100.0	103.9	108.1	111.3	114.7
Freight activity	61.3	66.6	83.7	95.6	100.0	106.6	113.7	121.1	129.1
Passenger activity	79.1	90.7	83.2	89.7	100.0	107.5	115.5	122.1	129.2

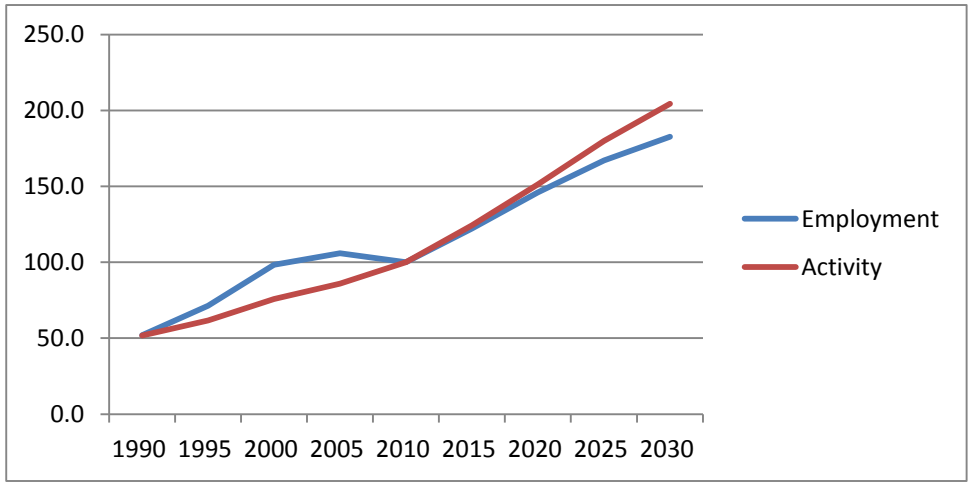


Austria

Aviation

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	4560	6279	8646	9311	8786	10727	12834	14671	16048
Activity	4.2	5.0	6.1	7.0	8.1	10.1	12.3	14.6	16.6
Productivity	923	798	711	748	924	940	956	995	1033

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	51.9	71.5	98.4	106.0	100.0	122.1	146.1	167.0	182.7
Activity	51.9	61.8	75.8	85.9	100.0	124.3	151.3	179.8	204.3

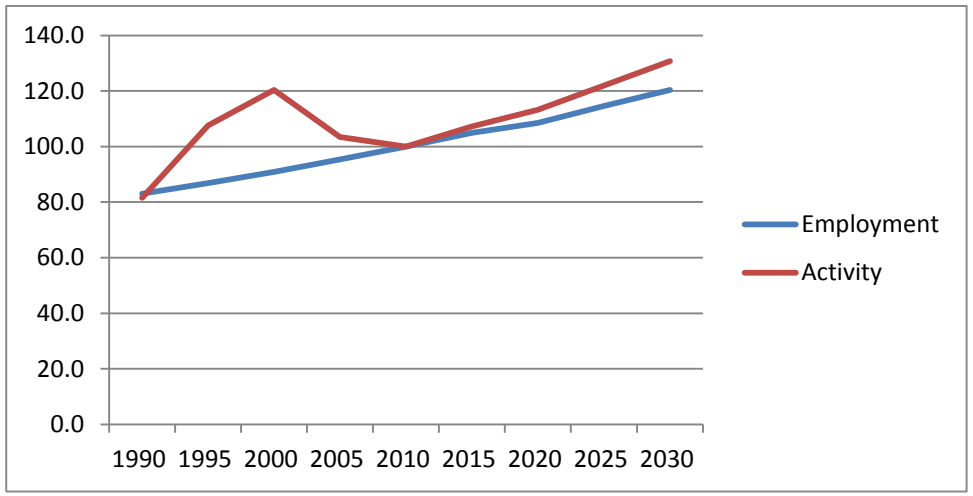


Belgium

Road freight transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	51561	53939	56426	59195	62100	65189	67406	71177	74772
Activity	34.6	45.6	51.0	43.8	42.4	45.5	48.0	51.7	55.4
Productivity	671	845	905	741	683	697	712	726	741

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	83.0	86.9	90.9	95.3	100.0	105.0	108.5	114.6	120.4
Activity	81.6	107.5	120.4	103.4	100.0	107.2	113.2	121.9	130.7

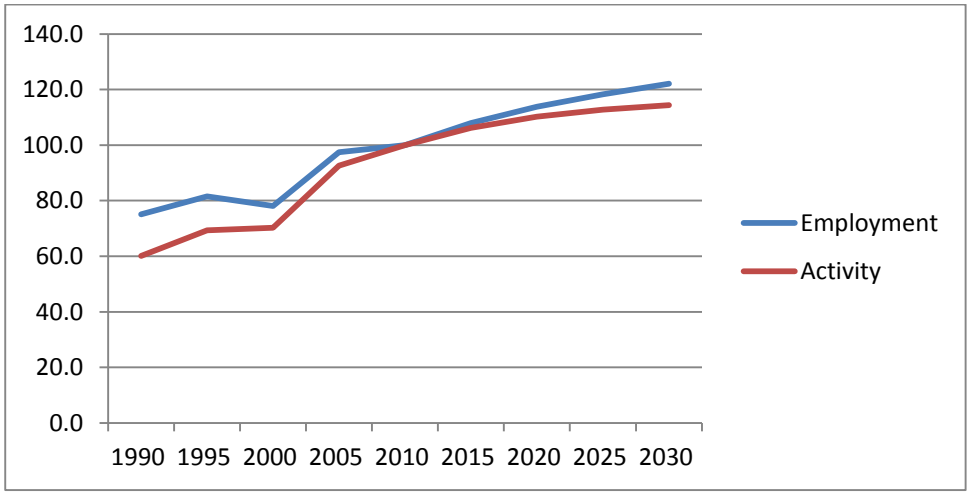


Belgium

Public transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	9390	10194	9761	12180	12500	13494	14229	14789	15255
Activity	11.4	13.1	13.3	17.5	18.9	20.1	20.9	21.3	21.6
Productivity	1211	1287	1362	1438	1514	1490	1466	1442	1418

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	75.1	81.6	78.1	97.4	100.0	108.0	113.8	118.3	122.0
Activity	60.1	69.3	70.3	92.6	100.0	106.2	110.2	112.7	114.3

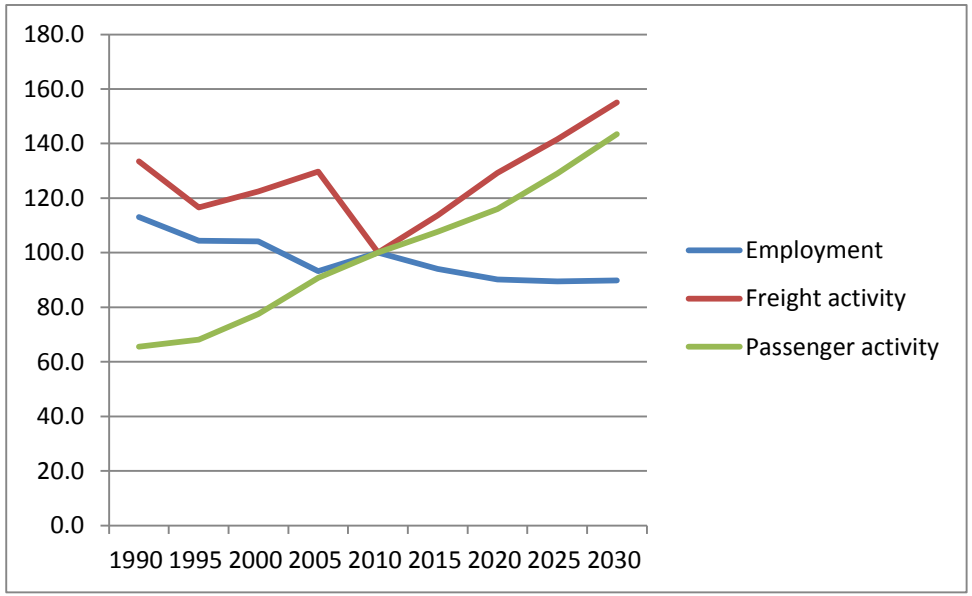


Belgium

Rail transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	45205	41730	41663	37290	40000	37646	36091	35813	35940
Freight activity	8.4	7.3	7.7	8.1	6.3	7.1	8.1	8.9	9.7
Passenger activity	7.3	7.6	8.6	10.1	11.1	12.0	12.9	14.3	15.9
Mixed activity	7.6	7.5	8.4	9.6	9.9	10.7	11.7	13.0	14.4
Productivity	167	180	201	257	247	285	324	362	400

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	113.0	104.3	104.2	93.2	100.0	94.1	90.2	89.5	89.8
Freight activity	133.5	116.5	122.4	129.7	100.0	113.7	129.3	141.6	155.0
Passenger activity	65.6	68.1	77.5	90.8	100.0	107.7	116.0	129.0	143.5

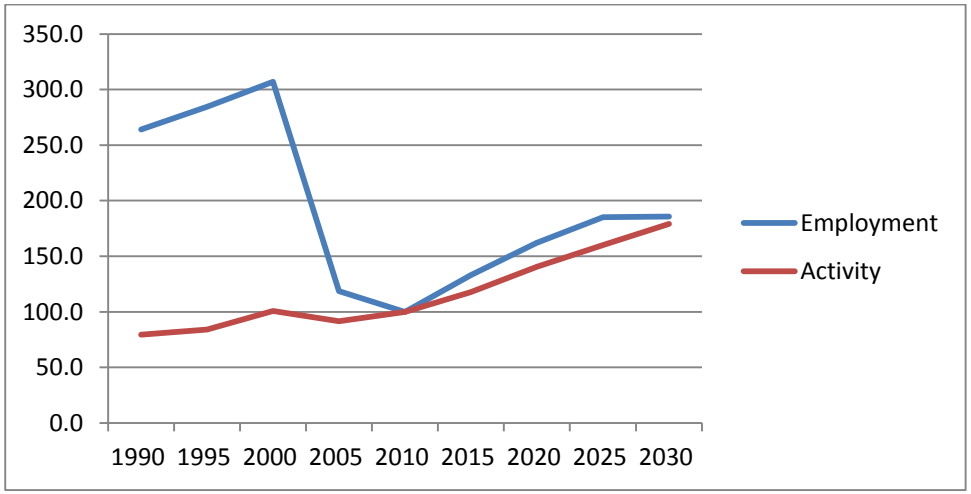


Belgium

Aviation

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	11196	12072	13016	5027	4242	5639	6872	7848	7881
Activity	6.6	7.0	8.4	7.6	8.3	9.8	11.7	13.3	14.9
Productivity	589	578	644	1512	1958	1734	1698	1693	1888

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	263.9	284.6	306.8	118.5	100.0	132.9	162.0	185.0	185.8
Activity	79.4	84.0	100.9	91.5	100.0	117.7	140.5	160.0	179.2

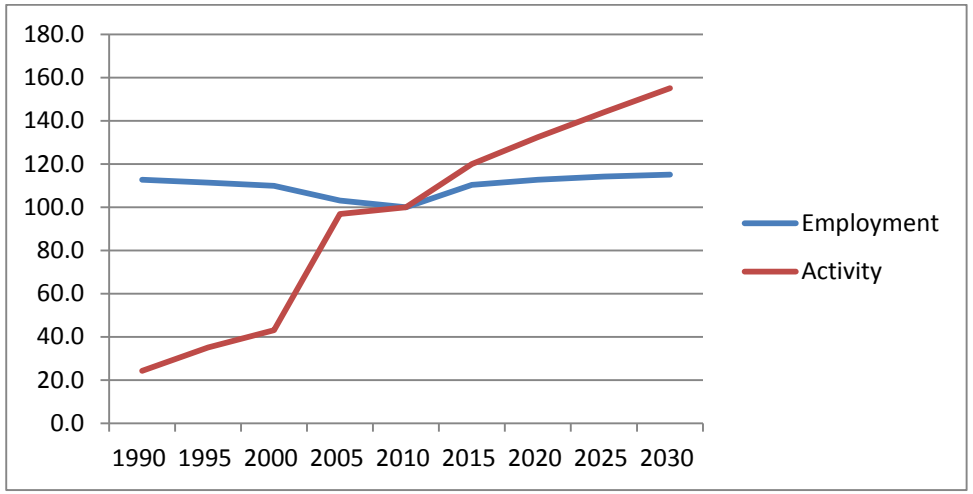


Bulgaria

Road freight transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	49380	48747	48121	45112	43800	48329	49379	49985	50398
Activity	3.6	5.2	6.4	14.4	14.8	17.8	19.7	21.4	23.0
Productivity	73	107	133	319	339	369	398	428	457

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	112.7	111.3	109.9	103.0	100.0	110.3	112.7	114.1	115.1
Activity	24.2	35.0	43.1	96.8	100.0	119.9	132.4	143.9	155.1

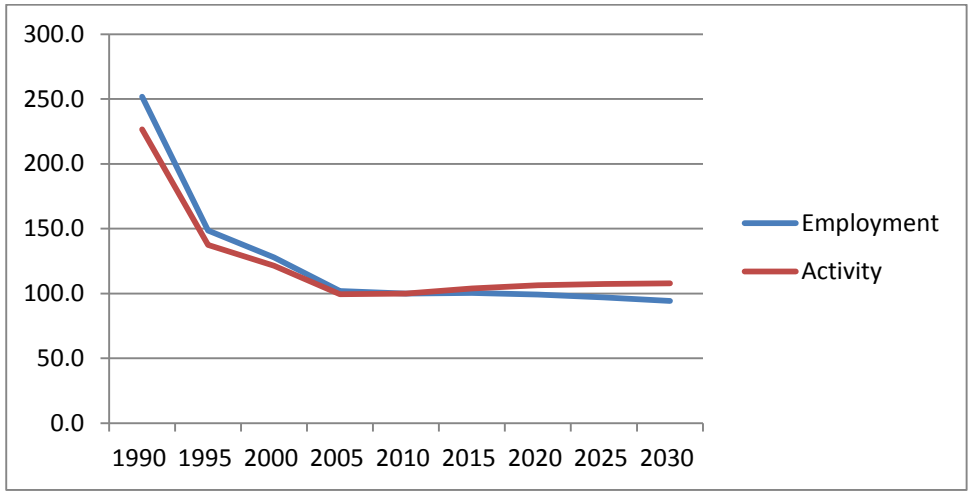


Bulgaria

Public transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	90406	53360	45930	36613	35900	36033	35575	34791	33833
Activity	25.9	15.7	13.9	11.4	11.4	11.9	12.1	12.3	12.3
Productivity	286	294	302	310	318	330	341	353	364

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	251.8	148.6	127.9	102.0	100.0	100.4	99.1	96.9	94.2
Activity	226.6	137.5	121.5	99.4	100.0	104.0	106.2	107.4	107.8

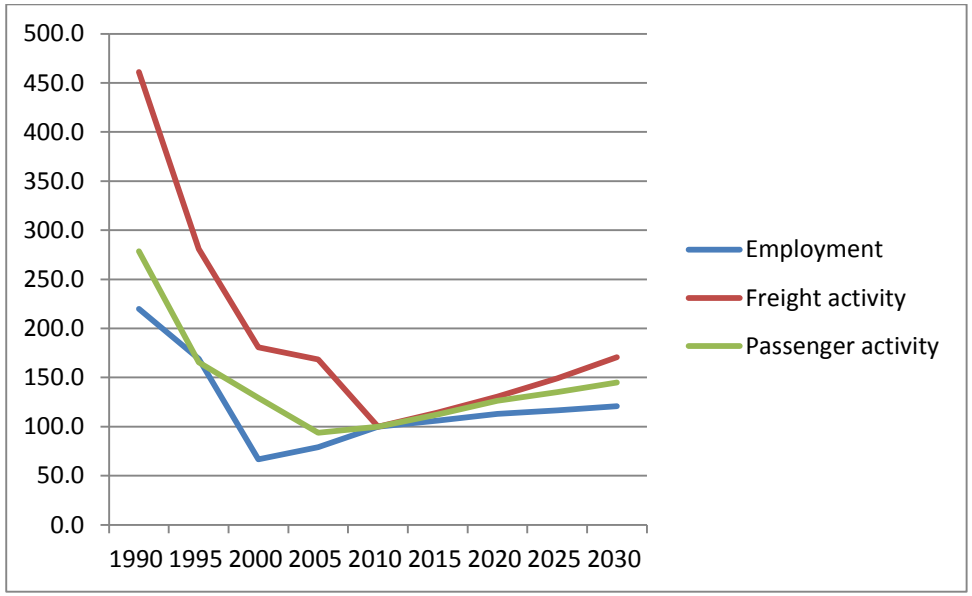


Bulgaria

Rail transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	64082	49224	19435	23000	29126	30912	32926	33991	35220
Freight activity	14.1	8.6	5.5	5.2	3.1	3.5	4.0	4.6	5.2
Passenger activity	8.4	5.0	3.9	2.8	3.0	3.4	3.8	4.1	4.4
Mixed activity	9.8	5.9	4.3	3.4	3.0	3.4	3.8	4.2	4.6
Productivity	153	119	221	148	104	110	117	123	130

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	220.0	169.0	66.7	79.0	100.0	106.1	113.0	116.7	120.9
Freight activity	461.2	280.7	180.7	168.5	100.0	114.2	130.5	149.3	170.8
Passenger activity	278.5	165.4	129.3	93.8	100.0	112.4	126.3	135.3	144.9

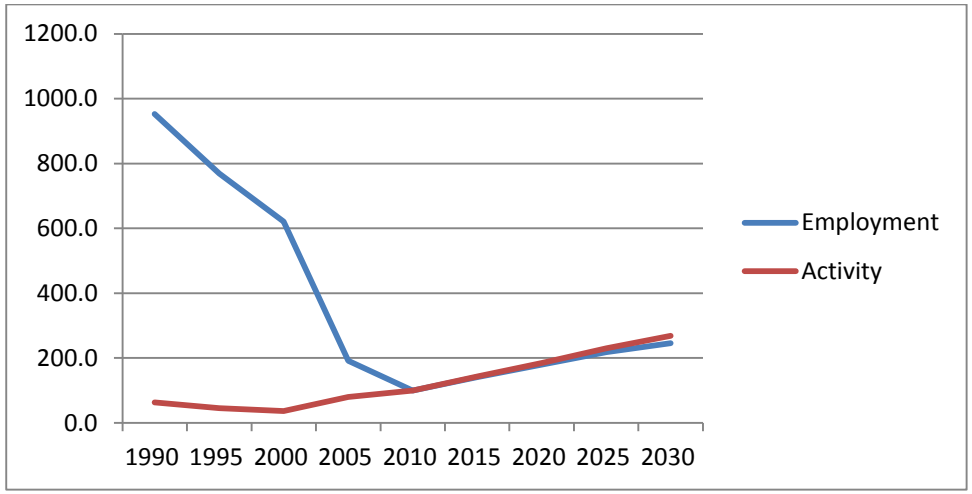


Bulgaria

Aviation

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	24776	19993	16133	4976	2600	3665	4670	5660	6402
Activity	2.8	2.1	1.7	3.6	4.5	6.4	8.3	10.4	12.1
Productivity	115	103	102	724	1731	1754	1777	1831	1885

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	952.9	768.9	620.5	191.4	100.0	141.0	179.6	217.7	246.2
Activity	63.3	45.8	36.7	80.1	100.0	142.8	184.4	230.3	268.2

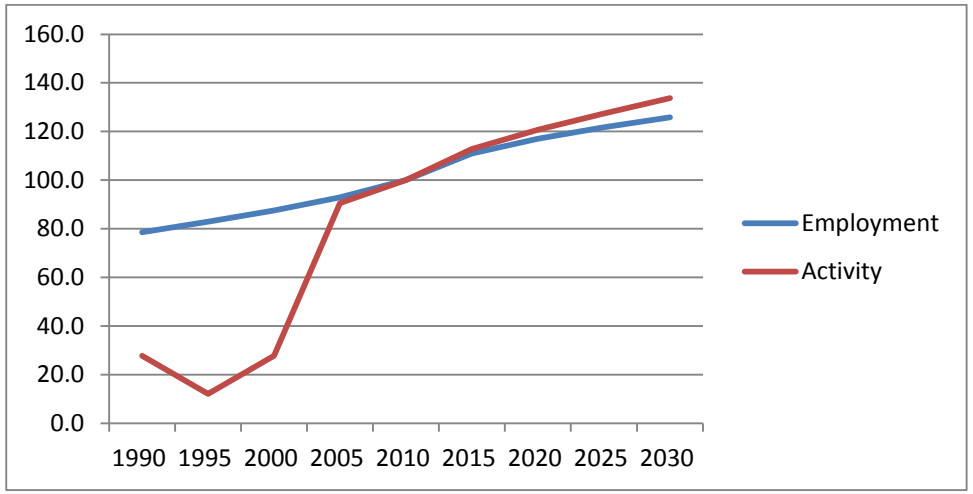


Croatia

Road freight transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	17053	18000	19000	20166	21700	24091	25404	26419	27312
Activity	2.9	1.3	2.9	9.3	10.3	11.6	12.4	13.1	13.8
Productivity	167	70	150	463	474	482	489	497	504

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	78.6	82.9	87.6	92.9	100.0	111.0	117.1	121.7	125.9
Activity	27.7	12.2	27.7	90.6	100.0	112.7	120.7	127.4	133.7

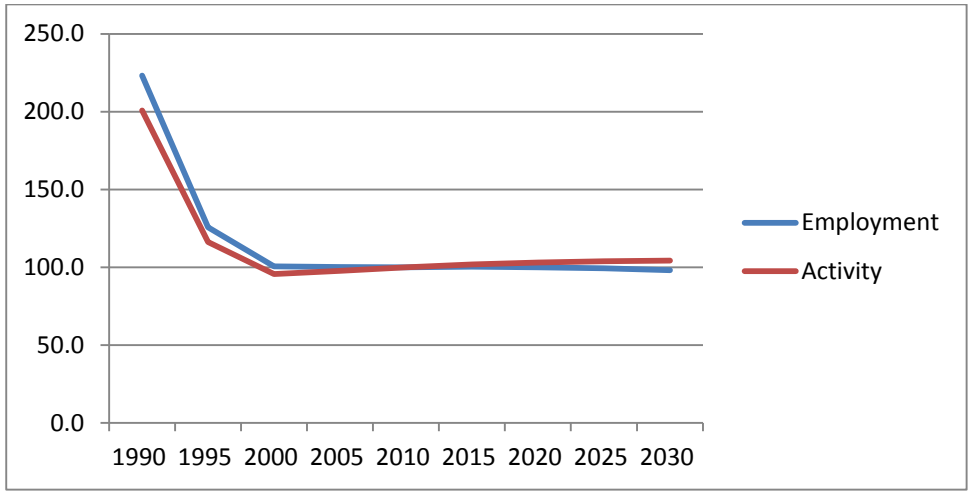


Croatia

Public transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	22754	12815	10258	10212	10200	10232	10201	10124	10016
Activity	7.0	4.1	3.3	3.4	3.5	3.6	3.6	3.6	3.6
Productivity	308	316	325	333	342	347	352	358	363

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	223.1	125.6	100.6	100.1	100.0	100.3	100.0	99.3	98.2
Activity	200.8	116.2	95.5	97.6	100.0	101.9	103.1	103.9	104.3

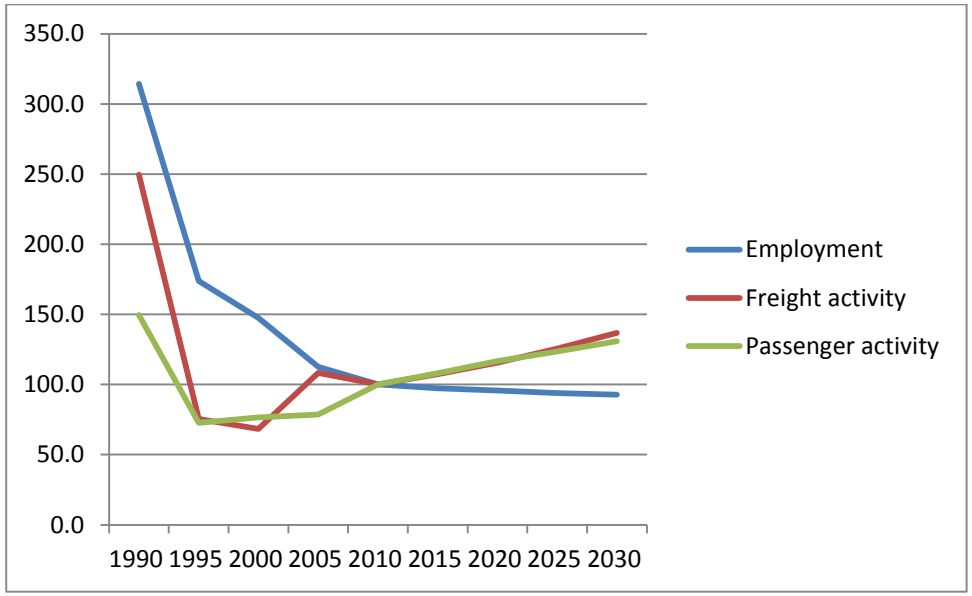


Croatia

Rail transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	39456	21812	18535	14152	12556	12232	12029	11798	11651
Freight activity	6.5	2.0	1.8	2.8	2.6	2.8	3.0	3.3	3.6
Passenger activity	3.4	1.7	1.8	1.8	2.3	2.5	2.7	2.8	3.0
Mixed activity	4.2	1.7	1.8	2.1	2.4	2.6	2.8	2.9	3.1
Productivity	107	80	95	145	189	209	229	250	270

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	314.2	173.7	147.6	112.7	100.0	97.4	95.8	94.0	92.8
Freight activity	249.6	75.4	68.3	108.3	100.0	107.5	115.5	125.7	136.9
Passenger activity	149.6	72.6	76.6	78.5	100.0	108.0	116.7	123.6	130.9

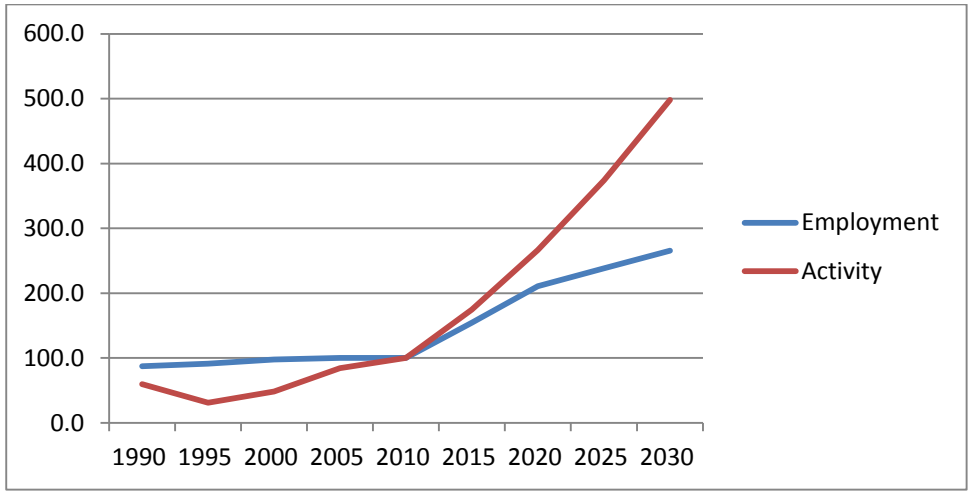


Croatia

Aviation

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	4100	4300	4600	4700	4700	7250	9911	11200	12483
Activity	0.8	0.4	0.6	1.1	1.3	2.3	3.5	5.0	6.6
Productivity	284	284	284	284	284	321	358	445	532

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	87.2	91.5	97.9	100.0	100.0	154.3	210.9	238.3	265.6
Activity	59.9	31.1	48.3	84.2	100.0	174.5	266.3	374.0	498.3

