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Quantifying Four Scenarios for Europe

Arjan Lejour

CPB Netherlands Bureau for Economic Policy Analysis
Van Stolkweg 14
P.O. Box 80510
2508 GM The Hague, the Netherlands

Telephone +31 70 338 33 80
Telefax +31 70 338 33 50
Internet www.cpb.nl

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Preface

In 1992 CPB published the study *Scanning the Future*. It offered four long-term scenarios for the world economy, based on an assessment of current trends, strengths and weaknesses. A number of follow-up studies used these scenarios as a tool for analysis of particular policies with long-term implications. The new study *Four Futures of Europe* develops four new scenarios. Again, the aim is to use them as a tool for analysis in subsequent studies. Moreover, this study elaborates on policy challenges that the European Union and the member states themselves will face during the coming decades in light of a number of social and international trends.

While *Four Futures of Europe* analyses in great detail the fundamental key-uncertainties of the scenarios, this accompanying study concentrates on a quantitative underpinning of the scenarios. The scenarios are quantified using WorldScan: a computable general-equilibrium model for the world economy developed at CPB.

The study was carried out by Arjan Lejour. A number of other CPB economists have provided useful contributions to and comments on the simulations and the texts, including Henri de Groot, Fré Huizinga, Ton Manders, Ruud de Mooij, Hans Roodenburg, Bert Smid, and Paul Tang. We thank Nico van Leeuwen and Gerard Verweij for their research assistance. From RIVM, Johannes Bollen, Petra van Egmond, Sonja Kruitwagen, Bert de Vries, and Detlef van Vuuren provided useful contributions. Moreover, we thank the participants of the seminars at CPB and at RIVM for their comments.

Henk Don

Director, CPB Netherlands Bureau for Economic Policy Analysis

Summary

This study presents four economic scenarios for Europe until 2040. The scenarios are developed around two key uncertainties: international cooperation and institutional reforms. In the scenarios Strong Europe (SE) and Global Economy (GE), international cooperation is prominent, while the other scenarios, Regional Communities (RC) and Transatlantic Market (TM), feature limited international cooperation. Public institutions are important in Strong Europe and Regional Communities. In Global Economy and Transatlantic Market the role of the public sector is limited. There is more room for private initiatives in these scenarios.

To illustrate the scenarios, this document presents quantitative developments described with an applied general equilibrium model developed at CPB: WorldScan. By using this model we are able to derive consistency between developments in the scenarios and to apply common economic mechanisms. The variation in the outcomes for the scenarios is derived by introducing differences in exogenous trends. This document explains and motivates these differences.

More regulation and income redistribution in Regional Communities and Strong Europe is accompanied by higher unemployment rates and lower participation, as compared to the scenarios in which private initiatives are given more leeway (i.e. Global Economy and Transatlantic Market). Combined with the ageing of the population, this result implies that employment contracts in Regional Communities, while it grows only moderately in Strong Europe, due to immigration. More incentives for labour supply imply a higher participation rate in Transatlantic Market than in Strong Europe. However, lower population growth in the former scenario has the effect that overall employment growth is equivalent in Strong Europe and Transatlantic Market.

The emphasis on an efficient functioning of markets in Global Economy and Transatlantic Market is accompanied by a higher labour productivity than in Strong Europe and Regional Communities. Labour productivity growth is weakest in Regional Communities. This weak growth, together with a fall in employment, causes GDP per capita in Regional Communities to grow by only 0.6% per year.

Trade liberalisation and economic integration boost trade and growth in Global Economy and Strong Europe. High growth in Asia redirects European trade flows towards that continent, so that the share of intra-EU trade decreases. In Transatlantic Market, the EU cooperates more closely with the United States and Latin America, which boosts EU-US trade. In Regional Communities, growth in world exports is negligible, and the share of intra-EU trade remains relatively high.

In Strong Europe and Global Economy, governments stimulate national savings by curbing budget deficits and stimulating private savings. Although this does not prevent a decline in

saving rates because of ageing, it is less dramatic than in Transatlantic Market and Regional Communities, where saving rates decrease by 6%-points between 2000 and 2040. As the demand for capital also falls substantially, real interest rates still decrease in Regional Communities and, to a lesser extent, in Strong Europe. In Global Economy and Transatlantic Market, increasing investment demand causes a higher real interest rate.

1 Introduction

This study presents a quantitative underpinning of four scenarios for Europe. Scenarios are feasible and consistent views of the future. They do not aim to predict the future, but rather to sketch alternative futures. These future states of the world then form the background against which strategic decisions can be explored.

Governments, non-governmental organisations and companies have to take strategic decisions under uncertainty. The uncertainty refers to the environment in which decision makers operate. Indeed, the world can change rapidly due to natural events, political changes, social developments, and technological trends. By considering alternative futures, one can better prepare for unforeseen circumstances and perhaps take early action to deal with a particular conjuncture.

The four new scenarios are extensively motivated and discussed in De Mooij and Tang (2003). Here, the focus is on the quantification of the scenarios. The scenarios are quantified, using a computable general-equilibrium (CGE) model for the world economy, WorldScan. The quantitative underpinning has several purposes. The first is that the CGE model ensures that the scenarios are consistent in several respects, since economic variables conform to identities, constraints and the current knowledge about interactions in the economy. Second, the quantification gives a feel for the relative importance of various developments for the future well being of society.

WorldScan is well suited for scenario analysis because it is a dynamic model. Originally built for CPB's long-run study "Scanning the Future" (CPB, 1992), WorldScan was used later for other scenario studies on globalisation and climate change.¹ WorldScan is able to reproduce not only scenario-specific assumptions on demography and technology, but also globalisation tendencies and energy developments. The model's general equilibrium character enables it to analyse the effects of scenario assumptions on goods, services, capital and labour markets.

The main characteristics of the scenarios are presented in De Mooij and Tang (2003), which does not present much detail, concentrating instead on the main variables for Europe. This document presents not only more detailed results for Europe, but also the results for other regions. This is useful because the results of this study will also be used for other scenarios studies, particularly for the CPB study for the Netherlands, and the RIVM study on sustainability.

Another important element of this document is the motivation of the quantitative results. CPB's CGE model WorldScan is discussed, together with the assumptions made for the various scenarios. We motivate the translation of the qualitative scenarios in De Mooij and Tang (2003) to the exogenous inputs in the CGE model, and discuss the varying assumptions underpinning the scenarios and their relation to the quantitative outcomes.

¹ Examples are our collaborative study with the OECD on globalisation (OECD, 1997), active involvement in the climate-change studies of the IPCC (2000), and Lejour (2003).

The document is set up as follows. The scenarios are summarised in chapter 2, which also presents some of the main scenario characteristics. Chapter 3 explains the main mechanisms of the model and some of the main inputs into the model. Chapters 4 to 7 present the scenario-specific assumptions and outcomes of the model. Chapter 4 focuses on population and labour supply developments. These are exogenous inputs in the model. Chapter 5 relates these developments to the outcomes on GDP and sectoral production in the model. Chapter 6 explains the working of the international capital market and the outcomes on interest rates in the various scenarios. Chapter 7 focuses on trade. The assumptions on the degree of globalisation and regionalisation are translated into the level of trade barriers and the size of trade. The direction and composition of trade are also covered. Chapter 8 concludes.

2 The scenarios²

This chapter presents the four scenarios (Strong Europe, Regional Communities, Global Economy and Transatlantic Market) and explains how they are constructed around two key uncertainties: international cooperation and institutional reforms in the public sector. The last section illustrates the scenarios with the simulation outcomes.

2.1 The scenarios introduced

Key uncertainties

The scenarios are developed around two key uncertainties, which are defined on a meta level, from which one can derive a general characterisation of the scenarios. In this study, the two key uncertainties refer to the policy responses to the challenges that Europe will face during the coming decades.³ The first challenge is whether countries will succeed in *international cooperation*, which is necessary in order to deal adequately with cross-border issues. In particular, this uncertainty springs from the difficulties in reforming current international organisations such as the European Union and the WTO, and institutionalising new forms of cooperation to deal with global problems. International cooperation thus refers to cooperation both in the European Union and between the European Union and other regions. The second key uncertainty refers to *institutional reforms in the public sector* in European economies. It involves developments that put the public sector under pressure such as ageing, the divide between low-skilled and high-skilled labour, policy competition, and individualisation. National governments are clearly unable to continue on the old footing. It is uncertain, however, how they will respond to these challenges.

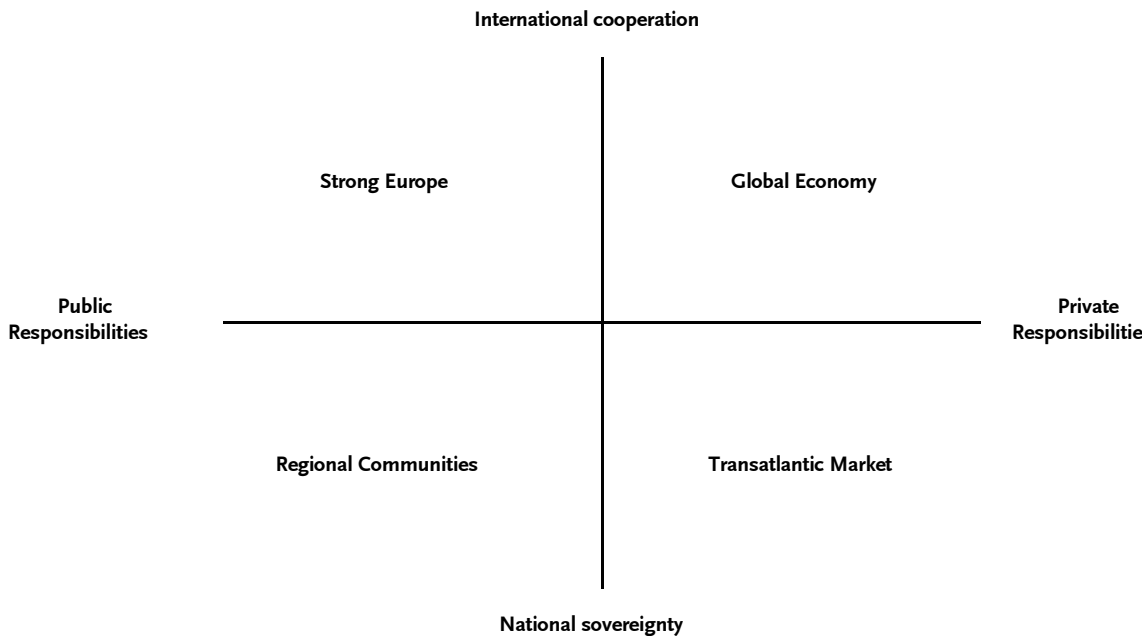
These two key uncertainties are illustrated in figure 2.1. Here, the horizontal axis represents outcomes with regard to the response of the public sector in Europe to various challenges. It runs from a focus on public responsibilities, at the left, to a focus on private responsibilities, at the right. The vertical axis, representing the outcomes with respect to international cooperation, moves from a focus on national issues, at the bottom, to broad international cooperation, at the top. Figure 2.1 thus yields four combinations in the two key uncertainties. The four quadrants each describe a perspective on the world. The upper left quadrant represents a world labelled Strong Europe (SE), featuring ample international cooperation and important public institutions. The bottom left reflects the scenario Regional Communities (RC), combining ample public responsibilities with little international cooperation. The lower right quadrant represents

² The scenarios are extensively described in De Mooij and Tang (2003). This chapter is a summary of their chapter 15.

³ In this study, our starting point is the scenarios developed in De Mooij and Tang (2003). Their publication describes the construction of the scenarios and provides an extensive motivation of the key uncertainties.

Transatlantic Market (TM), a world with affinity for national sovereignty and ample room for private initiatives. Finally, Global Economy is given in the upper right quadrant, combining flourishing international cooperation and a move towards more private responsibilities.

Figure 2.1 The two key-uncertainties in the scenarios



Strong Europe

European countries maintain social cohesion through public institutions. As a result, society accepts that the more equitable distribution of welfare limits the possibilities to improve economic efficiency. Yet, governments respond to the growing pressure on the public sector by undertaking selective reforms in the labour market, in social security, and in public production. Combined with early measures to accommodate the effects of ageing, these policies help to maintain a stable and growing economy. In the European Union, member states learn from each other’s experience, which creates a process of convergence of institutions within Europe.

Reform of the process of EU decision-making lays the foundation for a successful, strong European Union. The enlargement is a success, and integration advances— geographically, economically and politically. European leadership is important for achieving broad international cooperation, not only in the area of trade but also in other areas like climate change.

Regional Communities

European countries rely on collective arrangements to maintain an equal distribution of welfare. At the same time, governments are unsuccessful at modernising welfare-state arrangements. A strong lobby of vested interests blocks reforms in various areas. Together with an expanding public sector, this situation puts a severe strain on European economies.

The European Union cannot adequately cope with the Eastern enlargement and fails to reform its institutions. As an alternative, a core of rich European countries emerges. Cooperation in this sub-group of relatively homogeneous member states gains a more permanent character. The world is fragmented into a number of trade blocks, and multilateral cooperation is modest.

Global Economy

European countries find a new balance between private and public responsibilities. Increasing preferences of people for flexibility and diversity, and growing pressure on public sectors, give rise to reforms. New institutions are based on private initiatives and market-based solutions. European governments concentrate on their core tasks, such as the provision of pure public goods and the protection of property rights. They engage less in income redistribution and public insurance, so that income inequality grows.

International developments also reflect increasing preferences for diversity and efficiency. Political integration is not feasible, as governments assign a high value to their national sovereignty in many areas. Moreover, policy competition becomes standard in many policy areas. Economic integration, however, becomes broader (not always deeper), as countries find it in their mutual interest to remove barriers to trade, investment and migration. With a limited amount of competences and a focus on the functioning of the internal market, the European Union finds it relatively easy to enlarge further eastwards. Similarly, negotiations in the WTO are successfully completed. Regional and global integration puts poor countries on a path of catching-up and high growth. As international cooperation in non-trade issues fails, the problem of climate change intensifies, while European taxes on capital income gradually decline under tax competition.

Transatlantic Market

European countries limit the role of the state and rely more on market exchange. This boosts technology-driven growth and increases inequality. The inheritance of a large public sector in EU countries is not easily dissolved. New markets—e.g. for education and social insurances—lack transparency and competition, which brings about new social and economic problems. The interests of the elderly dominate policy decisions, which makes it difficult to dismantle the pay-as-you-go pension systems in continental Europe. Government failures thus compound to market failures.

EU member states focus primarily on national interests. EU decision-making is not reformed, which complicates further integration in the European Union. The EU redirects its attention to the United States, and agrees upon transatlantic economic integration. This intensifies trade in services, which yields welfare gains on both sides of the Atlantic. The prosperity of the club of rich countries is in sharp contrast with the poverty in Eastern Europe and in developing countries.

2.2 The scenarios illustrated

Table 2.1 compares the numerical characteristics of the four scenarios. It reveals the implications of the relative focus on equity concerns in Regional Communities and Strong Europe via a bigger role of the state. More regulations and income redistribution are accompanied by higher unemployment rates and lower participation, compared to the scenarios in which private initiatives are given more leeway (i.e. Global Economy and Transatlantic Market). Combined with ageing, this implies that employment contracts in Regional Communities, and grows only moderately in Strong Europe (due to immigration). In Transatlantic Market, the participation rate is higher than in Strong Europe, due to more incentives for labour supply among the young. However, overall employment growth is equivalent in Strong Europe and Transatlantic Market, since there is less immigration in the latter scenario.

