

Impact of the World Economic Crisis on Long-term Traffic Growth

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1 Introduction

The World Economic Crisis started in the financial sector and then affected international trade, production and finally employment. Countries with high international trade volume were hit most badly, as for instance Japan or Germany. When it comes to analyse the long-term impacts of the crisis on economic development and transport very simple and highly sophisticated approaches have been presented as well. A most simple hypothesis is based on the expectation that the crisis will only interrupt the development trends, and some years later the trajectories of economic and transport development will bounce back to the old trend lines. Under such optimistic assumptions the OECD has followed that the crisis might only cause a time delay of five years for the expected traffic development. Retrenchment scenarios construct a contrasting picture, which assumes a break of trends in the globalisation process and a further decline of growth rates compared with the old trends. Putting both impacts together, the breakdown during the crisis and the reduced growth rates after, lead to a very pessimistic vision for traffic development - while the chances to achieve environmental goals seem to improve. Most experts agree that the real development will lie somewhere in between the optimistic and pessimistic scenarios.

A return to the formerly expected economic growth profiles can hardly be expected under the old economic structures. In this paper we therefore construct a consistent economic environment for a positive development prospect, which is based on the assumption of particular technological and behavioural changes. We call it the Schumpeter scenario in memory of Joseph A. Schumpeter who is the founder of the evolutionary economic theory (Schumpeter, 1952). A crisis in his view gives the chance for a creative disruption of old structures in the economy and fosters innovation as well as technological change. This leads to the question, what the structural changes might be in the foreseeable future and whether we might even expect a new “Kondratieff cycle”¹, which would give an additional push to technology development and its spatial distribution. We try to give an answer to this question in terms of hypotheses for speculative future developments, which seem probable according to the view of futurologists. On this base we derive the consequences for the development of particular economic sectors and finally conclude with the associated impacts for the development of mobility and freight transport.

Using the system dynamics model² ASTRA we are able to simulate economic and transport scenarios in quantitative terms for the EU27+2 countries, which makes the major part of

¹ Explained in section 3.

² System Dynamics has been founded by Jay Forrester (1962) and is based on the feedback mechanisms between the variables of the system over time. The essential components are: cybernetics, decision theory, numerical simulation and mental creativity.

Europe. The Schumpeter scenario needs a number of country specific inputs and has been elaborated for the case of Germany, only.

As ASTRA includes a module on transport, which is closely linked to the economic modules (e.g. mobility with disposable income and freight transport with trade activity) such that trajectories can be drawn for the expected traffic developments on an aggregate level. One characteristic result will be that the factors, which might constitute the next Kondratieff – such as rise of energy costs, necessary energy savings and CO₂ reductions, light materials or a growing share of service economies– at the same time lead to a dampening of vehicle movements and transport intensity. In particular there seem to be many technological and organisational options for resource saving (green) logistics. This can lead to the conclusion that – if the economy will overcome the crisis through Schumpeter-type technological change - this type of technological change will influence production technology and organisation in a way that the development of transport can be decoupled from the development of GDP, in the long run. This would improve the chance that the transport sector can contribute more substantially to the reduction of CO₂ emissions in the future, even under an economic regime of economic growth and continuing globalisation.

2 The World Economic Crisis: Not Only a Financial Bubble

2.1 Financial Turmoil and Globalisation

The reasons of the world economic crisis of 2008 are manifold: low interest policy in the US, missing control on the speculative financial operations of banks and other financial institutions, epidemic diffusion of risk certificates of which only classified risk and return categories - evaluated by rating agencies - were known, but not the real values behind. „Financial investment banking“, „Financial Engineering“ „Financial Product Management“ were highly paid businesses for banking specialists who constructed clusters of certificates, tailored to the needs of financial institutions with respect to duration, risk and expected value of returns. The sector of financial services became most important in some countries and regions, e.g. the London financial district employed 350,000 people before the crisis and contributed 8% to the UK GDP.

Figure 2.1 shows an important driver of this development, the mortgage credit market in the US. As interest rates were kept low by the Federal Reserve, while the house prices went up such that it seemed to be safe business to invest in the housing market. This was the rational for the subprime mortgage loans given to low income house owners. These high-risk certificates were pooled with lower risk assets to form new products for financial trading. The instruments applied are:

- MBS: Mortgage back security, a certificate based on a mix of different mortgage loans,
- CDO: Collateralized debt obligations, these are constructed financial products with different maturity, risk and expected returns, secured by collaterals,
- CDS: Credit default swaps, a sort of insurance for bad risk.