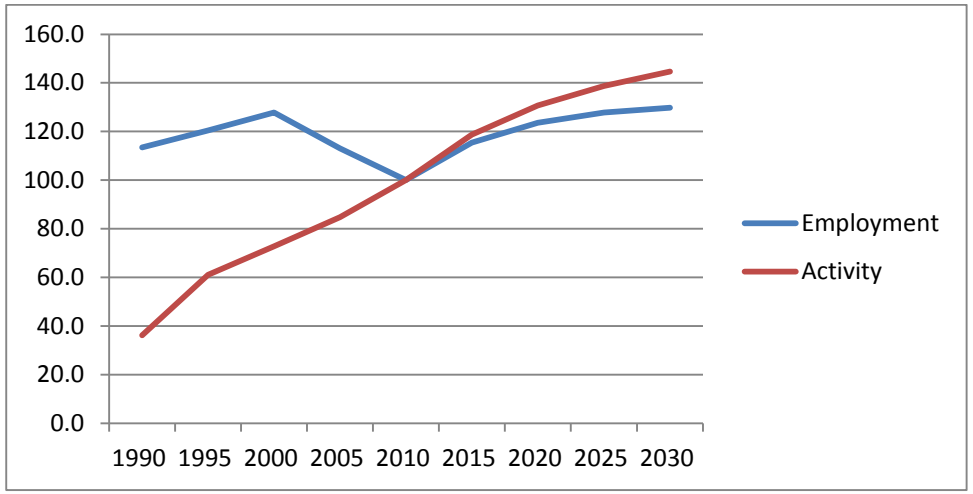


Czech Republic

Road freight transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	125821	133581	141820	125411	110900	128040	137148	141744	143972
Activity	18.6	31.3	37.3	43.4	51.3	60.9	67.0	71.1	74.1
Productivity	148	234	263	346	462	475	489	502	515

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	113.5	120.5	127.9	113.1	100.0	115.5	123.7	127.8	129.8
Activity	36.2	61.1	72.8	84.8	100.0	118.8	130.7	138.8	144.6

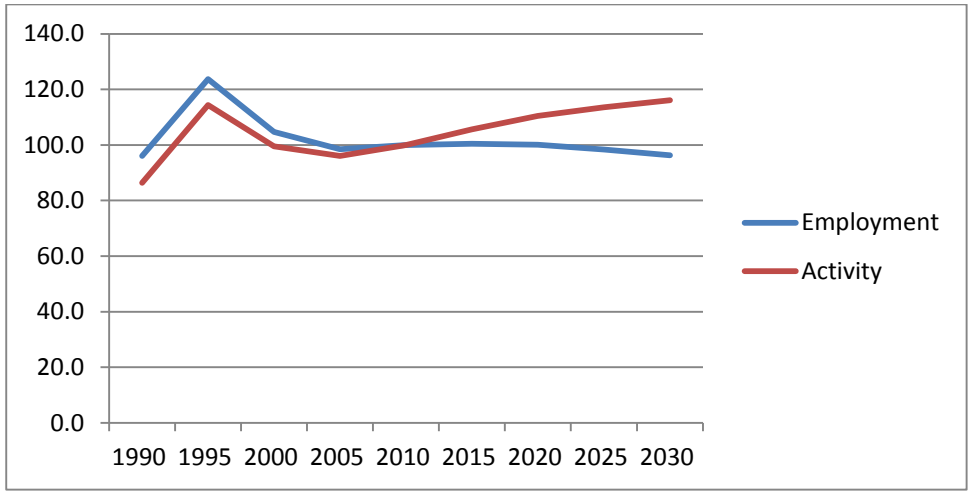


Czech Republic

Public transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	76828	98949	83762	78772	80000	80382	80094	78702	77012
Activity	14.1	18.6	16.2	15.6	16.3	17.2	17.9	18.5	18.9
Productivity	183	188	193	198	203	214	224	235	245

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	96.0	123.7	104.7	98.5	100.0	100.5	100.1	98.4	96.3
Activity	86.4	114.4	99.5	96.0	100.0	105.6	110.4	113.5	116.1

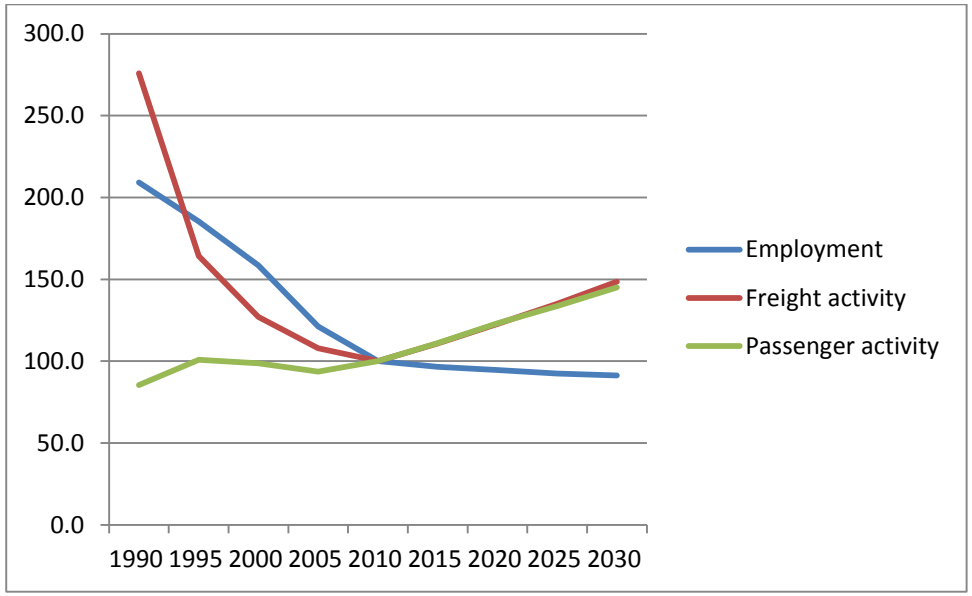


Czech Republic

Rail transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	115000	101874	87215	66627	55000	53053	52058	50839	50185
Freight activity	38.0	22.6	17.5	14.9	13.8	15.3	16.9	18.6	20.5
Passenger activity	13.3	15.7	15.4	14.6	15.6	17.3	19.2	20.8	22.6
Mixed activity	19.5	17.4	15.9	14.7	15.1	16.8	18.6	20.3	22.1
Productivity	169	171	182	220	275	316	358	399	440

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	209.1	185.2	158.6	121.1	100.0	96.5	94.7	92.4	91.2
Freight activity	275.9	164.3	127.1	108.0	100.0	110.8	122.8	135.1	148.6
Passenger activity	85.4	100.8	98.6	93.7	100.0	110.9	123.1	133.6	145.1

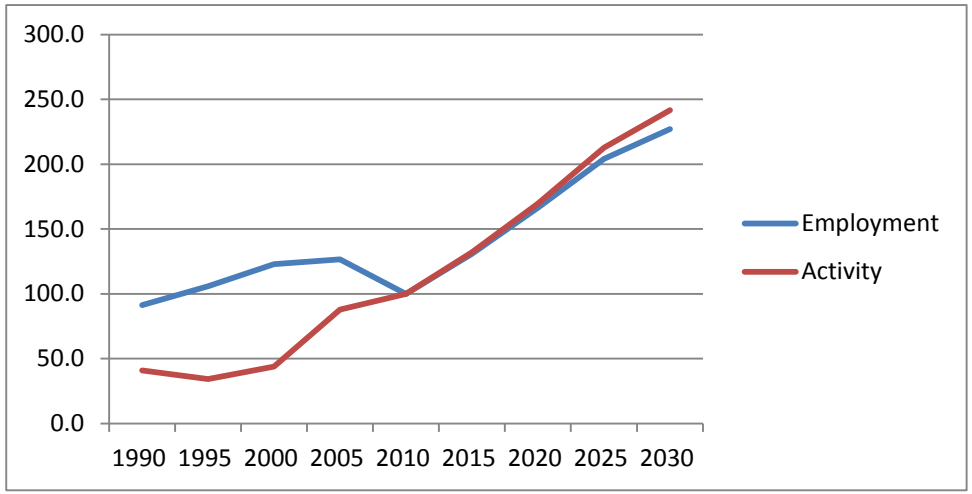


Czech Republic

Aviation

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	4466	5183	6015	6190	4893	6399	8139	9987	11106
Activity	4.6	3.9	5.0	9.9	11.3	14.9	19.2	24.1	27.4
Productivity	1040	751	828	1605	2314	2336	2359	2411	2463

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	91.3	105.9	122.9	126.5	100.0	130.8	166.3	204.1	227.0
Activity	41.0	34.4	44.0	87.7	100.0	132.0	169.5	212.7	241.6

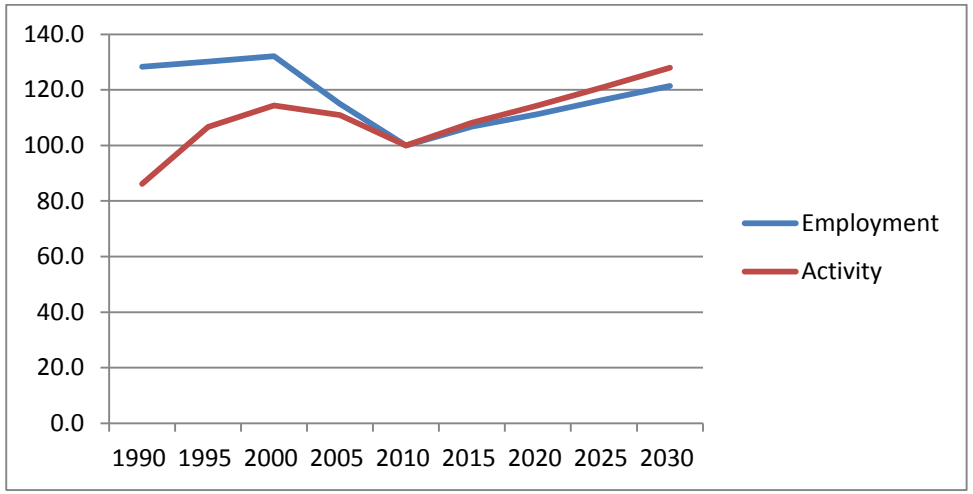


Denmark

Road freight transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	36561	37109	37666	32764	28500	30420	31725	33173	34593
Activity	18.1	22.4	24.0	23.3	21.0	22.7	24.0	25.4	26.9
Productivity	495	604	638	711	737	747	757	767	777

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	128.3	130.2	132.2	115.0	100.0	106.7	111.3	116.4	121.4
Activity	86.1	106.6	114.3	110.9	100.0	108.2	114.3	121.1	127.9

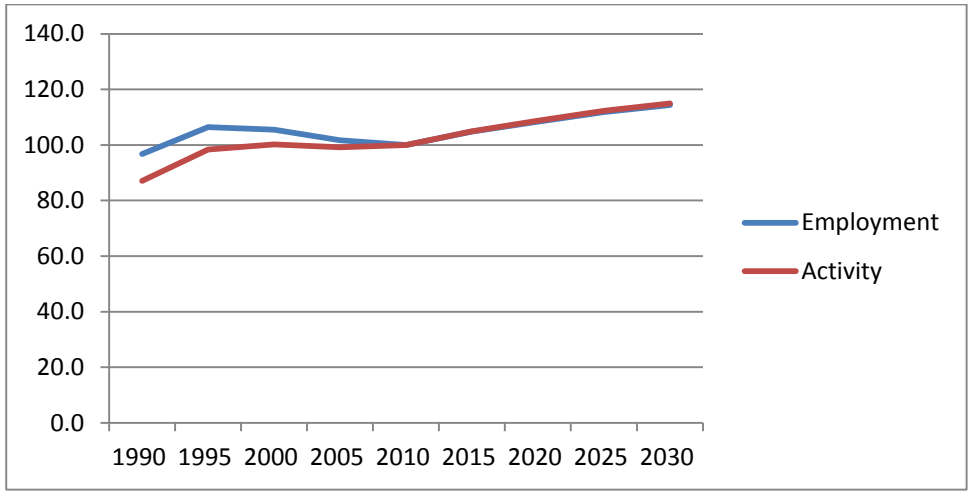


Denmark

Public transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	25432	27975	27739	26740	26300	27572	28511	29402	30081
Activity	6.4	7.3	7.4	7.3	7.4	7.8	8.0	8.3	8.5
Productivity	253	260	267	274	281	282	282	283	283

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	96.7	106.4	105.5	101.7	100.0	104.8	108.4	111.8	114.4
Activity	87.0	98.4	100.2	99.1	100.0	105.0	108.7	112.2	115.0

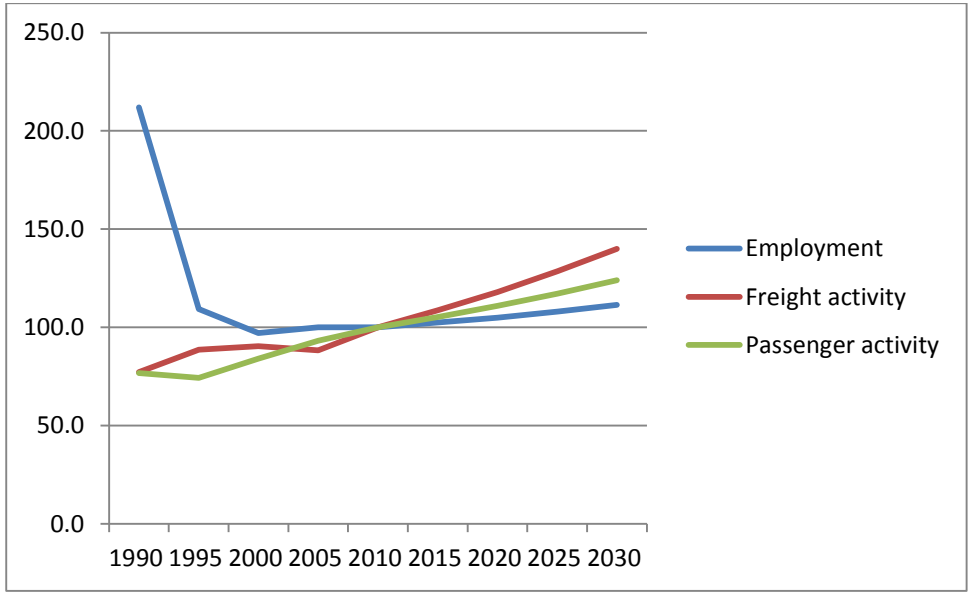


Denmark

Rail transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	21197	10937	9705	10000	10000	10236	10489	10802	11135
Freight activity	1.7	2.0	2.0	2.0	2.2	2.4	2.6	2.9	3.1
Passenger activity	5.1	4.9	5.5	6.1	6.6	6.9	7.3	7.7	8.2
Mixed activity	4.2	4.2	4.7	5.1	5.5	5.8	6.1	6.5	6.9
Productivity	199	381	480	510	550	568	585	603	620

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	212.0	109.4	97.1	100.0	100.0	102.4	104.9	108.0	111.4
Freight activity	77.3	88.7	90.4	88.3	100.0	108.6	118.0	128.5	139.9
Passenger activity	76.7	74.2	84.1	93.2	100.0	105.3	110.8	117.2	123.9

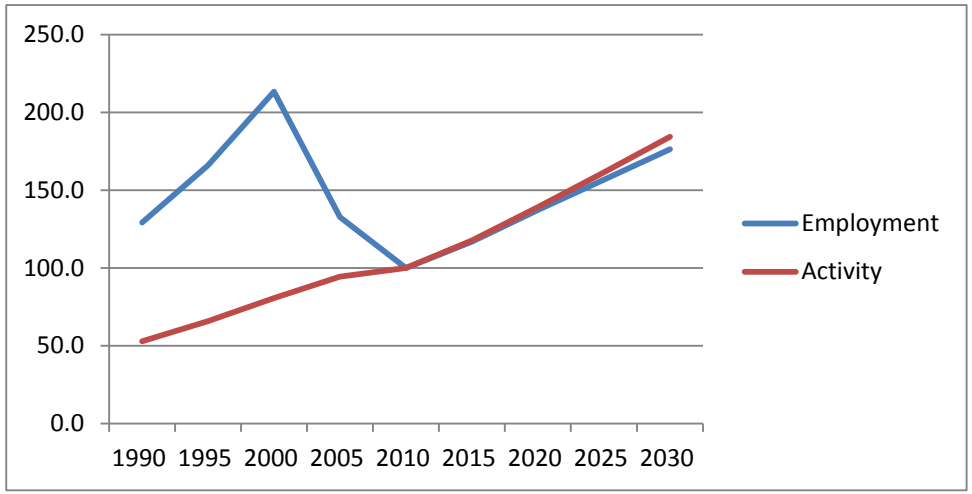


Denmark

Aviation

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	6066	7798	10025	6239	4700	5492	6449	7367	8281
Activity	5.2	6.5	7.9	9.3	9.8	11.6	13.7	15.9	18.1
Productivity	859	831	791	1491	2095	2110	2124	2158	2191

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	129.1	165.9	213.3	132.7	100.0	116.8	137.2	156.7	176.2
Activity	52.9	65.8	80.6	94.5	100.0	117.6	139.1	161.4	184.2

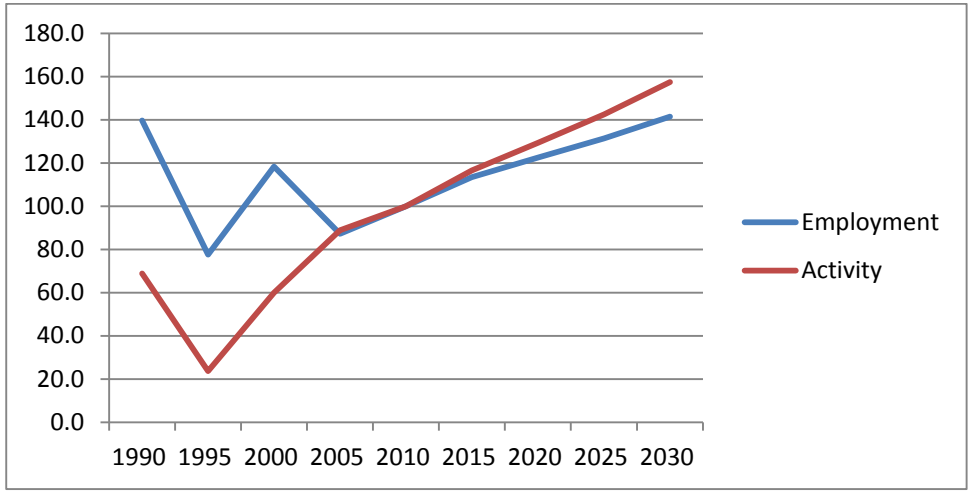


Estonia

Road freight transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	18000	10000	15250	11239	12886	14610	15774	16925	18217
Activity	4.5	1.5	3.9	5.8	6.6	7.6	8.5	9.3	10.3
Productivity	251	155	258	518	508	523	537	552	566

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	139.7	77.6	118.3	87.2	100.0	113.4	122.4	131.3	141.4
Activity	68.8	23.6	60.0	88.9	100.0	116.6	129.3	142.5	157.4

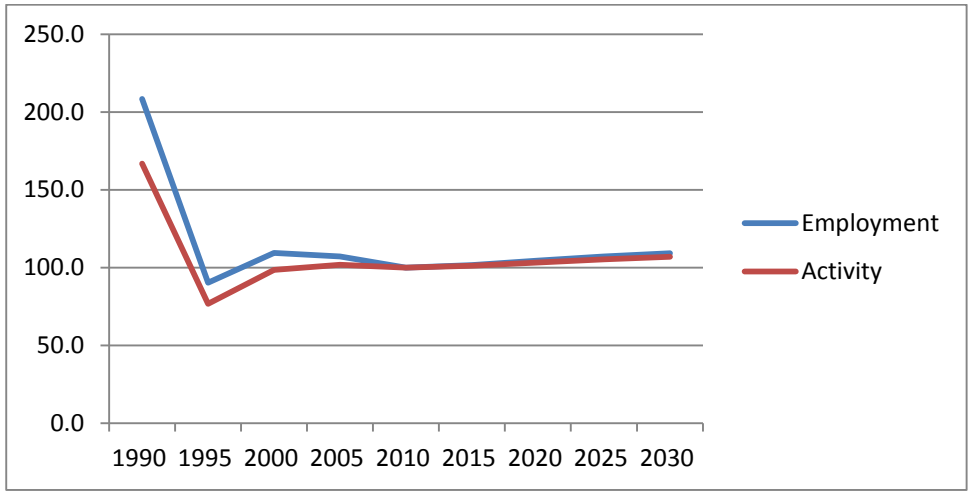


Estonia

Public transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	11046	4784	5803	5677	5300	5387	5533	5675	5793
Activity	4.5	2.0	2.6	2.7	2.7	2.7	2.8	2.8	2.9
Productivity	403	428	453	478	504	501	498	496	493

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	208.4	90.3	109.5	107.1	100.0	101.6	104.4	107.1	109.3
Activity	166.7	76.7	98.5	101.8	100.0	101.1	103.3	105.4	107.0

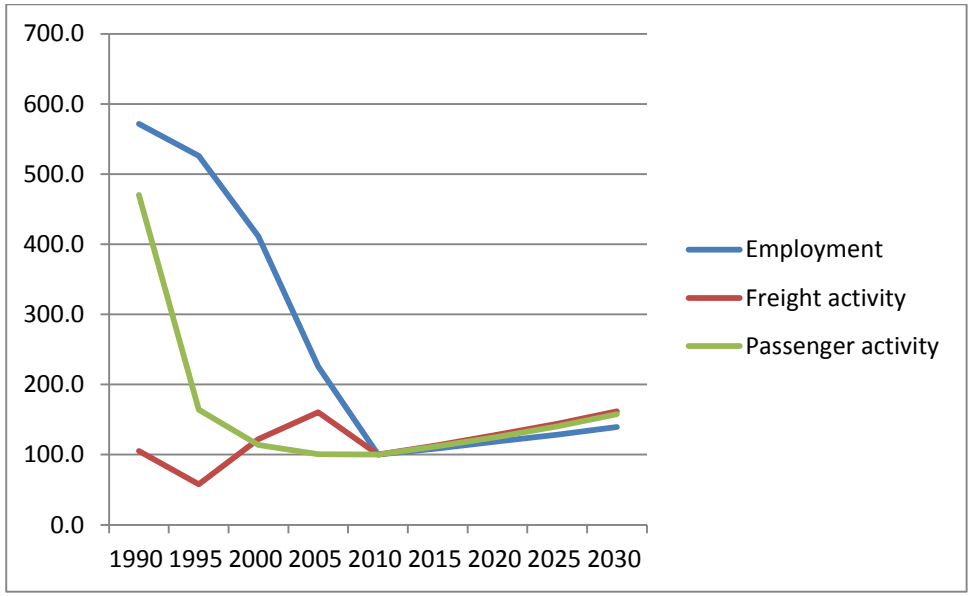


Estonia

Rail transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	8961	8250	6448	3536	1568	1708	1864	2018	2188
Freight activity	7.0	3.8	8.1	10.6	6.6	7.5	8.5	9.6	10.7
Passenger activity	1.5	0.5	0.4	0.3	0.3	0.4	0.4	0.5	0.5
Mixed activity	2.9	1.4	2.3	2.9	1.9	2.2	2.4	2.7	3.1
Productivity	321	164	357	821	1212	1259	1306	1353	1400

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	571.5	526.1	411.2	225.5	100.0	109.0	118.9	128.7	139.6
Freight activity	105.2	57.9	122.1	160.3	100.0	113.4	128.5	144.2	161.7
Passenger activity	470.4	164.0	113.9	100.7	100.0	112.0	125.4	140.6	157.6

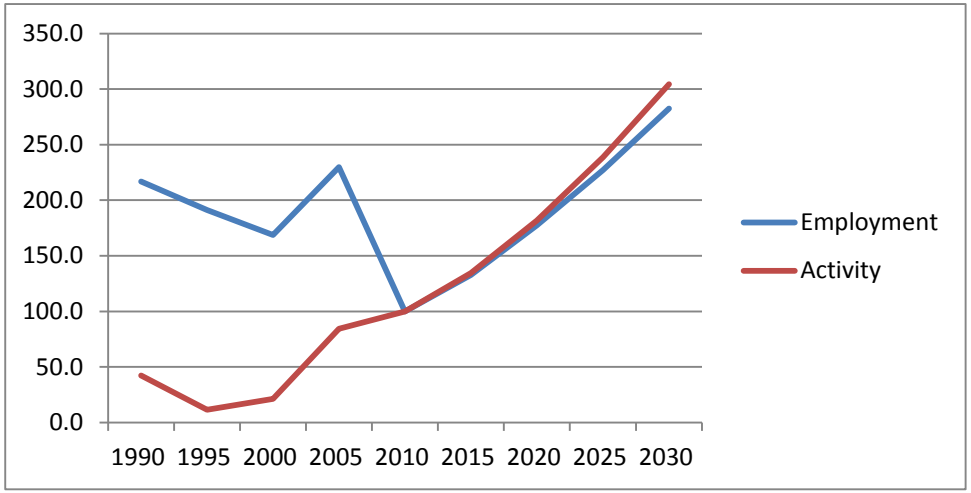


Estonia

Aviation

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	1752	1545	1362	1857	808	1073	1434	1835	2281
Activity	0.4	0.1	0.2	0.7	0.8	1.1	1.5	2.0	2.6
Productivity	204	63	132	386	1050	1062	1075	1103	1132

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	216.9	191.2	168.6	229.9	100.0	132.8	177.5	227.2	282.4
Activity	42.2	11.5	21.1	84.5	100.0	134.4	181.6	238.7	304.3

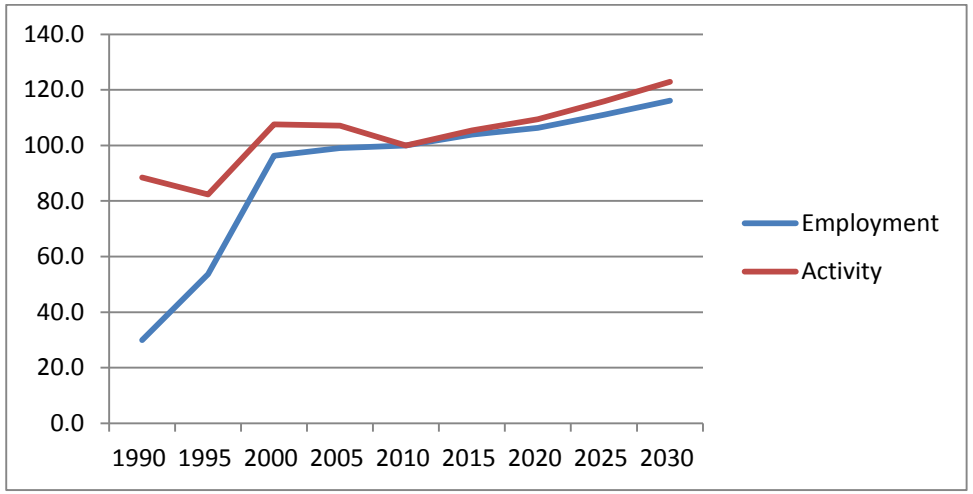


Finland

Road freight transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	11759	21086	37812	38906	39293	40825	41778	43618	45637
Activity	26.3	24.5	32.0	31.9	29.7	31.3	32.5	34.5	36.6
Productivity	2237	1162	846	819	757	768	779	790	801

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	29.9	53.7	96.2	99.0	100.0	103.9	106.3	111.0	116.1
Activity	88.5	82.4	107.5	107.1	100.0	105.4	109.4	115.9	122.9