The emphasis on an efficient functioning of markets in Global Economy and Transatlantic Market is accompanied by a higher labour productivity than in Strong Europe and Regional Communities. In Global Economy and Transatlantic Market, productivity grows by 2.1% and 1.8% per year, respectively. In Regional Communities, labour productivity growth is weakest, with a growth rate of 1.1%. Together with a fall in employment, GDP per capita in Regional Communities grows only by 0.8% per year.

Table 2.1 Characterisation of the EU-15 in the four scenarios

	Past	2000-2040			
	1980 -2000	Strong Europe	Transatlantic Market	Regional Communities	Global Economy
Annual growth rates					
GDP	2.2	1.6	1.9	0.6	2.5
Labour productivity	1.5	1.5	1.8	1.1	2.1
Employment	0.7	0.1	0.1	-0.5	0.4
Population	0.3	0.3	0.0	-0.2	0.3
World exports	5.6	4.5	3.7	2.4	5.6
	Past	2040			
Ratios	2000	Strong Europe	Transatlantic Market	Regional Communities	Global Economy
Participation rate	46.6	41.6	45.2	40.2	45.8
Unemployment	8.5	5.8	3.9	8.3	3.9
Savings rate	18.8	15.1	13.0	12.7	15.6
Interest rate	3.6	3.3	4.3	2.6	3.8
Share intra EU-15 trade	53.5	47.3	49.3	52.8	39.4
GDP per capita (index)	100.0	162.9	210.4	134.6	234.5

Source: World Bank (2001) for historical numbers, and WorldScan for simulation results from 2000 onwards. The EU-15 represents the current 15 EU members

Trade liberalisation and economic integration boost trade and growth in Global Economy and Strong Europe. World exports increase in these scenarios by 5.6% and 4.5%, respectively. Because of high growth in Asia, European trade flows redirect towards that continent so that the share of intra-EU trade decreases, except in Regional Communities. In Transatlantic Market, the EU cooperates more closely with the United States and Latin America, which boosts EU-US trade. In Regional Communities, growth in world exports is low, and the share of intra-EU trade remains relatively high.⁴

In Strong Europe and Global Economy, governments boost national savings by curbing budget deficits and stimulating private savings. Although this does not prevent a decline in saving rates due to ageing, this drop in savings is less dramatic than in Transatlantic Market and Regional Communities, where saving rates decrease by 6%-points between 2000 and 2040. As the demand for capital also falls substantially, real interest rates still decrease in Regional Communities and, to a lesser extent, in Strong Europe. In Global Economy and Transatlantic Market, increasing investment demand raises the real interest rate.

The rest of this document explains the results in table 2.1. First we present the model, and thereby the economic mechanism applied in the scenarios. Second, the exogenous variables and their sources are discussed. Finally, we present the outcomes of the model, not only for Europe but also for the other regions.

⁴ Note that in all scenarios the growth of world trade is lower than in the past, due to the ageing of the populations in OECD countries, and lower population growth in developing countries. This depresses growth. Moreover, the shift from agricultural and industrial economies towards services economies, especially in Asia, tends to moderate the growth in trade volumes because services are less tradable than commodities.

3 WorldScan

This chapter presents the characteristics of the simulation model and of the exogenous variables. Section 3.1 explains the model in an intuitive way, highlighting the main mechanisms of the model in order to give the reader a tool in understanding the simulation results. The second section presents the common elements in the scenarios. The last section briefly reviews the scenario-specific inputs in the model. These differences, together with the mechanisms of the model, drive the simulation outcomes of the scenarios.

3.1 The model

WorldScan

We quantify the scenarios by using our dynamic model WorldScan. WorldScan is an applied general equilibrium model for the world economy. The model was developed in the nineties for CPB's previous scenario study *Scanning the Future*. The model has thereafter often been used for scenario studies, analyses of climate-change policies and trade policies. WorldScan is well suited to reproduce scenario developments on demography, technology, energy and globalisation. A few years ago the model was documented (CPB, 1999). The current version of the model has been substantially revised, and will be described in the near future.⁵ Below we describe the main mechanisms of the model.

General Equilibrium

General equilibrium models describe the supply and demand relations of markets. In these models, prices of goods and factor inputs are flexible, such that demand and supply become equal at a given price. These models describe also the interactions between several markets. For example, firms must determine the factor inputs necessary to produce a final good, given the price and supply of that good. The supply, which is determined by the equilibrium price, determines the necessary inputs and therefore the demand at the input markets. Assume that consumers prefer more of these final goods. Then, the price of the goods will increase. Firms want to produce more and will demand more inputs. As a result, the prices for the input factors will increase because of the increase in demand of the final good. We call these mechanisms general equilibrium effects.

Producers

This version of WorldScan distinguishes 16 goods and services markets, a labour market, and a capital market. There are 16 types of producers, each of which produces one type of good. We call this a sector. All goods are produced by using labour, capital and intermediate inputs, albeit

⁵ Verweij (2002) gives a preliminary description of the new characteristics of WorldScan.

in different proportions. The relative demand for each of these inputs depends on the characteristics of the sectoral production function. In general, we assume that labour and capital are fairly good substitutes. Moreover, although we consider intermediate inputs to also be good substitutes, there are hardly any substitution possibilities between the intermediate inputs, on the one hand, and capital and labour, on the other hand.⁶

Consumers

Besides producers we have consumers. Consumers demand the sixteen different consumption goods and services, and provide labour and capital to the firms. We assume that the supply of labour is exogenous. Because consumers save a part of their income, they are able to deliver the firms capital in return for income. Savings depend on income growth and demographic characteristics. In the OECD countries, the latter variables represent ageing within the population, which harms savings.

Labour markets

In the section above we described the supply and demand relations. Consumers supply labour, and firms demand it. We assume that there is a national labour market in which the price of labour (the wage rate) is flexible. In the end, supply and demand are equal at the market-clearing wage. We have modelled unemployment exogenously. A part of the labour supply is unemployed: that share is scenario specific. The supply of labour minus the unemployment level will be equal to labour demand in equilibrium.

Capital markets

Consumers supply capital, and firms ask for it. The equilibrium between demand and supply determines the price of capital.⁷ In contrast to the labour market, the regional capital markets are assumed to be linked to each other. So if capital is abundant in one region (and thus is relatively inexpensive), it is invested in another region in which capital is scarce (capital is expensive). However, there are some barriers in investing abroad. Therefore, interregional capital mobility reduces, but does not eliminate, the capital price differentials between regions. In the latter case we would have one global capital market.

Capital can be used in production only if producers buy investment goods. An investment good consists of several goods from various sectors, such as capital goods, services, and buildings (construction). The producers supply these goods. The total demand for goods and services is determined by consumers, and by producers who demand intermediate and investment goods.

⁶ The appendix provides more details on the production structure.

⁷ Note that the price of capital is a function of the investment price times the sum of the real interest rate and depreciation rate.

Goods markets and trade

As for capital, the regional goods markets are linked to each other. Not only the home market, but also foreign markets determine the demand for a good. We assume that each region produces a different variety of that good. Because we distinguish 16 regions, there are 16 varieties for each of the 16 sectors. In principle, consumers demand all the varieties. The demand for each of the varieties depends on its relative price, the substitution possibilities between the varieties, transportation costs, trade barriers and preferences for the variety. If the price of a particular variety goes up, demand will decrease in favour of other varieties. Total demand for each variety depends thus on the demand at the home and foreign markets. Bilateral trade depends on consumer preferences for regional varieties of a good and differences in relative prices. The latter depend, for example, on trade barriers, which are described later on in this chapter.

GDP growth

So far, we have viewed the model only from a static perspective, and have neglected the dynamics—particularly economic growth. As economic growth is a prominent issue in scenarios with a forty-year time span, we must return to production. The value added of production is generated by using technology, capital and labour. Value added grows because of technological progress, employment growth or capital growth. To put it differently, value added grows by the increase in labour productivity and labour. Labour productivity is determined by technological progress and capital growth per unit of labour. We control the value-added growth in the scenarios because labour productivity and labour are, to some extent, exogenous variables. Employment growth is exogenous, and is derived from population growth, its composition, the age-specific participation rates, and the unemployment rate. In each of the scenarios we made specific assumptions on these variables. Labour productivity growth can be steered by the assumptions on technological progress. There is no one-to-one relation between technology and labour productivity, because the latter variable is also determined by capital growth per unit of labour, which is endogenous. To a large extent, however, technological progress determines labour productivity. The scenario-specific assumptions on technological progress and employment determine economic growth in the scenarios.

The government

Most CGE models do not model the government in much detail. This goes back to the national accounts and input-output tables that are normally used for data. These data do not report government transfers and social security. The government collects taxes on imports and consumption. It spends tax income on (export) subsidies and consumption. This is also the case in WorldScan. Government transfers and social security are not modelled. This implies that the model is better suited to explore the uncertainties involved with international cooperation quantitatively than with public and private responsibilities. The latter key uncertainty affects the

outcomes of the model only through exogenous changes in the unemployment rate and participation rates.

Regions and sectors

We distinguish 16 regions and 16 sectors. The EU-15 is divided into eight regions: Germany, France, UK, Netherlands, Belgium-Luxembourg, Italy, Spain and Rest EU (comprising of Austria, Belgium, Luxembourg, Ireland, Denmark, Sweden, Finland, Portugal and Greece). Moreover, we distinguish Central Europe, Former Soviet Union, Turkey, US, Rest OECD, Latin America, Middle East and North Africa and rest of the world (mainly Asia and Africa). For each region, we distinguish 16 sectors. These consist of agriculture, energy (primary energy and electricity), other raw materials, six manufacturing sectors and seven service sectors. The appendix provides more information on the country and sectoral details and the key parameter values.

3.2 Common characteristics in the scenarios

The quantitative outcomes of the various scenarios are steered by the variation in exogenous inputs. However, some exogenous variables are similar in all scenarios. We have two reasons to do this. The first is that some trends are common in all scenarios, such as trade liberalisation between the EU-15 and the Central and Eastern European countries (CEEC). The second is that the model is calibrated on one database, which is scenario independent. Many elasticities and exogenous variables, such as trade barriers, are determined in the calibration procedure and are therefore identical in all scenarios.

This section first discusses these common characteristics. We present the common trends on sectoral total factor productivity (TFP) growth, sectoral consumption patterns, and trade policy (see table 3.1). The subsequent section discusses the variation in exogenous inputs between the scenarios.

Variable	Source	Reference
Relative sectoral TFP growth	based on historical trends ISDB data (OECD)	see Kets and Lejour (2003)
Sectoral consumption	based on GTAP data	see Verweij (2003)
Europe agreements	elimination tariffs manufacturing EU-15- CEEC	see Lejour et al. (2001)
EU enlargement (partial)	elimination all remaining tariffs EU-15- CEEC	see Lejour et al. (2004)

Our calibration year is 1997. The model is calibrated on the basis of the GTAP database, version 5 (Dimaranan and McDougall, 2002). Using data of the World Bank (2001), we first simulated the model from 1997 to 2000 to reproduce GDP per capita and unemployment rates in 2000.

Sectoral total factor productivity growth

TFP growth depends on the scenario characteristics, but we introduce common trends for the relative sectoral TFP growth. Based on the ISDB data set from the OECD, Kets and Lejour (2003) calculated the relative sectoral TFP growth between 1970 and 1991 (see table 3.2). The numbers are an average of all OECD countries for which data were available. Unfortunately, they were not able to pick sectoral TFP developments in the nineties because of lack of data. This implies that rapid TFP developments in communication and some other services are not included in these data, although TFP in communication was already growing rapidly in the seventies and eighties. We increase relative sectoral TFP growth in the Transatlantic Market scenario for the sectors communication, capital goods and services, because that scenario is characterised by rapid ICT developments.

Table 3.2 Sectoral TFP growth relative to the mean

Sector	Growth	Sector	Growth
Agriculture	3.1	Capital goods	2.4
Energy ^a	1.0	Transport	1.6
Other raw materials ^a	1.0	Communication	3.9
Food processing	1.2	Construction ^b	0.3
Other consumption goods	1.8	Trade services	0.8
Paper and publishing	1.1	Financial services ^b	0.3
Chemicals and minerals	3.4	Other business services ^b	0.3
Metals	2.3	Other services	0.3

Source: Kets and Lejour (2003). Note that numbers larger (smaller) than 1 imply that sectoral TFP grows faster (slower) than average (macro) TFP.

^a Relative TFP growth is imposed due to missing data.

^b Relative TFP growth is set equal to that in other services, because underlying data delivered (implausible) negative growth

These numbers show that TFP growth is relatively high in telecommunications, agriculture, capital goods, chemicals and metals. It is very low or negligible in most service sectors, except transport and communications.

Consumption

Thus far, we have said that consumers demand final goods from different sectors. How do they choose among these goods? We know that consumption patterns differ across countries and depend on per capita income and relative prices. We represent this by using a linear expenditure

system to allocate total consumption over the various consumption sectors.⁸ The allocation pattern depends on subsistence levels that ‘guarantee’ minimal spending on each of the categories, and income and price elasticities. Table 3.3, which presents the income elasticities in the beginning of the simulation period, shows that if income per capita increases, then consumers spend relatively less on beverages and tobacco, food and clothing and footwear. They spend relatively more on education and medical care, household furniture, recreation, transport and communication and other goods and services. In time, the minimal spending levels become a smaller fraction of total spending. The income elasticities for sectoral consumption converge eventually to 1. This is delayed in the scenarios by increasing the minimal spending levels by a fraction of the GDP per capita increase.

Given that consumers have decided on their budget shares to spend on a particular type of good, they must then decide on which particular varieties of that good they will spend their money.

Table 3.3 Income elasticities for sectoral consumption

Sector	Income elasticity	Sector	Income elasticity
Beverages and tobacco	0.9	Household furniture	1.1
Clothing and footwear	0.9	Other goods and services	1.3
Education and medical care	1.2	Recreation	1.3
Food	0.4	Transport and communication	1.3
Gross rent and fuel	1.0		

Source: Verweij (2003).

Trade barriers

Besides the trends on sectoral TFP growth and sectoral consumption, economic events with respect to the EU enlargement have been incorporated in all scenarios.⁹ We included the Europe agreements, which imply that import tariffs in manufacturing between the current EU members and the candidates had to be eliminated in 2000. Moreover, we assume that the enlargement is to some extent an irreversible event. We eliminate all import and export tariffs in the other sectors (agriculture, food processing and energy) between 2001 and 2004. We also introduce common external import tariffs for the EU-15 and candidate countries (so the countries form a customs union). However, the completion of the internal market and free migration is scenario dependent.

⁸ The consumption sector structure is different from the production sector structure because empirical research on sectoral consumption often uses other consumption categories than the production sectors in our database. It is relatively easy to transform production sectors to consumption sectors and vice versa (see Verweij, 2003).

⁹ Lejour et al. (2004) describe this in more detail.

We introduce various forms of trade liberalisation on a regional and global scale in the scenarios. To give some idea of the possible effects, we present at an aggregated level some of the import and export tariffs in the model based on the GTAP data.