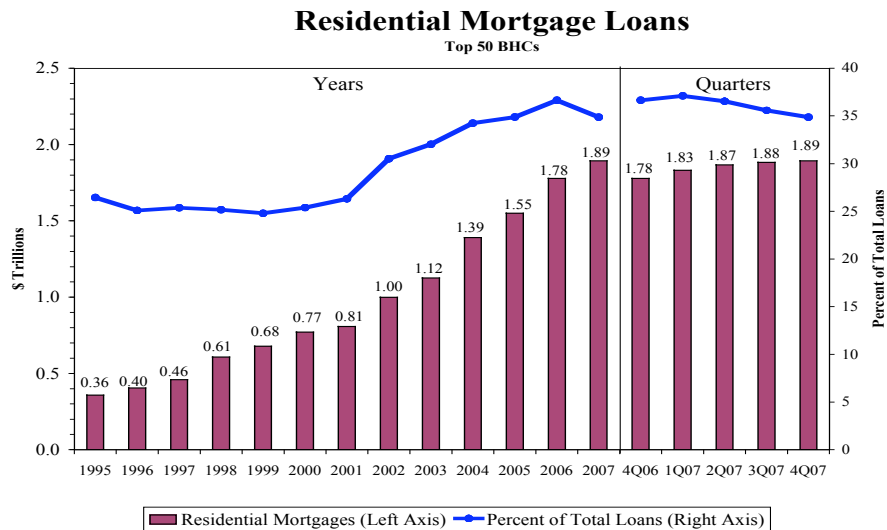


Figure 2.1: Development of Mortgage Loans in the US until 2007

Source: Li, 2008

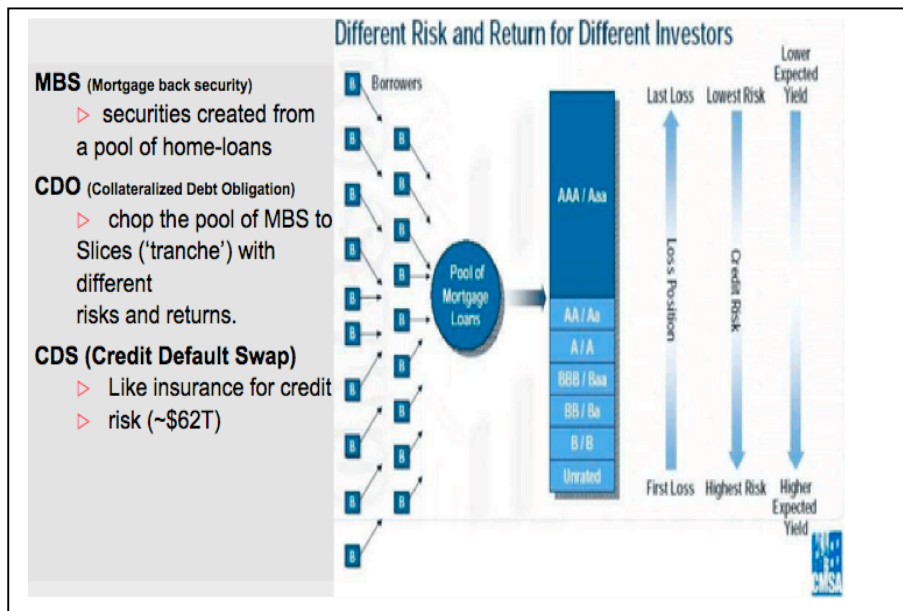


Figure 2.2: Construction of Certificates with Standard Financial Instruments

Source: Li, 2008

As a result huge amounts of anonymous credit certificates were traded without sufficient information on the real values behind for the trading parties and driven by the expectation of rising prices of valuable assets, which were assumed to be safe collaterals of the products. When house prices went down in 2007 and a crisis on the mortgage credit market in the US emerged, followed by problems of mortgage banks (Freddie Mac, Fannie Mae) in spring 2008, this was interpreted as a natural market correction in a particular sector. However, the trust in the financial institutions faded away at an unprecedented speed, and the bankruptcy of Lehman Brothers in September 2008 indicated that the financial turmoil was not local and limited to the mortgage credit market rather than global and including private and state-owned banks. This was the starting point for world-wide policy actions to save „system relevant“ financial institutions to prevent the financial system from collapsing (e.g. the spectacular rescue action for the AIG insurance company in the US).

The development of the financial markets went in parallel with the dynamic globalisation of production and trade. Since the beginning of the new millennium the imbalances of the country foreign trade activities increased rapidly. While countries like the US, UK, Italy or Turkey showed increasing deficits in their foreign trade balances, other countries like Japan, China or Germany enjoyed a rapid upturn of net exports, which was interpreted as a signal of economic strength. Figure 2.3 shows this development for the case of Germany, which was the leading export country until 2009 (recently outpaced by China). It can be seen that the developments of trade imbalances seem to be closely correlated with the relaxed monetary policy in the US and the boom on the financial markets. A further disharmony can be observed for the development of fiscal budgets because low interest rates provided incentives to increase public deficits, in particular in Japan and in the US, but also in some European countries. There is still an ongoing debate among economists to which extent the trade and fiscal imbalances can be interpreted as a cause of the economic crisis following the financial turmoil. But it is widely agreed that they have caused heavy multiplier effects in the phase of beginning slowdown of the economy. The sharp reaction of the world economy following the financial crisis supports the hypothesis that also the globalisation process had been heated up by a trade bubble, such that excessive expectations for global production and trade coincided with the bubble on the financial markets.

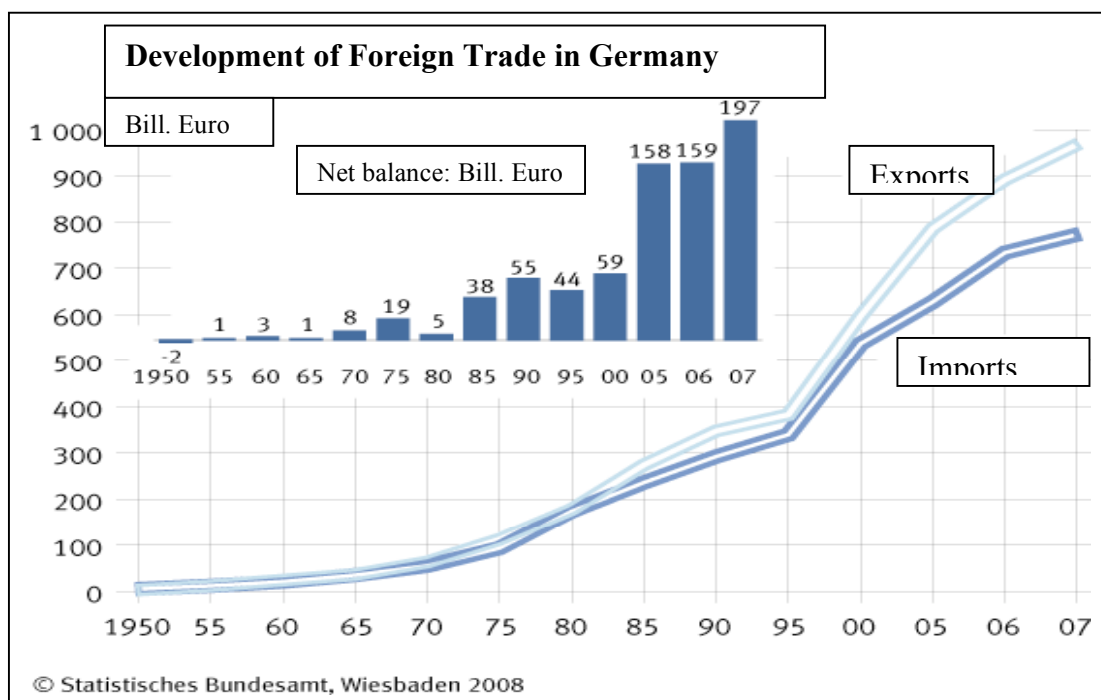


Figure 2.3: Development of Foreign Trade in Germany until 2007

Source: German Federal Statistical Office, 2008

2.2 Impacts on the World Economy

The financial turbulences arrived at the real markets in fall 2008, induced by a rapid slowdown of foreign trade. Export turned down globally by more than 10% between summer 2008 and 2009 and this developed even worse for the export champions Germany and Japan, which suffered from reductions of about 20%. The markets for some branches (steel production or chemical primary production) dropped at an order of magnitude of 40% and the exports of some transport related industries almost collapsed totally (up to minus 90% for heavy goods

trucks). Speed and magnitude of the economic slowdown exceeded the downturn of the economies in the first phase of the world economic crisis in 1929 (see Figure 2.4).

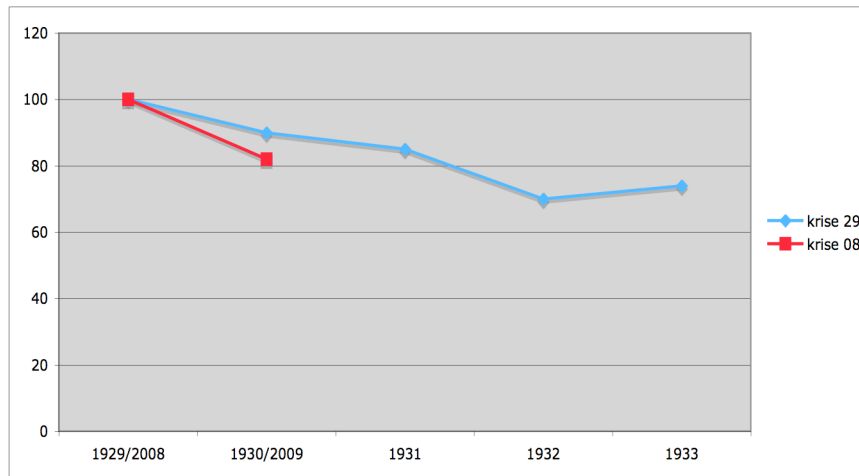


Figure 2.4: Intensity of the Economic Crisis 2008 Compared to 1929

Data Source: OECD, 2009

The weakness of foreign trade led to a reduction of GDP in many countries except for China. Table 2.1 shows the expected GDP losses for 2009 in the EU, as OECD and EU Commission have estimated them in fall 2009. According to these figures all EU countries but three (Cyprus, Luxemburg, Malta) will have big difficulties with meeting the Maastricht criteria for public financial stability.