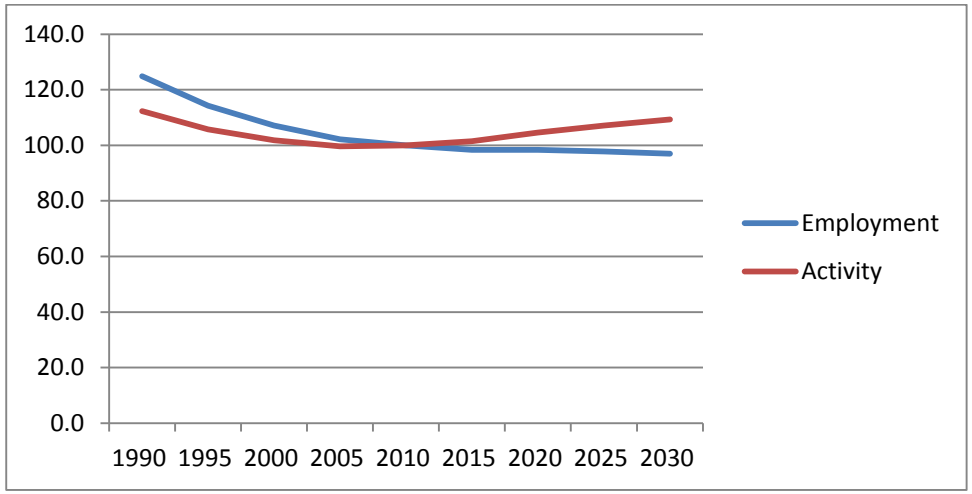


Finland

Public transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	38448	35208	32996	31482	30800	30284	30278	30107	29866
Activity	8.5	8.0	7.7	7.5	7.6	7.7	7.9	8.1	8.3
Productivity	221	227	233	240	246	253	261	269	277

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	124.8	114.3	107.1	102.2	100.0	98.3	98.3	97.8	97.0
Activity	112.3	105.7	101.8	99.7	100.0	101.5	104.6	107.1	109.3

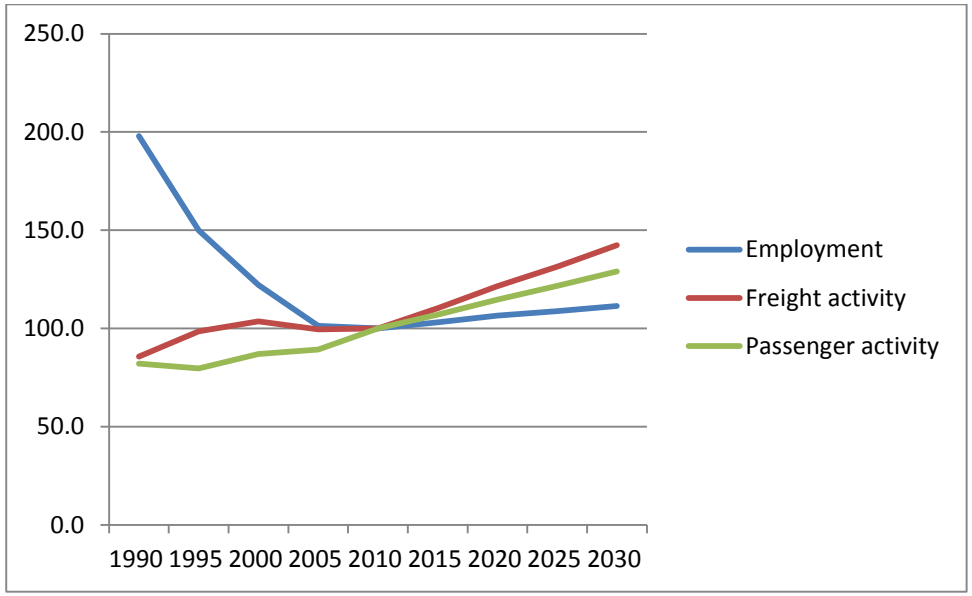


Finland

Rail transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	19824	15005	12236	10144	10015	10321	10665	10898	11160
Freight activity	8.4	9.6	10.1	9.7	9.8	10.8	11.9	12.8	13.9
Passenger activity	3.7	3.6	3.9	4.0	4.5	4.8	5.1	5.5	5.8
Mixed activity	4.9	5.1	5.5	5.4	5.8	6.3	6.8	7.3	7.8
Productivity	245	338	446	535	580	610	640	670	700

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	197.9	149.8	122.2	101.3	100.0	103.1	106.5	108.8	111.4
Freight activity	85.7	98.5	103.7	99.5	100.0	110.3	121.6	131.5	142.3
Passenger activity	82.0	79.6	86.9	89.2	100.0	107.1	114.6	121.6	129.0

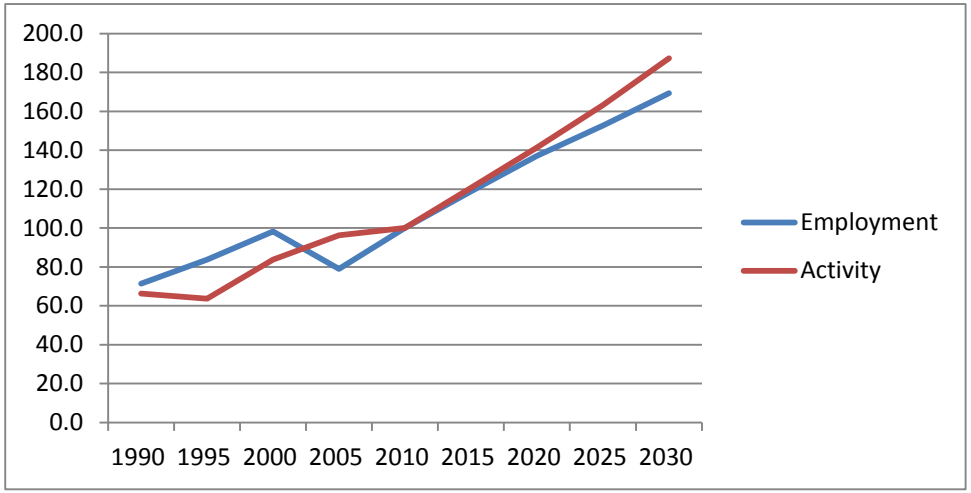


Finland

Aviation

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	4433	5200	6100	4900	6211	7378	8509	9487	10518
Activity	6.1	5.8	7.7	8.8	9.1	11.0	12.9	14.9	17.1
Productivity	1365	1117	1254	1794	1471	1494	1518	1572	1627

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	71.4	83.7	98.2	78.9	100.0	118.8	137.0	152.7	169.3
Activity	66.2	63.6	83.7	96.2	100.0	120.7	141.4	163.3	187.3

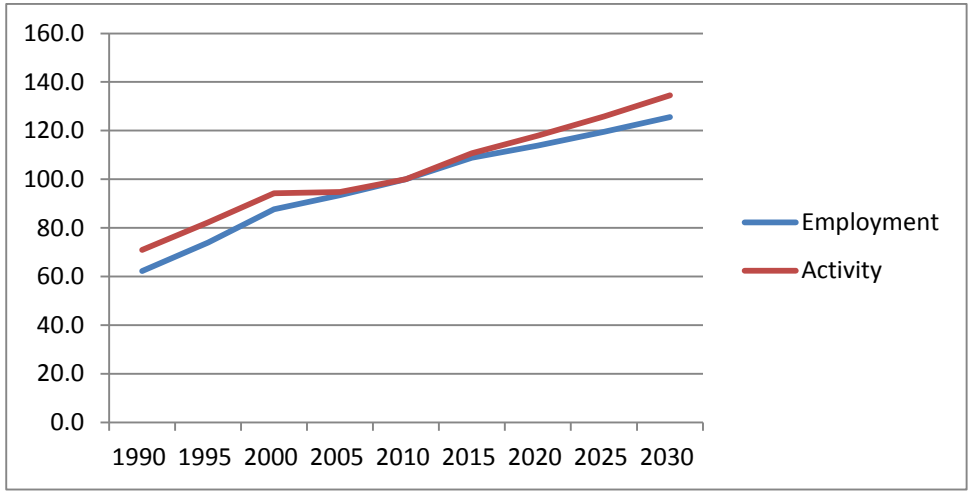


France

Road freight transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	233717	277276	328953	350354	375100	408246	427161	448295	471272
Activity	153.7	178.2	204.0	205.3	216.5	239.8	255.3	272.5	291.2
Productivity	658	643	620	586	577	587	598	608	618

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	62.3	73.9	87.7	93.4	100.0	108.8	113.9	119.5	125.6
Activity	71.0	82.3	94.2	94.8	100.0	110.8	117.9	125.8	134.5

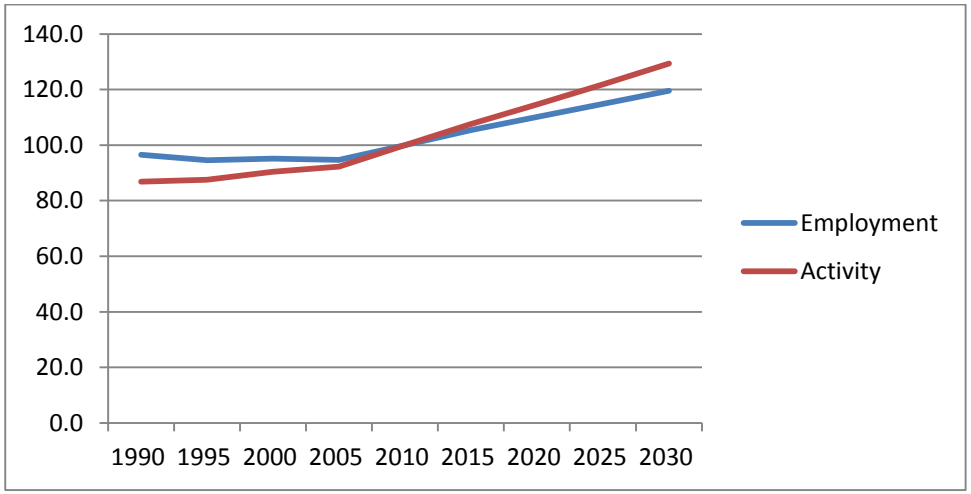


France

Public transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	235172	230568	231949	230677	243700	256876	268258	279852	291378
Activity	41.3	41.6	43.0	43.9	47.5	51.1	54.5	57.9	61.5
Productivity	176	180	185	190	195	199	203	207	211

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	96.5	94.6	95.2	94.7	100.0	105.4	110.1	114.8	119.6
Activity	86.9	87.5	90.4	92.3	100.0	107.6	114.6	121.9	129.4

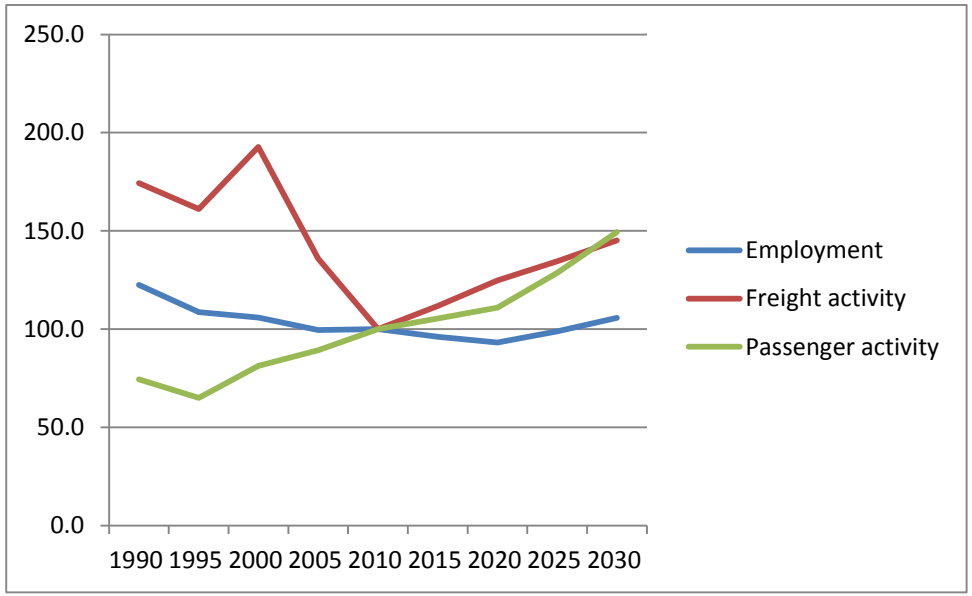


France

Rail transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	202081	179193	174787	164298	165000	158477	153584	163151	174466
Freight activity	52.2	48.3	57.7	40.7	30.0	33.5	37.4	40.3	43.5
Passenger activity	73.9	64.5	80.7	88.6	99.3	104.5	110.1	127.8	148.3
Mixed activity	68.5	60.4	75.0	76.7	81.9	86.8	91.9	105.9	122.1
Productivity	339	337	429	467	497	547	598	649	700

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	122.5	108.6	105.9	99.6	100.0	96.0	93.1	98.9	105.7
Freight activity	174.3	161.1	192.6	135.8	100.0	111.7	124.7	134.6	145.2
Passenger activity	74.5	65.0	81.3	89.3	100.0	105.3	110.9	128.7	149.5

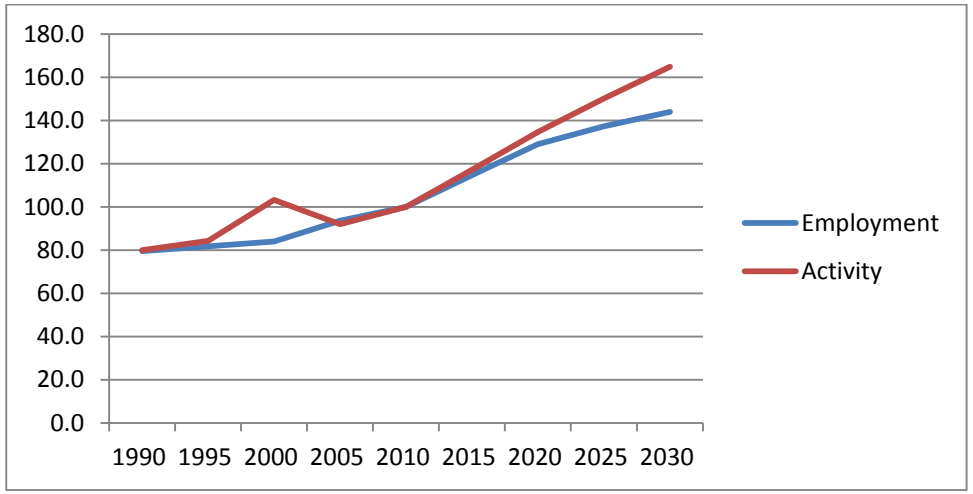


France

Aviation

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	68710	70584	72510	80875	86410	99103	111409	118557	124403
Activity	53.5	56.4	69.1	61.5	66.9	78.4	90.0	100.5	110.3
Productivity	779	799	953	761	775	791	808	848	887

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	79.5	81.7	83.9	93.6	100.0	114.7	128.9	137.2	144.0
Activity	80.0	84.2	103.2	91.9	100.0	117.2	134.5	150.2	164.9

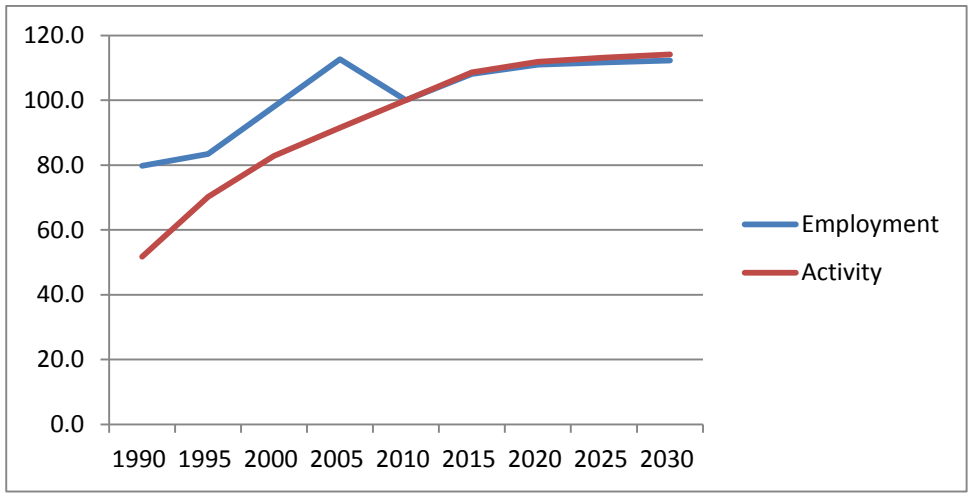


Germany

Road freight transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	286898	300130	352670	405209	359800	389006	399131	401845	403848
Activity	175.2	237.8	280.7	310.1	338.9	368.0	379.2	383.4	386.9
Productivity	611	792	796	765	942	946	950	954	958

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	79.7	83.4	98.0	112.6	100.0	108.1	110.9	111.7	112.2
Activity	51.7	70.2	82.8	91.5	100.0	108.6	111.9	113.1	114.2

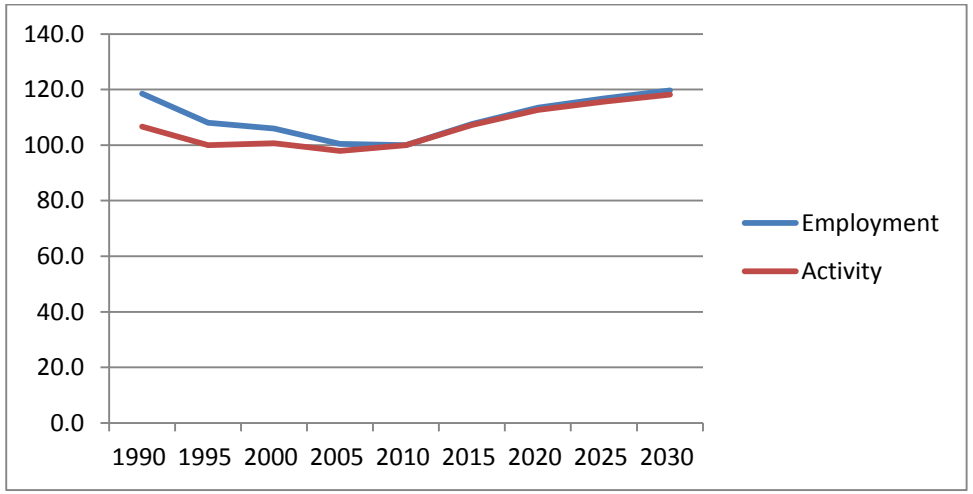


Germany

Public transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	393119	358425	351540	332905	331600	356613	376034	387250	396781
Activity	73.1	68.5	69.0	67.1	68.5	73.4	77.2	79.3	80.9
Productivity	186	191	196	201	207	206	205	205	204

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	118.6	108.1	106.0	100.4	100.0	107.5	113.4	116.8	119.7
Activity	106.7	100.0	100.7	97.9	100.0	107.2	112.7	115.7	118.1

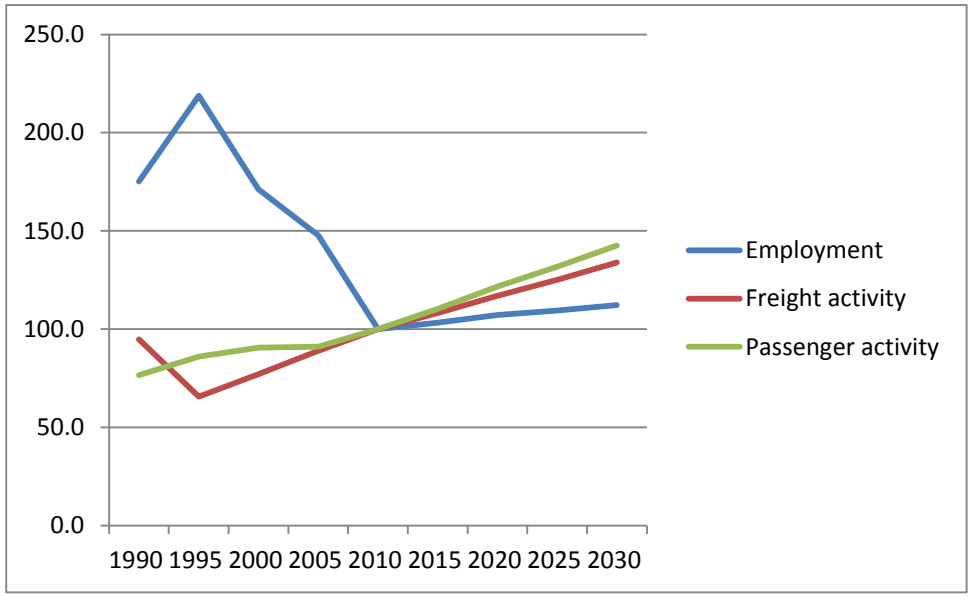


Germany

Rail transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	235975	294691	230615	199000	134702	139181	144317	147540	151255
Freight activity	101.7	70.5	82.7	95.4	107.3	116.1	125.6	134.3	143.6
Passenger activity	76.1	85.4	90.0	90.4	99.4	109.7	121.0	130.9	141.7
Mixed activity	82.5	81.7	88.2	91.7	101.4	111.3	122.1	131.8	142.2
Productivity	350	277	382	461	753	799	846	893	940

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	175.2	218.8	171.2	147.7	100.0	103.3	107.1	109.5	112.3
Freight activity	94.8	65.7	77.0	88.9	100.0	108.2	117.0	125.1	133.9
Passenger activity	76.6	85.9	90.6	91.0	100.0	110.3	121.7	131.7	142.6

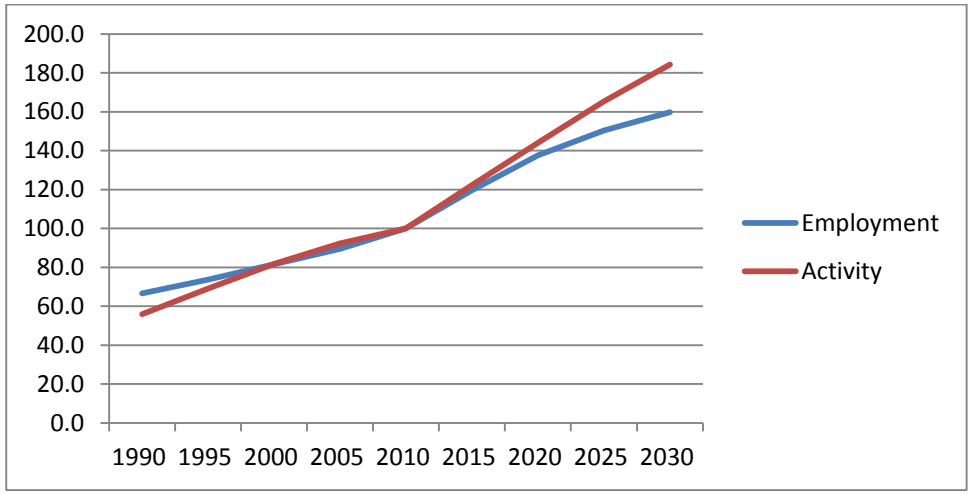


Germany

Aviation

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	42481	47000	52000	57000	63700	76157	87617	95753	101721
Activity	37.4	46.3	54.7	61.7	66.9	81.8	96.3	110.6	123.3
Productivity	881	984	1051	1083	1050	1075	1099	1155	1212

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	66.7	73.8	81.6	89.5	100.0	119.6	137.5	150.3	159.7
Activity	55.9	69.1	81.7	92.3	100.0	122.3	143.9	165.4	184.3

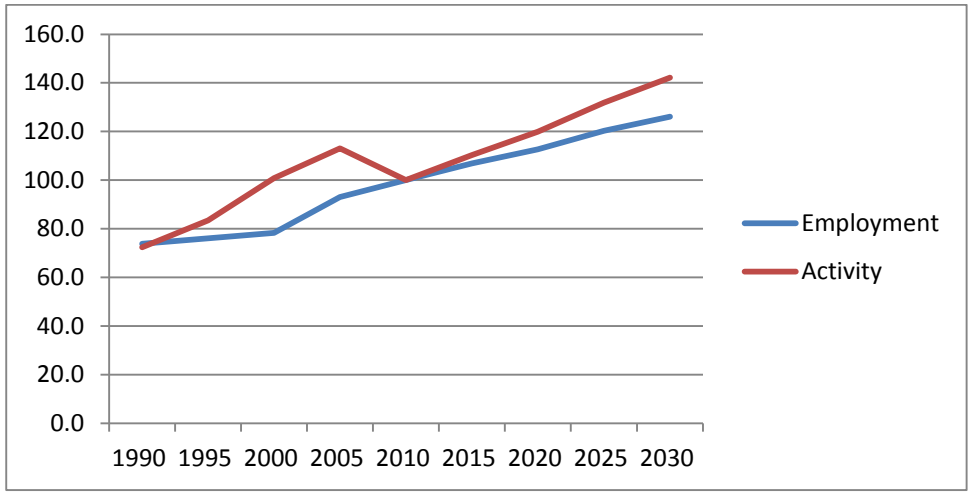


Greece

Road freight transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	33544	34531	35547	42278	45400	48508	51182	54638	57236
Activity	20.8	24.0	29.0	32.5	28.7	31.7	34.5	37.9	40.9
Productivity	620	695	816	769	633	653	674	694	714

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	73.9	76.1	78.3	93.1	100.0	106.8	112.7	120.3	126.1
Activity	72.4	83.5	100.9	113.1	100.0	110.3	119.9	131.9	142.2

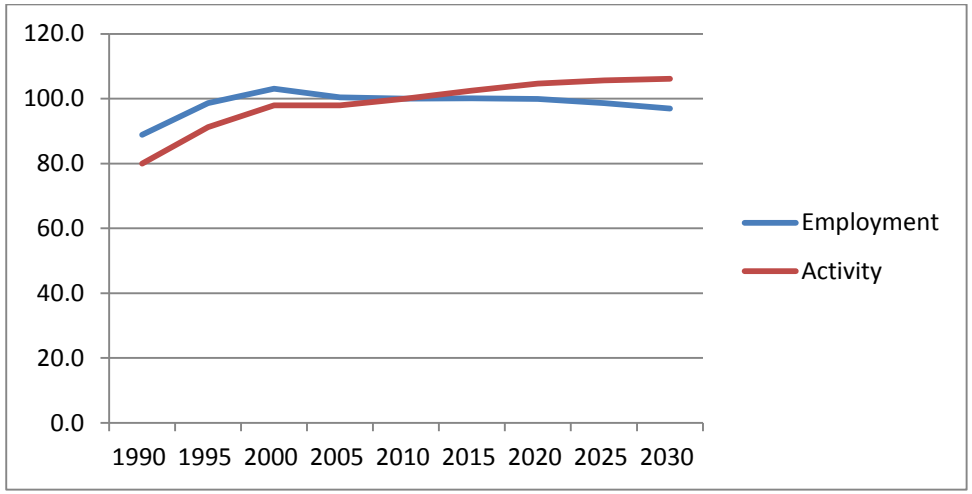


Greece

Public transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	47980	53279	55671	54243	54000	54072	53966	53269	52351
Activity	17.7	20.2	21.7	21.7	22.2	22.7	23.2	23.4	23.5
Productivity	369	380	390	400	410	420	430	439	449

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	88.9	98.7	103.1	100.5	100.0	100.1	99.9	98.6	96.9
Activity	80.0	91.3	97.9	97.9	100.0	102.5	104.6	105.6	106.1

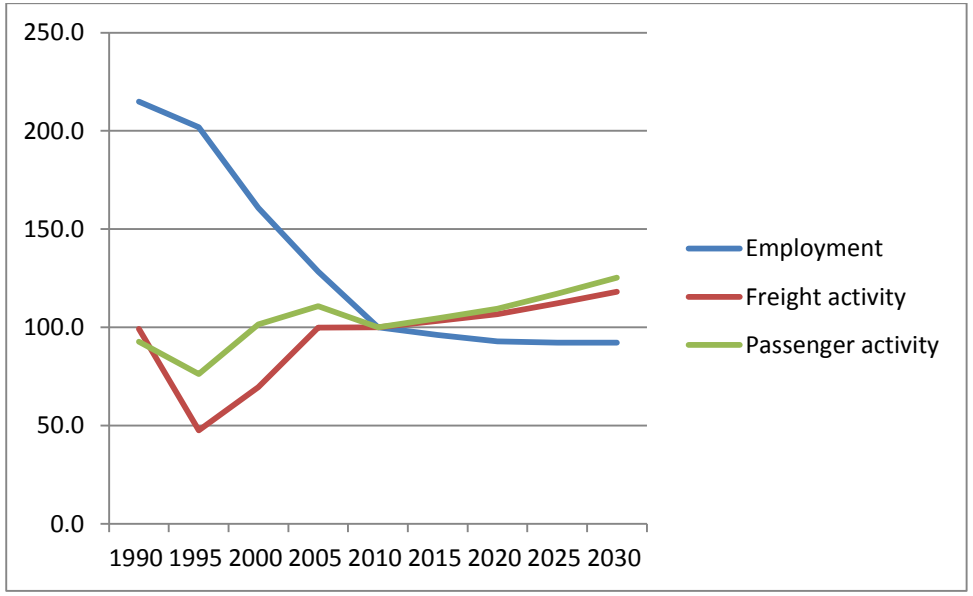


Greece

Rail transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	13324	12510	9973	7963	6200	5953	5754	5719	5712
Freight activity	0.6	0.3	0.4	0.6	0.6	0.6	0.7	0.7	0.7
Passenger activity	2.8	2.3	3.1	3.4	3.0	3.2	3.3	3.5	3.8
Mixed activity	2.3	1.8	2.4	2.7	2.4	2.5	2.7	2.8	3.0
Productivity	169	144	242	335	391	426	461	495	530