Table 3.4 Import tariffs in the OECD and non-OECD countries in 1997

Exporting region	Importing region		
	OECD	Non-OECD	World
Agriculture/food			
OECD	33.9	30.6	32.2
Non-OECD	24.1	32.3	25.7
Manufacturing			
OECD	2.7	9.2	5.5
Non-OECD	4.9	12.1	5.8

Source: GTAP database (Dimaranan and McDougall, 2002). Within the OECD, intra EU-15 trade is excluded, and Central and Eastern Europe are classified as OECD. The tariff data are bound rates. Applied rates are in general lower.

This table shows that countries levy substantial tariffs in agriculture of about 30% of the import value against world prices. The OECD levies relatively higher tariffs on import from the OECD than from imports originating from the non-OECD. One of the reasons is that the OECD imports consist, relatively, of much processed food from other OECD countries, which is subject to higher import tariffs than (basic) agricultural products from non-OECD countries. Export tariffs and subsidies are also significant. The OECD subsidises its agriculture exports, while the developing countries raise export taxes of about 2.5%. The general feeling is that the gains from liberalising agricultural policies are large. They could even outweigh the gains of liberalising trade in manufacturing goods, because current trade and production patterns in agriculture are severely distorted.

Table 3.4 also shows that OECD countries do not levy significant import tariffs in manufacturing, regardless of whether these are imported from other high income countries or the developing ones. The non-OECD countries levy tariffs of about 10% of the import prices. At the world level, the average import tariff is much lower because most trade takes place within the OECD. The numbers in table 3.4 are from 1997. Current applied tariffs are probably even lower.

The table also shows that if developing countries export their manufactures, they face higher import tariffs, on average, than OECD countries. WTO (2001) argues that tariffs are relatively high in sectors that are important for developing countries, such as textiles and clothing, leather and other labour-intensive goods. From that perspective, the gains of further trade liberalisation in manufacturing could be relatively large for the developing countries.

OECD countries do not levy import tariffs at all in the service sectors, and those of the developing countries do not exceed a half percent of the import value. In services, import tariffs

have never been important. Trade in services, however, is hampered by three other types of barriers (Hoekman and Braga, 1997). The first is quotas and prohibitions. This is the case in, for instance, landing rights for airplanes. Secondly, price regulations form an impediment to trade. Airport and tourist taxes, for example, reduce the demand for tourist services. Finally, there is sometimes discriminatory access to distribution networks. For instance, foreign providers are not always granted access to distribution networks. This not only hampers trade, but also reduces competition.

It therefore seems logical to incorporate non-tariff barriers (NTBs) in the model. These NTBs are important not only in services, but also in manufacturing and agriculture. Various restrictions fall under the heading of non-tariff barriers (NTB), such as anti-dumping and countervailing actions, non-automatic licensing and (voluntary) export restraints. The Uruguay round was aimed at reducing these barriers in manufacturing, and was fairly successful. Most of the NTBs apply to food processing, beverages and tobacco, and textiles and apparel. NTBs also include intentional and unintentional restrictions on international trade that stem from regulating product characteristics and production methods. Concerns for health, safety, the environment, and consumer protection are legitimate grounds for member states to restrict imports from other member states. These obstacles to trade are often referred to as technical barriers.

Quantification of the NTBs is based on Lejour et al. (2004). We estimated the sectoral NTBs based on the idea that the (empirical) differences in trade intensity between EU-15 countries and between non-EU countries can be ascribed to the EU internal market.¹⁰ The measures taken to create the EU internal market were directed to eliminate barriers to trade. We assume that the differences in trade intensity between inter and intra EU trade can be ascribed to NTBs. Table 3.5 presents these barriers.

Sector	NTB	Sector	NTB
Agriculture	21.7	Capital Goods	10.6
Energy	0.0	Transport services	0.6
Raw Materials	0.0	Construction	12.6
Consumption Goods	9.7	Trade services	22.2
Food Processing	14.0	Communication	0.0
Paper, printing, publishing	13.7	Financial services	0.0
Chemicals and minerals	2.5	Business services	17.6
Metals	0.0	Other services	4.8

Source: own calculations, based on Lejour et al. (2004) and Nahuis (2002).

¹⁰ Note that the differences in trade intensity are corrected for differences in GDP per capita, import tariffs and distances between the countries by using a gravity model.

3.3 Scenario-specific trends

This section gives an overview of the scenario-specific trends. These trends determine the variation between the scenarios in two ways: directly, because the exogenous trends differ between the scenarios; and indirectly, because these differences imply also the variation in the model outcomes. Here we briefly review the variation in exogenous inputs. The succeeding chapters describe these inputs and the results in greater detail.

Trend	Strong Europe	Transatlantic Market	Regional Communities	Global Economy
Population and labour				
Population growth EU-15	high	moderate	low	high
Population growth other regions	low	high	moderate	low
Migration to EU-15	high	moderate	low	high
Participation rate EU-15	moderate	high	low	high
Unemployment rate EU-15	moderate	low	high	low
Technology and growth				
Labour productivity EU-15	moderate	moderate/high	low	high
Relative TFP growth	baseline	high in services and capital goods	baseline	baseline
Energy efficiency ^a	high	low	high	low
Climate-change policy	yes	no	no	no
Capital and investment				
Savings policy	yes	no	no	yes
Capital mobility	high	moderate	low	high
Trade				
Global trade barriers	low	moderate	high	low
Deepening internal market EU	substantial	modest	substantial	modest

Note that terms like low, moderate, and high are used to describe the development of a trend in a scenario compared to the development in other scenarios. It is not meant to characterise differences between various trends in one scenario.

^aThe variation in energy efficiency and climate-change policy will be discussed in a new CPB publication on climate-change and energy scenarios. That study uses the same scenarios as here, but lays the emphasis on energy markets.

The exogenous trends are subdivided into four categories. Each category is discussed in one of the succeeding chapters. These chapters discuss the population and labour, technology and growth, capital and investment, and trade. Discussion of these topics goes beyond the motivation and variation in exogenous inputs to include the outcomes of the model. From a modelling perspective, it is not obvious to combine the presentation of exogenous and endogenous trends. The reason for doing so is that the focus is on the scenarios. The

characteristics of scenarios are always a combination of exogenous trends and endogenous outcomes.

This section aims to discriminate between the exogenous trends and model outcomes. As discussed earlier in the chapter, the model emphasises economic growth and trade relations. Population developments and labour inputs are exogenous. Chapter 4, which deals with these issues, presents the exogenous trends in population and labour. In Chapter 5, the modelling mechanisms come in. Economic growth is the result of technology, which is exogenous, exogenous labour inputs and capital. Because the macro TFP growth is more or less based on the expected outcomes for GDP growth, the results in this chapter are heavily based on the assumptions on the trends.

The model establishes a direct relation between macro TFP growth and GDP per capita growth. Take a simple production function in which output is produced with technology, labour and capital. In a balanced growth path, output and capital will have similar growth rates. The growth of labour inputs depends on labour supply, which is exogenous in the model. The size of TFP growth thus determines GDP (per capita) growth or vice versa— as we are able to target GDP per capita growth and the macro TFP growth rate. We may choose between determining TFP growth or GDP growth. Both options have their merits. In considering scenarios, we form opinions on GDP growth (and not directly on TFP growth, which is the unobserved growth variable). This suggests targeting GDP per capita growth directly. However, we also include in the model certain characteristics, such as globalisation, which have (temporary) growth effects. Targeting GDP means that these growth effects appear only in the form of lower TFP growth. Because we want to see these growth effects, this is undesirable. We therefore target the macro TFP rate (or labour productivity), while having in mind a desired GDP per capita growth target.

Chapter 6 focuses on savings, investment, foreign capital and the interest rates. Savings are affected by savings policy, and capital mobility by the degree of capital-market integration. Those are scenario-specific assumptions. The model outcomes are the results of several endogenous mechanisms in the model. The discussion in this chapter therefore concentrates more on the model outcomes and less on the exogenous trends than chapters 4 and 5. Chapter 7 discusses the trade relations of the EU with the rest of the world at a macro and sectoral level. The breakdown of trade barriers is an exogenous element in this chapter, but the development of the trade relations depends heavily on the mechanisms in the model.

In chapters 4 to 7, the focus shifts from exogenous trends to the endogenous outcomes of WorldScan. Combining the several trends into four themes clarifies the presentation of the quantitative characteristics of the model.

3.4 Conclusions

This chapter introduced the model that we will use for the scenario analysis and provided an overview of the exogenous trends. Our dynamic CGE model WorldScan is well suited for scenario analysis. It is easy to implement exogenous demographic trends. Demography affects labour supply and thereby economic growth and the savings rate. Employment growth is affected not only by demography, but also by participation rates and unemployment rates. Labour-market participation and unemployment are influenced by the generosity or tightness of the social security system. In this way, developments in the public sector— one of the key uncertainties in the scenarios—impact the economy to the extent that these developments affect labour-market participation and unemployment. Technology is implemented by the rate of technological progress. This affects labour productivity directly. Trends in energy developments can be simulated by energy efficiency and energy taxes. The trade barriers and imperfect capital mobility in the model help to steer the degree of globalisation in the various scenarios— the other key uncertainty in the scenarios.

4 Population and labour

This chapter highlights the population and labour-supply developments. First we present the population scenarios for the EU and the other regions. Then we discuss the participation rates in the various scenarios. Population developments and participation rates together determine labour supply. The last section shows that these developments have much more impact on employment growth than on unemployment rates. The ageing population will lead to a smaller labour force unless labour-market participation of the elderly is raised substantially.

4.1 Population growth

European Union

Population growth differs in the scenarios. The demographic developments in the EU-15 are based on the projections of Eurostat. A few years ago, Eurostat (2000) constructed three population scenarios until 2050: a base scenario, a high-population variant, and a low-population variant.

In the base (or mid) scenario, 600 thousand people migrate to the EU-15 each year. The fertility rate ranges from 1.42 children in Spain to 1.82 in Ireland in 2020. The life expectancy at birth is on average 78 years for males and 82 years for females in 2020. We use this population scenario in Transatlantic Market.

In Eurostat's high-population variant, migration flows, life expectancy and fertility are higher. Immigrants amount to 900,000 people (net) per year, the fertility rate is about 0.25 points higher, and life expectancy for males and females are about 2.5 and 3 years higher in 2020, respectively. These assumptions are based on the assumptions that economic growth is high and/or that there is a stronger focus on immaterial issues. We use this population scenario in Global Economy and in Strong Europe.

In the low-population variant, only 300,000 migrants enter Europe each year. Fertility is 0.2 points lower than in the base scenario, and life expectancy is 2 and 1.5 years lower for men and women, respectively, in 2020. In this population scenario, Eurostat assumes that economic growth is low. This corresponds to our Regional Communities scenario.

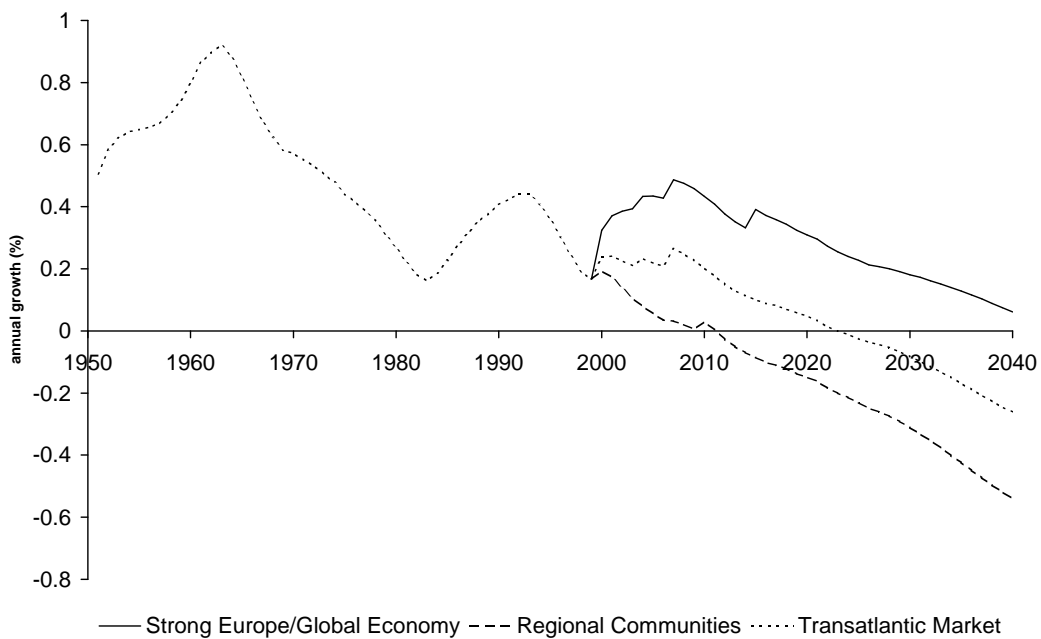
There is one caveat here. Eurostat's high- and low-population variants are extreme scenarios that depict the boundaries of the possible population developments; as such, they are less plausible than the baseline. This does not fit in our economic scenarios.¹¹ Therefore, we reduced the variation between the baseline and the high and low variant by a third. Population developments in these scenarios are thus less extreme than the original high and low variant of the Eurostat scenarios.

¹¹ We discussed this issue and our solution to that problem with the demographers that constructed these population scenarios.

Figure 4.1 presents the effects of these assumptions on population growth in the EU-15. In Transatlantic Market, population grows on average by 0.2% per year until 2020. After 2020, the population shrinks slightly. In Strong Europe and Global Economy, the population grows 0.2% faster until 2020, and even 0.3% after 2020, compared to Transatlantic Market. In Regional Communities, the population grows slower than in Transatlantic Market: 0.2% until 2020, and 0.3% after 2020. The assumptions on fertility, migration and life expectancy also affect the speed of ageing in the population.

In Regional Communities, 27.7% of the population in the EU-15 is older than 65 in 2040. In 2000, this is only 16.3%. In Transatlantic Market this is 27.9%, and in Strong Europe and Global Economy it is 26.5% in 2040. The ageing of the population will materialise in a higher old-age dependency ratio (i.e. the ratio between the old, inactive generation and the young, working generation). De Mooij and Tang (2003) show that this ratio is expected to increase in all industrialised countries. Whereas for every pensioner there are roughly four workers in 2000, there are only two in 2035. The old-age dependency ratio will thus more or less double in this period.¹²

Figure 4.1 Population growth in the EU-15



¹² CPB (2000) and De Mooij and Tang (2003) discuss extensively the phenomenon of ageing and its consequences for the labour market and public sector.

EU migration

The Eurostat population scenarios do not take account of possible migration flows due to the enlargement of the European Union. We want to take account of the migration flows. Although forecasting the migration effect of EU enlargement is inherently difficult, a number of researchers have made an attempt. These studies all use previous experiences to estimate the effect of income disparities (and other explanatory variables like unemployment or distance) on international migration. These estimates are then applied to the income differentials between the EU-15 and the CEECs. Thus, they arrive at an estimate of the migration effect of EU enlargement. We have collected twelve such studies.¹³ A median estimate is 2.9 million people. There is, however, quite some variation among the studies. The majority of estimates indicates somewhere between 1 and 4 million migrants.