Table 2.1: Expected Reduction of Economic Activity in 2009

Source: EU-Commission, 2009

Country	Change of GDP	State Deficit in % of GDP	Rate of Unemploy- ment in %
Belgium	- 3.5	- 4.5	8.5
Germany	- 5.4	- 3.9	8.6
Finland	- 4.7	- 0.8	8.9
France	- 3.0	- 6.6	9.6
Greece	- 0.9	- 5.1	9.1
Ireland	- 9.0	- 12.0	13.3
Italy	- 4.4	- 4.5	8.8
Luxemburg	- 3.0	- 1.5	5.9
Malta	- 0.9	- 3.6	7.1
Netherlands	- 3.5	- 3.4	3.9
Austria	- 4.0	- 4.2	6.0
Portugal	- 3.7	- 6.5	9.1
Slovak Rep.	- 2.6	- 4.7	12.0
Slovenia	- 3.4	- 5.5	6.6
Spain	- 3.2	- 8.6	17.3
Cyprus	+ 0.3	- 1.9	4.7

According to the forecasts prepared by international and national expert groups it is expected that the crisis will arrive at the labour market in the next phase of the economic feedback mechanism. This will have impacts on domestic consumption and investment.

Most of the industrialised countries have responded to this development by Keynesian Economic Policy, i.e. by stimulus packages to stop the downturn and to avoid the failures made after the crisis of 1929. While countries like China and Korea spend the major part of the stimulus money for investment, research and product development, the western industrialised countries are doing little to foster long-term investment in future technologies. This is partly caused by the rescuing activities for the financial system (China had no problem on this side) and partly due to the attempts of economic policy to stabilise trust in the economic development and support domestic consumption. One example is the scrapping programme for old cars in Germany, the UK and the US (in different forms) to foster the sales of new cars.

The Keynesian policies had significant positive effects in the short run:

- (1) The economic downturn could be smoothened, i.e. the actual figures for 2009 look less dramatic than exhibited in Table 2.1.
- (2) For 2010 most countries expect a modest positive growth rate again, followed by a higher growth rate in 2011, expectedly.
- (3) The impacts on the labour market are less severe because of “built-in stabilisers” such as employment guarantees, short-time work and education programmes.
- (4) The serious budget situation of some EU countries has improved (Baltic States, Hungary).

Nevertheless there remain high risks for the economic development in the medium run:

- (1) A consolidation of the state budgets will be necessary and the Central Banks will have to control money supply more strictly such that lower public expenditures and rising interest rates are probable.
- (2) After a brief upturn of investment due to refilling of inventories the overall investment activity might be lower than before the crisis because of more risk-averse behaviour of the firms, affecting also the labour market. Firms, when planning to invest, tend to focus on countries with low wages and increasing demand (in particular the BRIC countries).
- (3) The states seek to bring their industries into good positions after the crisis to gain a relative advantage in the phase of economic recovery. This increases the risk of protectionism, which is detrimental to world trade. In particular China is presently showing such a mercantillist behaviour.
- (4) The budget situations of some countries (e.g. Greece, Spain, Portugal, Ireland) still give rise to concern. Economic power of other countries will be absorbed to avoid bankruptcy of members of the European Currency Union.

In the long run the next generations will have to pay for the increase of debt following from the rescue and stimulus measures. As the share of long-term investment financed by stimulus packages is rather low in the EU the next generations will not enjoy major benefits from today’s deficit spending policy. This might lead to growing shares of interest payments for old debt or to higher tax rates.

2.3 Short-term Impacts on Transport and Logistics

While passenger transport is mainly driven by the disposable income of consumers freight transport is in particular dependent on trade activity. Often GDP is used as explaining variable for both, but its explanatory power is very limited. Fluctuations of trade are much higher than fluctuations of GDP as Figure 2.5 shows. In phases of economic upturn the growth of trade can be double of the growth of GDP, and this also holds for the negative direction. The present economic crisis demonstrates these relationships very clearly. Long-distance passenger transport went down proportionally to disposable income, i.e. around 5% in industrialised countries in 2009. Losses of air passenger transport are higher, because of reduced business travel, but not dramatically. While domestic freight transport has remained almost stable international freight transport has been hit almost proportional to the losses in global trade (around 10% on the average and 20% in export oriented countries).

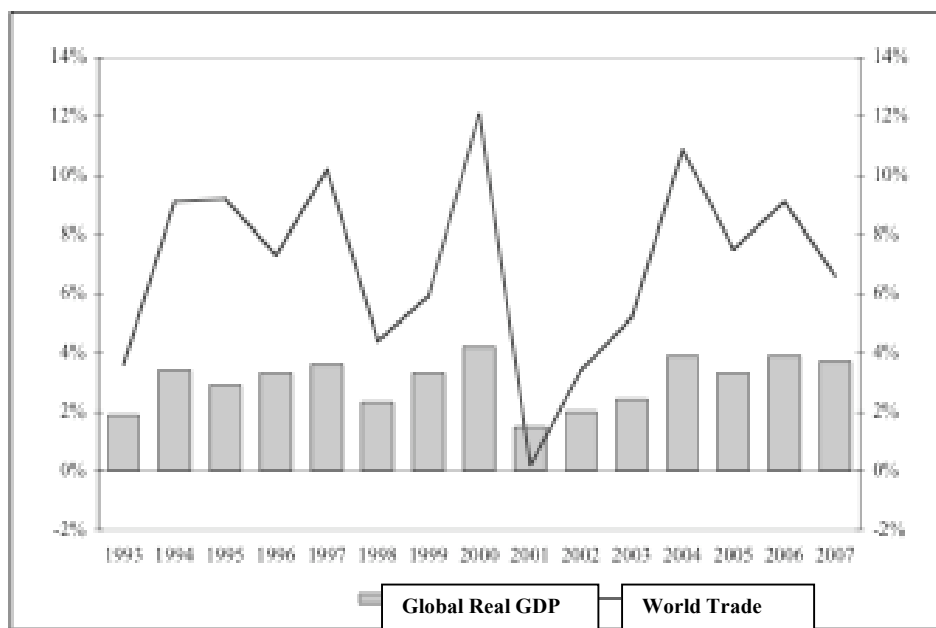


Figure 2.5: Development of World Trade and global GDP (real) until 2007

Source: Advisory Committee of the German Ministry of Economic Affairs, 2008

In the phase of the globalisation bubble, beginning after the year 2002, also the transport intensity went up in the industrialised countries. This means that freight transport has not been in the focus of rationalisation, because the relatively low transport prices induced miniaturisation of spare parts and global distribution of the workflow, making use of wage cost differentials and improved proximity to the markets. Global supply chains with scheduled delivery patterns were developed to minimise inventory holding, at the cost of additional transport activity.

