The Dutch growth accounts

2010

Statistics Netherlands

Explanation of symbols

.	data not available
*	provisional figure
**	revised provisional figure (but not definite)
x	publication prohibited (confidential figure)
–	nil
–	(between two figures) inclusive
0 (0.0)	less than half of unit concerned
empty cell	not applicable
2011–2012	2011 to 2012 inclusive
2011/2012	average for 2011 up to and including 2012
2011/'12	crop year, financial year, school year etc. beginning in 2011 and ending in 2012
2009/'10–2011/'12	crop year, financial year, etc. 2009/'10 to 2011/'12 inclusive

Due to rounding, some totals may not correspond with the sum of the separate figures.

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Summary of key-findings

Productivity in the Dutch commercial sector increased by 1.4 percent

In 2010 the real (consolidated) output of the Dutch commercial sector increased by 2.7 percent. The total input of capital, labour, energy, materials and services went up by 1.3 percent. This resulted in a 1.4 percent output increase per unit production factor. This improvement represents an increase of multi-factor productivity (*mfp*).

Negative development of labour input less severe than in 2009

The number of hours worked in the commercial sector decreased by 0.7 percent. As a consequence, the contribution of labour to gross output change was –0.5 percentage points. The negative development of labour input was less severe than in 2009 and also relatively modest compared to the large decrease of gross output in 2009.

Positive contribution of capital mainly determined by cold winter

In 2010 capital made a positive contribution to gross output change. The volume change of capital services was 2.1 percent. This increase is mainly determined by an increased demand for natural gas due to a relatively cold winter. In the Dutch growth accounts, the use of natural oil and gas reserves is considered a capital input in the production process. Higher extraction levels therefore lead to increased capital cost.

Increased capital deepening for more than a decade

Capital deepening, measured as the volume change of capital services per hour worked, has increased since 1996, the first year for which *mfp* statistics are available. In the years before 2002, investments in ICT capital mainly determined the higher growth rates of capital input. In most recent years, capital deepening is mainly influenced by a reduction of hours worked as a consequence of the economic crisis.

Declining trend of investments in intellectual capital

Since 2002, investments in intellectual capital as a share of gross domestic product (GDP) have gradually declined. Particularly, investments in innovative property (e.g. research and development) and economic competencies (e.g. organisational structures) experienced declining trends in recent years. The contribution of intellectual capital to gross output growth went down to zero percentage points, which suggests that the knowledge orientation of the Dutch economy is falling back.

Decreased level of patent applications

According to the World Intellectual Property Organization the number of patent applications of Dutch companies decreased in the period 2006–2010. In 2010, the Netherlands was one of the few countries with a negative development of the number of patent applications. As a share of GDP, R&D expenditure in the Netherlands slightly increased in 2010. This may positively influence future patent application levels.

Content

1 Introduction

This is the fifth edition of *The Dutch growth accounts* in which Statistics Netherlands presents statistics on multi-factor productivity *(mfp)* at the macro and meso level. The growth accounts describe the determinants of economic growth, with *mfp* representing a measure of change in the efficiency of production processes. Statistics on *mfp* are a logical addition to the existing statistics on economic growth and labour productivity. Since not only labour but a variety of other production factors contribute to output, measuring labour productivity provides only a partial picture of efficiency change. Efficiency measurement becomes more complete when based on *mfp*. Besides labour this measure takes into account the use of other production inputs such as capital, energy, materials, and services. The residual part of output change, which cannot be explained by changes in the use of these inputs, is called *mfp* change. *Mfp* change is greatly influenced by business cycle movements. Over a longer range of years *mfp* is an efficiency measure that indicates the innovative strength of an economy. Although on occasions multi-factor productivity change can be positive as well as negative, structurally negative *mfp* trends over longer time periods are quite rare.

The multi-factor productivity index is determined by dividing a volume index of the outputs (one industry branch can produce several types of products) by a volume index combining all inputs. In this publication two different models are applied to calculate *mfp* change. In the first model, capital (K), labour (L), energy (E), materials (M) and services (S) are used as inputs to produce consolidated (gross) output. This model results in the so-called *KLEMS mfp* estimate. Consolidation means that all intra-industry product deliveries are deducted from both gross output and intermediate consumption. In effect, the industry is described as being one single company. This consolidation assures that productivity change is independently determined from the way an industry is subdivided into industries, and thus only depends on the production process of the industry as a whole and not on the number of intra-industry deliveries.

In the second model, value-added is generated by using capital and labour. Value added roughly constitutes the return to labour and capital. By excluding intermediate consumption this more restricted model takes value added as the output measure. Unless stated otherwise, in the remainder of this publication productivity change refers to the development of *mfp* based on consolidated gross output.