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	214.9	201.8	160.9	128.4	100.0	96.0	92.8	92.2	92.1
Freight activity	99.2	47.6	69.5	99.8	100.0	103.3	106.6	112.2	118.1
Passenger activity	92.6	76.2	101.5	110.7	100.0	104.6	109.4	117.1	125.2

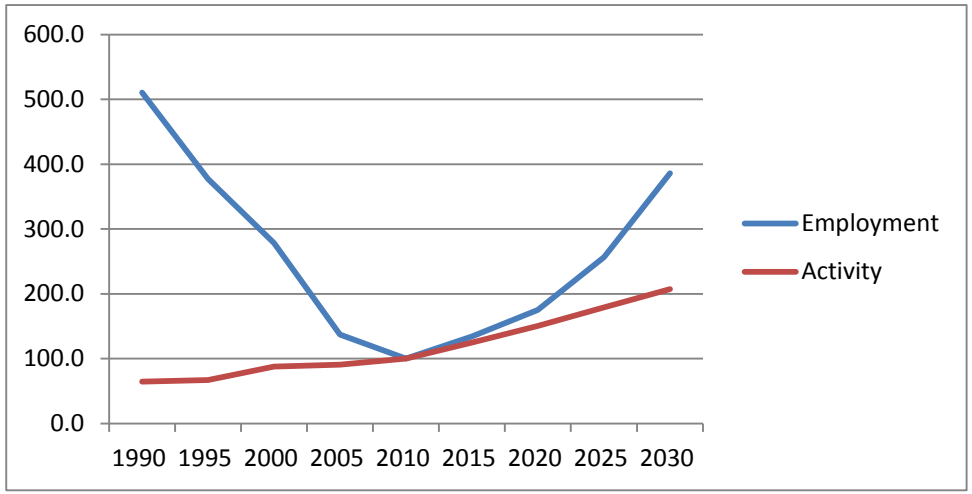


Greece

Aviation

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	25200	18613	13748	6768	4936	6616	8644	12659	19060
Activity	22.1	22.8	29.9	31.1	34.1	42.6	51.5	61.2	70.7
Productivity	878	1227	2176	4588	6918	6437	5956	4833	3710

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	510.5	377.1	278.5	137.1	100.0	134.0	175.1	256.5	386.1
Activity	64.8	66.9	87.6	90.9	100.0	124.7	150.8	179.2	207.1

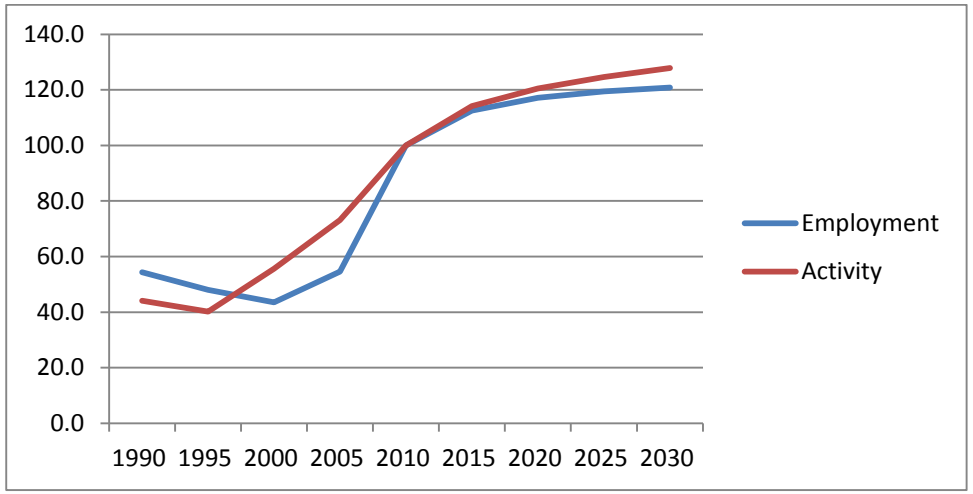


Hungary

Road freight transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	34000	30000	27200	34128	62500	70310	73200	74644	75516
Activity	15.2	13.8	19.1	25.2	34.4	39.2	41.4	42.8	44.0
Productivity	446	460	703	737	550	558	566	574	582

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	54.4	48.0	43.5	54.6	100.0	112.5	117.1	119.4	120.8
Activity	44.1	40.1	55.6	73.2	100.0	114.1	120.5	124.6	127.9

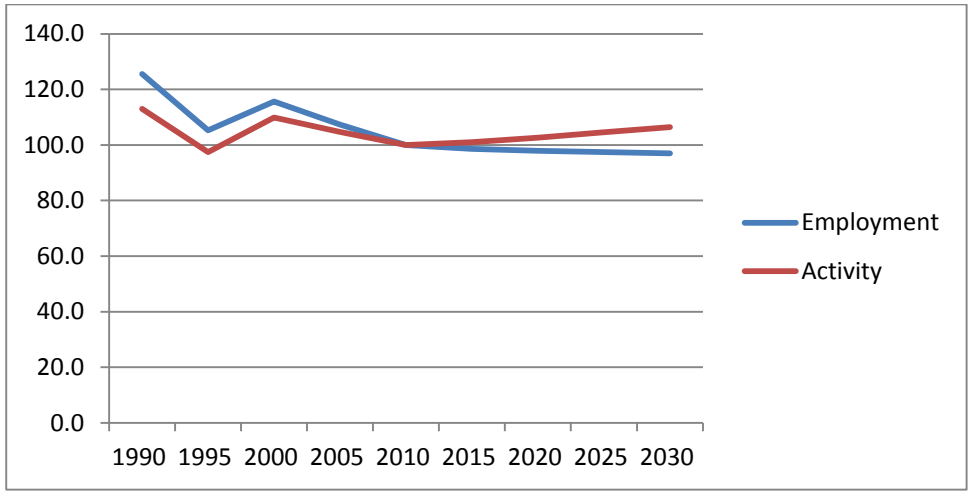


Hungary

Public transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	61006	51172	56208	52173	48600	47918	47572	47358	47114
Activity	19.3	16.6	18.7	17.8	17.0	17.2	17.5	17.8	18.1
Productivity	316	324	333	342	351	359	368	376	385

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	125.5	105.3	115.7	107.4	100.0	98.6	97.9	97.4	96.9
Activity	113.0	97.4	109.9	104.7	100.0	101.0	102.7	104.6	106.4

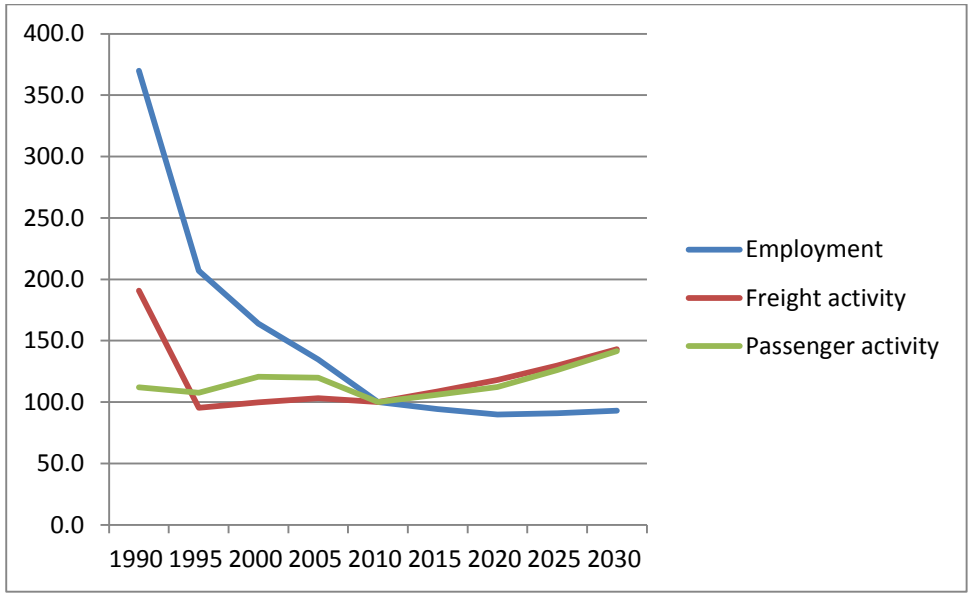


Hungary

Rail transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	129067	72246	57242	47000	34900	32868	31382	31753	32419
Freight activity	16.8	8.4	8.8	9.1	8.8	9.6	10.4	11.4	12.6
Passenger activity	11.4	10.9	12.3	12.2	10.2	10.8	11.4	12.8	14.4
Mixed activity	12.8	10.3	11.4	11.4	9.8	10.5	11.2	12.5	13.9
Productivity	99	143	199	243	282	319	356	393	430

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	369.8	207.0	164.0	134.7	100.0	94.2	89.9	91.0	92.9
Freight activity	190.7	95.4	99.9	103.2	100.0	108.6	118.0	129.9	142.9
Passenger activity	112.1	107.5	120.5	120.0	100.0	106.0	112.3	126.0	141.4

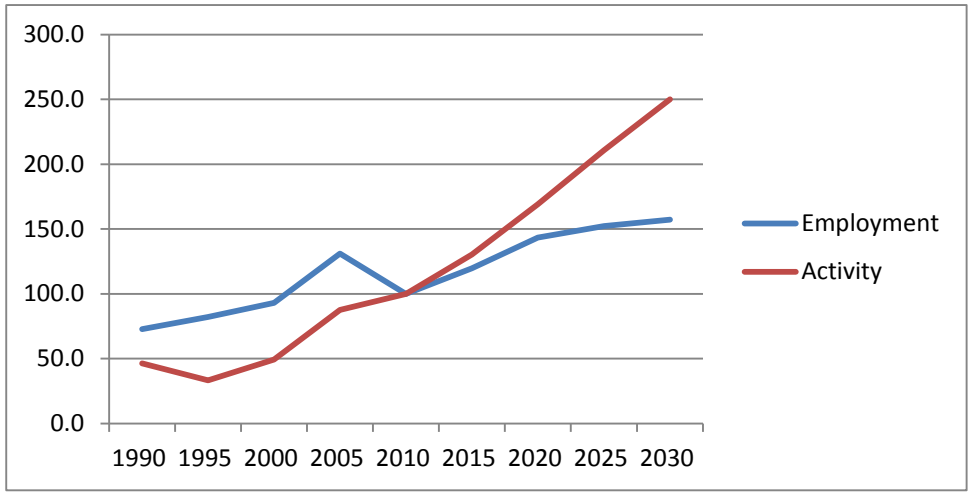


Hungary

Aviation

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	6130	6927	7828	11042	8422	10088	12082	12817	13230
Activity	1.9	1.4	2.1	3.7	4.2	5.5	7.1	8.8	10.5
Productivity	316	201	264	331	496	540	584	687	790

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	72.8	82.2	92.9	131.1	100.0	119.8	143.5	152.2	157.1
Activity	46.3	33.3	49.4	87.6	100.0	130.4	168.9	210.7	250.1

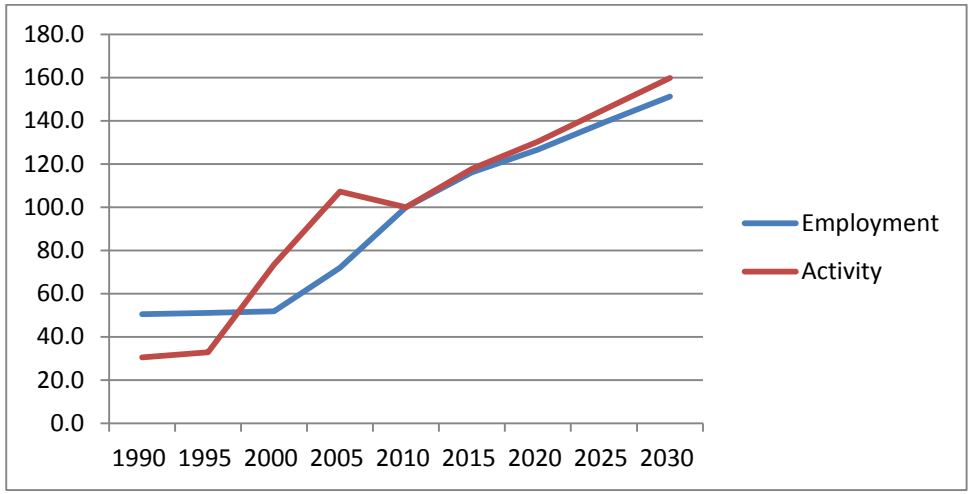


Ireland

Road freight transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	9736	9867	10000	13892	19300	22398	24449	26871	29182
Activity	5.1	5.5	12.3	17.9	16.7	19.7	21.8	24.3	26.7
Productivity	524	557	1228	1289	866	878	890	903	915

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	50.4	51.1	51.8	72.0	100.0	116.1	126.7	139.2	151.2
Activity	30.5	32.9	73.4	107.2	100.0	117.7	130.3	145.1	159.8

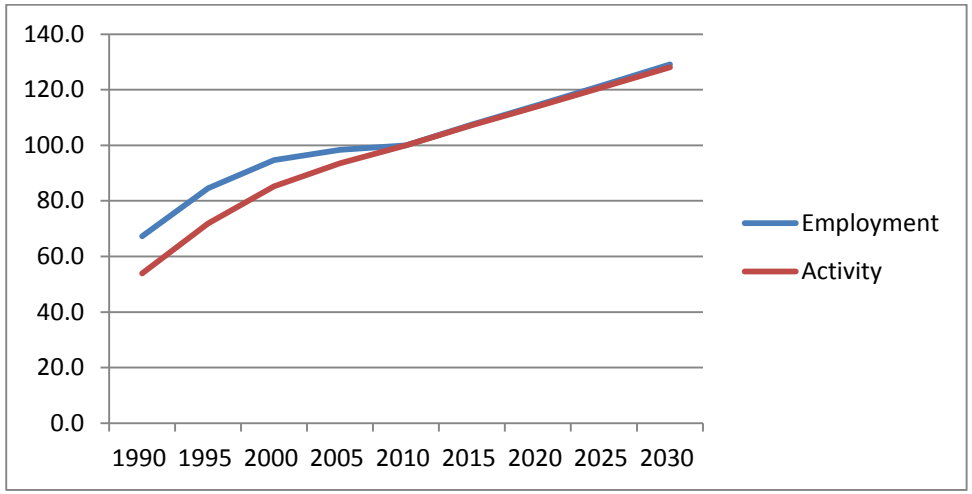


Ireland

Public transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	6462	8115	9093	9446	9600	10315	10985	11686	12391
Activity	3.9	5.2	6.1	6.7	7.2	7.7	8.2	8.7	9.2
Productivity	597	635	672	709	747	745	744	742	741

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	67.3	84.5	94.7	98.4	100.0	107.4	114.4	121.7	129.1
Activity	53.9	71.8	85.2	93.5	100.0	107.2	114.0	121.0	128.1

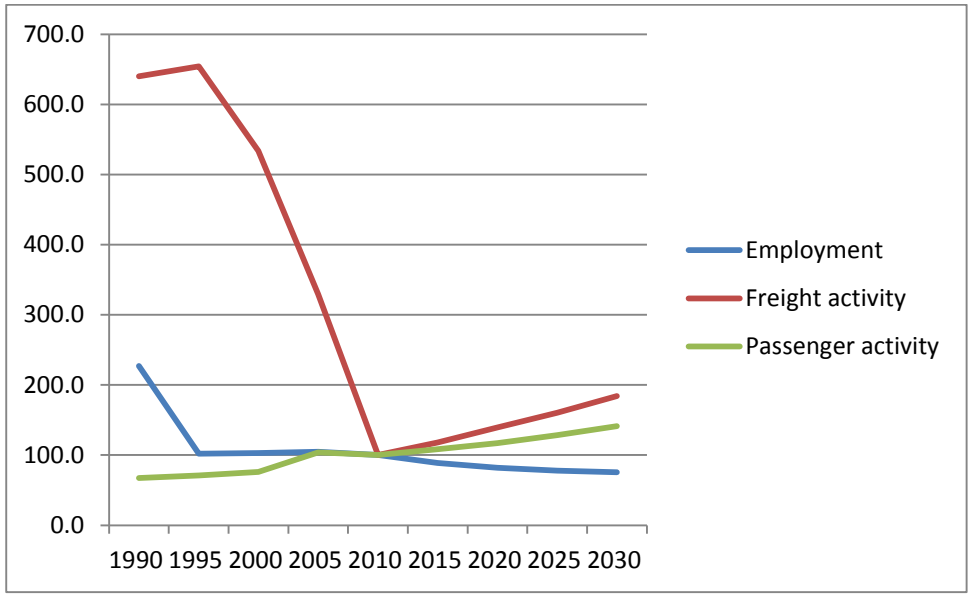


Ireland

Rail transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	11799	5313	5358	5450	5200	4628	4255	4059	3940
Freight activity	0.6	0.6	0.5	0.3	0.1	0.1	0.1	0.1	0.2
Passenger activity	1.2	1.3	1.4	1.9	1.8	2.0	2.1	2.3	2.6
Mixed activity	1.1	1.1	1.2	1.5	1.4	1.5	1.6	1.8	2.0
Productivity	90	211	217	274	267	325	384	442	500

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	226.9	102.2	103.0	104.8	100.0	89.0	81.8	78.1	75.8
Freight activity	640.2	654.3	533.7	329.3	100.0	118.0	139.4	160.3	184.4
Passenger activity	67.3	70.9	76.2	103.8	100.0	108.2	117.1	128.5	141.1

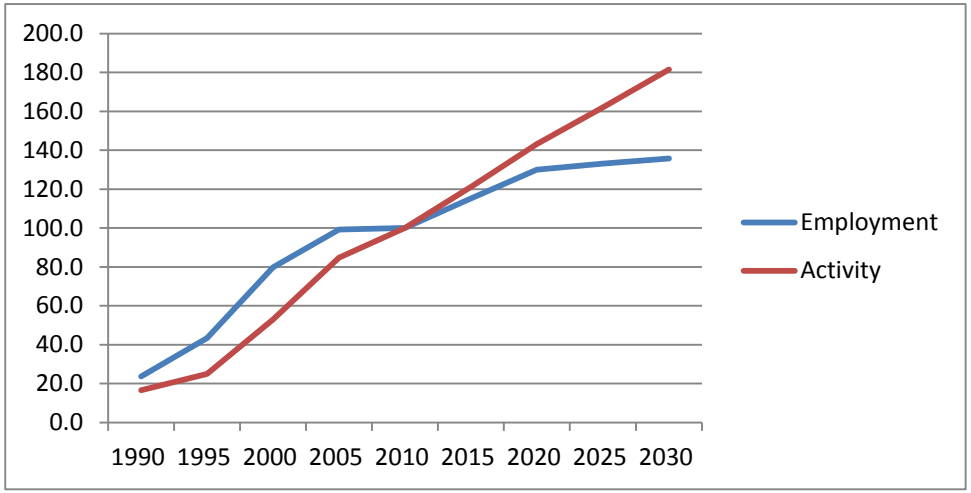


Ireland

Aviation

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	5611	10295	18889	23501	23692	27296	30802	31517	32174
Activity	2.0	3.0	6.3	10.1	11.9	14.4	17.0	19.2	21.5
Productivity	351	288	332	428	501	526	551	610	669

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	23.7	43.5	79.7	99.2	100.0	115.2	130.0	133.0	135.8
Activity	16.6	25.0	52.9	84.8	100.0	121.0	143.1	162.1	181.5

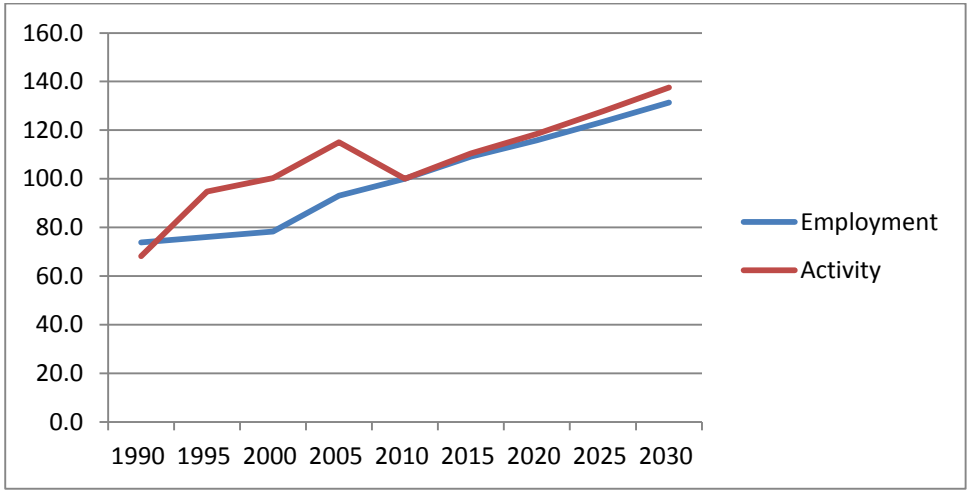


Italy

Road freight transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	165143	170000	175000	208141	223509	243873	258778	275823	293761
Activity	125.5	174.4	184.7	211.8	184.0	203.1	218.1	235.1	253.2
Productivity	760	1026	1055	1018	823	833	843	852	862

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	73.9	76.1	78.3	93.1	100.0	109.1	115.8	123.4	131.4
Activity	68.2	94.8	100.4	115.1	100.0	110.4	118.5	127.8	137.6

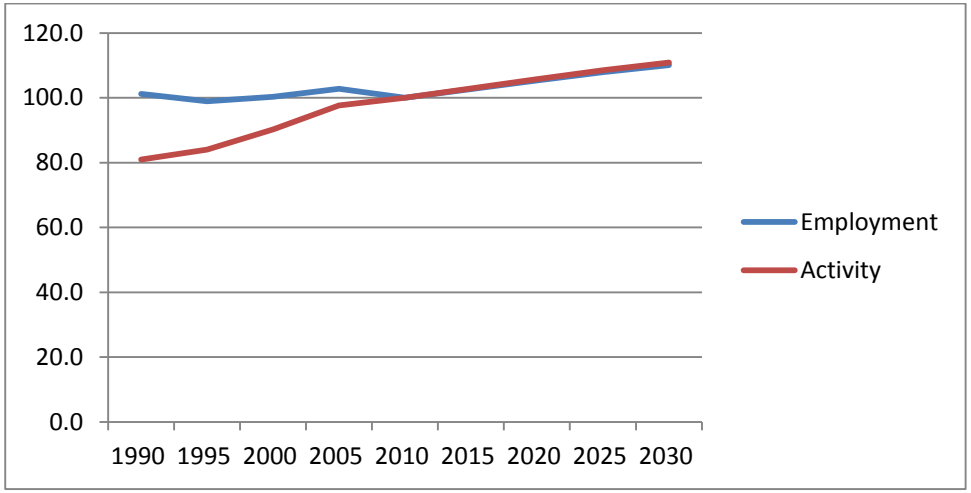


Italy

Public transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	177047	172968	175361	179758	174900	179609	184184	188786	192546
Activity	84.0	87.1	93.6	101.2	103.7	106.7	109.6	112.5	115.0
Productivity	474	504	533	563	593	594	595	596	597

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	101.2	98.9	100.3	102.8	100.0	102.7	105.3	107.9	110.1
Activity	81.0	84.1	90.2	97.6	100.0	102.9	105.7	108.5	110.9

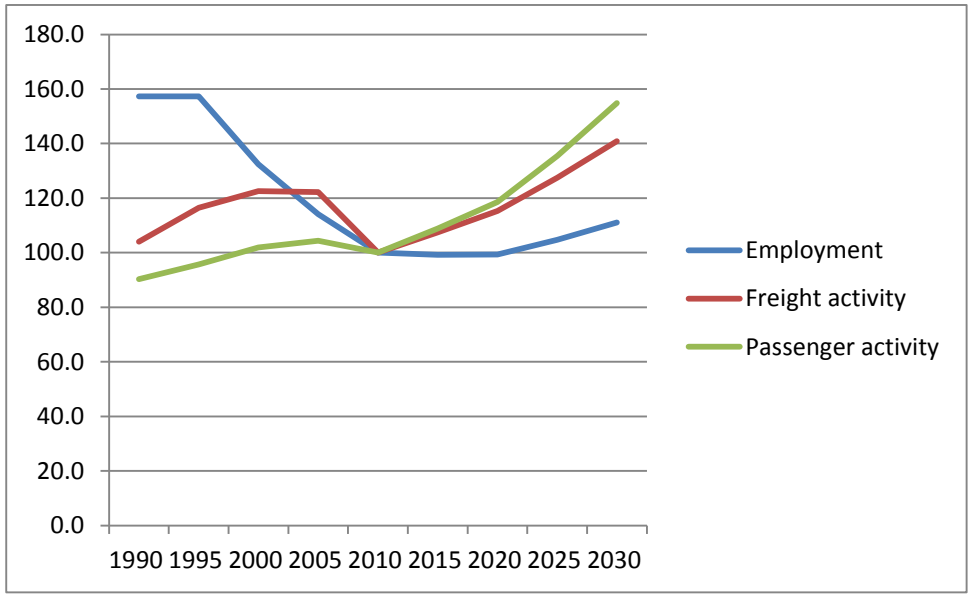


Italy

Rail transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	126061	126061	106180	91500	80153	79575	79604	83945	89020
Freight activity	19.4	21.7	22.8	22.8	18.6	20.0	21.5	23.7	26.2
Passenger activity	48.9	51.8	55.2	56.5	54.2	59.0	64.2	73.4	83.8
Mixed activity	41.5	44.3	47.1	48.1	45.3	49.2	53.5	61.0	69.4
Productivity	329	351	443	525	565	619	672	726	780

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	157.3	157.3	132.5	114.2	100.0	99.3	99.3	104.7	111.1
Freight activity	104.0	116.5	122.6	122.3	100.0	107.4	115.3	127.4	140.9
Passenger activity	90.3	95.6	101.9	104.3	100.0	108.9	118.6	135.5	154.8

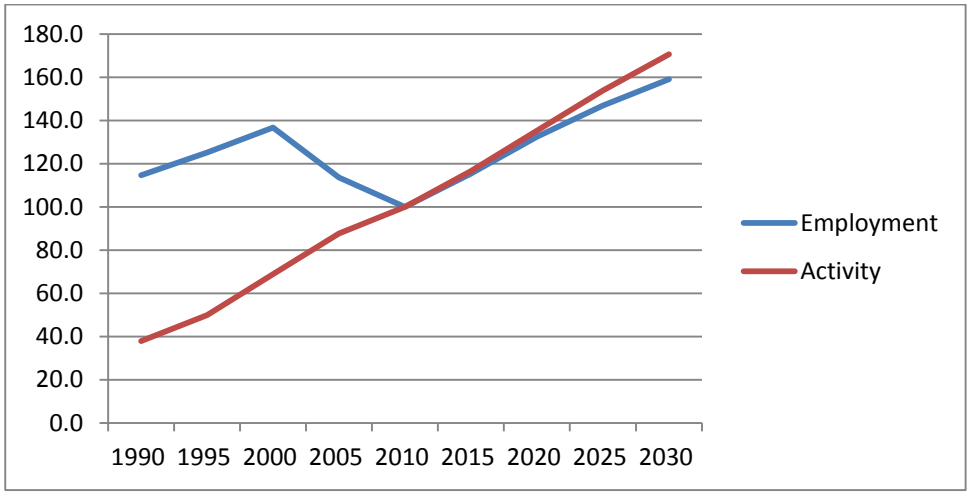


Italy

Aviation

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	20877	22800	24900	20700	18215	21009	24106	26768	28974
Activity	18.4	24.3	33.5	42.7	48.6	56.7	65.7	74.8	83.0
Productivity	881	1064	1346	2061	2669	2698	2728	2795	2863