The economic crisis has led to a dramatic reduction of international trade and freight transport. The firms have adjusted through short-term contracting and lean inventory holding to save costs in the short-run and foster flexibility in a phase of high uncertainty. The railways have lost more freight compared with road in the EU because of higher distances and dependency on bulk cargo consignments, which went down dramatically (steel, chemical basic products). Air freight transport lost about 13% world-wide in 2009 and even more than 20% in the export oriented countries.

Also maritime transport is suffering from a drastic decline of international trade. Container transport, instead of growing at a rate of 8% and more, like in the phase of the globalisation bubble, declined by around 10% (worldwide) and 20% (export champions). In May 2009 about 10% of world-wide container ship capacity was unused.

The agents in production and transportation businesses seem to expect a change of the globalisation trend to lower growth rates and have started to adjust to this by reducing capacity. In May 2009 the orders for 325 freight vessels, 47 tankers and 78 container ships were cancelled (OECD, 2009). The professionals in the business expect lower growth paired with higher fluctuations and try to reduce the sunk costs accordingly.

3 Scenarios of OECD/ITF for the Development after the Crisis

3.1 Economic Development

OECD/ITF (2009) have constructed several scenarios of the economic and transport development after the crisis:

- Trend development as it was forecasted before the crisis („global economy“).
- Fast return to the growth path, which was forecasted before the crisis („bounce back“).
- Sharp reduction of globalisation and shift of production to regional clusters („regional communities“).
- Sharp reduction of globalisation and economic growth („retrenchment“).

„Bounce Back“ means in this context that the growth rates, which were predicted before the crisis are reached again after five years. This is regarded as an optimistic perspective, while the regional communities and the retrenchment scenarios represent pessimistic cases (see Figure 3.1).

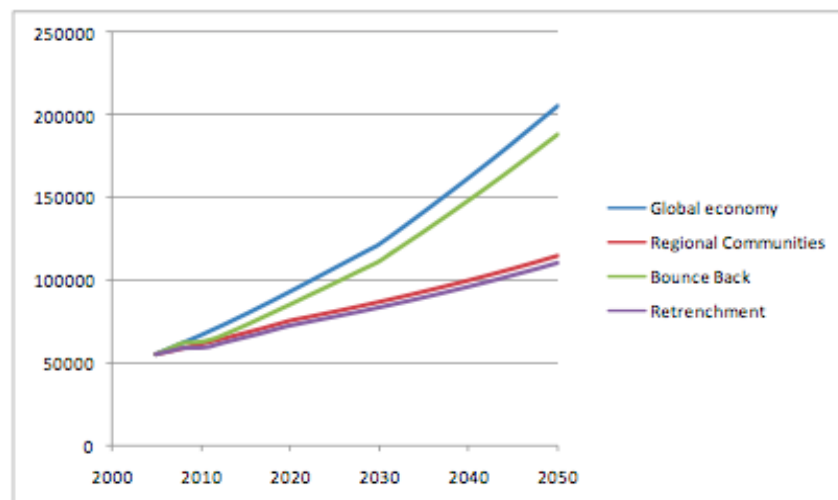


Figure 3.1: Scenarios of the OECD/ITF Study (2009)

As the most probable development might lie in between the extreme cases a further scenario was defined, called „adjustment“ scenario, without a detailed specification of assumptions and the resulting development path.

3.2 Transport Development

The OECD/ITF study uses the IMO scenarios for the development of maritime transport, which have been derived from the scenarios of the IPCC assuming different climate mitigation policies, i.e. they are not related to the crisis and are skipped here. The study gives own predictions on the development global sales of road vehicles and of air passenger transport (Figure 3.2). The gap between the trend and the adjustment scenario is up to the factor 1.7 until the year 2050, which underlines the high degree of uncertainty of all forecasts presented in these days.

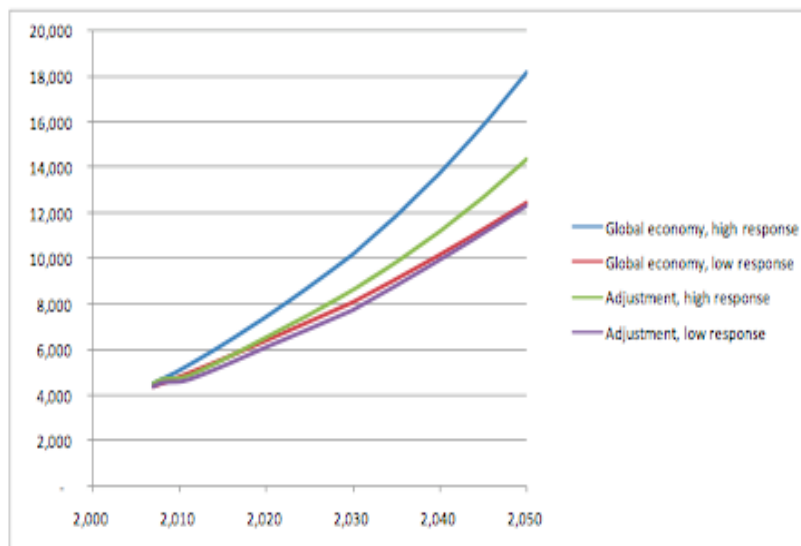


Figure 3.2: Development of Global Air Passenger Transport according to OECD/ITF (2009)

The OECD/ITF study can be summarised as follows:

- A fast „bounce back“ to the growth rates of transport as they have been predicted before the crisis seems not highly probable.
- The same holds for scenarios, which assume a long-term weakness of the economy or an end of the globalisation processes.
- The most probable development lies in between, but there is no specific description of assumptions and outcomes in quantitative terms. This reflects the high uncertainty of forecasts made in the present phase.

This gives the point of departure for the following own scenarios and simulations.

4 Schumpeter Paradigm and Structural Change

4.1 The Schumpeter Paradigm

The world economic crisis has led to serious doubts that the neoclassical economic theory, which was the main stream of economic theory before, is a productive approach to explain the economic dynamics (see Roubini et al., 1997). The basic assumptions of neoclassics are rational behaviour of agents, perfect information, rational expectations, convex preferences and technologies as well as widely polypolistic markets. This is a world of no failure and no surprise, which leads to economic equilibria, which are pareto-optimal³ at the same time. Keynes was one of the first prominent authors who attacked this abstract world, in particular the reasoning of neoclassic authors that their theory might not represent the short-term reality but would correctly describe the development path in the long run („... in the long run we are all dead“, Keynes, 1923). The Keynesian theory takes up non-rational behaviour of agents, in particular herd behaviour on financial markets, which cause business cycles and sudden turbulences. But Keynesian theory gives little help for understanding the dynamics of growth and the structural changes associated with long-term development in a second-best environment. J.A. Schumpeter (1952), the founder of the economic theory of evolution, closed this analytical gap. The heart of Schumpeter's theory is given by the following properties:

- Crises are not exceptional phenomena rather than periodically repeating episodes in a market economy.
- The agents are not perfectly informed and don't behave strictly rational. They follow routines, which they only change in the case of obvious failure.
- The dynamics of a market economy stem from intrinsic imperfections on one hand and the ability to adjust to changes of the environment quickly on the other hand.
- Agents change routines in or after a phase of crisis, not in a phase of prosperity. The propensity of entrepreneurs for innovation is maximal in such a phase.
- A crisis fosters structural change, which is necessary to guide the economy to a new phase of growth, stimulated by new products and new production processes.