We assume that the median estimate of 2.9 million is the immigration flow for the period 2000 to 2040. It corresponds to a long-term migration effect of about 2.5% of the total population in the CEECs. Most of these people will come in the first years after the enlargement. The flow will vanish because income differentials will diminish in time. In Regional Communities, the enlargement process will not be completed. There will be no free movement of labour, and migration flows will remain limited. In Transatlantic Market, this migration flow from Central Europe is larger because the income differences between Central and Western Europe remain larger.¹⁴

In Strong Europe and Global Economy, Turkey will become a full member of the EU, which also implies that people are free to migrate between the EU and Turkey. As an educated guess, we used the implicit elasticity from the studies for the CEEC to make such an assessment. In particular, Turkish GNP per capita (measured in purchasing power parities in 1999) is 31% of the EU-15 average, which is somewhat below the average of the CEECs. Applying the implicit wage elasticity of migration to the income differential with Turkey yields an estimate of the migration potential from Turkey to the European Union. Thereby, we take account of the demographic development in Turkey. The Turkish population is expected to increase from 65 million inhabitants in 2000 to more than 100 million in 2040. Applying the Turkish population of 2040, we guess that 3.4 million people will migrate from 2015 until 2040.

Table 4.1 Migration flows to EU-15 due to enlargement (in millions, 2000-2040)

Region of origin	Strong Europe	Transatlantic Market	Regional Communities	Global Economy
Central Europe	2.9	4.0	1.1	2.9
Turkey	3.4	0.0	0.0	3.4

Source: De Mooij and Tang (2003).

¹³ De Mooij and Tang (2003) present the results of these studies.

¹⁴ Table 5.4 shows that Central Europe will catch up to EU-15 productivity levels in Strong Europe and Global Economy, but less so in Transatlantic Market and Regional Communities.

The rest of the world

For the regions outside the EU-15, we use the population projections constructed by RIVM for the scenarios of the International Panel on Climate Change (IPCC). For Strong Europe and Global Economy, we use the same IPCC population scenario. That scenario indicates rapid changes in population development— from high mortality rates and high fertility rates toward much lower rates in the developing world. This rapid transition reflects social and educational developments in Strong Europe and economic developments in Global Economy (IPCC, 2000).

The population scenario in Transatlantic Market is characterised by a slower transition path. This is motivated by slower economic and social developments in the developing countries compared to the scenarios Strong Europe and Global Economy. As a result, mortality rates and fertility rates do not decline rapidly. As a consequence, population growth in Transatlantic Market is a bit higher than in Strong Europe and Global Economy, due to higher fertility rates. The population is on average also younger than in Strong Europe and Global Economy. A higher share of youngsters in the population implies a lower macro participation rate.

The differences between the scenarios are relatively modest compared to the variation between the regions. In the non-OECD, all population scenarios project an annual increase in the population of more than 1% per year. In the US, the size of the population increases also relatively fast, while in the Rest OECD and Eastern Europe the population hardly grows or even shrinks.

The relation between economic and population developments in the EU-15 and the non-OECD are each opposite in the scenarios. The population in the EU-15 increases more rapidly if economic growth is high, due to greater life expectancy, higher fertility and higher migration flows. In the non-OECD, the transition path in population development is more rapid if economic growth is high, such that fertility declines more rapidly. These differences can be traced back to the differences in the income levels in both regions.

Table 4.2 Population growth, annual averages 2000-2040

	Strong Europe		Transatlantic Market		Regional Communities		Global Economy	
	00-20	20-40	00-20	20-40	00-20	20-40	00-20	20-40
EU	0.4	0.2	0.2	-0.1	0.0	-0.3	0.4	0.2
Eastern Europe	0.2	0.0	0.4	0.4	0.1	0.0	0.2	0.0
United States	0.8	0.6	0.9	0.8	0.8	0.3	0.8	0.6
Rest OECD	0.2	-0.1	0.2	-0.1	0.2	-0.1	0.2	-0.1
Non-OECD	1.3	0.7	1.7	1.3	1.4	0.9	1.3	0.7

Source: Eurostat (2000) and own calculations for EU-15, and IPCC (2000) for other regions.

4.2 Labour-market participation

In the coming decades participation rates in the OECD are affected by four factors: demographic changes, social security, participation rates of women and participation of the elderly. We deal with each of these factors in turn, and also discuss the scenario-specific content of each of them. For the non-OECD we do not make scenario-specific assumptions on the social security systems and participation rates of women and the elderly.

Ageing

Demography is important because labour-market participation of people between 25 and 60 years of age is much higher than for other age groups. Due to ageing, a larger share of the population will be older than 65. This reduces the macro participation rates. This is also the baseline of Lejour and Van Leeuwen (2002), who project participation rates until 2040 based on historical participation rates of the ILO. Ageing is a common factor in all scenarios. Given the various population scenarios and correspondingly different population composition, the impact on labour-market participation is not identical in all scenarios.

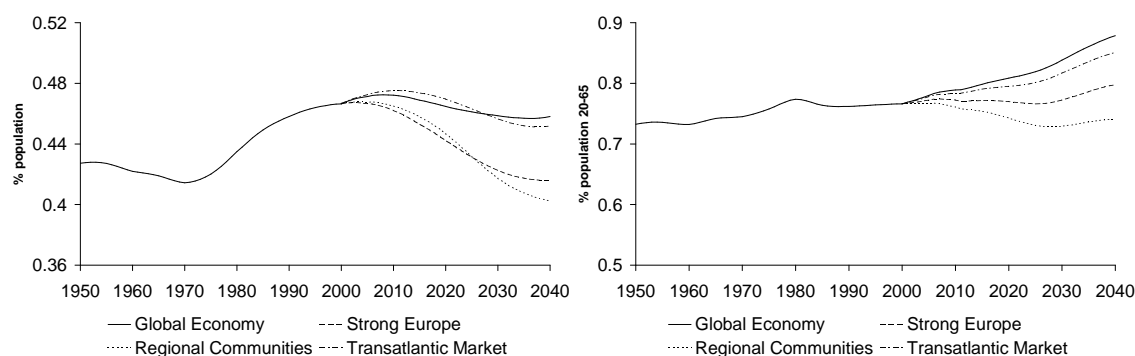
Social security system

A generous social security system stimulates the incentives of people to use that system. The opposite of that is a meagre system that stimulates labour market participation, as the entry and income transfers of such a system are not attractive. The generosity of social security systems varies between the scenarios. Strong Europe and Regional Communities feature a focus on equity. Social security systems are relatively generous. In Regional Communities, all existing arrangements are kept in place. Figure 4.2 also shows that participation rates of persons between the ages of 20 to 65 hardly change. In Strong Europe the social security system is generous, but people are aware of the economic problems of an ageing society. Although social benefits are still high, the demands for receiving a benefit become stricter. The participation rates will consequently be a bit higher than in Regional Communities. Transatlantic Market and Global Economy focus more on efficiency than on equity. Social security systems are less generous. The low social benefits increase labour-market participation rates.

Participation rates of women

Labour-market participation of women between 25 and 55 years is about 30%-points lower than that of men in the OECD. Twenty years ago, the difference was much larger. Participation rates of women are rising, and the difference in participation rates is diminishing. In our baseline projection we assume that the trend of rising participation will continue until 2040, independent of the scenario.

Figure 4.2 Labour-market participation rates EU-15 as ratio of population aged 20-65 and of the total population¹⁵



Participation of the elderly

After the age of 55, the participation of men on the labour market declines sharply. While the participation rate of men between the ages of 60 and 64 was about 80% in 1950, it is now only 50% in the OECD. Some reasons for this decline include the introduction of early retirement programs and an expanded social security system. Regional Communities is a scenario in which existing rules and policies will continue. The early retirement arrangements stimulate the trend towards low participation of the elderly. Due to ageing, the macro-participation rate declines to 40% in 2040 for the EU-15 as a whole. This is a decline of about 6% compared to 2000. Figure 4.2 shows that this decline is fully due to the changing age structure of the population. The participation rates for population aged 20 to 65 stays more or less constant between 2000 and 2040, while the participation rate for the total population drops. Strong Europe also emphasises solidarity between different groups in the population, but people are aware of the economic problems of an ageing society. Early retirement programs become fiscally less attractive. As a result, participation of those aged 20 to 65 will increase by about 5%-points. The macro participation rates in 2040 will be about 1% higher in Strong Europe than in Regional Communities.

In Transatlantic Market and Global Economy, people are stimulated to stay employed even after the age of 65. The low social benefits, including the pension benefits of the PAYG systems, increase participation rates of the elderly, both men and women. In Transatlantic Market, labour-market participation of men between the ages of 60 and 64 increases from about 50% to 60% in the OECD, and in Global Economy it increases to 70%. Early-retirement arrangements are skipped, and it becomes fiscally more attractive to retire after the age of 65, instead of earlier. 30% of the men and 18% of the women aged 65 to 69 participate in the labour market in that scenario. As a result, the participation rate in 2040 (measured as share of total

¹⁵ The numerator in these ratios includes everybody who participates, including those 65 years and older. The high ratios for the group aged 20 to 65 years also include participation of the elderly. Without that group, labour-market participation of the population aged 20 to 65 would be about 5%-points lower.

population) is at about the same levels as in 2000 in the EU-15, and increases to nearly 88% as share of the group aged 20 to 65.

Table 4.3 Participation rates (as ratio of total population)

	Past		Strong Europe		Transatlantic Market		Regional Communities		Global Economy	
	1980	2000	2020	2040	2020	2040	2020	2040	2020	2040
EU-15		46.6 (76.6)	44.3 (77.0)	41.6 (79.8)	47 (79.5)	45.2 (85.1)	44.7 (74.3)	40.2 (74.1)	46.5 (80.9)	45.8 (87.9)
Eastern Europe	49.9	49.4	48.9	45.7	48.7	44.1	48.5	45.1	48.9	45.7
United States	47.1	50.4	48.8	46.5	48.0	44.8	48.2	44.8	48.8	46.5
Rest OECD	46.6	51.4	48.5	44.6	49.9	47.7	47.1	41.7	49.8	47.6
Non-OECD	41.5	46.3	49.8	50.7	47.2	46.8	49.2	49.3	49.8	50.7

Source: Lejour and van Leeuwen (2002). Numbers in parentheses are participation rates as share of the age group 20 to 65 years.

The drop in participation (as a share of total population) in the EU-15 is thus due to population developments. The labour-market participation of those between 20 and 65 years of age increases in nearly all scenarios. In Global Economy, this rate even increases to 88%.

4.3 Employment growth

With respect to unemployment, the institutional settings in Regional Communities will not be changed. We assume that the unemployment rates will be similar to those in 2000. However, in Transatlantic Market and Global Economy, the EU-15 chooses to reform institutions to a more American type of labour-market setting. There will be less income protection and solidarity. This increases the incentives for the unemployed to find a job, and decreases the burden for employers to attract employees. We assume that the unemployment rates will decrease to about 4% of the labour force in the OECD. In Strong Europe, governments combine a more active labour-market policy with a generous social security system. The social security systems are reformed to limit entry and to stimulate exit, but benefit levels are not reduced. As a result, unemployment will decrease—but not as fast as in Transatlantic Market and Global Economy.

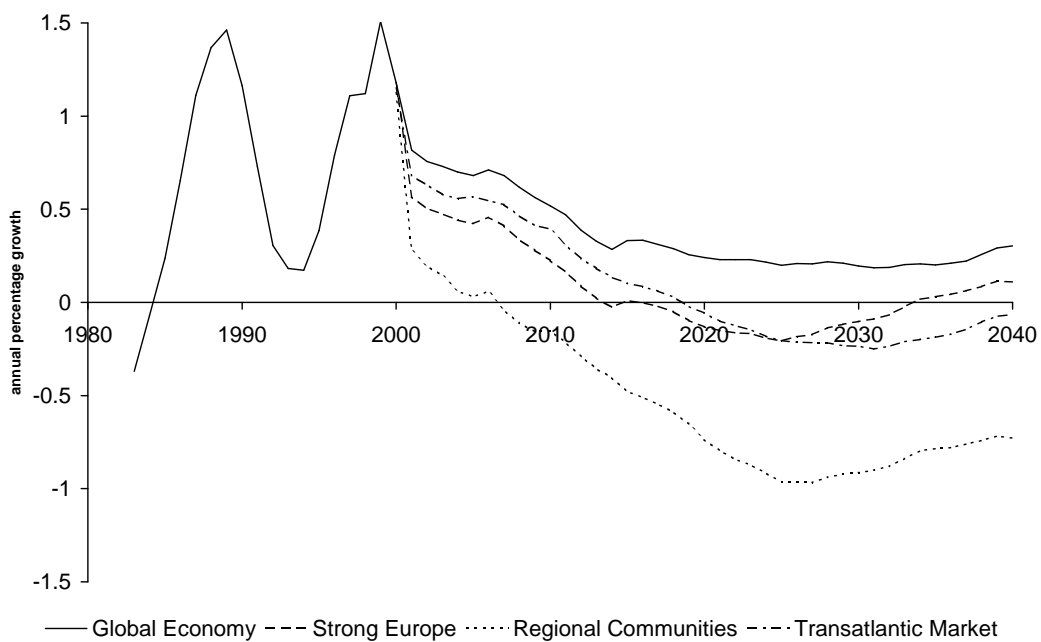
Table 4.4 Unemployment rates (as ratio of labour force)

	Past	Strong Europe	Transatlantic Market		Regional Communities		Global Economy		
	2000	2020	2040	2020	2040	2020	2040	2020	2040
EU-15	8.5	7.1	5.8	6.2	3.9	8.4	8.3	6.2	3.9
Eastern Europe	10.8	9.7	8.5	9.0	7.2	10.7	10.6	8.1	5.5
United States	4.1	4.0	4.0	3.6	3.0	4.1	4.1	3.5	3.0
Rest OECD	4.8	4.4	4.0	4.4	4.0	4.8	4.8	4.4	4.0
Non-OECD	9.9	9.9	9.9	10.2	10.5	9.9	9.9	10.2	10.6

Source: World Bank (2001) for numbers in the year 2000 and own assumptions. For the non-OECD regions, we assumed constant unemployment rates because we do not analyse the labour market in these regions.

The assumptions on unemployment rates together with the demographic trends and labour supply determine employment growth. Figure 4.3 shows that employment decreases in the EU-15 and becomes even negative in some scenarios. In Global Economy, employment growth is positive, while it is negative in Regional Communities.

Figure 4.3 Employment growth in the EU



In Global Economy and Transatlantic Market, employment growth exceeds population growth by 0.1%-points, while in the other scenarios employment growth is about 0.3%-points lower. These differences are related to the type of institutions in the scenarios.

Table 4.5 decomposes these differences into two components: changes in labour supply and changes in involuntary unemployment. The developments in labour supply cause the largest disparities among the various scenarios. In light of population ageing, labour supply contracts due to a lower participation rate. In Global Economy, this reduction in participation is offset by policies to encourage the participation of younger generations and by increasing the effective retirement age. To a smaller degree, also Transatlantic Market and Strong Europe mitigate the downward trend in the participation rate. In Regional Communities, participation drops most substantially because no policies to stimulate the participation rate are developed.

Apart from participation, also different trends in the population affect labour-supply developments. In Regional Communities, we observe from table 4.5 a shrinking population, which further reduces labour supply. In Global Economy and Strong Europe, immigration offsets the decline in labour supply. Overall, labour supply grows in Global Economy, while it remains more or less constant in Strong Europe and Transatlantic Market. Only in Regional Communities does labour supply fall substantially in the coming decades.