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	114.6	125.2	136.7	113.6	100.0	115.3	132.3	147.0	159.1
Activity	37.8	49.9	68.9	87.7	100.0	116.6	135.2	153.9	170.6

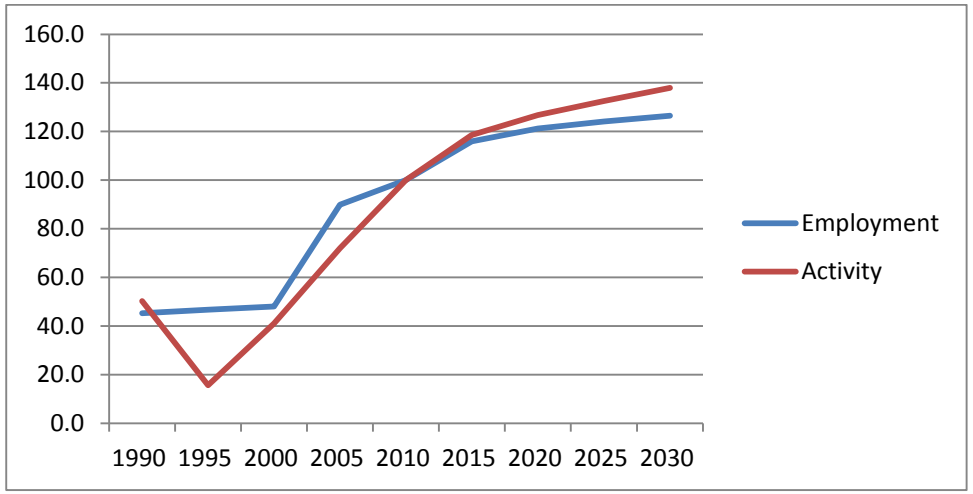


Latvia

Road freight transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	8176	8423	8677	16220	18043	20921	21874	22404	22829
Activity	5.9	1.8	4.8	8.4	11.6	13.8	14.8	15.4	16.1
Productivity	715	217	552	518	646	660	675	689	704

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	45.3	46.7	48.1	89.9	100.0	116.0	121.2	124.2	126.5
Activity	50.2	15.7	41.1	72.1	100.0	118.6	126.7	132.6	138.0

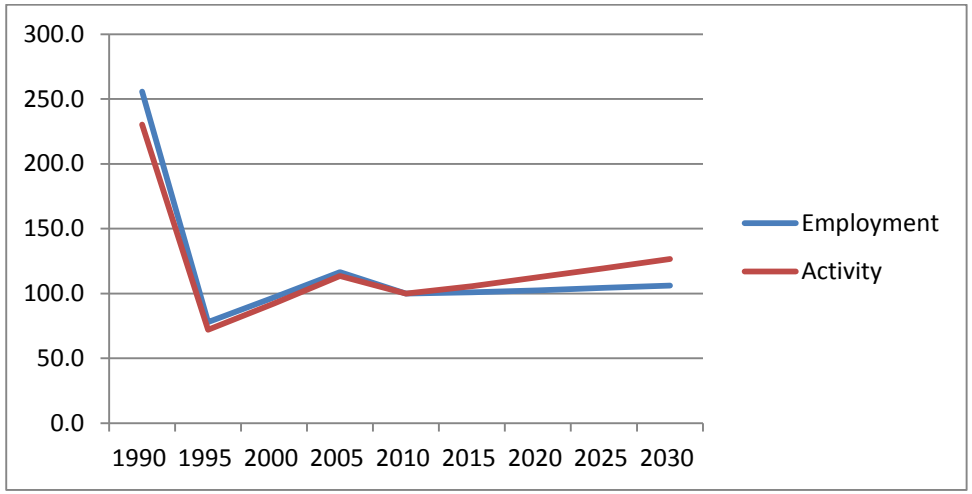


Latvia

Public transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	31976	9739	12134	14557	12500	12608	12817	13052	13256
Activity	5.9	1.8	2.3	2.9	2.5	2.7	2.9	3.0	3.2
Productivity	183	188	194	199	204	214	223	233	243

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	255.8	77.9	97.1	116.5	100.0	100.9	102.5	104.4	106.0
Activity	230.2	72.1	92.2	113.5	100.0	105.7	112.4	119.5	126.5

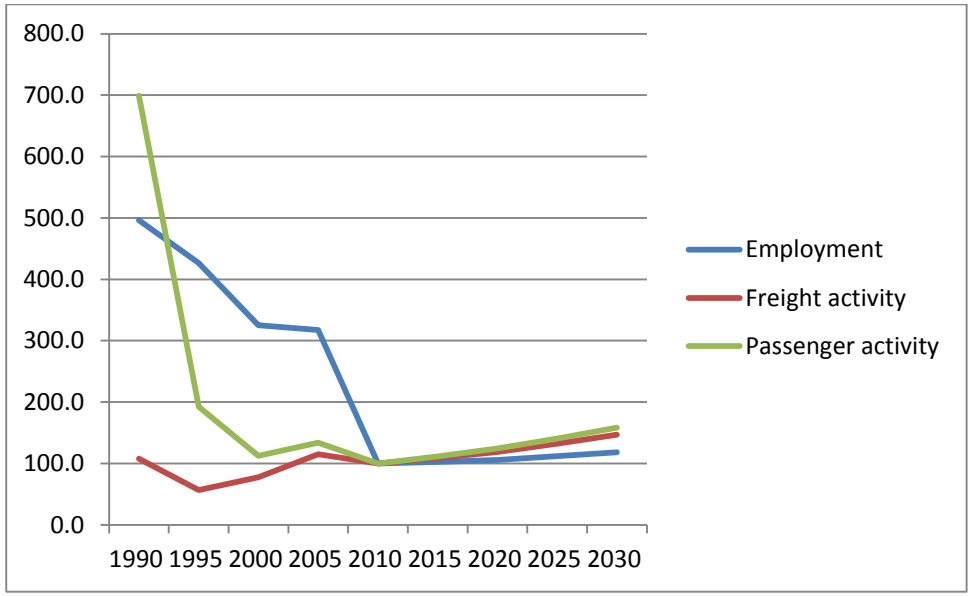


Latvia

Rail transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	23736	20399	15563	15178	4785	4915	5068	5344	5652
Freight activity	18.5	9.8	13.3	19.8	17.2	18.7	20.4	22.7	25.2
Passenger activity	6.1	1.7	1.0	1.2	0.9	1.0	1.1	1.2	1.4
Mixed activity	9.2	3.7	4.1	5.8	4.9	5.4	5.9	6.6	7.3
Productivity	388	181	261	383	1034	1101	1167	1234	1300

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	496.1	426.3	325.2	317.2	100.0	102.7	105.9	111.7	118.1
Freight activity	107.9	56.8	77.5	115.1	100.0	109.0	118.8	132.1	146.9
Passenger activity	699.0	192.3	112.6	133.8	100.0	111.6	124.6	140.5	158.5

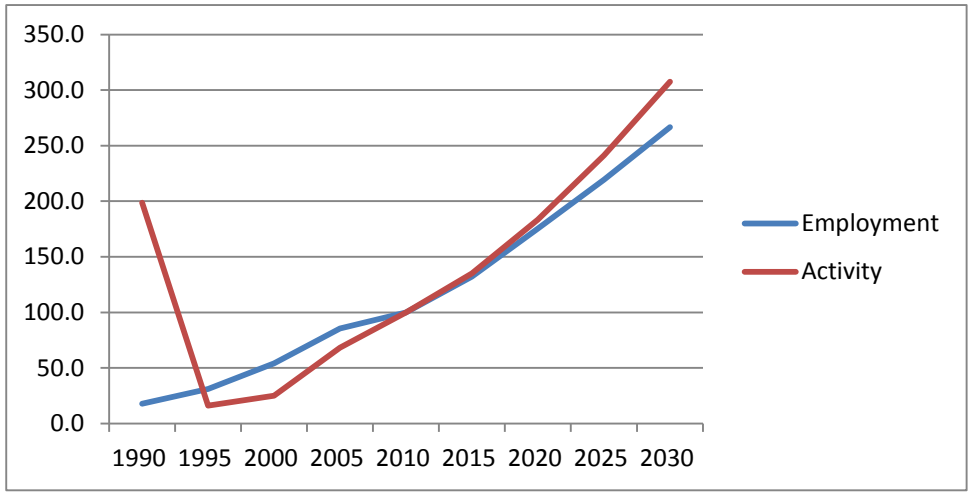


Latvia

Aviation

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	257	449	783	1233	1444	1906	2533	3166	3849
Activity	2.5	0.2	0.3	0.8	1.2	1.7	2.3	3.0	3.8
Productivity	9574	445	395	686	859	878	898	945	991

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	17.8	31.1	54.2	85.4	100.0	132.0	175.4	219.3	266.6
Activity	198.6	16.1	24.9	68.2	100.0	135.1	183.5	241.3	307.7

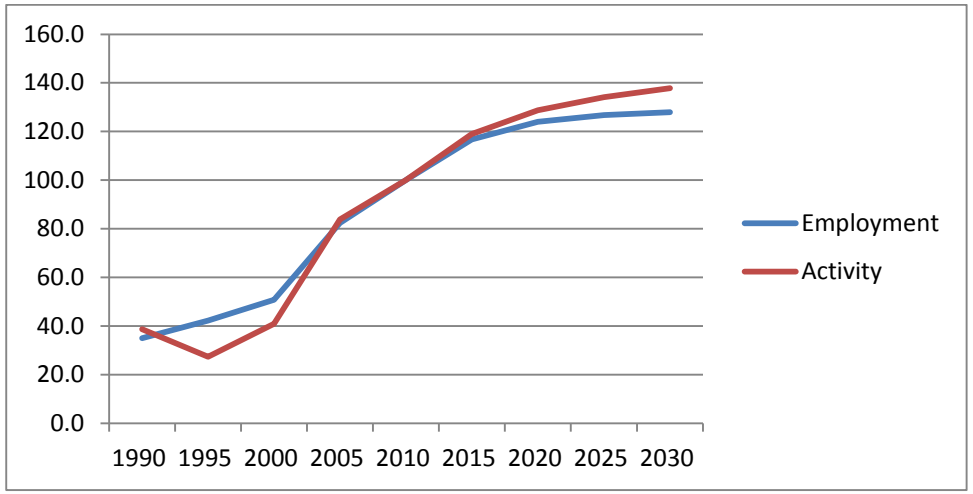


Lithuania

Road freight transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	12551	15112	18195	29517	35800	41807	44371	45378	45795
Activity	7.3	5.2	7.8	15.9	19.0	22.6	24.4	25.4	26.1
Productivity	584	344	427	539	530	540	550	561	571

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	35.1	42.2	50.8	82.4	100.0	116.8	123.9	126.8	127.9
Activity	38.7	27.4	41.0	83.9	100.0	119.1	128.8	134.2	137.9

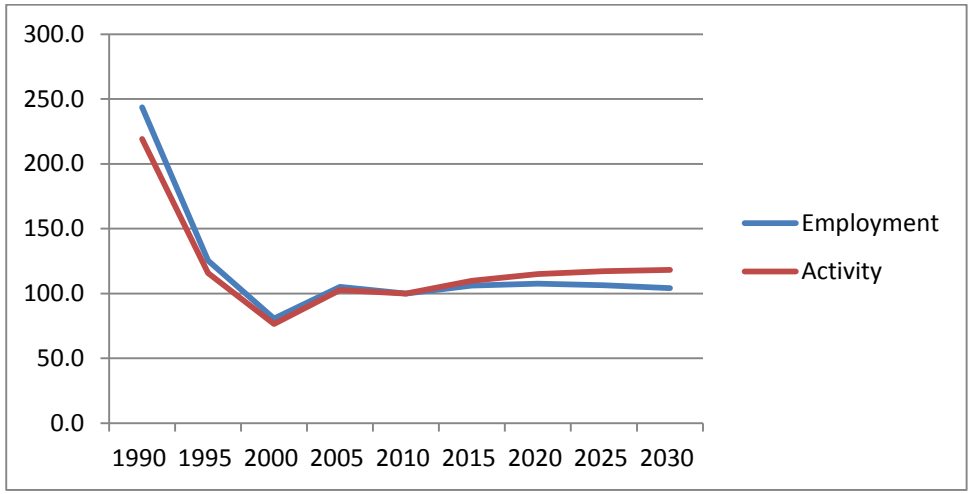


Lithuania

Public transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	37273	19165	12331	16097	15300	16246	16473	16290	15923
Activity	7.9	4.2	2.8	3.7	3.6	3.9	4.1	4.2	4.3
Productivity	212	218	223	229	235	243	251	259	267

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	243.6	125.3	80.6	105.2	100.0	106.2	107.7	106.5	104.1
Activity	219.3	115.9	76.6	102.6	100.0	109.8	114.9	117.3	118.2

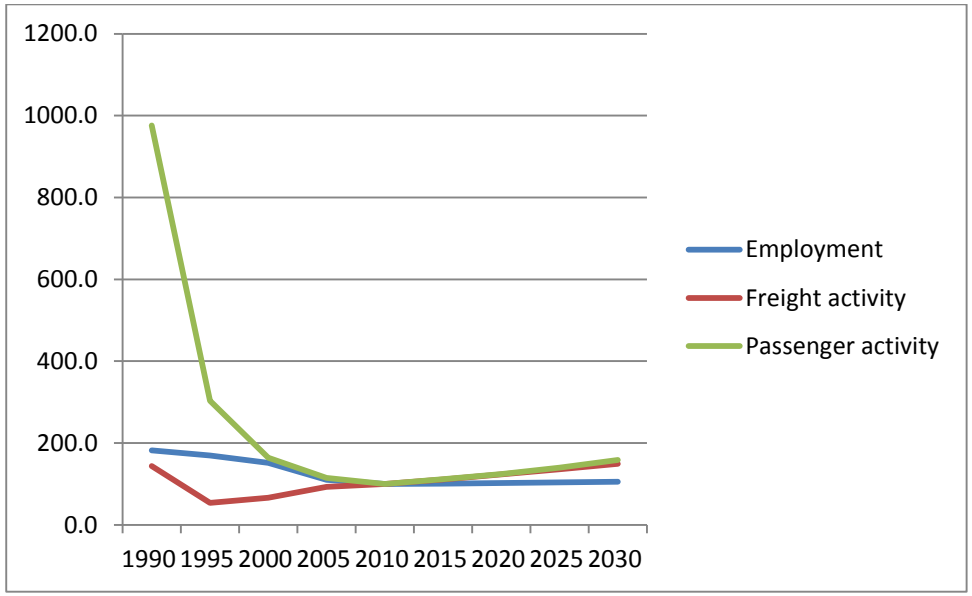


Lithuania

Rail transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	18788	17511	15618	11327	10318	10377	10532	10677	10893
Freight activity	19.3	7.2	8.9	12.5	13.4	14.9	16.6	18.2	20.0
Passenger activity	3.6	1.1	0.6	0.4	0.4	0.4	0.5	0.5	0.6
Mixed activity	7.5	2.6	2.7	3.4	3.6	4.0	4.5	4.9	5.4
Productivity	402	151	172	303	353	389	426	463	500

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	182.1	169.7	151.4	109.8	100.0	100.6	102.1	103.5	105.6
Freight activity	143.4	53.6	66.4	92.7	100.0	111.1	123.4	135.6	149.0
Passenger activity	975.7	302.9	163.8	114.7	100.0	111.2	123.8	140.0	158.3

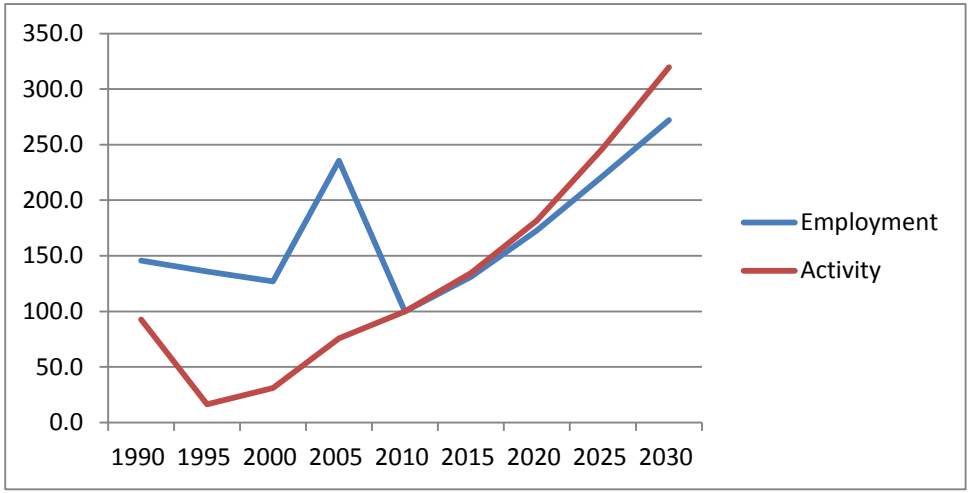


Lithuania

Aviation

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	1607	1500	1400	2600	1104	1446	1906	2449	3004
Activity	1.0	0.2	0.3	0.8	1.0	1.4	1.9	2.6	3.3
Productivity	600	113	231	303	943	968	993	1050	1108

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	145.6	135.9	126.8	235.5	100.0	131.0	172.7	221.9	272.1
Activity	92.6	16.3	31.1	75.6	100.0	134.4	181.7	247.0	319.6

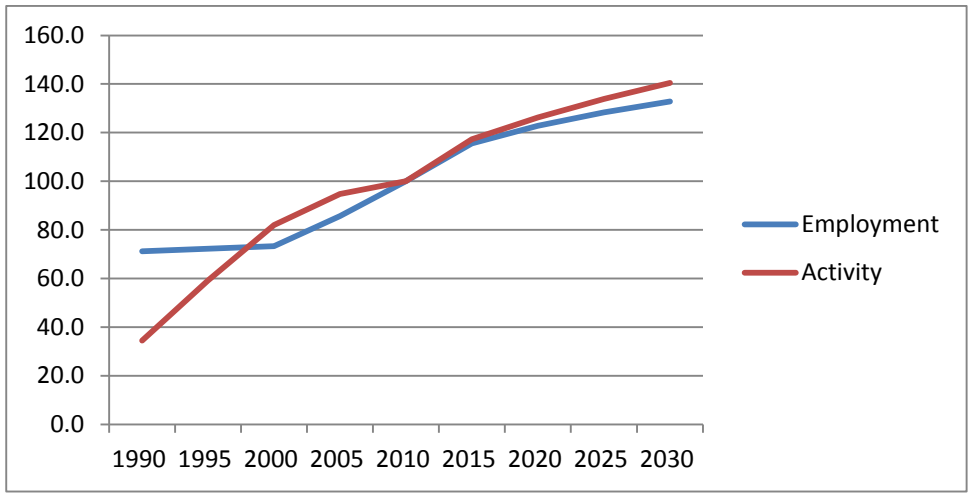


Luxembourg

Road freight transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	5915	6000	6086	7107	8300	9594	10191	10654	11028
Activity	3.2	5.5	7.6	8.8	9.3	10.9	11.7	12.4	13.0
Productivity	541	917	1250	1239	1118	1134	1150	1166	1182

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	71.3	72.3	73.3	85.6	100.0	115.6	122.8	128.4	132.9
Activity	34.5	59.2	82.0	94.8	100.0	117.2	126.3	133.8	140.4

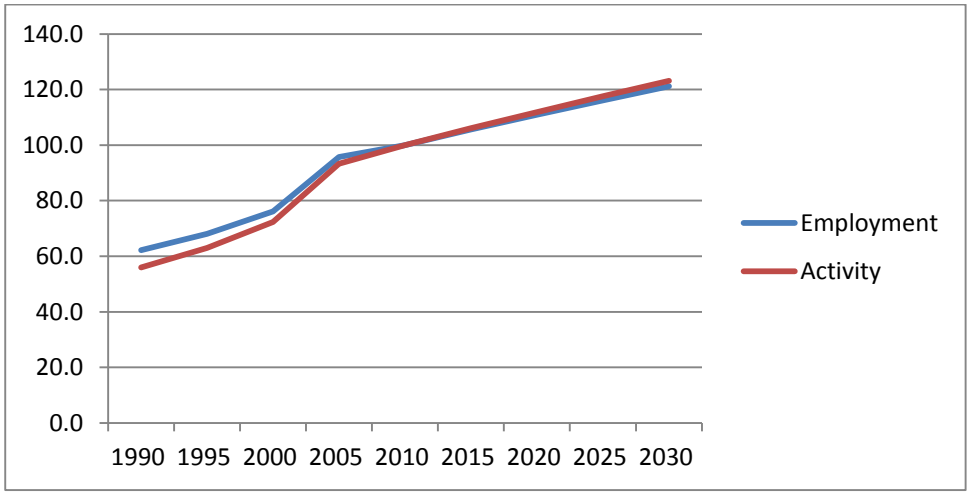


Luxembourg

Public transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	2052	2247	2512	3158	3300	3486	3660	3833	3999
Activity	0.5	0.5	0.6	0.8	0.9	0.9	1.0	1.0	1.1
Productivity	234	240	247	253	260	261	262	263	264

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	62.2	68.1	76.1	95.7	100.0	105.6	110.9	116.2	121.2
Activity	56.0	63.0	72.3	93.3	100.0	106.1	111.8	117.5	123.1

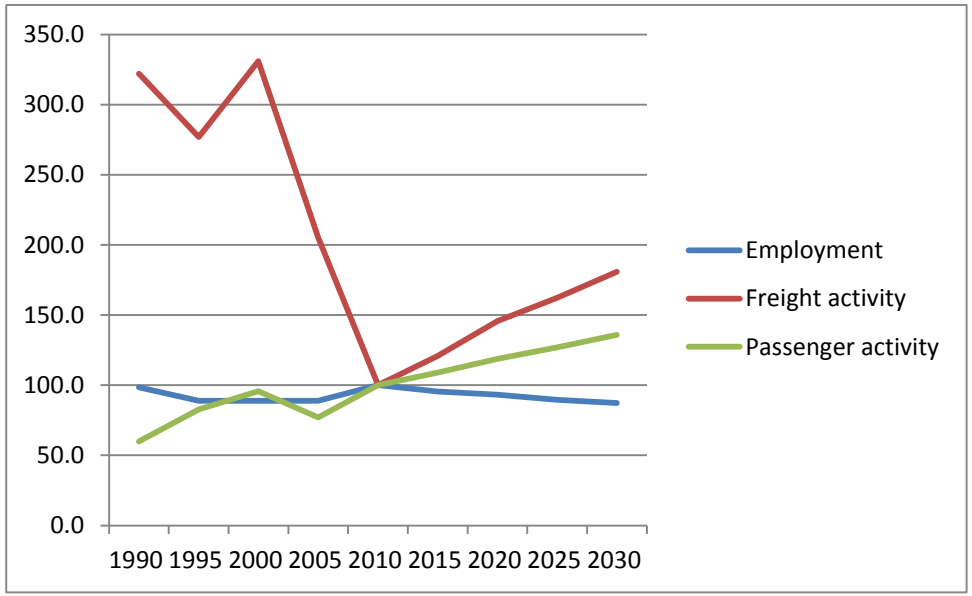


Luxembourg

Rail transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	3543	3200	3200	3200	3600	3441	3358	3229	3142
Freight activity	0.6	0.5	0.6	0.4	0.2	0.2	0.3	0.3	0.3
Passenger activity	0.2	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.5
Mixed activity	0.3	0.3	0.4	0.3	0.3	0.3	0.4	0.4	0.4
Productivity	87	109	127	93	86	99	113	126	140

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	98.4	88.9	88.9	88.9	100.0	95.6	93.3	89.7	87.3
Freight activity	322.0	277.0	330.9	205.2	100.0	120.7	145.8	162.4	180.8
Passenger activity	59.9	82.7	95.7	76.9	100.0	109.0	118.7	127.0	135.8

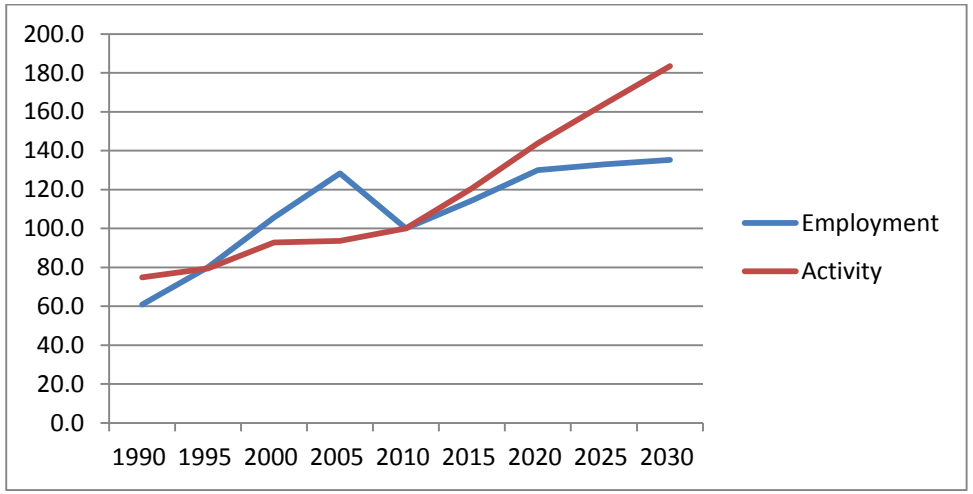


Luxembourg

Aviation

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	1659	2186	2881	3500	2728	3122	3546	3628	3688
Activity	0.5	0.5	0.6	0.6	0.7	0.8	1.0	1.1	1.2
Productivity	304	245	217	180	247	260	273	304	335

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	60.8	80.1	105.6	128.3	100.0	114.4	130.0	133.0	135.2
Activity	74.9	79.5	92.9	93.7	100.0	120.6	143.9	163.8	183.4

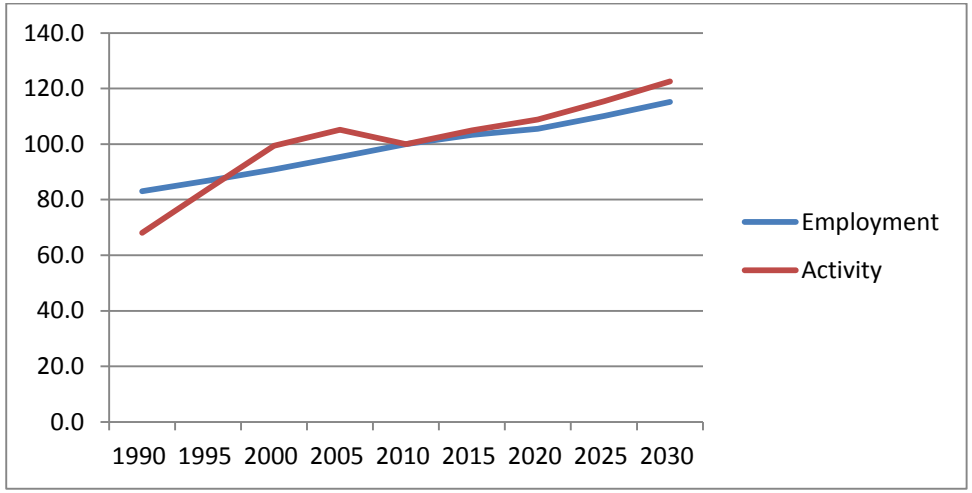


Netherlands

Road freight transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	99053	103621	108400	113 719	119300	123251	125868	131410	137415
Activity	54.5	67.1	79.6	84.2	80.0	84.0	87.2	92.4	98.1
Productivity	550	648	734	740	671	682	692	703	714