The state can foster this process by investing in research and development, supporting the implementation of new technology (pilot applications) and by public investment in the necessary infrastructure.

3.2 Structural Change of the Economy

While it is highly probable that a severe economic crisis is followed by a substantial structural change it is impossible to predict the type of changes and their intensity with some degree of accuracy. Therefore the following considerations include speculative elements. They are based on two pillars: First, the observed reactions of the economy to rising energy prices and to

³ A single individual cannot improve on her economic position without making any other individual worse off.

to expected climate change mitigation policies; and secondly, the ideas of futurologists as to the drivers of long-term societal and economic change.

While a decade ago the industrialists argued that environmental policy would jeopardise economic growth, today the environmental products make a good part of the production portfolio of big companies (e.g.: Siemens). The industry of highly industrialised countries has discovered that this is a market segment, in which they have - and are able to preserve – a technological advantage. This explains why parts of the industry were very much disappointed about the results of the Copenhagen Climate Conference (COP 15) and are putting pressure on the political side to come to international agreements. Furthermore, the last period of rising oil prices has shown – contrasting the opinion of neoclassical economists – that higher oil prices are not detrimental to economic growth as soon as the industry expects this development and has time to adjust. Energy savings technology has developed a prosperous business. For instance, the Japanese and European automobile industry was able to adjust within a short time range to the challenge set by the European Directive 2009/443 to reduce the average consumption of newly licensed cars to 120 g/km. As it seems highly probable that fossil energy will become more expensive in the long term future and that climate policy will become more severe to achieve the reduction goals set one can follow that all economic sectors, which contribute to energy saving and clean products will have high chances to grow.

When it comes to speculative future economic trends the work of L. Nefiodow (2006) on the sixth Kondratieff deserves attention. W. Kondratieff (1926) had established the hypothesis that the economy shows long-term cyclical movements, where every upturn is initiated by new technologies. Schumpeter (1952) did a similar analysis and came like Kondratieff to the conclusion that the period of a long wave is 40 to 60 years. Starting with the industrial revolution (invention of the steam engine) they count four Kondratieff cycles until world war II. The fifth Kondratieff is linked basically information technology, which has been pushed by micro-electronics. In his analysis of the sixth Kondratieff, expected in the future, Nefiodow points out that some industries will play a dominating role. This may be (extending the list given by Nefiodow):

- Nano-technology
- Material compounds
- Robotics and Assistant Systems
- Energy technology
- Network clouds in information technology
- Health technology
- Knowledge economy.

But there will not be one technology to play the role of the driver rather than a network of different industries. The same holds on the social side. Nefiodow expects that social networks develop, supported by the above technologies and that –after a long phase of individual egoism – the social networks will create new forms of life styles, preferences and activity patterns.

These ideas can be translated into development prospects of economic sectors and change the composition of final demand and of inter-industrial flows in the input-output matrix. Both, the

relative changes in the composition of final demand and of the input-output flows is what we call the structural change of the economy.

3.3 Structural Change of Freight Transport and Logistics

In this section we concentrate on freight transport and treat possible changes of consumer preferences only implicitly. This means that we assume that the changed world of production and trade meets the demand of consumers. On the side of production and trade the following changes are assumed:

- The trend towards lower shares of bulk cargo versus unitised and containerised goods will continue.
- The trend towards growing shares of services of GDP will continue.
- The trend towards smaller and lighter products (de-materialisation of products) will continue, with an increasing share of electronics and communication technology.
- Energy efficient products will be preferred, in particular in the automotive sector.
- The industry will plan the production of parts and subassemblies increasingly under consideration of logistic requirements.

This will lead to adjustments in the sector of freight transport and logistics and add to the structural changes, which will be induced by energy scarcity and the climate challenge. In particular, the following structural changes are expected:

- Further bundling of consignments and optimisation of hubbing versus direct delivery.
- Increasing share of container shipping on intermodal routes.
- Better loading factors for road and rail.
- Further increase of 4PL contracts and start of collaborative logistics (see Tavasszy et al., 2009).
- Stagnation of the trend towards fast JIT/JIS⁴ processes and upcoming moving logistic platforms with fixed operation schedules at freight centres and slower transport operations on route. These platforms can be organised as open networks (see Logotakt, 2009).

The state is assumed to support this development by the following measures:

- Substitution of quantitative capacity expansion by higher quality on the main corridors (focusing on reliability instead of operation speed).
- Introduction of infrastructure pricing for all transport networks with the result of higher costs of infrastructure use and higher reliability because of reduction of peak traffic demand.
- Stricter control of transport and social regulations.
- Successive internalisation of external costs, in particular the costs of climate change.

⁴ 4PL: Forth Party Logistics (contracting logistic business out). JIT: Just in Time. JIS: Just in Sequence

It follows from these assumptions that two types of reactions can be expected: First of all the growth of transport volumes will be more modest or even tend to stagnation in industrialised countries, while the growth of tonkm will continue at lower rates compared with the forecasts made before the crisis. Secondly, the growth of vehicle km on roads might fall below the growth of GDP, which means a decoupling of freight transport movements from GDP. The chances of rail and inland waterways, and eventually also of coastal shipping, might increase such that the modal split changes in favour of environmentally more friendly transport modes. These expectations are qualitative in nature and have to be backed by quantitative analysis. This is the aim of the following chapter.

4 Simulations for Economic and Transport Development in the EU after the Crisis

4.1 The Scenarios

In a study for the German Ministry of Transport, Construction and Town Planning (Rothen-gatter et al., 2010) three scenarios have been constructed:

- A status-quo scenario without the crisis.
- A base scenario with the crisis.
- A Schumpeter scenario with structural adjustments after the crisis.

4.1.1 Status-quo Scenario

The development of the economy and the freight transport demand is modelled under the assumption that there was no interruption of growth through the economic crisis. However, the scenario abstracts from the bubble development of globalisation in the period 2002-2007 and substitutes this boom development by a continuous stable growth path based on the change of technology and demand (abstraction from exogenous influences such as the temporary booms of east-west trade after opening of the borders, the liberalisation phase in the EU with dramatically dropping costs of road transport and the financial crisis).

4.1.2 Base Scenario

The base scenario takes into account the temporary decline of the economy and of transport demand in the phase of crisis and assumes that globalisation processes will be dampened substantially. With this regard this scenario is comparable to the “retrenchment” and “regional communities” scenarios of the OECE/ITF and can be characterised as a pessimistic view for the future development.