From table 4.5, we see that the decline in unemployment rates is relatively unimportant for employment growth, as compared to the developments in labour supply. In Regional Communities, unemployment rates do not fall. In the other scenarios, labour-market reforms are responsible for a drop in unemployment, so that this contributes to a rise in employment.

Table 4.5 The contributing factors to employment growth in the EU-15 2000-2040

Average annual growth	Strong Europe	Transatlantic Market	Regional Communities	Global Economy
Employment	0.1	0.1	-0.5	0.4
Labour supply	0.0	0.0	-0.5	0.2
of which population	0.3	0.0	-0.2	0.3
participation	-0.3	-0.1	-0.4	0.0
Unemployment	0.1	0.1	0.0	0.1

Source: WorldScan and IPCC (2000). Note that a decrease in the unemployment rate contributes positively to employment growth. A '+' sign in the row for unemployment implies a lower unemployment rate.

4.4 Conclusions

In all scenarios population growth diminishes in Europe. In Regional Communities and Transatlantic Market, population even shrinks after 2020. These developments do not take place only in Europe. Worldwide, population growth will diminish in the coming fifty years. Apart from its size, the population will also change in terms of composition. In Europe, the ratio of the elderly in the total population will increase. The scenarios show that without changes in the age-specific labour-market participation rates, macro participation will fall, and harm employment growth. Then, employment growth will not match population growth (which occurs in Regional Communities). Other scenarios show that if labour-market participation can be raised, then the fall in the macro participation rate will be less severe or even negligible. The latter is possible only if the participation of those aged 20 to 65 increases from 73% to 88%. This occurs in Global Economy, where labour supply increases to such an extent that employment growth is positive and exceeds population growth. In this scenario, ageing hardly affects the labour market. In the other scenarios, employment growth is stagnant or even negative. This chapter thus shows that ageing in the EU-15 will diminish employment growth and eventually even lead to a smaller labour force. However if the labour-market participation of the elderly is raised substantially, employment growth can even surpass population growth.

5 Economic growth and technology

This chapter focuses on labour productivity and growth. We discuss the assumptions on labour productivity growth in the various scenarios and their implications for economic growth and growth per capita. Declining employment growth in time induced by ageing diminishes GDP and GDP per capita growth. The comparison of labour productivity developments shows that Central and Eastern Europe and Turkey catch up to the EU-15 in Strong Europe and Global Economy. Finally, we turn our attention to sectoral growth patterns.

The previous chapter used our assumptions on population growth, participation and unemployment to derive employment growth in the various scenarios for the EU-15 and the other regions. Employment and labour productivity together determine production and growth. That is the topic of this chapter. First, we present the assumptions on labour productivity growth (or implicitly on total factor productivity). Then, we derive the implications for economic growth. Given population developments, we know growth per capita. We analyse these results and compare these developments in the different regions. Finally, we discuss the sectoral production structure, and examine the developments of the service economy and sectoral growth patterns.

5.1 Labour productivity

Strong Europe and Global Economy are the globalisation scenarios represented by successful trade-liberalisation rounds, increasing capital mobility and large migration flows. Economic growth is higher in Global Economy because of more technology spillovers and a more rapid catching up of the developing countries (represented in higher TFP growth). The differences in labour productivity growth between Strong Europe and Transatlantic Market are mainly affected by various globalisation characteristics, and by more TFP growth in ICT and other services in the EU-15. Global Economy sees increased TFP growth compared to Strong Europe. Regional Communities has a lower TFP growth rate, since TFP growth is more biased to manufacturing and is very low in services.

Table 5.1 presents the annual average growth rates in labour productivity for the sub-periods 2000-2020 and 2020-2040. The growth in labour productivity is heavily based on the growth in TFP and the capital-labour ratio. In Strong Europe, labour productivity grows according to its historical path of the last decades in the EU. In Central and Eastern Europe (including the Former Soviet Union and Turkey), it grows much faster due to catching up to the EU-15. Labour productivity in the non-OECD also grows fast.

Table 5.1 Labour productivity growth, annual averages 2000-2040

	Strong Europe		Transatlantic Market		Regional Communities		Global Economy	
	00-20	20-40	00-20	20-40	00-20	20-40	00-20	20-40
EU	1.6	1.4	1.9	1.8	1.2	1.0	2.1	2.0
Eastern Europe	3.9	3.4	2.9	2.3	2.5	2.0	4.1	3.5
United States	1.6	1.2	2.2	1.8	1.4	1.0	2.3	1.8
Rest OECD	1.3	1.1	1.3	1.2	1.2	0.9	1.7	1.9
Non-OECD	3.3	3.5	1.9	1.5	2.4	2.3	3.8	3.9

Source: WorldScan.

In Transatlantic Market, labour productivity in the EU-15 is larger, due to the ICT developments that affect productivity in capital goods, telecommunications and (indirectly) most other services sectors. Growth in the non-OECD is among the lowest in the world. Lack of economic integration with the OECD and other non-OECD countries prevents the inflow of foreign direct investment and technology spillovers. The investment climate in these countries is unstable, due to political and social unrest.

In Regional Communities, labour productivity growth is lower. No important innovations spur economic growth. That is the case for nearly all regions. In the non-OECD, labour productivity growth is higher than in Transatlantic Market because the investment climate is much better than in the latter scenario.

Global Economy focuses on a smooth functioning of national and international goods and services markets. Innovation and fierce competition spur labour productivity all over the world.

Table 5.1 shows that the spread between labour productivity growth rates is 1%-point. As we see below, that explains a large part of the variation in GDP growth. From the table it also follows that growth is about 0.1%-points to 0.2%-points lower in the period 2020-2040 than in the period 2000-2020 in the EU, while sectoral TFP growth is constant over time. The main reason for this result is the structural shift from manufacturing towards more services. Macro labour productivity growth is the aggregate of sectoral growth, and service sectors inhibit productivity growth less than the former sectors. This mechanism also explains the fall in labour productivity growth in the US and Eastern Europe. Besides that mechanism, the growth of the capital-labour ratio affects labour productivity growth. Rapid capital growth in Strong Europe and Global Economy, for example, raises labour productivity growth in the non-OECD.

5.2 Economic growth

The developments in labour productivity and employment growth determine GDP growth. The numbers in table 5.2 are thus the sum of those in table 4.5 and table 5.2 (for the EU-15). The pattern of GDP growth is similar to that of labour productivity growth. Therefore, we focus only on the differences with table 5.1.

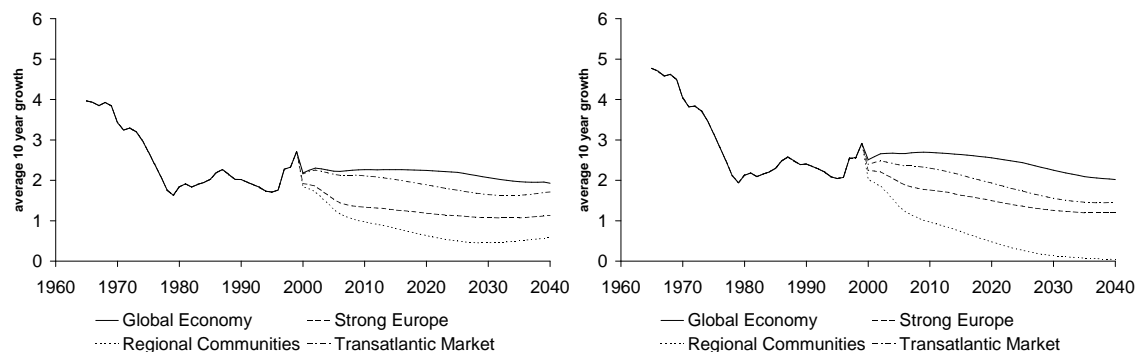
Table 5.2 GDP growth, annual averages 2000-2040

	Strong Europe		Transatlantic Market		Regional Communities		Global Economy	
	00-20	20-40	00-20	20-40	00-20	20-40	00-20	20-40
EU	1.8	1.3	2.3	1.6	1.1	0.2	2.7	2.3
Eastern Europe	4.1	3.2	3.4	2.3	2.6	1.5	4.4	3.3
United States	2.3	1.5	3.0	2.2	2.0	0.9	3.0	2.2
Rest OECD	1.2	0.6	1.4	0.9	1.0	0.2	1.8	1.6
Non-OECD	5.0	4.3	3.6	2.8	4.1	3.2	5.5	4.6
World	2.7	2.4	2.7	2.0	2.1	1.4	3.4	2.9

Source: WorldScan.

Between 2000 and 2020, GDP growth varies between 1.1% and 2.7%; between 2020 and 2040, it varies between 0.2% and 2.3%. The variation in growth is thus twice as high as in labour productivity. This is caused by the developments in employment growth. In scenarios with low economic growth (such as Regional Communities), employment growth is also low. The latter is due to low population growth, low labour-market participation rates and high unemployment rates. In Global Economy, all these three factors work in an opposite direction, and the developments in employment and labour productivity growth reinforce each other. The decline in GDP growth is also larger than for labour productivity, due to the sizable changes in employment growth over time.

Figure 5.1 Annual GDP growth 1960-2040 in the EU-15 (macro and per capita)



The variation in GDP per capita is smaller because high GDP growth is partly offset by high population growth in per capita terms for the EU-15. The variation between the scenarios is 1.4%-points. In Regional Communities, GDP per capita growth is on average 0.8% per year, and in Global Economy 2.2% per year. This implies that per capita income is about 30% to 130% higher in 2040 than in 2000. High population growth in the non-OECD also narrows the differences in GDP per capita growth between the regions. Note that the growth rate of about 4% in the CEECs and the non-OECD in the period until 2020 is comparable to that of the Asian tigers in the recent past.

The differences in per capita GDP between Strong Europe and Transatlantic Market are relatively large in the EU-15, compared to that of labour productivity and GDP. Relatively high population growth in Strong Europe slows down growth in per capita terms.

Table 5.3 GDP growth per capita, annual averages 2000-2040

	Strong Europe		Transatlantic Market		Regional Communities		Global Economy	
	00-20	20-40	00-20	20-40	00-20	20-40	00-20	20-40
EU	1.4	1.1	2.1	1.7	1.1	0.5	2.3	2.1
Eastern Europe	3.9	3.1	3.0	1.9	2.5	1.6	4.2	3.3
United States	1.5	0.9	2.0	1.5	1.3	0.6	2.2	1.5
Rest OECD	1.0	0.7	1.2	1.0	0.8	0.3	1.6	1.7
Non-OECD	3.6	3.6	1.9	1.5	2.7	2.3	4.1	3.9
World	1.6	1.8	1.2	0.9	1.0	0.6	2.2	2.3

Source: WorldScan.

Growth in poorer regions exceeds that in Europe, also because of higher productivity growth. This is related to a process of catching up.¹⁶ This pattern becomes clear from table 5.4, which shows the ratio of labour productivity between regions. More specifically, we explore the ratios between the EU-15 and the candidate members from Central and Eastern Europe, the EU-15 and Turkey, Europe and the US, and the OECD and non-OECD countries.

Table 5.4 Catching up in labour productivity between regions in 2040

	2000	Strong Europe	Transatlantic Market	Regional Communities	Global Economy
Central Europe to EU-15	13.8	32.4	20.0	20.8	25.7
Turkey to EU-15	14.1	37.1	18.2	22.3	27.1
EU-15 to US	80.5	83.8	75.9	78.1	76.2
Non-OECD to OECD	8.4	17.3	7.9	13.0	15.9

Source: WorldScan.

¹⁶ The scenarios do not distinguish between rapidly growing and declining regions outside Europe. Indeed, the scenarios differ primarily with respect to developments within Europe.

Table 5.4 shows that Central and Eastern Europe and Turkey catch up with the EU-15 in all scenarios. Convergence is the most rapid in Strong Europe, and the productivity ratio actually more than doubles. In the other scenarios, convergence is slower. In Transatlantic Market, productivity in Turkey hardly catches up with the EU-15 because Turkey shifts its economic attention to poorer Eastern neighbours, rather than to the richer European Union.

The EU-15 outperforms productivity growth in the US in Strong Europe. Here, productivity levels catch up with those in the US, because of the relatively low productivity increases in the latter country. In other scenarios, labour productivity growth in the US actually exceeds that in Europe (because of the poor results regarding European integration, as is the case in Regional Communities, and to a lesser extent in Transatlantic Market).

Table 5.4 shows that globalisation helps non-OECD countries to converge towards the OECD, at least in Strong Europe and Global Economy. The Transatlantic Market scenario features divergence between productivity levels. The rich industrialised countries integrate, while the poor non-OECD countries suffer from this development, remaining outsiders.

5.3 Sectoral growth¹⁷

The growth of total GDP hides some important differences between sectors. In particular, some sectors will experience faster growth than others, while the relative performance of sectors may differ substantially among scenarios.

Table 5.5 presents the value-added shares of four (aggregated) sectors for the years 2000 and 2040. In each of the four scenarios, the service sector is growing relative to other sectors. Indeed, whereas this share is about 73% in 2000, it increases to between 81% (in Regional Communities) and 85% (in Global Economy) in 2040. The share of the Service sector varies between scenarios because of different developments in per capita income, combined with relatively high income elasticities for consumer services.¹⁸ Hence, the faster the growth of welfare is, the larger will be the share of income that households spend on services.

¹⁷ Note that these sectoral patterns for Europe are based on general developments in supply and demand and do not take account of specific sectoral market structures of the underlying countries.

¹⁸ In Transatlantic Market, the share of services is lower than in Global Economy. This may seem strange because of the flourishing ICT sector in Transatlantic Market. Two reasons explain this result. First, the implementation of ICT leads to higher productivity and lower prices in service sectors. Second, the internal market with the US implies that Europe starts to import ICT services

Table 5.5 Sectoral value added (as share of GDP (excluding taxes) in the EU-15) in 2040

	2000	Strong Europe	Transatlantic Market	Regional Communities	Global Economy
Agriculture and food	6.5	4.2	3.5	4.7	3.2
Energy and raw materials	1.8	0.9	1.4	1.5	2.1
Manufacturing	18.6	13.3	12.2	12.4	10.2
Services	73.2	81.7	83.1	81.3	84.7

Source: WorldScan; see the appendix for the aggregation of the 16 sectors into these four aggregated sectors.

As a complement to the increase in the share of services in total value added, the shares of agriculture and manufacturing sectors decline. These sectors experience higher TFP growth than service sectors, so that relative prices of these sectors decline correspondingly. The low income elasticity for food further contributes to the decline in the demand for products from agriculture and food processing. The demand for energy and raw materials contracts in Strong Europe, Transatlantic Market and Regional Communities. In Global Economy, however, robust economic growth in combination with lax environmental policies makes growth relatively pollution-intensive.

The different developments in TFP cause diverging developments in relative prices between sectors. Accordingly, the diverse growth rates in the volumes of production may show a different pattern than the trends in the shares of value added. Table 5.6 therefore presents growth in production volumes. It adopts a lower level of aggregation to investigate, in greater detail, which sectors gain relative to others. In general, table 5.5 and table 5.6 show different patterns. Sectors in which production volumes increase relatively quickly become less important in terms of value-added terms. The reason is that in these sectors production prices dwindle rapidly, and such production loses its relative value.