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	83.0	86.9	90.9	95.3	100.0	103.3	105.5	110.2	115.2
Activity	68.1	83.8	99.4	105.1	100.0	105.0	108.9	115.5	122.6

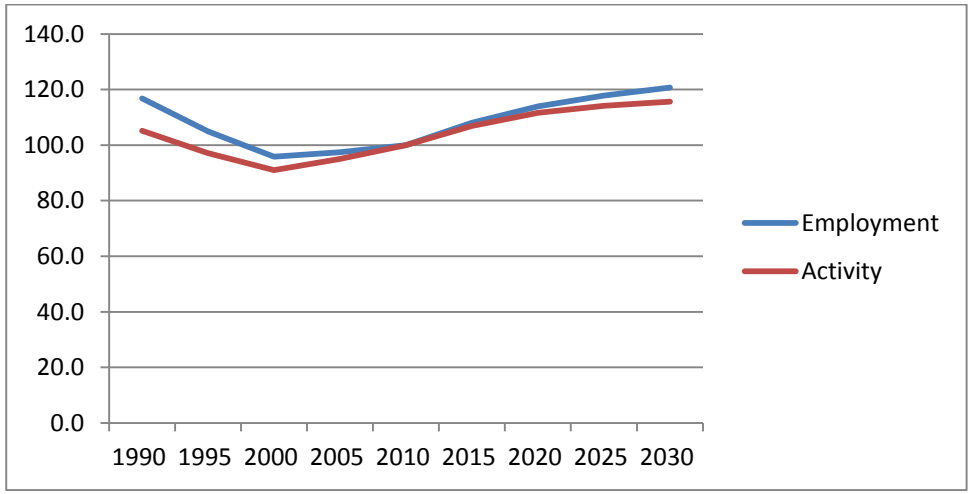


Netherlands

Public transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	80488	72289	65987	67153	68900	74407	78517	81200	83148
Activity	13.0	12.0	11.3	11.8	12.4	13.2	13.8	14.1	14.3
Productivity	162	166	170	175	179	178	176	174	172

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	116.8	104.9	95.8	97.5	100.0	108.0	114.0	117.9	120.7
Activity	105.1	97.0	91.0	95.0	100.0	106.9	111.6	114.2	115.7

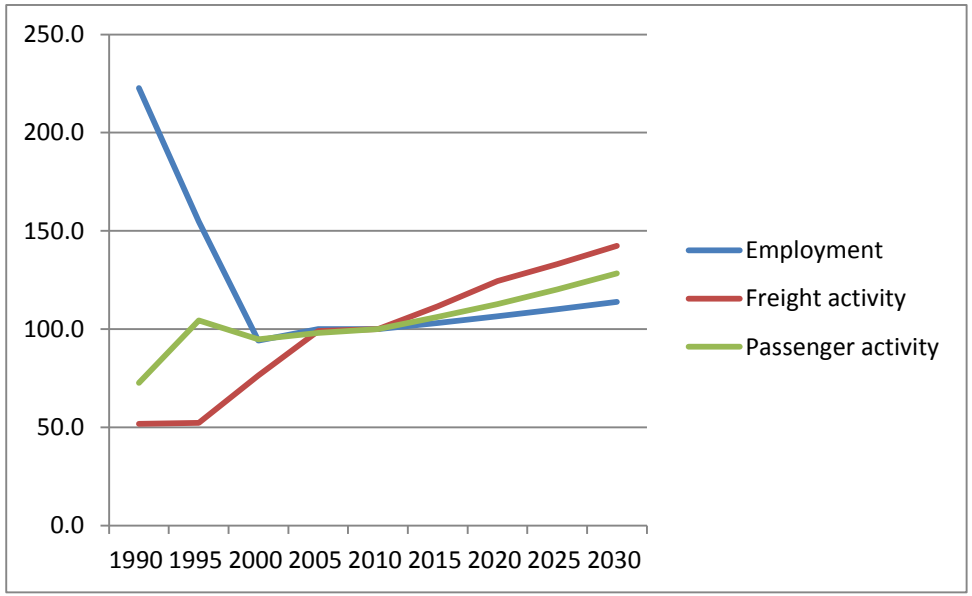


Netherlands

Rail transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	26719	18580	11300	12000	12000	12376	12782	13210	13666
Freight activity	3.1	3.1	4.5	5.9	5.9	6.6	7.4	7.9	8.4
Passenger activity	12.3	17.7	16.1	16.7	17.0	18.0	19.1	20.4	21.8
Mixed activity	10.0	14.1	13.2	14.0	14.2	15.2	16.2	17.3	18.4
Productivity	375	757	1168	1163	1185	1226	1267	1309	1350

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	222.7	154.8	94.2	100.0	100.0	103.1	106.5	110.1	113.9
Freight activity	51.8	52.3	76.3	99.0	100.0	111.6	124.4	133.1	142.4
Passenger activity	72.6	104.4	94.8	98.1	100.0	106.2	112.7	120.3	128.3

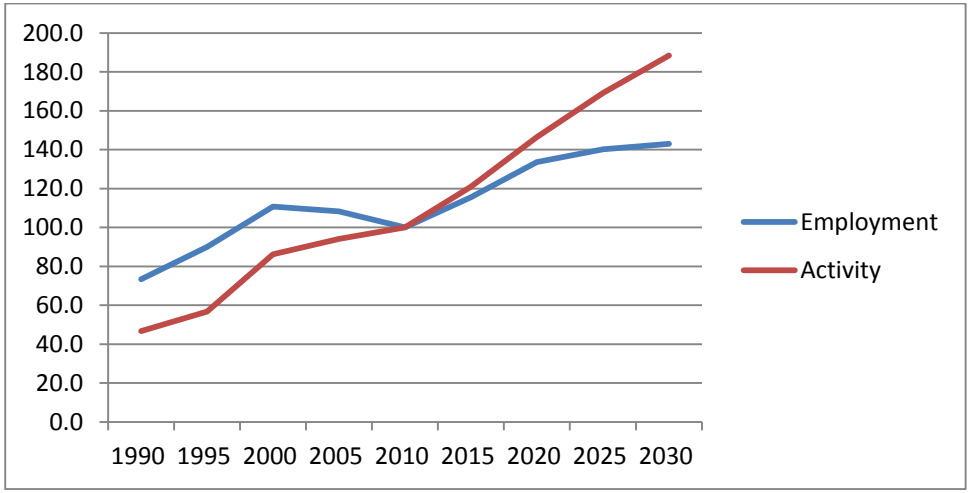


Netherlands

Aviation

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	21655	26607	32691	31998	29537	34104	39484	41411	42245
Activity	7.0	8.5	13.0	14.2	15.1	18.2	22.1	25.5	28.4
Productivity	325	321	398	443	510	534	559	615	672

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	73.3	90.1	110.7	108.3	100.0	115.5	133.7	140.2	143.0
Activity	46.8	56.8	86.3	94.1	100.0	121.0	146.4	169.2	188.5

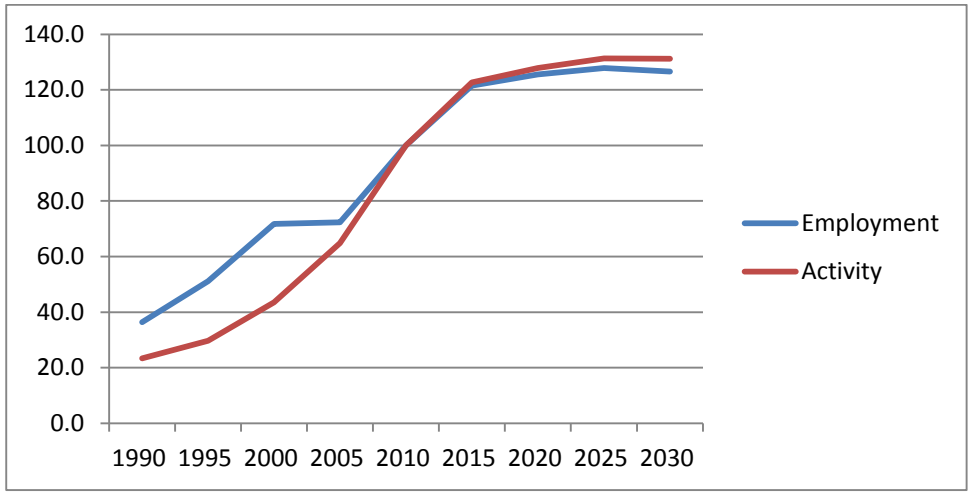


Poland

Road freight transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	98891	138992	195354	196812	272100	330763	341657	347738	344337
Activity	40.3	51.2	75.0	111.8	172.5	211.6	220.5	226.5	226.2
Productivity	407	368	384	568	634	640	645	651	657

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	36.3	51.1	71.8	72.3	100.0	121.6	125.6	127.8	126.5
Activity	23.4	29.7	43.5	64.8	100.0	122.7	127.8	131.3	131.1

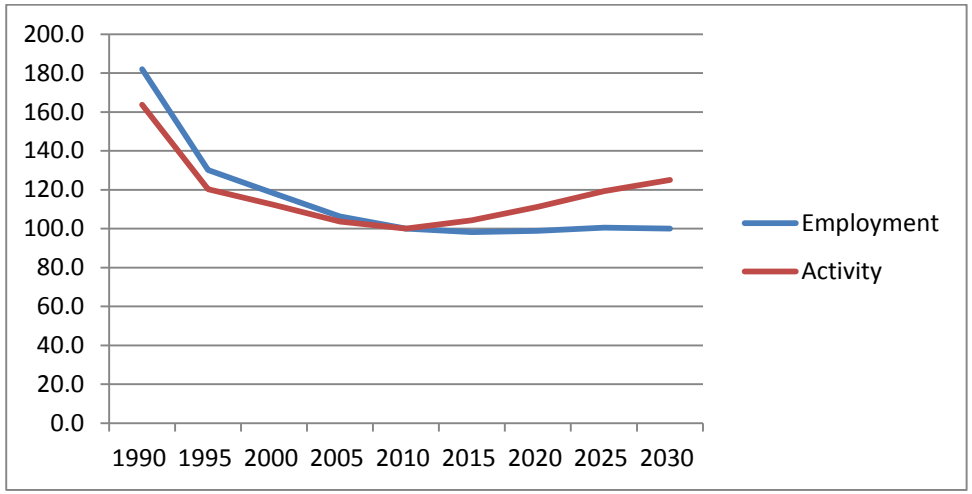


Poland

Public transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	270149	193156	175420	157883	148500	145836	146772	149190	148674
Activity	46.3	34.0	31.7	29.3	28.3	29.5	31.4	33.7	35.4
Productivity	171	176	181	186	190	202	214	226	238

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	181.9	130.1	118.1	106.3	100.0	98.2	98.8	100.5	100.1
Activity	163.7	120.3	112.2	103.7	100.0	104.3	111.2	119.3	125.1

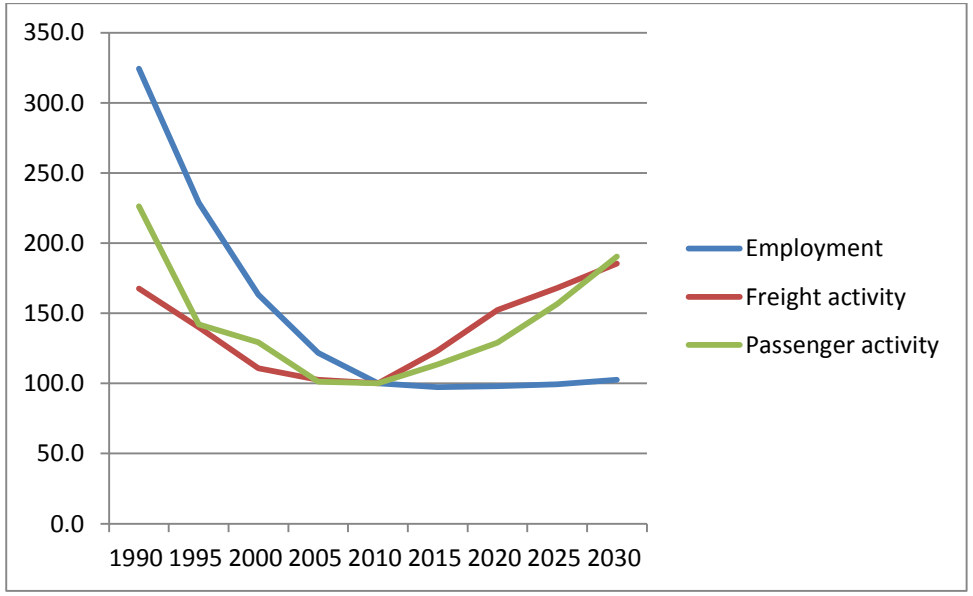


Poland

Rail transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	336614	237338	169488	126342	103806	101159	101775	103183	106603
Freight activity	81.6	68.2	54.0	50.0	48.7	60.1	74.2	81.9	90.3
Passenger activity	50.4	31.6	28.8	22.6	22.3	25.3	28.7	34.9	42.4
Mixed activity	58.2	40.8	35.1	29.4	28.9	34.0	40.1	46.6	54.4
Productivity	173	172	207	233	278	336	394	452	510

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	324.3	228.6	163.3	121.7	100.0	97.5	98.0	99.4	102.7
Freight activity	167.5	140.0	110.9	102.6	100.0	123.5	152.4	168.1	185.4
Passenger activity	226.3	142.1	129.3	101.3	100.0	113.6	129.1	156.8	190.4

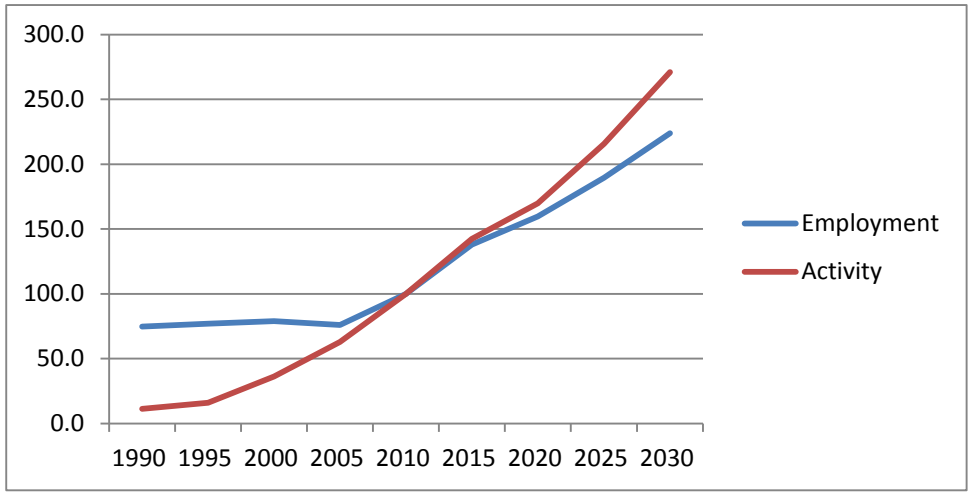


Poland

Aviation

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	4881	5017	5157	4956	6526	9002	10414	12378	14611
Activity	0.9	1.2	2.8	4.8	7.6	10.9	12.9	16.5	20.7
Productivity	177	243	538	971	1169	1206	1243	1330	1416

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	74.8	76.9	79.0	75.9	100.0	137.9	159.6	189.7	223.9
Activity	11.3	16.0	36.3	63.0	100.0	142.3	169.7	215.7	271.1

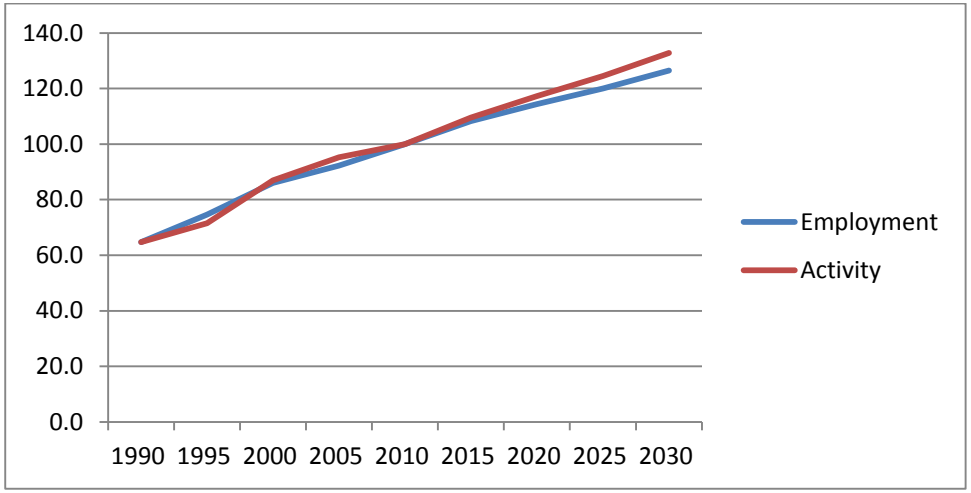


Portugal

Road freight transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	42445	48942	56433	60485	65600	70991	75062	78718	82961
Activity	28.9	32.0	38.9	42.6	44.7	49.0	52.5	55.7	59.4
Productivity	682	654	689	704	682	690	699	707	716

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	64.7	74.6	86.0	92.2	100.0	108.2	114.4	120.0	126.5
Activity	64.7	71.5	87.0	95.3	100.0	109.6	117.3	124.5	132.8

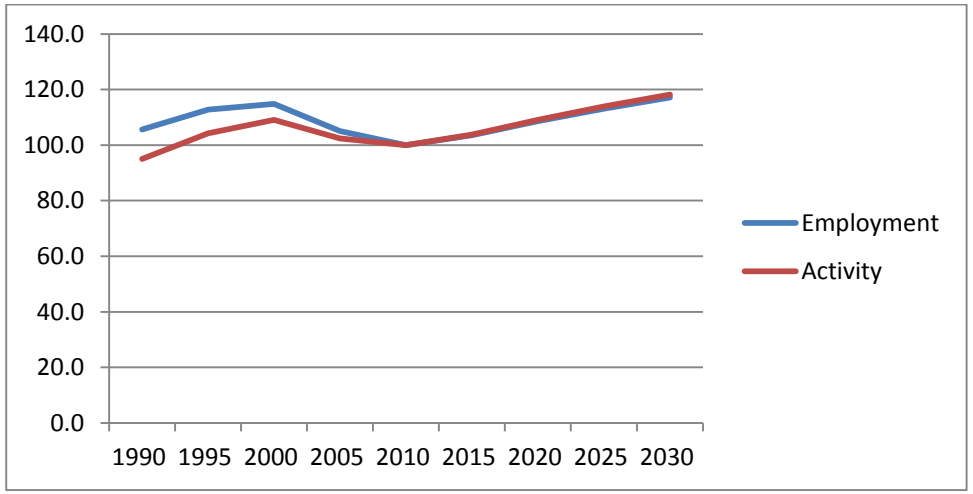


Portugal

Public transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	37482	40010	40753	37287	35500	36766	38539	40155	41585
Activity	10.3	11.3	11.8	11.1	10.8	11.3	11.8	12.3	12.8
Productivity	275	282	290	298	305	306	307	307	308

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	105.6	112.7	114.8	105.0	100.0	103.6	108.6	113.1	117.1
Activity	95.0	104.3	109.1	102.4	100.0	103.8	109.0	113.9	118.2

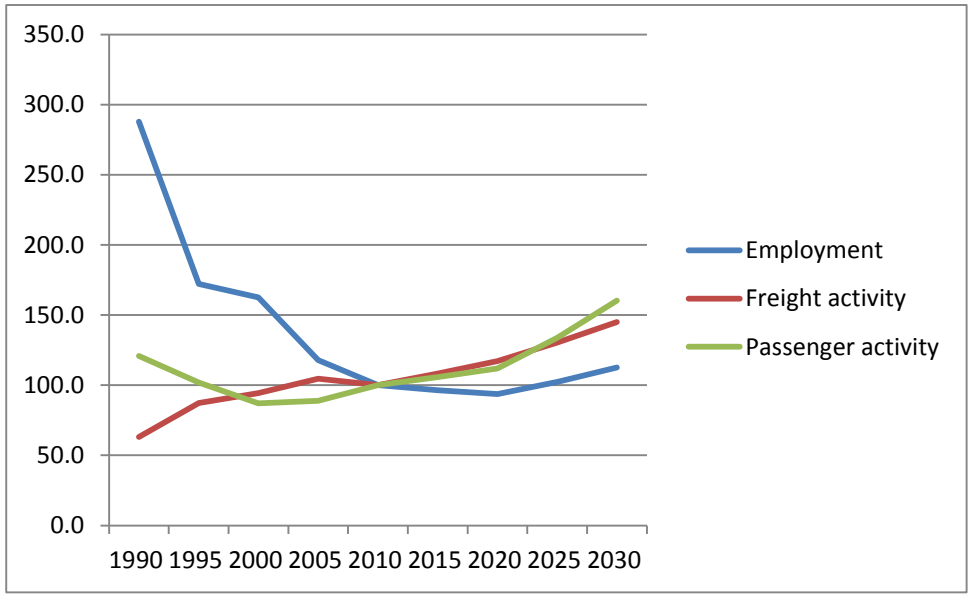


Portugal

Rail transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	21980	13148	12417	9000	7637	7357	7149	7817	8604
Freight activity	1.5	2.0	2.2	2.4	2.3	2.5	2.7	3.0	3.4
Passenger activity	6.3	5.3	4.6	4.7	5.2	5.5	5.9	7.0	8.4
Mixed activity	5.1	4.5	4.0	4.1	4.5	4.8	5.1	6.0	7.1
Productivity	233	343	320	455	591	651	710	770	830

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	287.8	172.2	162.6	117.8	100.0	96.3	93.6	102.4	112.7
Freight activity	63.1	87.3	94.4	104.7	100.0	108.3	117.2	130.4	145.1
Passenger activity	120.8	101.8	87.0	88.8	100.0	105.8	111.9	133.9	160.2

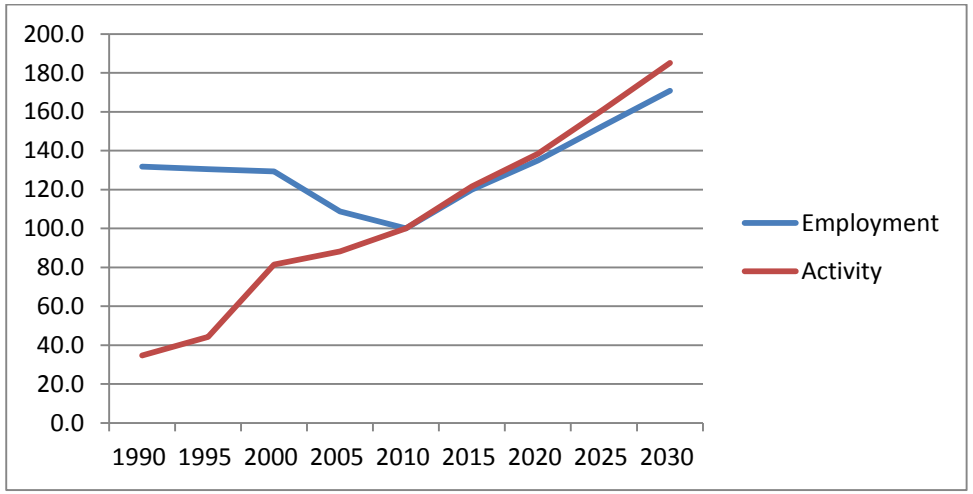


Portugal

Aviation

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	11402	11291	11181	9400	8648	10379	11670	13235	14775
Activity	6.7	8.5	15.7	17.0	19.2	23.4	26.6	31.1	35.6
Productivity	586	754	1401	1806	2226	2254	2282	2347	2412

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	131.8	130.6	129.3	108.7	100.0	120.0	134.9	153.0	170.8
Activity	34.7	44.2	81.4	88.2	100.0	121.5	138.3	161.4	185.1

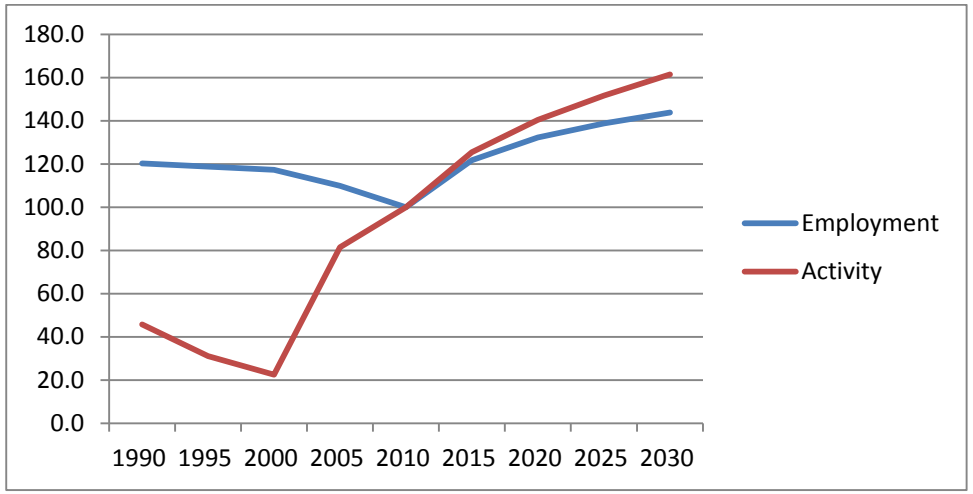


Romania

Road freight transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	105615	104260	102922	96485	87805	106874	116165	121852	126239
Activity	29.0	19.7	14.3	51.5	63.3	79.4	88.9	96.0	102.3
Productivity	275	189	139	534	721	743	766	788	810

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	120.3	118.7	117.2	109.9	100.0	121.7	132.3	138.8	143.8
Activity	45.8	31.1	22.6	81.4	100.0	125.5	140.4	151.6	161.5

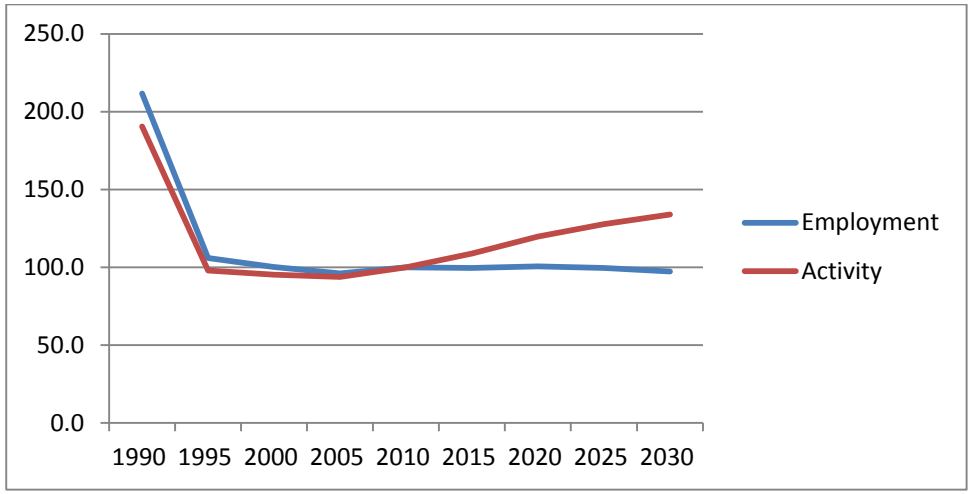


Romania

Public transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	161068	80573	76273	73153	76100	75734	76586	75754	74031
Activity	24.0	12.3	12.0	11.8	12.6	13.7	15.1	16.1	16.9
Productivity	149	153	157	161	166	181	197	212	228

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	211.7	105.9	100.2	96.1	100.0	99.5	100.6	99.5	97.3
Activity	190.5	97.9	95.2	93.7	100.0	108.9	119.6	127.7	133.9