4.1.3 Schumpeter Scenario

If the world economy recovers and the globalisation process is going on then structural changes are necessary. These are described by the assumptions in section 3.3. The quantitative assumptions underlying the computation cannot be given in detail here. They can be found in the study prepared for the German MoT (Rothen-gatter et al., 2010), where the quantitative figures are described. They can be characterised as a modest move to new structures, but not as a radical change of economics and transportation, which could happen in a new Kondratieff cycle. Reason for sticking to a more conservative world of quantitative assumptions is that the simulation model, which is used for the quantitative computations, is calibrated on the development of the past decade 1995-2005. This implies it would have been

necessary to exchange calibrated equations in the model by speculative elements, which cannot be explained by observations of the past. The advantage of this approach is that the model is closer to reality in the first phase after the crisis while it indicates possible changes of structures for the future. These changes can develop more dramatic if actually a new Kondratieff cycle will occur, and they can be smaller if the technology and behaviour are bouncing back to the old regimes before the crisis.

4.2 The ASTRA Model

The basic modules of the ASTRA model, developed by IWW, Karlsruhe, and TRT, Milan, are depicted in the following diagram.

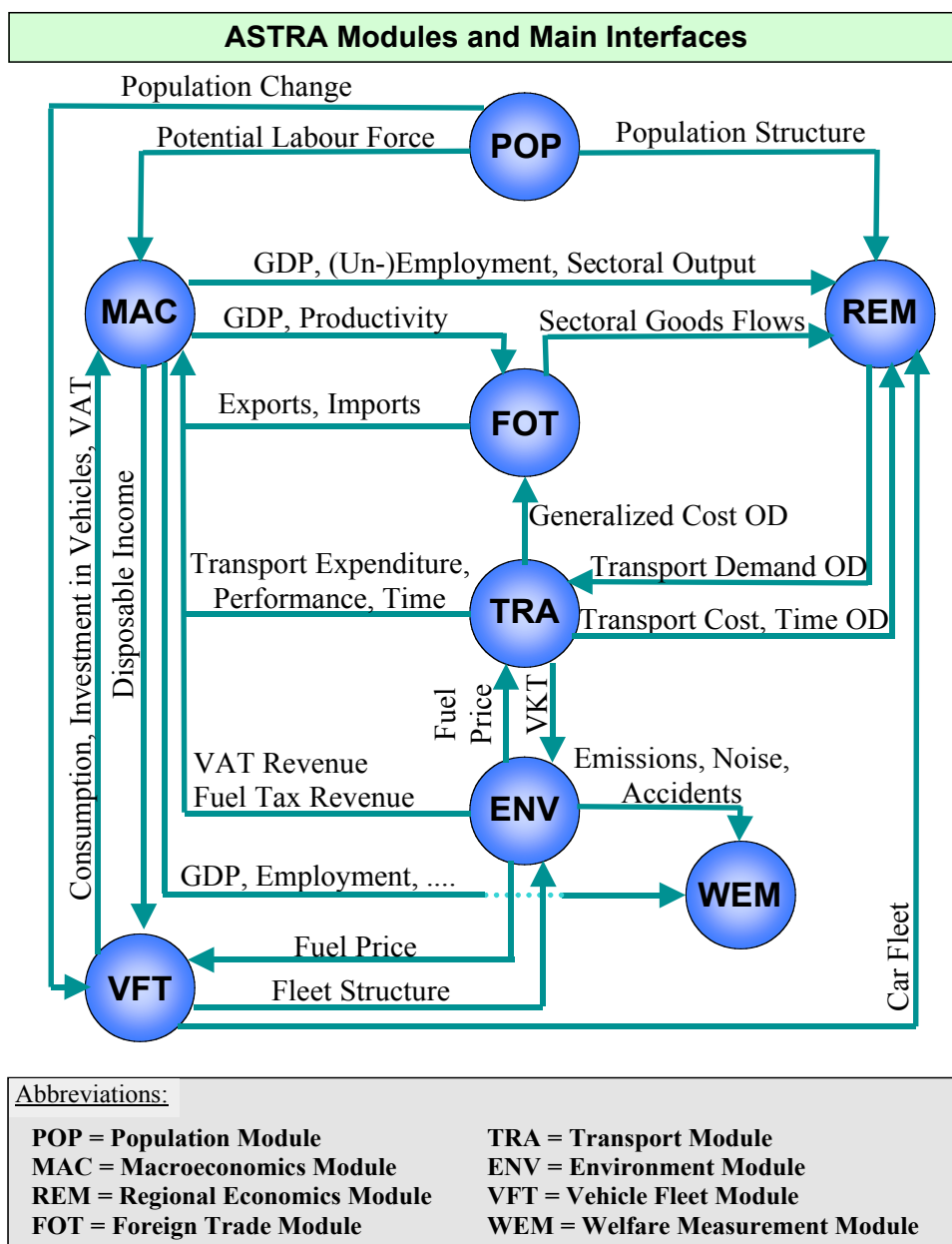


Figure 4.1: Modules of the ASTRA System Dynamics Model

Detailed descriptions of ASTRA can be found in the PhD theses of the developers W. Schade (2004) and M. Krail (2009).

ASTRA includes 29 European countries (EU27 + Norway and Switzerland) with their systems of national accounts and input-output tables (25 sectors). The model is based on the system dynamics philosophy, which means that it is composed of state and flow variables, which are interlinked by dynamic (difference) equations. These equations are treated sequentially by numerical integration such that dynamic profiles for the variables are constructed, which not necessarily lead to a general equilibrium. The model is calibrated for the years 1995 to 2005. It produces ex post forecasts for the years 2006 to 2008, i.e. the results can be compared with the actual statistical data. Beginning with the year 2009 the model moves to the future sequentially in three months steps.

ASTRA is able to analyse and predict feedback mechanisms between the different modules, in particular the dynamic interdependencies between transport and the economy. It has been applied for European projects to simulate the long-term effects of transport investment programmes, of technological change, of taxation and charging or of regulations set by climate protection policy. With respect to transport the simulation capacity of the model is limited, such that it can only generate cluster results (e.g. freight transport by goods and distance classes) but no network figures. But it can be linked to a transport model (ASTRA) if detailed information on network flows are important.

4.2 Scenario Results

4.2.1 Macro-economic Indicators

Figure 4.2 shows a comparison between the development in the base scenario and the status-quo scenario. The latter defines the zero-line, this means the zero-line does not represent the status of variables before the crisis rather than the development of variables if the crisis would not have occurred.