The production volume of trade and transport services increases relatively quickly in all scenarios compared to the other service sectors. This is due to increased trade volumes and rapid TFP growth, which keeps prices low. In general, changes in production volumes are most pronounced in scenarios with high GDP growth, such as Global Economy and Transatlantic Market. In Regional Communities, production volumes in agriculture and manufacturing sectors grow rapidly, while growth is relatively low in service sectors. In Transatlantic Market, the volume of the trade and transport sector and that of the capital goods sector grow rapidly, reflecting the emphasis on ICT production in that scenario.

Table 5.6 Production growth of different sectors in the EU-15 (annual growth in %)

	Strong Europe	Transatlantic Market	Regional Communities	Global Economy
Agriculture and food	1.7	1.8	1.1	2.6
Energy and raw materials	0.4	1.9	0.9	3.4
Chemicals and minerals	3.0	3.5	1.9	5.1
Capital goods	2.0	3.2	0.8	3.5
Other manufacturing	2.1	2.6	1.2	3.5
Trade and transport	2.0	3.1	0.9	3.4
Business services	1.6	2.1	0.6	2.4
Other services	1.4	1.7	0.6	2.2

Source: WorldScan; see the appendix for the aggregation of the 16 sectors into these 8 aggregated sectors.

5.4 Conclusions

GDP and GDP growth per capita in Europe will decline. In most scenarios the growth will be lower than in recent decades, due mainly to the decline in employment growth. Only if the decline is less outspoken, and labour productivity rises above its historical levels, can the GDP per capita exceed the 2% growth rate. Shrinking employment levels and low labour productivity growth could lead to very modest increases in GDP per capita. In Regional Communities, per capita GDP growth is only 0.5% per year, on average. In nearly all regions macro labour productivity growth diminishes, due to structural changes in the economy to less productive services.

6 Capital Markets

This chapter focuses on capital markets. First, we discuss savings patterns for the various scenarios. Savings are shown to decline due to ageing. Differences in saving patterns around the world lead to capital flows from the non-OECD and Rest OECD to the EU. The size of the flows depends on the degree of capital mobility. The availability of regional savings, together with capital demand, determines the scarcity of capital in the scenarios. This affects the real interest rate; if economic growth is high and capital scarce, the real interest rate will increase (while it decreases otherwise).

6.1 Savings

In the globalisation scenarios Strong Europe and Global Economy we assume that capital market integration will increase. In these scenarios it will become easier for the OECD to attract capital from the non-OECD in order to finance investment, given the decreasing macro savings rates due to ageing. Moreover, we assume that governments in the EU-15 and the US are active in increasing savings by eliminating budget deficits and by stimulating private savings. This is reflected by higher macro savings rates of about 2%-points in 2020 and 2040. Governments do not follow these policies in Regional Communities and Transatlantic Market, and savings rates are subsequently lower. Besides that, in the fragmented world of Regional Communities, capital mobility is even reduced. Irrespective of these differences, figure 6.1 shows that saving rates in the EU-15 decline in all scenarios.

Savings depend on GDP per capita growth, demographic characteristics and policy. Higher GDP growth stimulates savings, while ageing hinders it. As a result, savings are highest in Global Economy and lowest in Regional Communities (as confirmed in table 6.1).

Even in Global Economy, national savings decline (as a share of national income) by 3%-points. The effect of ageing on savings dominates the effects of higher GDP growth and a savings policy. Savings in the EU-15 are higher in Strong Europe than in Transatlantic Market, because of the savings policy in Strong Europe, which offsets lower GDP growth. In Regional Communities, savings implode to 12.7% of national income in the EU. Also in Eastern Europe, the United States and the Rest of the OECD, savings decline by about 6%-points in this scenario. The OECD (Turner et al., 1998) makes similar assumptions on the reduction in savings

Figure 6.1 Savings as share of national income in the EU

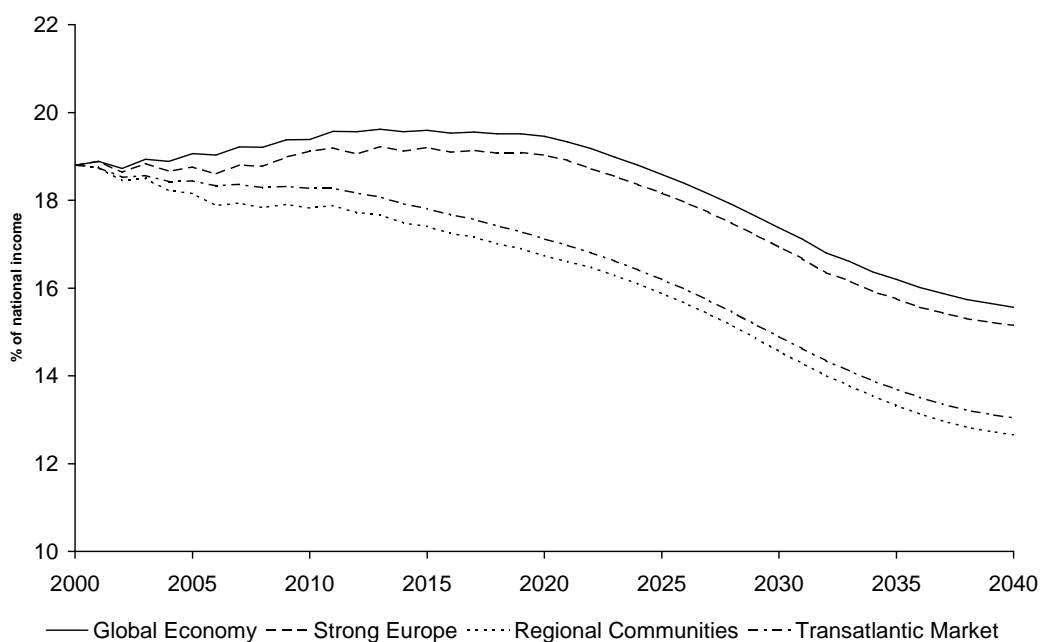


Table 6.1 National savings (as ratio of national income)

	Past		Strong Europe		Transatlantic Market		Regional Communities		Global Economy	
	2000	2020	2020	2040	2020	2040	2020	2040	2020	2040
EU-15	18.8	19.0	19.0	15.1	17.1	13.0	16.7	12.7	19.5	15.6
Eastern Europe	22.7	22.7	22.7	18.4	22.5	17.2	21.9	16.6	22.7	18.2
United States	17.5	17.1	17.1	14.9	15.7	14.2	14.5	11.1	17.5	15.3
Rest OECD	26.6	22.5	22.5	19.3	22.5	19.3	22.4	19.2	23.0	19.7
Non-OECD	26.1	29.4	29.4	25.9	26.6	21.8	28.5	23.8	29.8	26.1

Source: WorldScan.

In all scenarios savings are relatively high in the Rest OECD (in particular Japan) and the non-OECD (Asia). These numbers suggest that these regions will be net lenders on the international capital market. Table 6.2 confirms this. The negative (positive) numbers imply that regions are borrowers (lenders). Brooks (2003) supports this view, showing in an overlapping generations model that in the coming decades the EU-15 and the US will be net borrowers on the international capital markets, and Japan and Asia net lenders.

Table 6.2 Net foreign asset positions (as ratio of national income)

	Past	Strong Europe		Transatlantic Market		Regional Communities		Global Economy	
	2000	2020	2040	2020	2040	2020	2040	2020	2040
EU-15	- 0.8	-13.9	-35.3	-17.2	-29.3	-5.5	-9.9	-25.5	-72.4
Eastern Europe	-10.2	-9.5	-15.2	5.9	11.8	1.4	2.1	4.9	10.5
United States	-23.9	-12.8	-16.7	-25.1	-23.0	-17.9	-25.5	-21.7	-38.2
Rest OECD	40.7	66.5	67.9	69.6	82.6	41.8	51.8	80.5	47.3
Non-OECD	-1.0	-6.9	8.5	5.3	12.4	-0.7	3.9	0.7	39.2

Source: WorldScan.

Activating capital controls reduces the net foreign asset positions for countries in Regional Communities. There are fewer opportunities to lend to or borrow from other countries. These opportunities increase if capital controls are eliminated and international capital mobility is facilitated by measures like international bookkeeping standards in Strong Europe and Global Economy. It then becomes cheaper to borrow from abroad and more profitable to lend to other countries. This will lead to more extreme net positions in Global Economy. EU-15 and United States borrow relatively more on the international capital markets, and the non-OECD provides the capital.

This result contrasts with the popular idea that the developed countries in the North will finance their future pensions by investing their funds in developing countries in the South. Without this possibility, higher savings in developed countries would sooner depress the rate of return on investment. With capital mobility, in contrast, higher savings in the North would not reduce the interest rate, as they can alternatively be invested in the South at relatively high rates of return.

This idea should be qualified, however, for several reasons. First, the return to investment in poor countries is not necessarily higher than in rich countries, as is shown in table 6.2. The return seems conditional on several institutional factors. Second, many developing countries, especially in Asia, feature high savings rates themselves (see table 6.1). This implies that these countries do not need to import capital from the North. Third, ageing is not confined to developed countries: it is a worldwide phenomenon that also applies to developing countries. The demand for capital in developing countries may therefore fall as well. Finally, many impediments exist to cross-border capital flows. Developing countries would need to liberalise their financial markets so as to remove these impediments. But even when financial capital would be fully mobile, the return on investment may quickly fall when the pace of investment is high. The reason is that countries that expand and grow rapidly see their terms-of-trade deteriorate. This leads to a lower return on investment and limits the incentive to invest in rapidly growing countries.

6.2 Investment and the real interest rate

Savings and international capital markets determine the amount of capital that is available on the regional market. Investment determines the demand. Capital demand is closely related to economic growth in the scenarios. Demand for capital is high in Global Economy and low in Regional Communities. The differences between Strong Europe and Transatlantic Market are minor for the EU-15, although GDP growth is higher in Transatlantic Market. The reason is that higher GDP growth is spurred on by more technology and not by capital.

Comparing regions, capital demand is high in Eastern Europe and the non-OECD. These are the fast-growing regions.

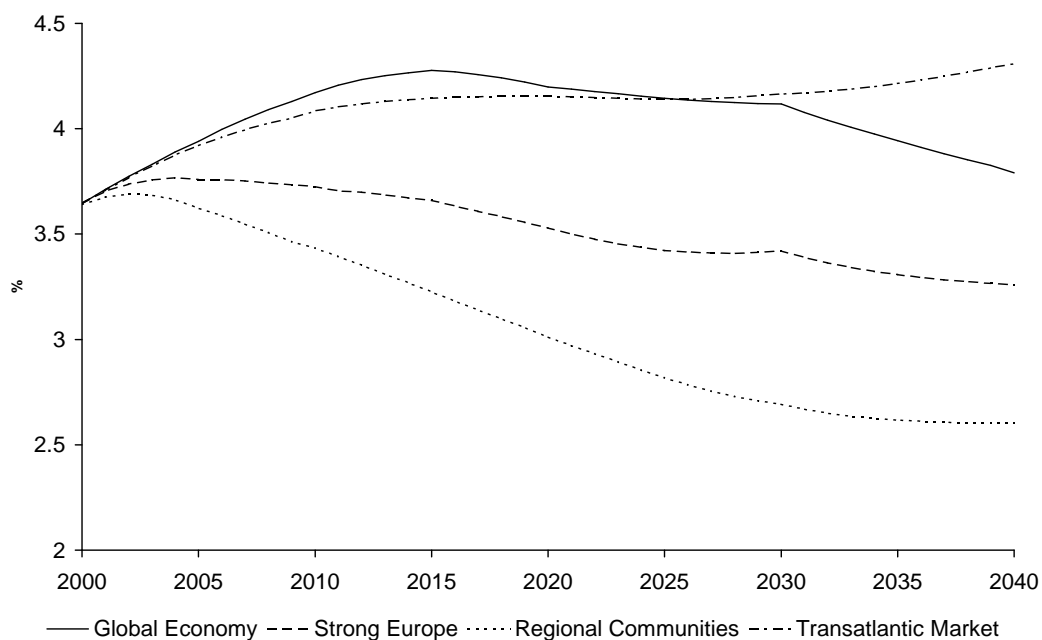
Table 6.3 Capital demand, annual averages 2000-2040

	Strong Europe		Transatlantic Market		Regional Communities		Global Economy	
	00-20	20-40	00-20	20-40	00-20	20-40	00-20	20-40
EU-15	2.3	2.0	2.3	1.9	1.7	0.8	2.8	3.1
Eastern Europe	4.7	3.3	4.3	2.6	3.9	2.0	4.8	3.6
United States	3.1	2.1	3.4	2.5	2.8	1.3	3.6	3.0
Rest OECD	2.1	1.3	2.1	1.3	2.2	0.9	2.3	2.5
Non-OECD	4.4	4.4	3.6	3.0	3.9	3.5	4.6	4.6

Source: WorldScan.

Based on the demand for capital, we would expect that the price of capital is high in Global Economy and low in Regional Communities. However, the price of capital is also affected by the supply, which is high in Strong Europe and Global Economy and low in Regional Communities. Figure 6.2 shows that the pressure of capital demand seems to dominate the supply effect in Regional Communities. The real interest rate decreases from 3.6% in 2000 to 2.6% in 2040. In Strong Europe, the real interest rate also decreases due to the abundant capital supply induced by savings policy and capital mobility in EU-15. In Transatlantic Market, the real interest rate rises in the EU-15. The supply of capital is limited (see figure 6.1), while demand is reasonably high. In Global Economy, the European real interest rate first rises before it starts to fall. The rise until 2015 is induced by high capital demand. After 2015, capital demand is still high, but the European Union benefits from the integrated capital markets. Savings in the non-OECD increase enormously. Although the savings rate is not much higher than in other scenarios for the non-OECD, savings themselves are much higher due to higher economic growth. The European Union benefits from this supply. They attract a lot of foreign capital.

Figure 6.2 The real interest rate in the EU-15



The ample availability of capital in the non-OECD in Global Economy is also reflected by a low real interest rate, which falls from 5.3% in 2020 to 4.1% in 2040. In nearly all regions and scenarios real interest rates decrease. This would suggest that ageing causes an increase in the capital labour ratio such that capital becomes less scarce. The negative effect of ageing on employment growth seems to dominate the effect of dissavings of the elderly on capital growth in the OECD. High savings in Asia and its growing economic importance reinforces this effect.

Table 6.4 Real interest rate

	Past 2000	Strong Europe 2020	Strong Europe 2040	Transatlantic Market 2020	Transatlantic Market 2040	Regional Communities 2020	Regional Communities 2040	Global Economy 2020	Global Economy 2040
EU-15	3.6	3.5	3.3	4.2	4.3	3.0	2.6	4.2	3.8
Eastern Europe	5.5	3.8	2.9	3.4	2.7	2.9	2.2	4.2	3.1
United States	5.2	4.0	3.5	4.8	4.7	4.1	3.9	4.5	3.8
Rest OECD	3.3	2.2	1.6	2.5	2.1	1.6	1.0	3.0	2.2
Non-OECD	4.4	4.8	3.6	4.4	3.9	4.3	3.2	5.3	4.1

Source: WorldScan.