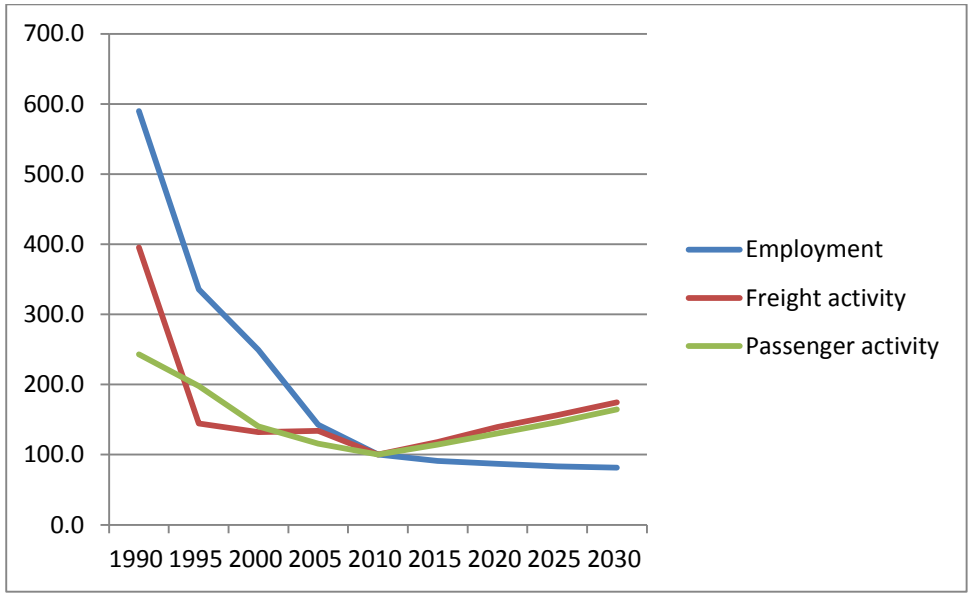


Romania

Rail transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	247659	141027	104795	60000	42000	38344	36585	35052	34321
Freight activity	48.9	17.9	16.4	16.6	12.4	14.6	17.3	19.3	21.6
Passenger activity	30.6	24.9	17.6	14.6	12.6	14.4	16.4	18.4	20.7
Mixed activity	35.2	23.1	17.3	15.1	12.5	14.4	16.6	18.6	20.9
Productivity	142	164	165	251	298	376	454	532	610

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	589.7	335.8	249.5	142.9	100.0	91.3	87.1	83.5	81.7
Freight activity	395.2	144.7	132.2	134.0	100.0	118.2	139.7	156.2	174.7
Passenger activity	243.2	197.8	140.2	115.9	100.0	114.2	130.3	146.5	164.6

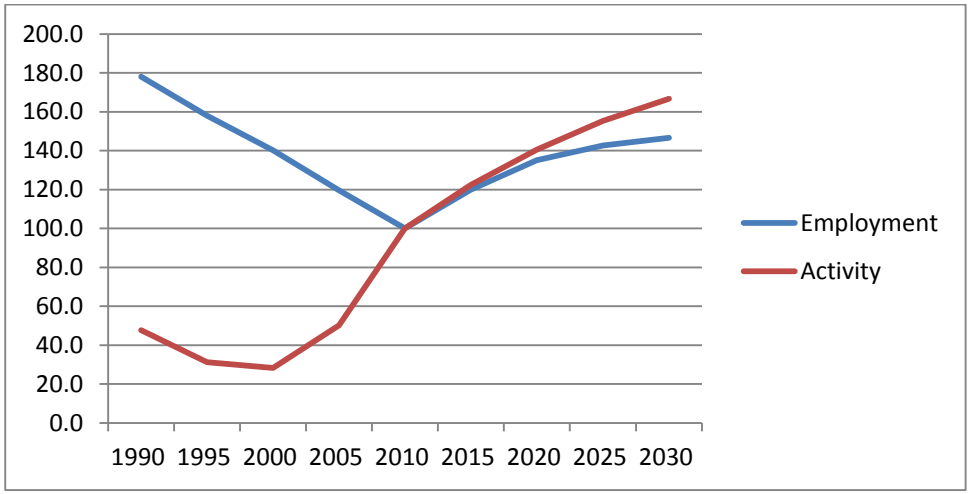


Romania

Aviation

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	13849	12286	10900	9300	7778	9332	10502	11096	11400
Activity	2.8	1.8	1.7	3.0	5.9	7.2	8.3	9.2	9.8
Productivity	203	150	154	319	760	776	791	828	864

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	178.1	158.0	140.1	119.6	100.0	120.0	135.0	142.7	146.6
Activity	47.6	31.2	28.3	50.2	100.0	122.5	140.6	155.4	166.6

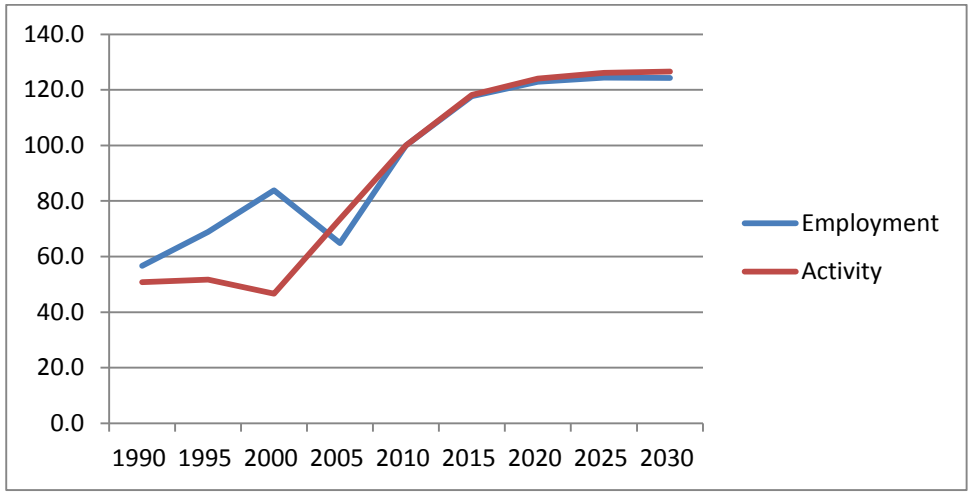


Slovakia

Road freight transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	16104	19594	23841	18442	28445	33474	34961	35388	35355
Activity	15.6	15.9	14.3	22.6	30.7	36.3	38.1	38.7	38.9
Productivity	968	811	601	1224	1080	1085	1090	1095	1100

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	56.6	68.9	83.8	64.8	100.0	117.7	122.9	124.4	124.3
Activity	50.7	51.8	46.7	73.5	100.0	118.2	124.0	126.1	126.6

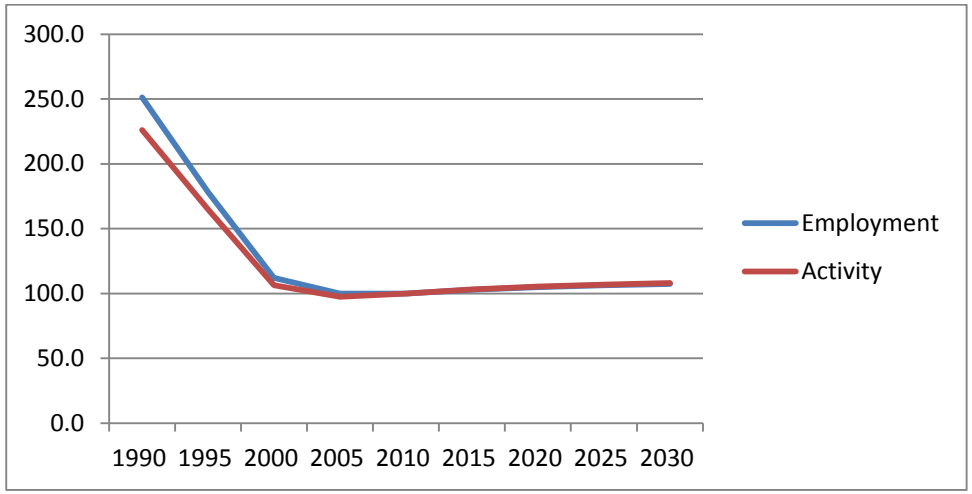


Slovakia

Public transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	46241	32800	20606	18397	18400	18938	19307	19583	19769
Activity	19.8	14.4	9.3	8.5	8.8	9.0	9.2	9.4	9.5
Productivity	428	440	452	464	476	477	477	478	479

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	251.3	178.3	112.0	100.0	100.0	102.9	104.9	106.4	107.4
Activity	226.2	164.9	106.4	97.5	100.0	103.1	105.3	106.9	108.1

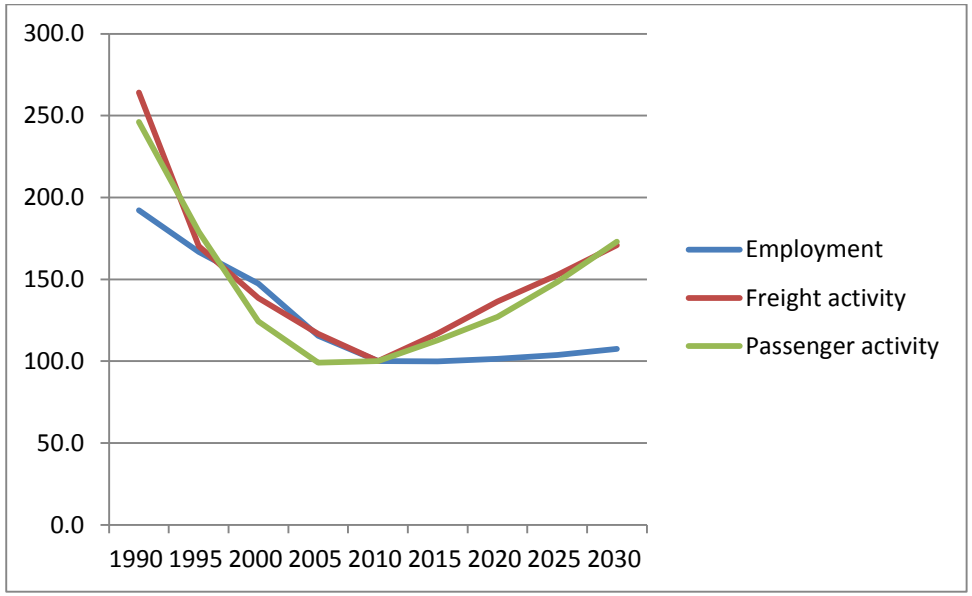


Slovakia

Rail transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	61000	52965	46813	36664	31749	31700	32209	32977	34142
Freight activity	21.4	13.8	11.2	9.5	8.1	9.5	11.1	12.4	13.9
Passenger activity	6.4	4.6	3.2	2.6	2.6	2.9	3.3	3.8	4.5
Mixed activity	10.1	6.9	5.2	4.3	4.0	4.6	5.2	6.0	6.8
Productivity	166	131	112	117	125	144	163	181	200

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	192.1	166.8	147.4	115.5	100.0	99.8	101.4	103.9	107.5
Freight activity	264.1	170.3	138.6	116.8	100.0	116.8	136.4	152.7	170.9
Passenger activity	246.1	179.0	124.2	99.1	100.0	112.7	127.1	148.3	173.1

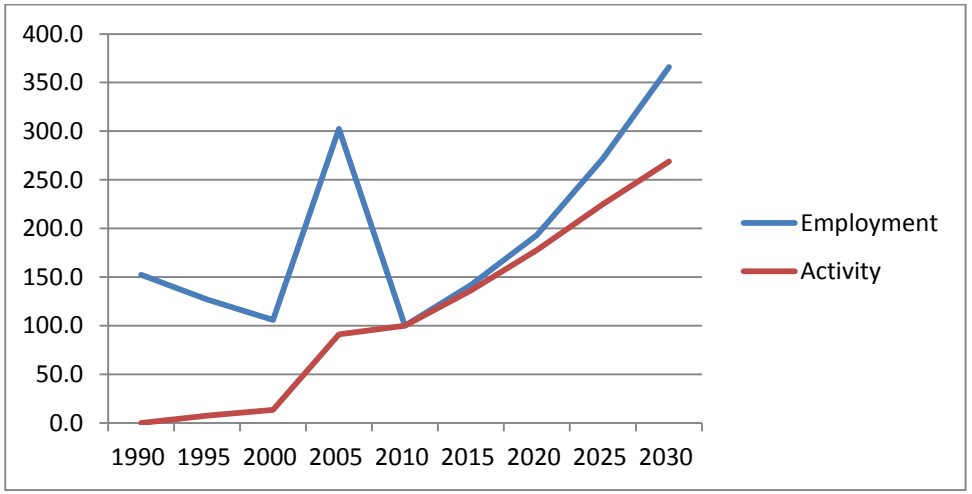


Slovakia

Aviation

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	435	363	303	864	286	405	552	778	1045
Activity	0.0	0.1	0.2	1.5	1.7	2.3	3.0	3.8	4.5
Productivity	0	353	748	1756	5836	5603	5371	4828	4286

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	152.2	127.1	106.1	302.4	100.0	141.9	193.1	272.2	365.9
Activity	0.0	7.7	13.6	91.0	100.0	136.2	177.7	225.2	268.8

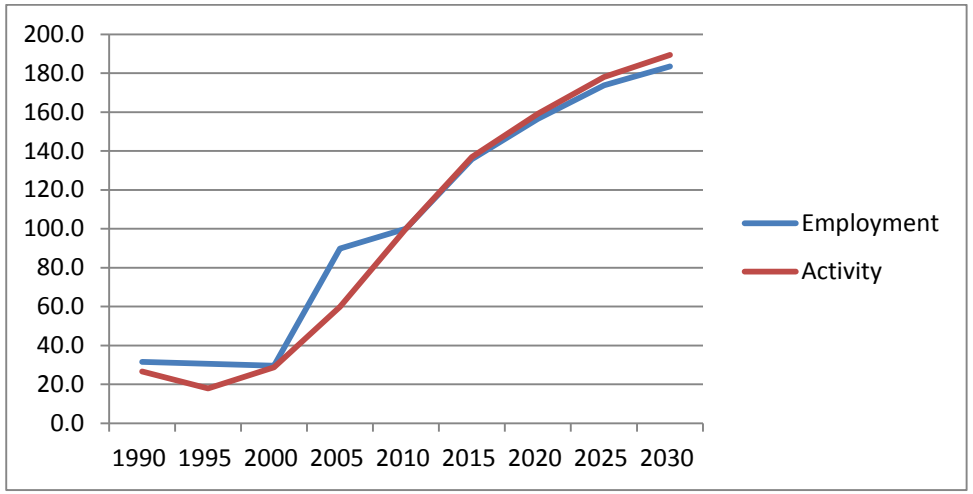


Slovenia

Road freight transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	6450	6253	6062	18403	20475	27800	32047	35565	37562
Activity	4.9	3.3	5.3	11.0	18.4	25.2	29.3	32.8	34.9
Productivity	760	528	874	599	900	908	915	923	930

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	31.5	30.5	29.6	89.9	100.0	135.8	156.5	173.7	183.5
Activity	26.6	17.9	28.7	59.8	100.0	136.9	159.1	178.0	189.5

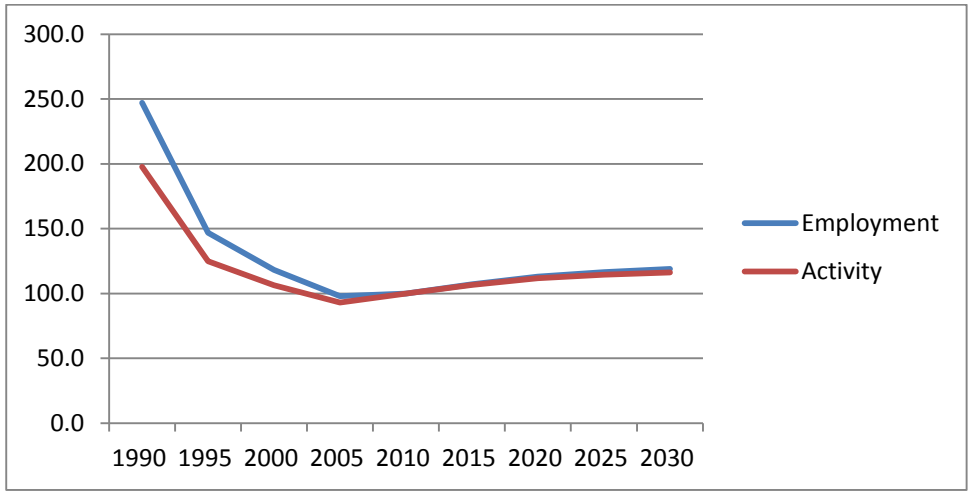


Slovenia

Public transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	12600	7495	6027	4992	5100	5466	5764	5944	6061
Activity	6.5	4.1	3.5	3.1	3.3	3.5	3.7	3.8	3.8
Productivity	516	549	581	613	646	642	638	635	631

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	247.1	147.0	118.2	97.9	100.0	107.2	113.0	116.5	118.9
Activity	197.7	124.9	106.4	93.0	100.0	106.6	111.7	114.6	116.2

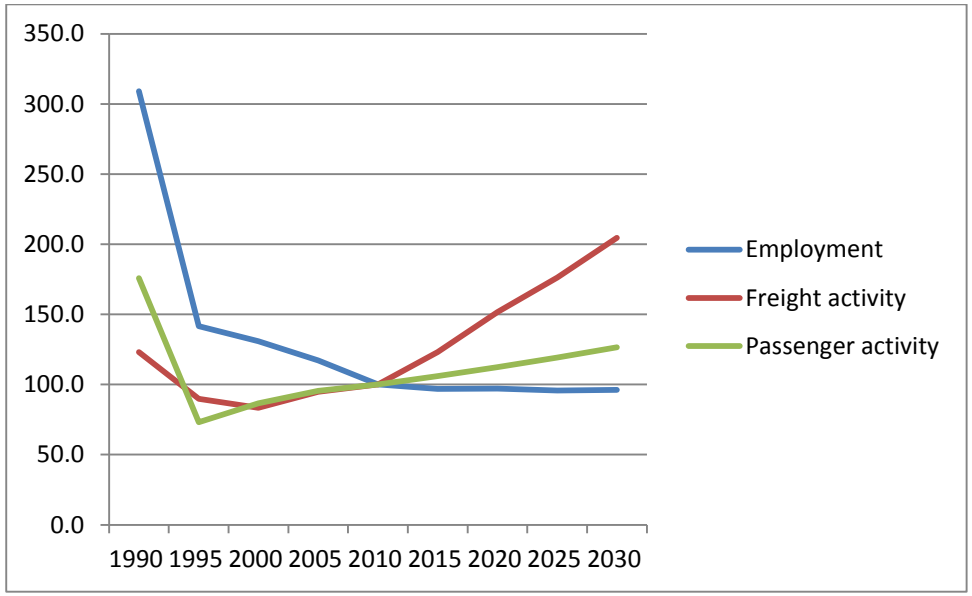


Slovenia

Rail transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	21295	9761	9026	8075	6892	6680	6690	6606	6636
Freight activity	4.2	3.1	2.9	3.2	3.4	4.2	5.2	6.0	7.0
Passenger activity	1.4	0.6	0.7	0.8	0.8	0.9	0.9	1.0	1.0
Mixed activity	2.1	1.2	1.2	1.4	1.5	1.7	2.0	2.2	2.5
Productivity	100	125	138	173	213	254	296	338	380

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	309.0	141.6	131.0	117.2	100.0	96.9	97.1	95.8	96.3
Freight activity	123.1	89.9	83.5	94.9	100.0	123.2	151.7	176.2	204.6
Passenger activity	175.8	73.2	86.7	95.6	100.0	106.0	112.3	119.2	126.5

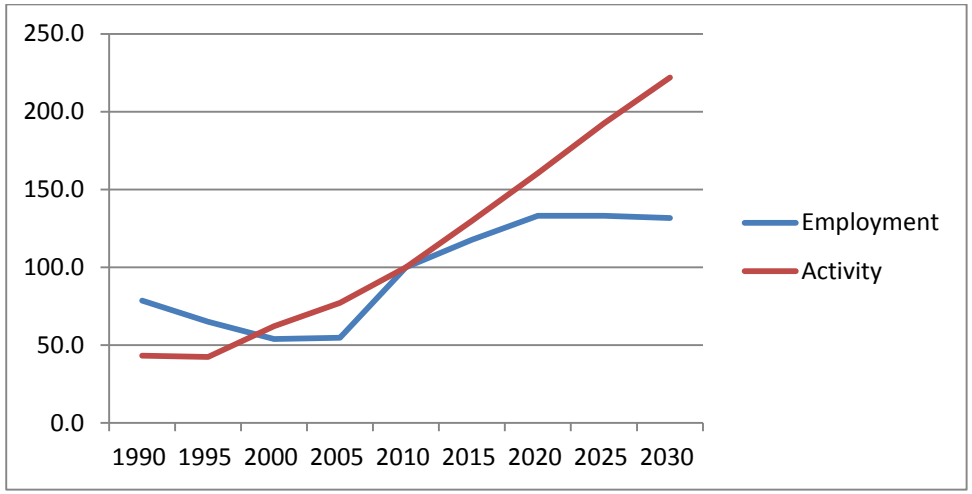


Slovenia

Aviation

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	895	742	615	625	1141	1343	1517	1519	1501
Activity	0.2	0.2	0.3	0.4	0.5	0.6	0.7	0.9	1.0
Productivity	224	265	471	575	408	450	492	590	688

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	78.5	65.0	53.9	54.8	100.0	117.7	133.0	133.1	131.6
Activity	43.2	42.3	62.2	77.2	100.0	129.8	160.4	192.6	222.0

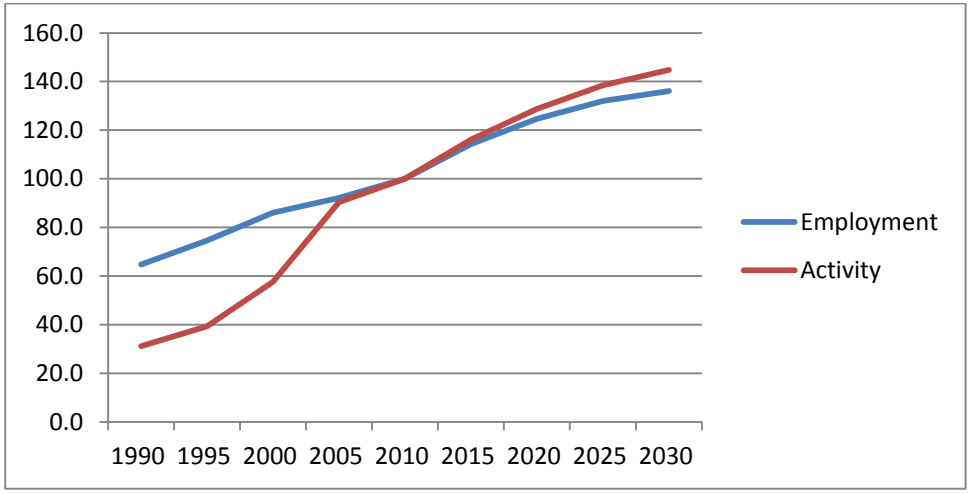


Spain

Road freight transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	234158	270000	311328	333679	361900	413393	451336	477978	492437
Activity	80.5	101.6	148.7	233.2	258.1	299.5	332.2	357.3	373.8
Productivity	344	376	478	699	713	725	736	748	759

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	64.7	74.6	86.0	92.2	100.0	114.2	124.7	132.1	136.1
Activity	31.2	39.4	57.6	90.4	100.0	116.1	128.7	138.4	144.8

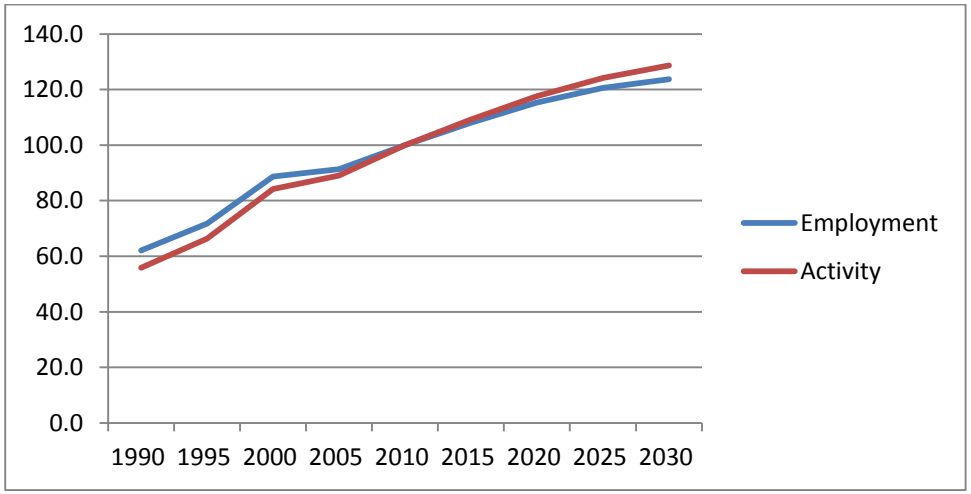


Spain

Public transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	111402	128666	159062	163916	179400	193861	206888	216309	221894
Activity	33.4	39.6	50.3	53.2	59.7	65.1	70.2	74.1	76.8
Productivity	299	308	316	324	333	336	339	343	346

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	62.1	71.7	88.7	91.4	100.0	108.1	115.3	120.6	123.7
Activity	55.9	66.3	84.2	89.1	100.0	109.1	117.6	124.2	128.6

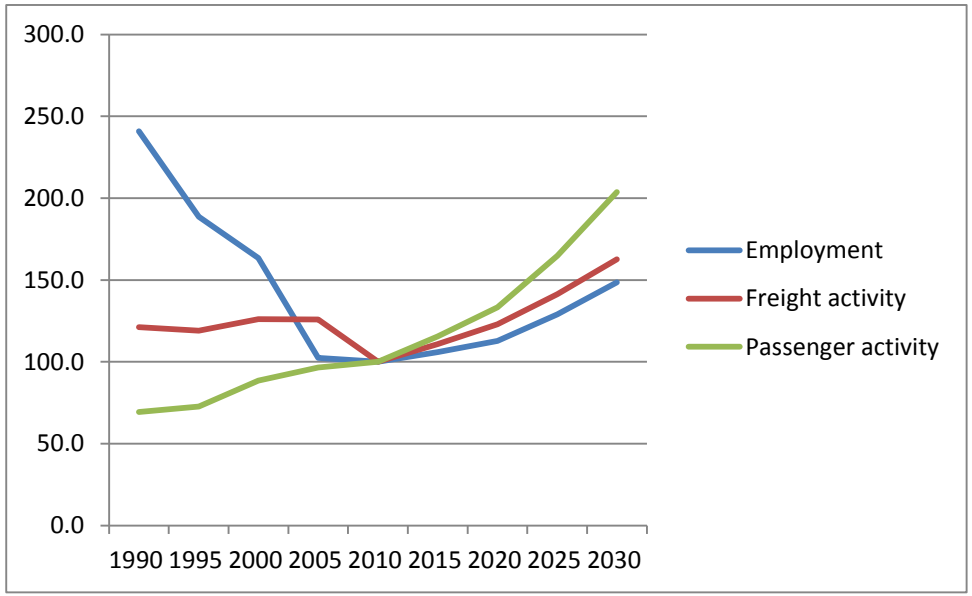


Spain

Rail transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	49724	38958	33747	21141	20642	21848	23275	26638	30644
Freight activity	11.2	11.0	11.6	11.6	9.2	10.2	11.3	13.0	15.0
Passenger activity	19.9	20.8	25.4	27.6	28.6	33.1	38.2	47.2	58.3
Mixed activity	17.7	18.4	21.9	23.6	23.8	27.3	31.4	38.6	47.5
Productivity	356	471	650	1117	1152	1251	1351	1450	1550

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	240.9	188.7	163.5	102.4	100.0	105.8	112.8	129.0	148.5
Freight activity	121.1	118.9	126.1	125.8	100.0	110.9	122.9	141.4	162.6
Passenger activity	69.3	72.7	88.6	96.5	100.0	115.4	133.2	164.8	203.7