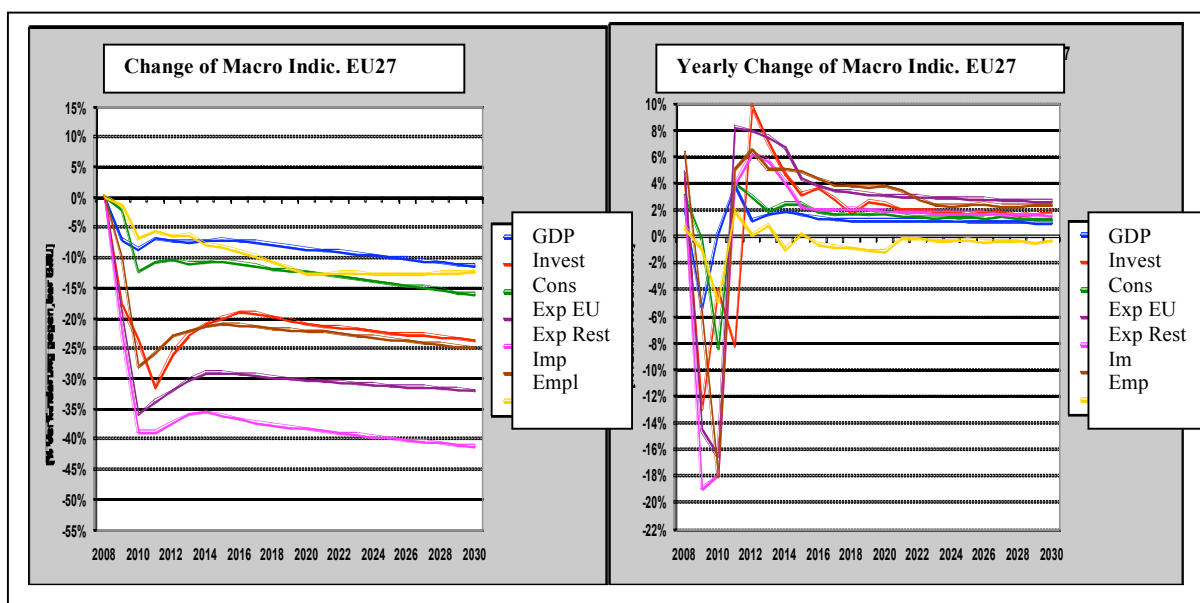


Figure 4.2: Development of Macro-economic Variables in the Base Scenario Compared with the Status-quo Scenario (Zero Line, left figure); Growth Rates of Variables in the Base Scenario (right figure), EU 27+2

Source: Rothengatter et al. (2010)

The downward sloping time profiles for the variables (like GDP, consumption or exports, left picture) indicate that growth occurs, but it is significantly lower than it was expected without the crisis. GDP in the year 2030 is about 10% lower than in the status-quo case. The average growth rate of GDP is about 0.2% lower than it was expected before the crisis (right picture). This can be regarded as the quantitative impact which has to be expected if the economy is not able to develop new structures after the crisis: Following the old routines will not bring sufficient new economic dynamics, expectedly.

It is interesting to compare the results for EU27+2 with the results for EU12 (the accession countries):

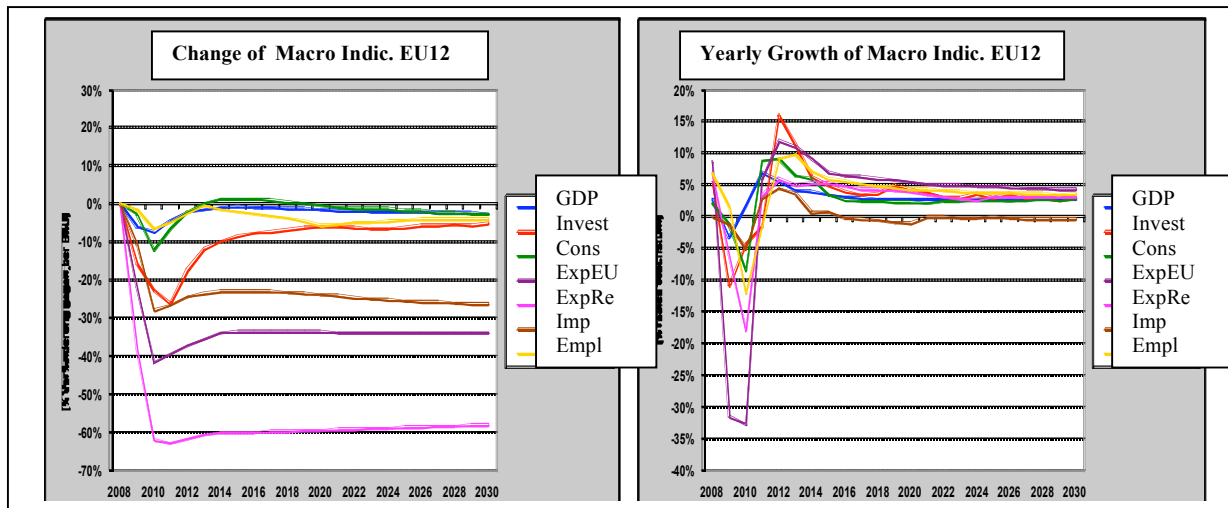


Figure 4.3: Development of Macro-economic Variables in the Base Scenario Compared with the Status-quo Scenario (Zero Line, left figure); Growth Rates of Variables in the Base Scenario (right figure), EU 12

Source: Rothengatter et al. (2010)

It can be seen on the left hand picture that also the EU12 countries are hit dramatically by the crisis. But they show higher growth rates compared with EU15+2 (right picture) and are able to recover more quickly. This is indicated by the upward sloping curves for investment and exports and the stable position of GDP (on the zero line after a medium-term adjustment). This can be interpreted in terms of the OECD/ITF that the accession countries have a chance of a “bounce-back development”, which leads them back to the previous growth path after a delay of about five years.

The Schumpeter-Scenario has been elaborated only for the case of Germany. This is because preparing such a scenario for 29 countries would require high research inputs as the structural preconditions are different, in particular for the accession countries. Furthermore, recent input-output tables are not available for all countries such that the results for structural effects could be biased.

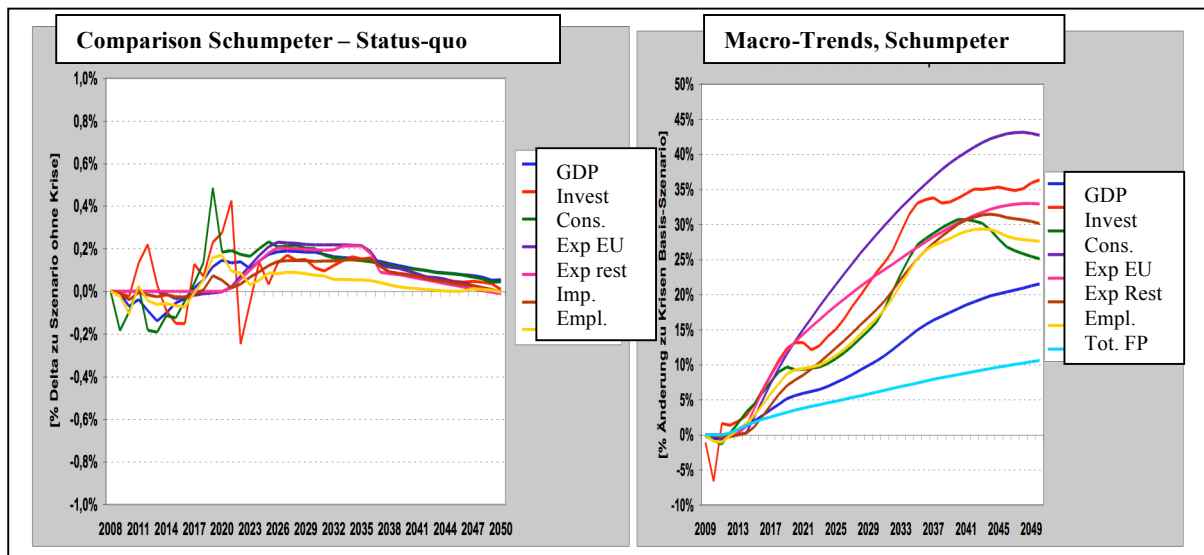


Figure 4.4: Comparison of the Development of Macro-variables in the Schumpeter-Scenario versus the Status-quo Scenario (change of growth rates, left picture) and the Base Scenario (percent changes of variables, right picture). The Case of Germany.