6.3 Conclusions

This chapter focused on capital markets. It showed that savings in Europe would decline due to ageing. In the absence of any savings policy, savings as share of national income could decrease by 6%-points in 2040. This does not automatically imply that capital becomes very scarce in Europe. That depends on international capital mobility and economic growth. If international capital mobility increases, EU-15 could borrow capital from the Rest OECD and Asia. In the latter regions savings are very high. Capital mobility thus reduces the price of capital in Europe. Economic growth (and, consequently, investment demand) is at least as important for the scarcity of capital. In Regional Communities capital demand is very low; in spite of low savings, the real interest rate decreases in that scenario. In the high growth scenarios Transatlantic Market and Global Economy, the interest rates are relatively high in the EU-15. The net effect of ageing on the real interest rates in the EU-15 is thus unclear. At least as important is the rate of economic growth. Our scenarios suggest that the real interest rate could increase in the long run if economic growth is high. However, if international capital mobility increases, and economic growth is low, the real interest rate could decrease.

7 Trade

This chapter focuses on one of the central key uncertainties in the scenarios: regional and global cooperation on trade policies. First we describe these policies (such as the deepening of the EU internal market, EU enlargement with countries as Turkey, and global trade liberalisation). Global trade liberalisation increases the degree of openness of the EU. Trade policies also affect trade relations with other regions and the composition of trade. All these effects are discussed subsequently. We then shift the focus to the sectoral export pattern of the EU-15 and its comparative advantage.

7.1 Trade-liberalisation policies

Table 7.1 shows the various regional and global trade-liberalisation policies that we assume in the four scenarios. Within the EU-15, the internal market in goods and services (in particular) improves. This process is most prominent in Strong Europe and Regional Communities. In Transatlantic Market the internal market improves due to the creation of a European-American common market. Also in Global Economy the functioning of the internal market improves. Bilateral trade becomes increasingly important, and preferences for national goods seem to fade.

Scenario	Strong Europe	Transatlantic Market	Regional Communities	Global Economy
EU-15 internal market deepening	substantial	modest	substantial	modest
CEEC-EU-15	EMU	internal market	customs union	EMU
Turkey-EU	internal market	-	-	internal market
Russia-EU	free trade area in manufacturing	-	-	free trade area in manufacturing
EU-US-Latin America	-	internal market	-	-
Global	tariffs eliminated NTBs reduced by 40%	-	-	Tariffs eliminated manufacturing. halved agriculture, NTBs halved
Regional: USA-LAT, TUR-MNA, Rest-FSU	-	-	free trade areas in manufacturing	-

Free trade area (FTA) implies that bilateral tariffs are eliminated. Customs union (CU) implies that members have common external tariffs towards third countries on top of FTA. Internal market implies that also NTBs are eliminated on top of CU.

In all scenarios, the countries from Central and Eastern Europe will become EU members. They join the internal market, which implies a removal of all formal and informal barriers to trade. In Regional Communities, transitional periods for various aspects of the internal market take on a more permanent character (e.g. in agriculture and food), so that the EU accession effectively

boils down to a Customs Union. At the same time, the current fifteen member states deepen their internal market, excluding the new member states. In Strong Europe and Global Economy, the candidate countries integrate beyond the internal market as they enter the EMU. Moreover, the EU enlarges with Turkey and concludes association agreements with Russia.

In Strong Europe and Global Economy, global trade-liberalisation is successful and lead to a reduction in tariffs and NTBs between 2006-2015 and 2021-2030. In Strong Europe, all trade barriers and OECD domestic support in agriculture is eliminated, which gives the developing countries full access to the markets in the OECD countries. In Global Economy, trade liberalisation focuses more on market access in services. The Transatlantic Market scenario is characterised by more intense cooperation between the US, the EU and Latin America. Global trade liberalisation fails in Regional Communities. Instead, regional trade liberalisation arrangements are set up between the Americas in 2015.

7.2 A redirection of trade

The variation in regional and global trade policies leads to a diverse picture of openness in the scenarios. Table 7.2 presents the openness of the EU-15 and the other regions. Openness is measured as the average value of imports and exports divided by national income. It also includes intra EU-15 trade, which is an important share of total trade, as we will see below. Openness barely increases in Transatlantic Market and Regional Communities. In Transatlantic Market the common internal market with the US stimulates trade somewhat, and in Regional Communities trade increases through the deeper internal market of the current 15 EU members. The lack of openness to the rest of the world does not stimulate trade.

Table 7.2 Openness of the various regions in 2040

	2000	Strong Europe	Transatlantic Market	Regional Communities	Global Economy
EU-15	29.5	45.7	33.4	33.5	43.0
Eastern Europe	27.7	41.9	30.2	26.7	42.6
US	11.5	18.4	12.5	11.0	19.3
Rest OECD	15.5	29.7	18.0	17.9	29.0
Non-OECD	21.7	25.7	25.3	15.9	31.5

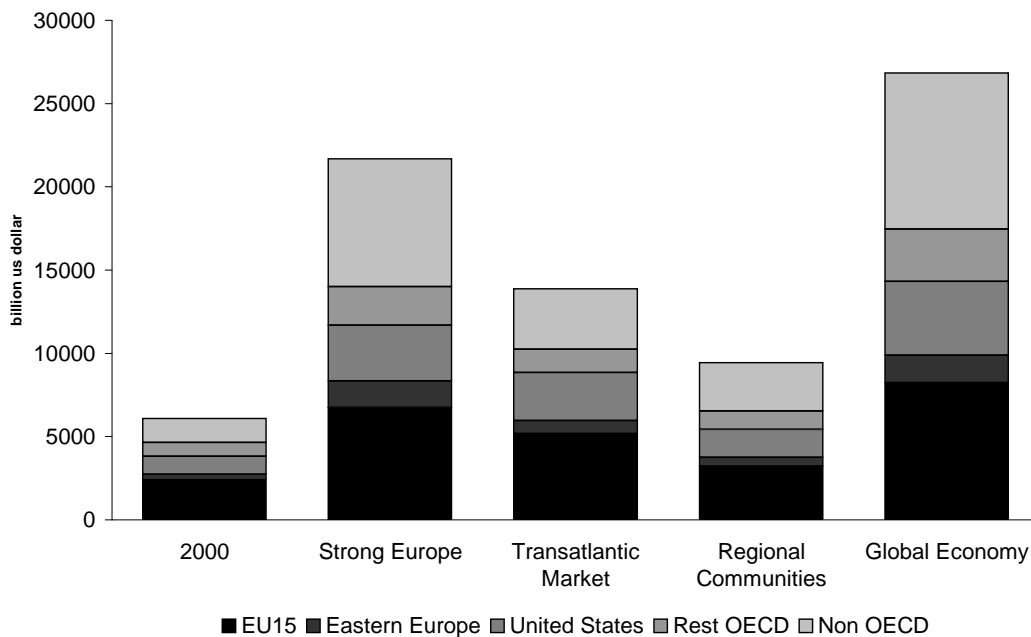
Source: WorldScan, regional; all aggregates include intra trade.

This is completely different in Strong Europe and Global Economy, which both feature liberalised global trade. Not only are tariffs and non-tariff barriers lowered or even eliminated, but also trade is facilitated by more transparent and uniform customs procedures. The degree of openness increases by about 15%-points. In Strong Europe, openness is even higher than in

Global Economy, due to the strong deepening of the internal market of the EU. This also stimulates intra EU-15 trade. Similar patterns also show up for the other regions. In the non-OECD and Eastern Europe, openness is even reduced in Regional Communities.

Changes in the openness of regions and differences in regional growth patterns affect also the size and direction of trade flows.¹⁹ In Regional Communities, the value of world trade increases from 6000 billion US\$ in 2000 to 9500 billion US\$ in 2040. In Global Economy, it is a factor three higher: 27,000 billion US\$. An increasing share of the trade takes place within the non-OECD and between OECD and non-OECD regions. According to our statistics, nearly 40% of all trade takes place in the EU-15 in the year 2000. This decreases to about 30% in Strong Europe and Global Economy. In the other scenarios the share is a bit higher. These differences can be ascribed to the degree of globalisation and economic growth in the non-OECD in the former scenarios. The share of the non-OECD in total trade increases most significantly in Strong Europe and Global Economy— from 23% in the year 2000 to 35% in 2040.

Figure 7.1 The size of trade flows in 2040 (billions US\$)



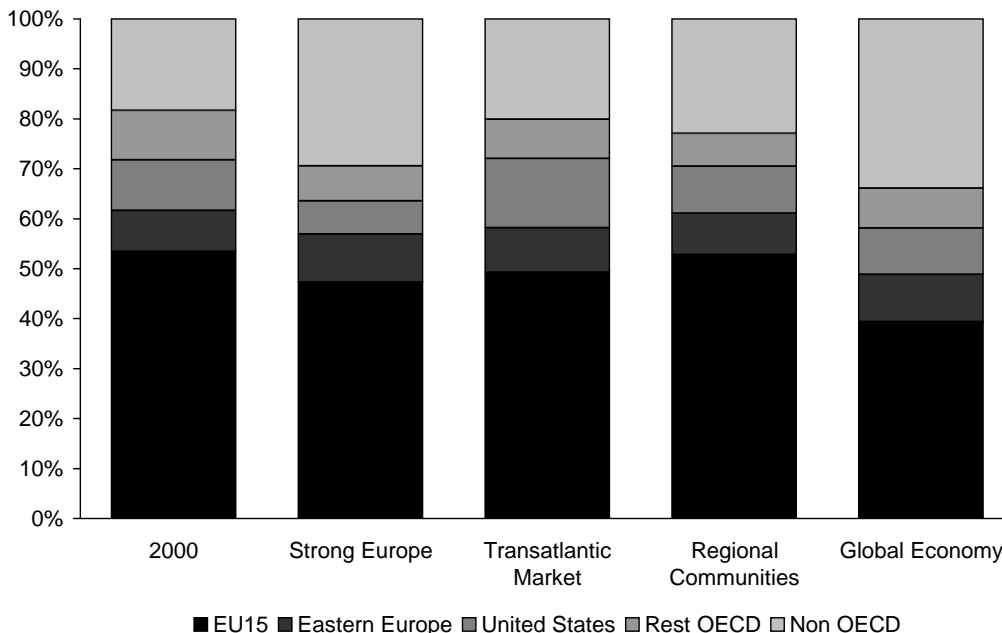
¹⁹ Note that the size/magnitude of trade is here defined as the value of exports and imports in a region, divided by two. If the region is a composite of several WorldScan regions, trade also includes intra trade between these regions. The statistics on the size of the trade flows in 2000 cannot be compared to other data. The reason is that in constructing our 16 regions based on the more than 60 regions from the original database, we excluded intra trade. This implies that we ignore a lot of trade in Asia (which is one constructed region Rest of World), but represent relatively a lot of intra trade in Europe, because we distinguish eight regions there. We thus overestimate the share in total trade by the EU-15 in 2000. However, the relative changes in the size and direction of trade in the scenarios is not affected by the construction of regions.

The magnitude of trade in the non-OECD increases two-fold in Regional Communities, and six-fold in Global Economy. Eastern Europe's share in total trade increases most significantly in Strong Europe, due to a well-functioning common internal market in the enlarged EU. The size of the trade flows increases by a factor of five. In Transatlantic Market, the United States benefits from the common internal market with the EU-15 and Latin America, and its share in total trade increases slightly. The magnitude of trade increases by 300% between 2000 and 2040. That is larger than for any other region in that scenario.

In 2000, almost 54% of all exports of EU-15 countries concern intra-EU trade. Slightly more than 18% flow to non-OECD countries (mainly in Asia), while the remaining 28% flow more or less equally to the US, the Rest of the OECD, and the Eastern part of Europe (Central and Eastern European countries, Russia and Turkey).

The direction of trade changes drastically in most scenarios, as shown in figure 7.2. Asia will become a more important trading partner for Europe during the coming decades in Strong Europe and Global Economy, in particular. This is triggered by high economic growth in Asia, and explains the high export share in non-OECD countries in the other scenarios. The internal market deepens and widens most in Strong Europe and Regional Communities, and least in Transatlantic Market. The deepening of the internal market stimulates EU intra trade. For that reason, the EU-15 export much less to Asia in Strong Europe than in Global Economy— in spite of high growth in both scenarios.

Figure 7.2 Direction of EU-15 exports flows



The smallest changes in trade patterns occur in Regional Communities, where overall GDP growth is low and trade barriers remain largely intact. The share of exports to non-OECD regions increases from 18% in 2000 to more than 23% in 2040, due primarily to the relatively high growth rates in Asia compared to the OECD. This increase comes at the expense of trade to other OECD regions. The share of intra EU-15 trade hardly changes because of the deepening of the internal market.

In Transatlantic Market, the trade intensity between the EU-15 and the US increases, thereby boosting the export share from 10% to almost 14%. Increasing Transatlantic trade also leads to trade diversion, which shows up in a lower share of intra-EU trade (falling to 49%) and a more moderate increase in the trade share with non-OECD countries (rising to 20%).

The share of intra-EU-15 trade falls most substantially in Global Economy, where trade with non-OECD countries almost doubles, primarily because of the high growth in Asia, together with the removal of trade barriers. In both Strong Europe and Global Economy, trade with Central and Eastern Europe increases, due to the enlargement of the EU. In Strong Europe, the export share with these regions increases from 8% in 2000 to more than 10% in 2040.

7.3 The comparative advantages of regions

Trade liberalisation also affects the sectoral pattern of trade. In particular, table 7.3 reveals that the share of services in EU-15 exports increases from 20.8% in 2000 to about 28% in 2040. This comes at the expense of manufacturing, the share of which decreases from 70% in 2000, to between 59% and 62% in 2040, depending on the scenario. The reason for the fall in the export share of manufacturing is that other countries (such as Asian ones) specialise more in the production of manufacturing goods, thereby competing with manufacturing sectors in Europe.²⁰

	2000	Strong Europe	Transatlantic Market	Regional Communities	Global Economy
Agriculture and food	7.5	10.9	5.7	8.1	7.1
Energy and raw materials	2.4	1.8	3.5	4.4	6.9
Chemicals and minerals	14.6	14.9	15.1	14.9	17.9
Capital goods	38.1	28.7	32.6	28.8	26.8
Other manufacturing	16.7	16.2	15.1	15.7	14.7
Trade and transport	10.1	11.2	16.9	13.5	12.7
Business services	6.8	10.5	6.9	9.2	9.3
Other services	3.8	5.8	4.1	5.5	4.9

Source: WorldScan; see the appendix for the aggregation of the sectors.

²⁰Moreover, the price of services increases relative to manufacturing goods, so that the export share of services in value-added terms increases more than that in volume terms.

Figure 7.3 shows the so-called revealed comparative advantages of various sectors in the EU. It measures the exports of a particular sector in total exports relative to the average export share of that sector in other countries in the world (and multiplied by 100). Hence, if a sector features an index higher than 100, then it is said that a region specialises its exports in that sector (i.e. it has a comparative advantage in that sector relative to other regions). From figure 7.3, we learn that the EU-15 specialises today in the exports of agriculture, chemicals and minerals, capital goods and business services. In all scenarios, the EU-15 maintains its comparative advantage in chemicals and minerals and business services. It becomes less specialised in capital goods and in other manufacturing.