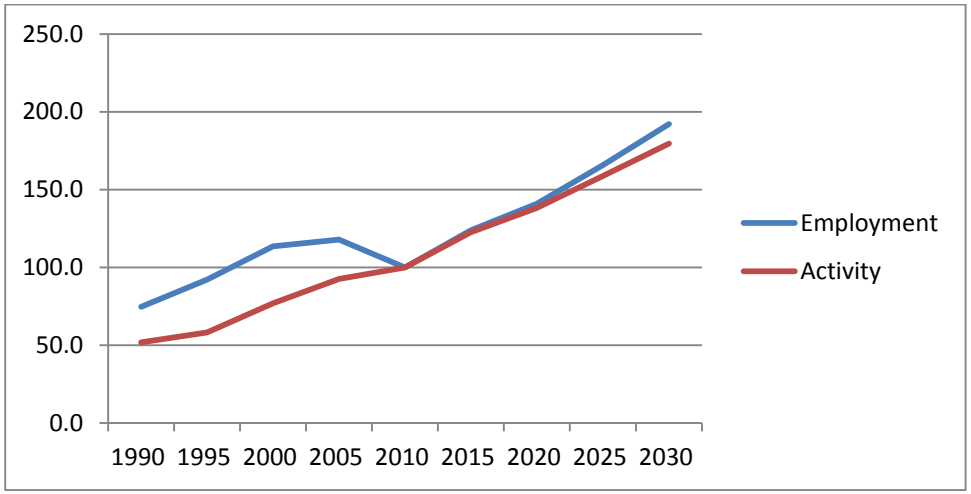


Spain

Aviation

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	24357	30020	37000	38400	32600	40351	45924	54046	62598
Activity	59.6	67.0	88.6	106.5	115.1	141.0	158.9	182.7	206.5
Productivity	2449	2232	2395	2773	3530	3495	3460	3380	3299

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	74.7	92.1	113.5	117.8	100.0	123.8	140.9	165.8	192.0
Activity	51.8	58.2	77.0	92.5	100.0	122.6	138.1	158.7	179.5

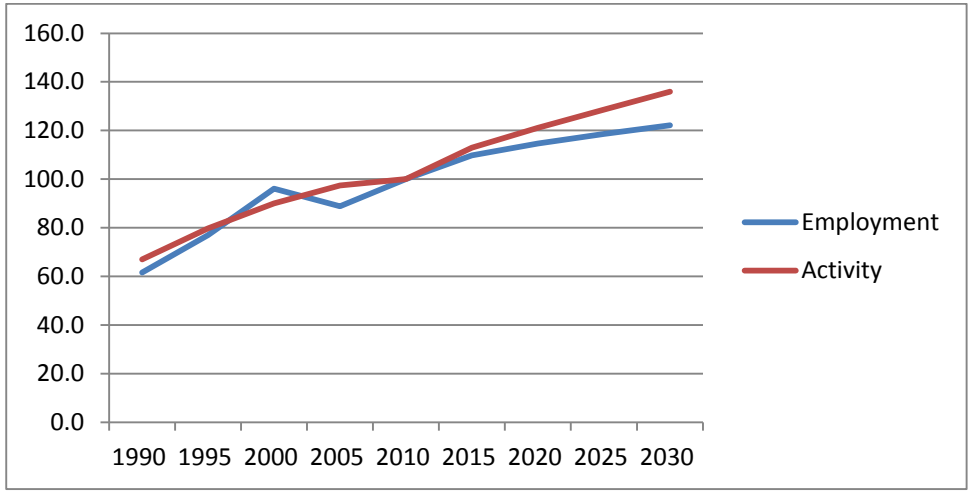


Sweden

Road freight transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	35394	44223	55255	51069	57479	63110	65931	68175	70247
Activity	26.5	31.6	35.6	38.6	39.6	44.7	48.0	50.9	53.8
Productivity	749	715	645	755	689	708	727	747	766

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	61.6	76.9	96.1	88.8	100.0	109.8	114.7	118.6	122.2
Activity	66.9	79.8	90.0	97.4	100.0	112.9	121.1	128.6	135.9

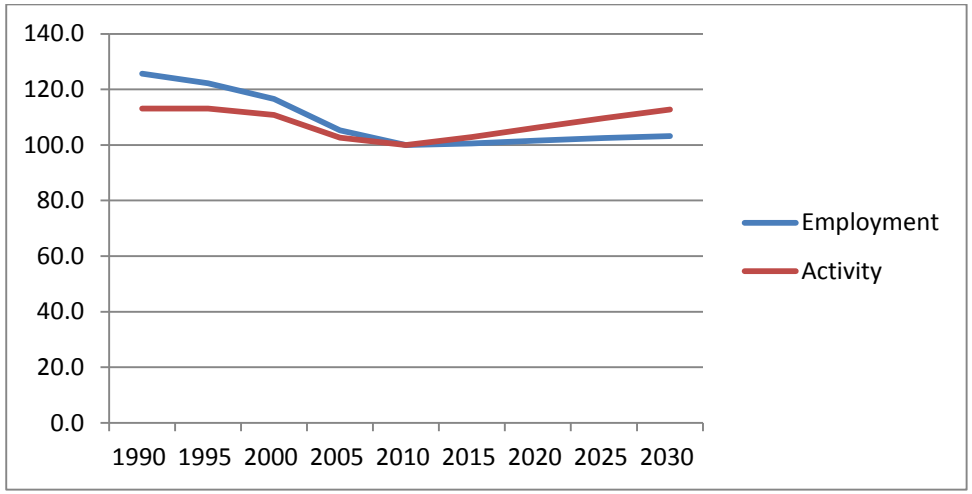


Sweden

Public transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	81793	79583	75891	68496	65100	65464	66168	66735	67161
Activity	9.7	9.7	9.5	8.8	8.6	8.8	9.1	9.4	9.7
Productivity	119	122	125	128	132	135	138	141	144

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	125.6	122.2	116.6	105.2	100.0	100.6	101.6	102.5	103.2
Activity	113.1	113.1	110.7	102.6	100.0	102.9	106.4	109.6	112.7

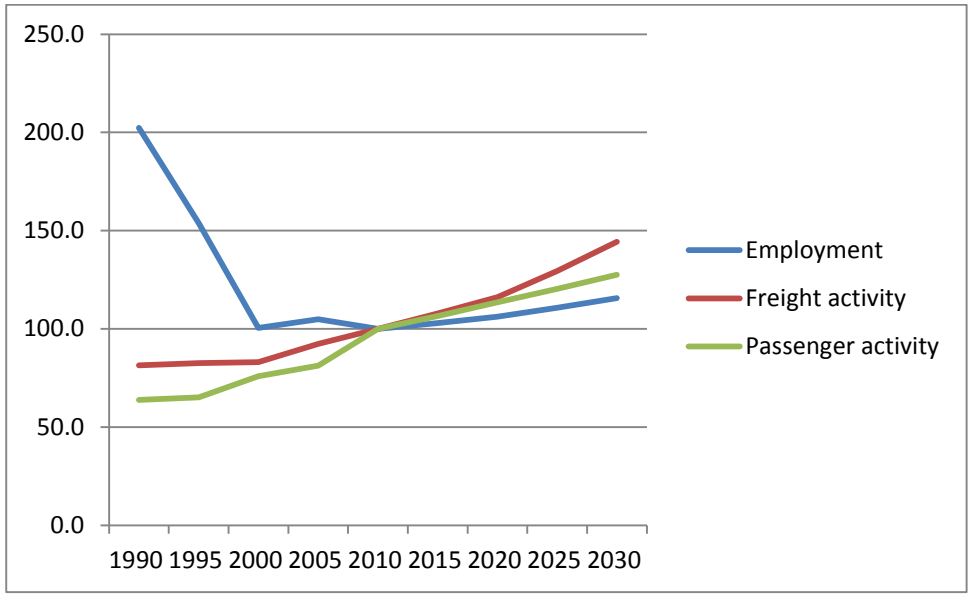


Sweden

Rail transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	29196	22190	14499	15124	14428	14858	15324	15979	16693
Freight activity	19.1	19.4	19.5	21.7	23.5	25.3	27.2	30.4	33.9
Passenger activity	8.6	8.8	10.2	11.0	13.5	14.4	15.3	16.2	17.2
Mixed activity	11.2	11.4	12.5	13.6	16.0	17.1	18.3	19.8	21.4
Productivity	385	515	865	901	1107	1151	1194	1237	1280

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	202.4	153.8	100.5	104.8	100.0	103.0	106.2	110.8	115.7
Freight activity	81.4	82.6	83.0	92.4	100.0	107.8	116.1	129.4	144.3
Passenger activity	63.9	65.1	75.8	81.2	100.0	106.5	113.5	120.4	127.6

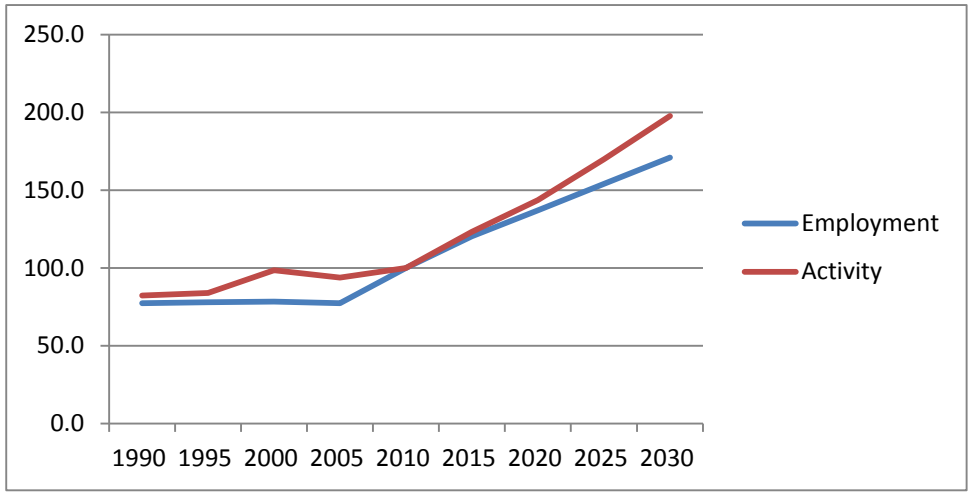


Sweden

Aviation

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	14601	14700	14800	14600	18872	22698	25869	29088	32258
Activity	11.8	12.1	14.2	13.5	14.4	17.7	20.6	24.4	28.4
Productivity	810	821	956	923	762	780	797	839	881

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	77.4	77.9	78.4	77.4	100.0	120.3	137.1	154.1	170.9
Activity	82.3	84.0	98.4	93.7	100.0	123.1	143.5	169.8	197.7

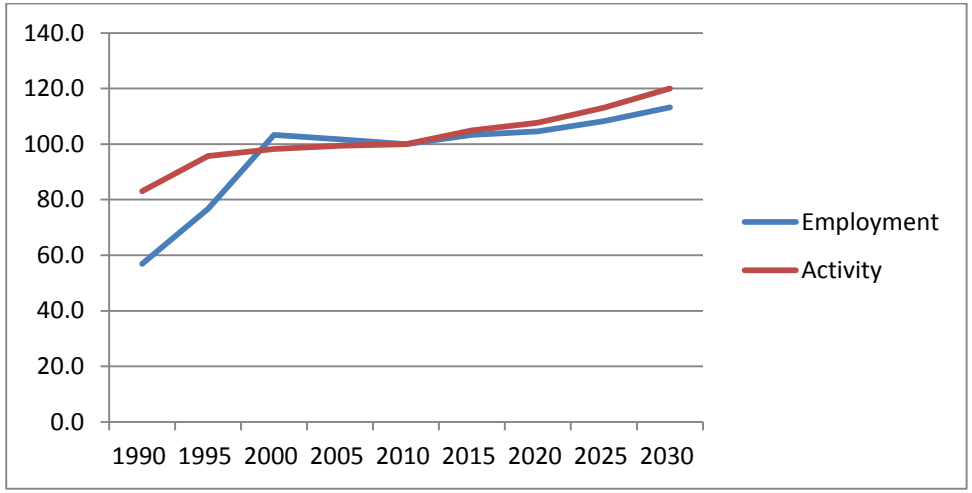


United Kingdom

Road freight transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	152257	205190	276525	272026	267600	276604	279893	289741	302862
Activity	140.0	161.5	165.6	167.5	168.6	176.9	181.7	190.8	202.3
Productivity	920	787	599	616	630	640	649	659	668

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	56.9	76.7	103.3	101.7	100.0	103.4	104.6	108.3	113.2
Activity	83.0	95.8	98.2	99.3	100.0	104.9	107.7	113.1	120.0

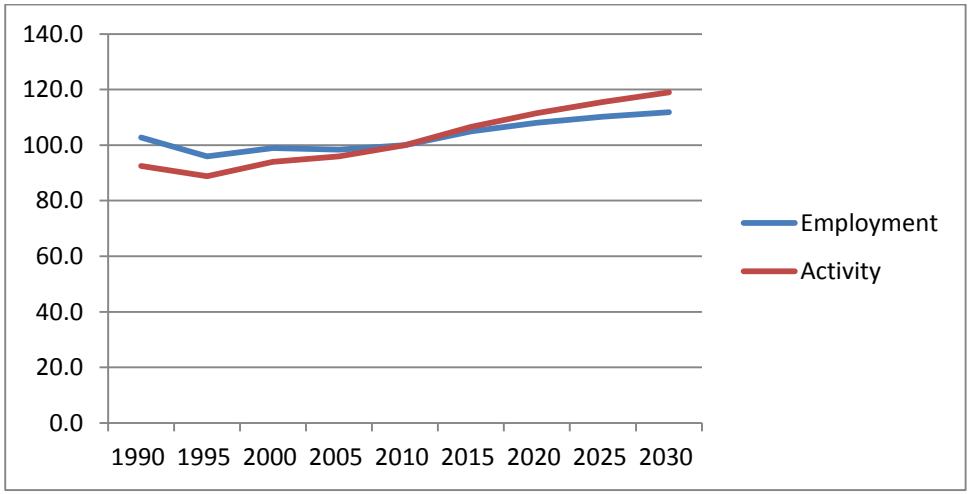


United Kingdom

Public transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	172876	161503	166524	165599	168300	176558	181912	185572	188289
Activity	47.7	45.8	48.5	49.5	51.6	55.0	57.5	59.6	61.4
Productivity	276	284	291	299	307	311	316	321	326

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	102.7	96.0	98.9	98.4	100.0	104.9	108.1	110.3	111.9
Activity	92.4	88.8	94.0	95.9	100.0	106.6	111.5	115.5	119.0

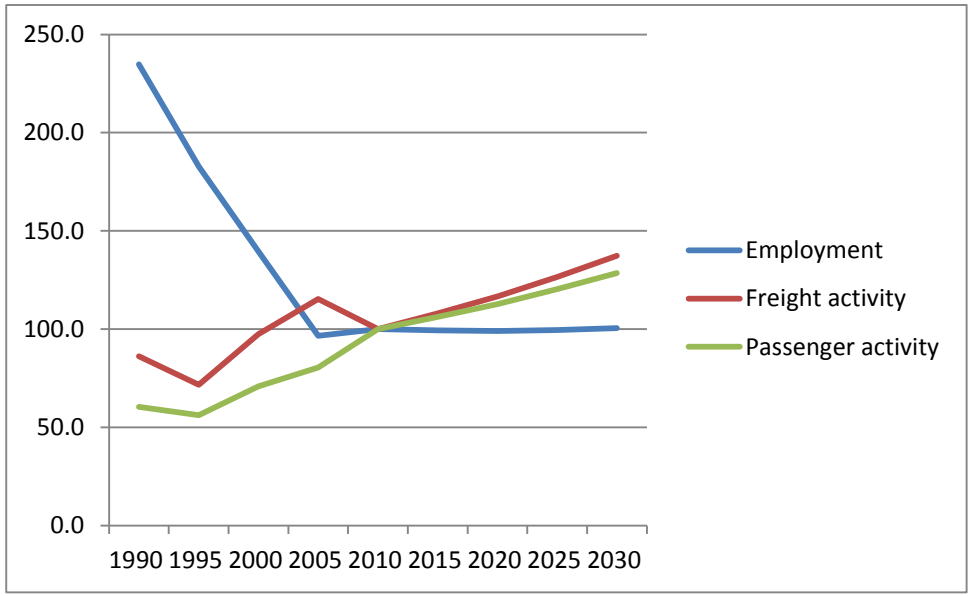


United Kingdom

Rail transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	136158	106000	81000	56000	58000	57576	57410	57756	58307
Freight activity	16.0	13.3	18.1	21.4	18.6	20.1	21.7	23.5	25.5
Passenger activity	39.9	37.1	46.7	53.1	66.0	70.1	74.4	79.5	84.8
Mixed activity	33.9	31.1	39.6	45.2	54.2	57.6	61.2	65.5	70.0
Productivity	249	294	489	807	934	1000	1067	1133	1200

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	234.8	182.8	139.7	96.6	100.0	99.3	99.0	99.6	100.5
Freight activity	86.1	71.6	97.4	115.3	100.0	108.0	116.6	126.5	137.3
Passenger activity	60.4	56.2	70.8	80.4	100.0	106.2	112.8	120.4	128.4

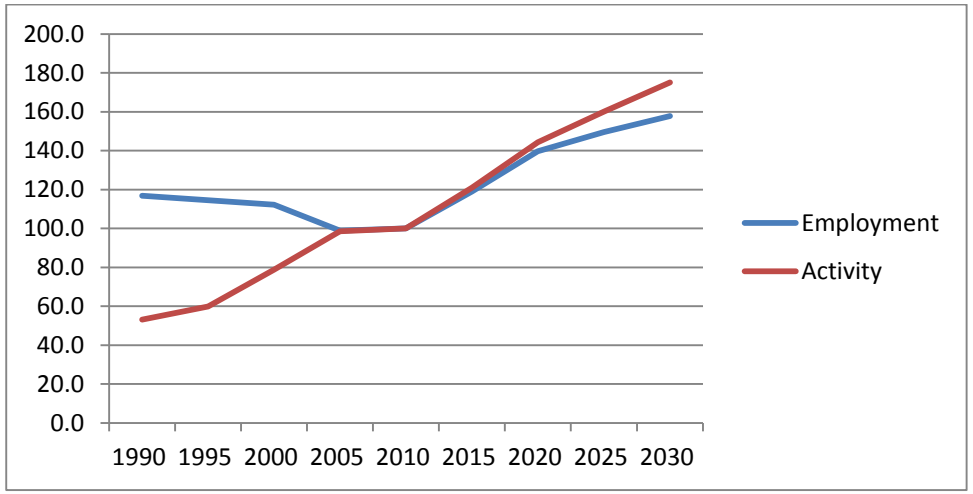


United Kingdom

Aviation

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	90743	88942	87176	76866	77722	92427	108560	116280	122698
Activity	52.2	58.8	77.4	96.7	98.2	118.7	141.7	157.3	171.9
Productivity	576	661	888	1259	1264	1284	1305	1353	1401

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	116.8	114.4	112.2	98.9	100.0	118.9	139.7	149.6	157.9
Activity	53.2	59.9	78.8	98.5	100.0	120.9	144.2	160.2	175.0

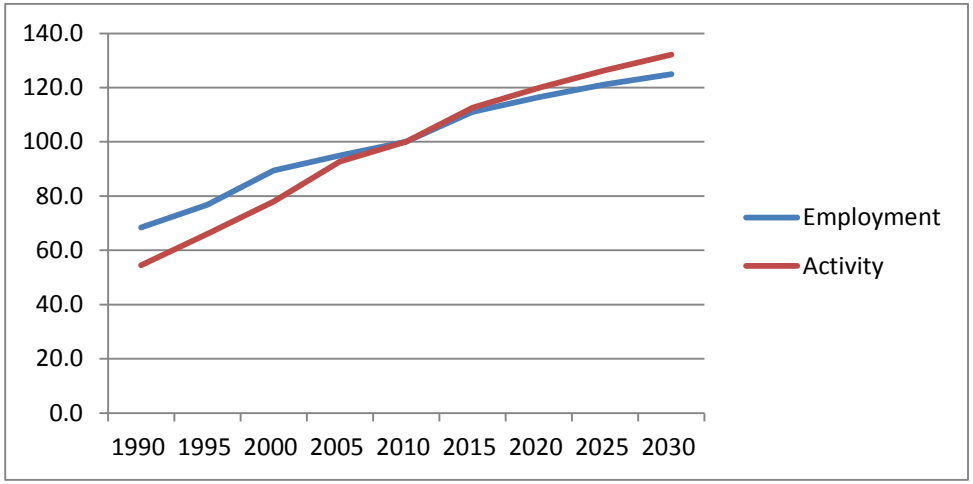


EU28

Road freight transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	1915635	2149701	2502192	2658337	2798647	3108220	3260604	3390371	3496394
Activity	1062.2	1288.5	1520.0	1807.9	1949.0	2194.7	2335.8	2462.8	2575.3
Productivity	55.4	59.9	60.7	68.0	69.6	70.6	71.6	72.6	73.7

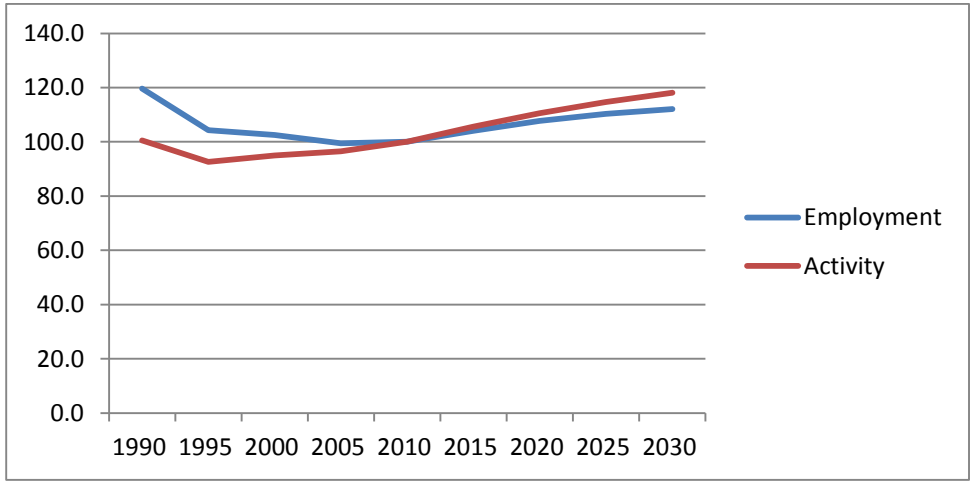
	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	68.4	76.8	89.4	95.0	100.0	111.1	116.5	121.1	124.9
Activity	54.5	66.1	78.0	92.8	100.0	112.6	119.8	126.4	132.1



EU28
Public transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	2,288,281	1,996,209	1,962,336	1,903,462	1,913,200	1,991,895	2,060,347	2,110,001	2,145,163
Activity	549.7	506.6	519.4	527.6	546.7	577.0	604.4	627.1	645.4
Productivity	240	254	265	277	286	290	293	297	301

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	119.6	104.3	102.6	99.5	100.0	104.1	107.7	110.3	112.1
Activity	100.6	92.7	95.0	96.5	100.0	105.6	110.6	114.7	118.1

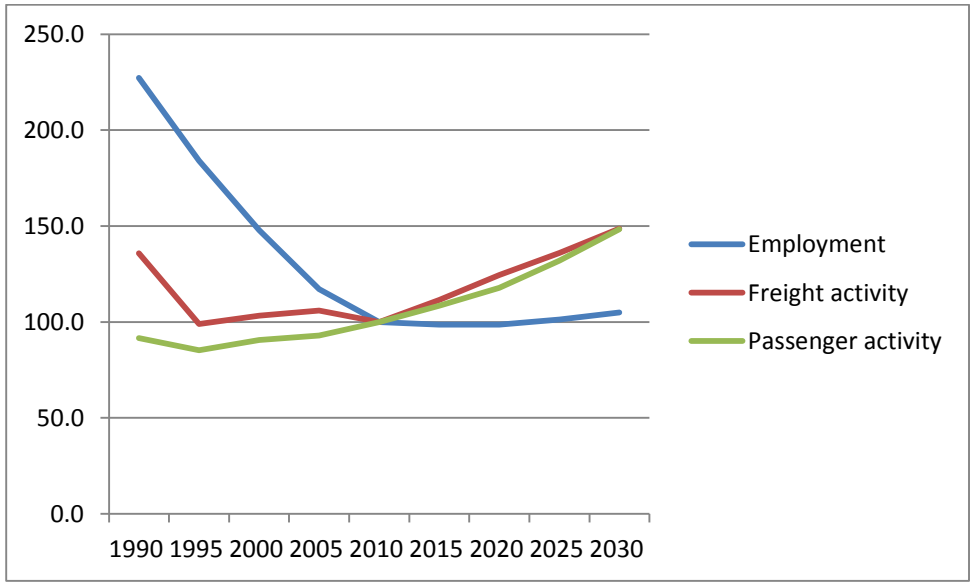


EU28

Rail transport

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	2073444	1680275	1349412	1069908	912745	900381	900650	924672	957894
Freight activity	532.9	388.1	405.5	416.0	392.5	437.4	488.5	533.9	583.7
Passenger activity	454.5	423.2	449.6	461.4	496.2	538.5	584.8	655.2	735.7
Mixed activity	474.1	414.4	438.6	450.1	470.3	513.2	560.7	624.8	697.7
Productivity	229	247	325	421	515	570	623	676	728

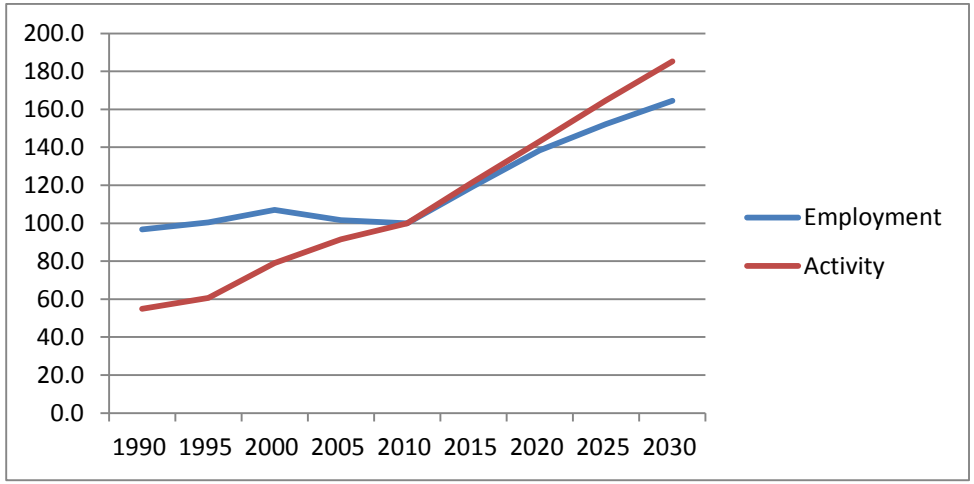
	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	227.2	184.1	147.8	117.2	100.0	98.6	98.7	101.3	104.9
Freight activity	135.8	98.9	103.3	106.0	100.0	111.4	124.5	136.0	148.7
Passenger activity	91.6	85.3	90.6	93.0	100.0	108.5	117.9	132.0	148.3



EU28
Aviation

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	416698	432692	460660	437428	430701	514407	595953	655203	708235
Activity	311.4	344.1	448.2	518.5	566.6	690.6	810.7	933.2	1049.9
Productivity	747	795	973	1185	1316	1342	1360	1424	1482

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Employment	96.7	100.5	107.0	101.6	100.0	119.4	138.4	152.1	164.4
Activity	54.9	60.7	79.1	91.5	100.0	121.9	143.1	164.7	185.3



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Abstract

This report presents the results of the analysis carried out by the Joint Research Centre (JRC) in support of DG MOVE for the analysis of employment and skills issues in the EU transport sector, with the purpose of designing the policies targeting an increased competitiveness in the sector, and improving the labour productivity and job quality.
The study analyses the development of employment in various transport sectors from different viewpoints, and by means of a variety of analytical approaches. The study addresses both the supply side (i.e. the workforce capacity) and the demand side (i.e., the number of employees required in order to meet the future transport activity). In doing so it aims to identify the gap between the supply and demand side and to provide some indications on the degree of change required in the labour force dynamics in order to close this gap. The analysis mainly focuses on the quantitative discrepancies between capacity and demand, but also addresses relevant qualitative aspects including the demographic composition of the workforce.

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