Source: Rothengatter et al. (2010)

In the diagram the comparison scenarios (status-quo, left and base, right) define the zero line. The left diagram shows that in the first phase after the crisis all variables except for the investments develop at lower growth rates compared with the status-quo. The investment path is derived from assumptions on the allocation of money from the stimulus packages of the state. After a time of restructuring, which the model predicts until the end of this decade, the economy recovers and the growth rates become even higher than in the case without a crisis. At the end of the time horizon, moving towards the year 2050, the profiles converge to the zero axis, i.e. the growth rates correspond to the originally expected development. Despite the higher growth rates the economy will not bounce back to the original growth path, i.e. the GDP values of the Schumpeter scenario are still lower than the GDP values of the Status-quo scenario in 2025 and in 2050. This means that the decline in the years 2008 and 2009, and the losses of growth in the phase of restructuring are so big that a “bouncing back” to the original growth path, i.e. the formerly predicted levels of variables in the future, is not possible.

The right diagram exhibits that the structural changes assumed in the Schumpeter scenario will help to move the economy away from the pessimistic base scenario path. In the year 2025 the value of GDP is about 2% and in the year 2050 about 4% higher compared with the base scenario.

4.2.2 Transport Indicators

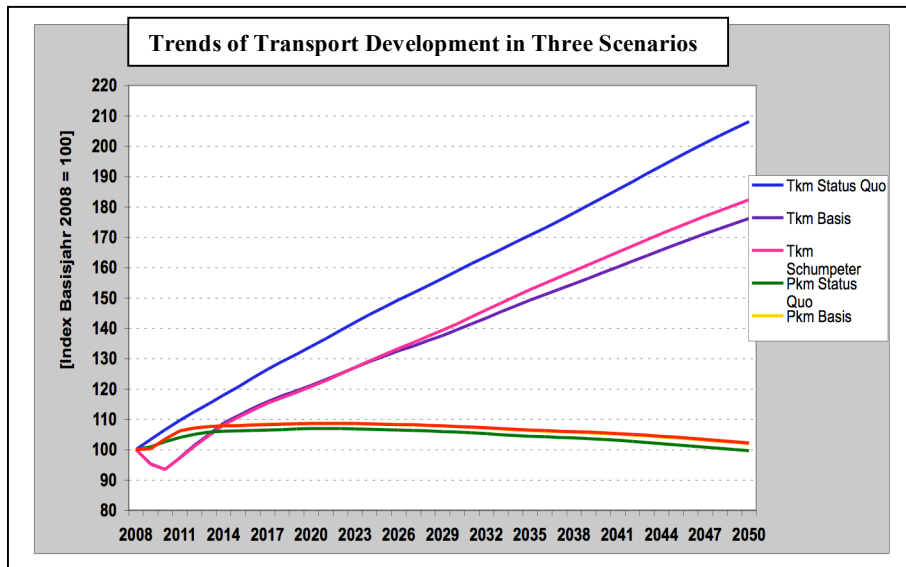


Figure 4.5: Development of Transport Variables in Different Scenarios; Case of Germany

Source: Rothengatter et al. (2010)

Figure 4.5 summarises the results for the transport variables. Freight transport in Germany will tend to grow in the future, which is shown by the upper three lines. The status-quo Scenario is depicted by the highest line, but this is no longer realistic after the crisis, as is underlined by the lines for the Schumpeter and the base Scenario. While the growth factor for the status-quo development is 1.5 (2025) and 2.1 (2050) it is reduced to about 1.3 (2025) or 1.8 (2050) in the scenarios considering the effects of the crisis. Although the GDP development is prosperous in the Schumpeter scenario the growth of freight transport performance is modest, due to the assumptions on structural change.

A further impact shall be added in qualitative terms because the model results are less reliable in this area. The tonkm predicted in the Schumpeter scenario can be transported with less vehiclekm, because of the logistic effects listed in section 3.3. Better bundling and loading of vehicles and the change of modal split lead to a significant reduction of the growth of road transport. While the forecasts for the German MoT predicted a growth of road freight transport in an order of magnitude of 84% between 2004 and 2025 this figure could be cut by half in a Schumpeter world – depending on the policy measures on the field of charging and regulating road transport. This would imply nevertheless that road transport will grow substantially despite restraining policy measures. It has to be kept in mind that Germany will be export oriented in the future and the most frequented transit country of Europe. International transport is the main driver of freight transport and the structure of goods and distances leaves only limited options for modal split – as a whole. But the growth could be limited to the growth rate of GDP from the present point of view and further changes (e.g. energy prices, technology) in the long run (speculative futures) could cut the growth rates further.

Passenger transport is not very much affected by the crisis and might return soon to the original growth path. For Germany, passenger transport will most probably decline in the long run, as depicted by Figure 4.5, because of the declining population, the changing age structure and the limited increase of disposable income for the lower and medium income groups.

5 Conclusions

The economic crisis has hit the industrialized countries badly and had a big impact on freight transport, which collapsed temporarily in line with the trade activities. It can be expected that the economies will recover, but this recovery process presupposes that economic and transport structures change. This corresponds to the Schumpeter paradigm, which states that business cycles and fluctuations are natural phenomena in a market economy. A crisis gives the chance for a structural change, which is never possible in a phase of prosperity because routines only will be changed after the perception of failure. Against this background the construction of a “Schumpeter Scenario” has been tried in the paper to explore the possible development in the case of structural changes of the economy and of the transport sector.

It was shown that the change of the transport sector is consistent with a Schumpeter world, if transport operations are becoming more energy efficient and environmentally friendly. A quantitative simulation shows that there is a high potential for creating such a world in the freight transport area, using the options of better bundling, loading, routing and modal split. Vehicle operations on roads can be reduced substantially by such changes. Nevertheless it will hardly be possible to construct a Schumpeter world with dynamic growth of the economy and stagnation or reduction of road freight transport. Nevertheless, the Schumpeter scenario describes a possible change of trends. If the economy and the transport sector change to this trajectory it seems probable that additional market forces emerge, which foster the technological change towards even more sustainable production and transport, such that the challenging environmental goals can be met in a world of economic growth and modestly continuing globalisation.

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