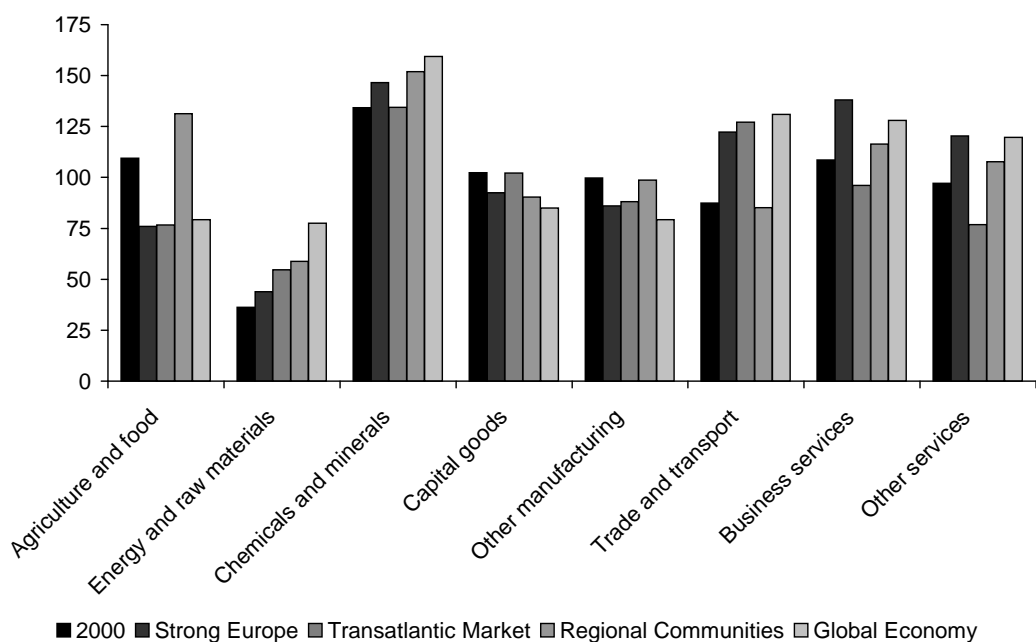
Despite these similarities, the development in comparative advantages varies substantially among the scenarios. In general, the revealed comparative advantages change most in Strong Europe and Global Economy, where markets become more integrated. The relative export specialisation of Europe in agriculture deteriorates in most scenarios—except for Regional Communities, where it increases (since agricultural trade barriers still exist in that scenario). These barriers protect the position of European agriculture and food processing. In Strong Europe, all these barriers are eliminated, which explains the reduction in competitiveness. This is a bit less pronounced in Transatlantic Market and Global Economy. In the former scenario, the trade barriers between the EU-15 and Asia and Africa remain. Only the barriers with Latin America and the US cease to exist. In Global Economy, the trade barriers in agriculture are reduced but not eliminated.

The export pattern of the EU-15 becomes more specialised in Trade and Transport in all scenarios, excepting Regional Communities. This sector benefits from more trade, whether that is directed to the US, in Transatlantic Market, or to the non-OECD, as in the other scenarios.

The comparative advantage of Business Services and Other Services decreases in Transatlantic Market. The reason is that the US has a comparative advantage in these sectors and, therefore, enters Europe in the common internal market. In the other scenarios Europe can also compete with other regions. Compared to these regions, it has a comparative advantage in services.

The relatively strong position of energy and raw materials in Global Economy compared to the other scenarios is inflated by a price effect. In the former scenario energy becomes scarce, and prices increase. Because in Europe the extraction and production of energy and raw materials require less energy and raw materials than in other regions, the increase in the production price is moderate. As a result, European competitiveness in this sector increases.

Figure 7.3 Revealed Comparative Advantage for aggregated EU-15 sectors (including intra EU-15 trade)



7.4 Conclusions

Trade policies have an important effect on the degree of openness of countries and the direction of trade flows. In scenarios with nearly no or only some regional trade liberalisation policies, the degree of openness hardly changes. Regional trade policies steer the direction of trade flows, as in Transatlantic Market. Trade openness increases substantially if trade is liberalised at a global level. Combined with high economic growth in Asia, European trade with Asia becomes relatively more important.

In globalising environments, the EU-15 specialises in chemicals and services. This specialisation pattern is much more pronounced in these scenarios than in the Atlantic economic union with the US. The reason is that the US is even more specialised in services than the EU-15 is. The EU-15 seems to benefit more from global trade liberalisation than from a regional arrangement with the US. On the other hand, competitiveness in capital goods and other manufacturing deteriorates less if trade barriers with the non-OECD remain. The scenarios also show that fortress Europe effectively protects agriculture and food processing. If the trade barriers in agriculture disappear, then Europe faces more fierce competition.

8 Conclusions

Before presenting the conclusions, we have to put them into perspective. The numbers presented are not the predictions of future economic developments, but numerical illustrations of the four scenarios. With that in mind, some general conclusions can be drawn.

We have used Eurostat population scenarios in our study. These indicate that annual population growth will diminish in the next forty years. On average, population growth will be in the range of -0.2% to 0.3% per year. During the last two decades of the 20th century the growth was on average 0.3% per year. The composition of the population will also change. The population ages: a much larger share of the population will be older than 65 years. That is the case in every scenario—even including substantial immigration flows.

A first conclusion is that if age-specific participation rates do not change in the next decades, the macro labour-participation rate will decline by about 5% to 6%-points between 2000 and 2040. Higher age-specific participation rates could reduce the fall in the macro participation rate. If labour-market participation of the population aged 20 to 65 increases from 75% to 88%, the macro participation rate will be more or less constant in time. This increase stems primarily from higher labour market-participation of those aged 55 and older, and higher labour-market participation of women. Participation increases substantially in Transatlantic Market and Global Economy. Together with low unemployment, employment growth exceeds population growth by 0.1%-point. This seems remarkable, considering ageing. It is often concluded that ageing will have a negative effect on employment growth. Our scenarios show that if labour-market participation of the elderly can be raised substantially and unemployment levels can be reduced, employment growth remains on track with population growth. These conditions will not be met automatically. In the other scenarios, Strong Europe and Regional Communities, employment growth is negative, and is about 0.3%-points lower than population growth. This contrasts with developments in the last decades of the 20th century, when employment growth surpassed population growth by 0.4%-points per year.

A second conclusion is that GDP and GDP per capita growth will decline. On average, annual GDP growth in the scenario period lies between 0.6% and 2.5%. This is lower than in the recent past, except for Global Economy. GDP growth diminishes primarily because of declining employment growth. That is not the only reason, however. Labour productivity decreases slightly, due to a shift in the economy towards services: service sectors experience less productivity growth than manufacturing and agriculture. Labour productivity growth is in the range of 1.1 to 2.1% per year. GDP per capita growth lies between 0.8% and 2.2% per year. In time, GDP per capita growth slows down, as the decrease in employment growth exceeds that in population growth.

Ageing leads to a reduction in savings as a share of national income: the elderly dissave. Savings as a share of national income drop by 5% to 6%-points between 2000 and 2040. The various demographic and economic developments in the scenarios have a minor impact on the

variation in savings rates. The question is how the real interest rate is affected by ageing. This is particularly relevant for the affordability of capital-funded pensions systems. In our scenarios the effect of ageing on the pattern of the real interest rate is unclear. Dissavings exert upward pressure on the interest rate, but lower employment growth exerts downward pressure.

Moreover, the rate of economic growth and the degree of capital mobility is important. In 2040, the spread of the real interest rate over the scenarios is 1.7%-points. If economic growth is high, the real interest rate could rise slightly. In the scenarios featuring modest economic growth, the real interest rates will decrease. This suggests that the affordability of pension systems is related more to the rate of economic growth than to the savings rate or degree of capital mobility. The EU-15 becomes a net borrower on the international capital market. Capital is relatively abundant in Asia, due to high savings rates. After 2010, a part of the savings in Asia flows to the EU-15. The higher the degree of capital mobility, the larger the inflow will be. This depresses real interest rates in the EU-15.

A fourth conclusion is that global trade-liberalisation policies aimed at reducing tariff and non-tariff barriers substantially increase the openness of countries. Together with high economic growth in Asia, EU openness measured as share of GDP increases from 30% to about 45% in Strong Europe and Global Economy. Global trade liberalisation seems to benefit trade and transport, business services, and chemicals and minerals in the EU-15, at the expense of capital goods and manufacturing. European agriculture and food processing loses competitiveness if agricultural trade is liberalised.

References

- Brooks, R., 2003, Population ageing and global capital flows in a parallel universe, *IMF Staff Papers* 50, 200-221.
- CPB, 1992, *Scanning the Future*, The Hague, Sdu Publishers.
- CPB, 1999, *WorldScan: the Core Version*, The Hague.
- CPB, 2000, *Ageing in the Netherlands*. The Hague, Sdu Publishers.
- De Jong, A., and H. Visser, 2000, Long-term international migration scenarios for the European Economic Area, Eurostat Working paper, Luxembourg.
- De Mooij, R.A., and P.J.G. Tang, 2003, *Four Futures of Europe*, The Hague, Sdu Publishers.
- Dimaranan, B.V. and R.A. McDougall, 2002, *Global Trade, Assistance, and Production: The GTAP 5 Data Base*, Center for Global Trade Analysis, Purdue University.
- Eurostat, 2000, *Eurostat New National Baseline Population Scenarios*, Luxembourg.
- Hoekman, B., and C.P. Braga, 1997, Protection and trade in services: a survey, Policy Research Paper #1747, World Bank, Washington, DC.
- Hummels D., 1999, Towards a Geography of trade Costs, University of Chicago, mimeo.
- IPCC, 2000, *Emission Scenarios*, Cambridge University Press.
- Kets, W., and A.M. Lejour, 2003, Sectoral TFP growth in the OECD, CPB Memorandum 58.
- Lejour, A.M., 2003, Globalisation and the global environment: Four quantitative scenarios, *Transportation Planning and Technology* 26, p. 9-40.
- Lejour, A.M., R.A. de Mooij and R. Nahuis, 2004, EU enlargement: Economic implications for countries and industries, in .H. Berger, T. Moutos, H-W. Sinn (eds), *Managing EU enlargement*, MIT Press.
- Lejour, A.M., and N. van Leeuwen, 2002, Population size and participation rates in WorldScan, CPB Memorandum IV/2002/08.

Nahuis, R., 2002, One size fits all? Accession to the internal market, an industry-level assessment of EU enlargement, CPB Discussion Paper 014.

OECD, 1997, *The World in 2020: towards a new global age*, Paris.

Turner D., C. Giorno, A. de Serres, A. Vourc'h, and P. Richardson, 1998, The macroeconomic implications of ageing in a global context, OECD Working Paper 193, Paris.

Verweij, G., 2002, documentation of the WorldScan Core 2002 version, draft.

Verweij, G., 2003, Sectorale consumptiepatronen in WorldScan, CPB memorandum IV/2003/02.

World Bank, 2001, *World Development Indicators*, Washington, DC.

WTO, 2001, *Market Access: unfinished business*, Geneva.

Appendix

This appendix presents more details of WorldScan. First, it presents the production structure with the relevant substitution elasticities. Second, it presents the Armington elasticities in the model, and finally, it gives an overview of the regional and sectoral structure of the model based on the GTAP database.

Production technologies

Sectoral production technologies are modelled as nested CES functions. The value of the substitution parameter determines the substitution possibilities between input factors. The top level, where the fixed factor is split off, is relevant only for the sectors agriculture, energy carriers and raw materials. For all manufacturing and service sectors we assume constant returns to scale in production. In the next level of the production tree, value-added plus energy carriers and material inputs are subdivided. This CES-function has a very low substitution elasticity (.01), creating a Leontief structure. The nesting structure of the Material inputs has a substitution elasticity of .60. We assume relatively high substitution elasticities between Value-added and Energy carriers (.50). The Value-added nest has a substitution elasticity of 0.85 between capital and labour.

Sectoral production elasticities

	All sectors	Agriculture	Energy	Other raw materials
Fixed factor and rest	0.10	0.90	0.40	0.80
Nest of intermediates and nest of value added/energy	0.01	0.30	0.01	0.01
Energy and value added	0.50	0.60	0.10	0.10
Capital and labour	0.85	0.85	0.85	0.85
Intermediates	0.60	0.60	0.60	0.60

Trade

Trade represents the difference between regional production and consumption. With respect to trade, WorldScan adopts an Armington specification, explaining two-way trade between regions and allowing market power of each region. The demand elasticity for manufacturing industries, agriculture and raw materials is set at 5.6, based on the work of Hummels (1999). For services, the elasticity is set at a lower level: 4.0. Bilateral trade depends on consumer preferences for regional varieties of a good, and differences in relative prices. The latter depend among other things on trade barriers. These are described in chapter 3.

Regional concordance between WorldScan and GTAP data

Germany	
France	
United Kingdom	
Netherlands	
BLU	Belgium-Luxembourg
Italy	
Spain	
Rest EU	Sweden, Denmark, Finland, Ireland, Austria, Portugal, Greece
Central Europe	Poland, Hungary, Rest Central Europe
Former Soviet Union	
Turkey	
United States	
Rest OECD	Japan, Australia, New Zealand, Canada, Iceland & Norway, Switzerland
Latin America and Caribbean	Central America and Caribbean, Mexico, Argentina, Brazil, Chile, Uruguay, Venezuela, Colombia, Rest of South America
Middle East and North Africa	Rest of Middle East, Morocco, Rest of North Africa,
Rest World	All regions in Africa (except Morocco and Rest of North Africa), all regions in Asia (except Japan), and Rest of World

Sectoral concordance between WorldScan and GTAP

Agriculture	Paddy rice, Wheat, Grains, Cereal Grains, Non grain crops, Vegetables, Oil seeds, Sugar cane Plant-based fibres, Crops, Bovine cattle, Animal products, Raw milk, Wool, Forestry, Fisheries
Energy	Refined Petrol and Coal, Gas, Coal, Electricity
Other raw materials	Oil, Minerals
Food processing	Processed rice, Meat products, Vegetable Oils, Dairy products, Sugar, Other food products, Beverages and tobacco
Consumption goods	Textile, Wearing Apparel, Leather products, Wood products, Other manufacturing
Printing, paper and publishing	
Chemicals and minerals	Chemicals, Rubbers and Plastics, Mineral Products
Metals	Nonferrous Minerals, Ferrous Minerals
Capital goods	Fabricated Metal Products, Machinery and Equipment, Other Transport Industries, Motor Vehicles and parts, Electronic Equipment
Transport services	Water, Air and other Transport
Trade services	
Communication	
Construction	
Financial services	Insurance, Other financial services
Other business services	
Other services	Gas manufacturing and distribution, Water, Recreational services, Government services

For expositional purposes, sectors are often combined into the aggregates presented in the table below.

Sectoral aggregation of WorldScan sectors		
<i>Four aggregated sectors</i>	<i>Eight aggregated sectors</i>	<i>All 16 sectors</i>
Agriculture and food	Agriculture and food	Agriculture Processed food
Energy and raw materials	Energy and raw materials	Energy Other raw materials
Manufacturing	Chemicals and minerals Capital goods Other manufacturing goods	Chemicals and minerals Capital goods Consumption goods Paper, printing and publishing Metals
Services	Trade and transport Business services Other services	Trade services Transport services Communication Financial services Other business services Construction Other services