The total volume index of all inputs of production is determined by weighing the volume indices of each input with their cost shares in the total (consolidated) production cost. The volume index of labour is based on hours worked by employees and self-employed persons. The cost of labour consists of the compensation of employees plus the imputed compensation for labour of the self-employed. The labour income of the self-employed cannot be measured directly since their mixed income not only consists of a compensation of the labour element, but also consists of a reward for capital input and an entrepreneurial income element. The productivity statistics are based on the assumption that in most industries the self-employed have the same yearly labour income as employees in the same industry, leading in practice for the self-employed to lower wage rates per hour worked. There are a few exceptions to this assumption. In the construction industry it is assumed that the self-employed have the same hourly income as employees and in some medical sectors a direct measure of the labour income of the self-employed is used based on a so-called standard income measure of these professions.

The volume index of the capital services of fixed assets is based on the volume change of the productive capital stock. This capital stock measure is corrected for efficiency losses due to ageing. Capital cost are determined by multiplying the quantity of assets, broken down by asset type and age, with the user cost per quantity of assets. The user cost represent all (imputed) cost to hold and use an asset in production for the period of one year. It contains the following elements: (imputed) interest (or rate of return) representing the opportunity cost of holding the asset, consumption of fixed capital, and holding gains and losses. An exogenous rate of return is used, based on the average interest rate on outstanding bonds. The applied rate of return is represented by the interbank interest rate supplemented by a constant risk premium. Conceptually, the user cost of an asset can best be compared with an asset's rental price.

The user cost of other types of capital inputs are estimated in a similar way. However, a number of different methods is applied for estimating the volume changes of other asset types. The volume changes of the capital services derived from subsoil assets are based on physical extraction levels. For inventories, the quantity levels of inventories by commodity are used. Volume changes of the use of land are derived from data on land surface area by type, corrected for quality (spatial) differences. Land underneath favourable locations has a relatively higher economic value. In the growth accounts, this land is therefore treated as land of higher quality than land in less favourable areas.

The Dutch growth accounts systematically quantify the contribution of individual inputs to output growth at industry branch level. The contribution of one particular input, say labour, to output growth is determined by examining how much output would have changed in the (hypothetical) situation that only labour input would have changed, keeping all other inputs and *mfp* constant. The contribution of labour is thus determined by multiplying the volume change of labour input with the share of labour in the total production cost. Subsequently, multi-factor productivity growth can be interpreted as that part of output growth that cannot be explained by any growth of inputs. As such, multi-factor productivity change is determined as a residual in the growth accounts and represents a change in the efficiency of existing production processes.

Statistics Netherlands publishes *mfp* statistics at the macro, meso, and micro level. Micro level analyses may help to investigate for example the enabling role of ICT investment in corporate innovation strategies. Furthermore, combining findings of micro and macro studies can be valuable in tracking down productivity developments in specific industries, or in analysing the effects of information technology or international competition on productivity. Usually, Statistics Netherlands presents such analyses at the micro and combined micro-macro level in separate publications.

This edition of *The Dutch growth accounts* presents the results of *mfp* measurement at the macro and industry level. The outcomes presented are fully consistent with the Dutch national accounts. However, the results may occasionally deviate from those released on behalf of EU-KLEMS (the international productivity database) due to requirements of international harmonisation on the latter.

The results presented in this publication still have an experimental status. The Dutch growth accounts are subject to ongoing developments. By now the accounts cover the most important types of capital, including fixed assets, subsoil assets, inventories, agricultural land, and land underlying dwellings and buildings. Recreational land and construction land are the most important types of capital that are not (yet) covered.

In addition, the subdivision of labour based on characteristics such as age and gender (as a proxy of working experience) and education level has not yet been introduced on a regular basis in the Dutch growth accounts. It is expected that these additions will follow in the near future. This implies that the results presented in this publication are likely to be further refined in the coming years.

In 2011, the National accounts of the Netherlands have changed the classification of industries into the new Standard industrial classification 2008 (SBI 2008). This code is based on the Statistical Classification of Economic Activities in the European Community (NACE Rev. 2) which is used in all Member States of the European Union. Annex 1 lists the new classification of industries according to SBI 2008 as introduced in the Dutch growth accounts.

The Dutch growth accounts use the concept of the commercial sector to aggregate industry-outcomes to a macro-economic total. The commercial sector covers the entire economy except the industry branches public administration and services; education; renting, buying, selling real estate; renting and leasing of tangible goods; and activities of households[1]. The main reason for excluding these economic activities is the absence of proper indicators for measuring their output volumes. These excluded industry branches are thus represented neither in the figures of the commercial sector nor in the figures of the industries government and care; business services; and culture, recreation, other services as presented here.

The demarcation of the commercial sector has slightly changed as a result of the new industry classification. In the previous editions of The Dutch growth accounts the commercial sector included the industry non-subsidised education. In SBI 2008, the activities of the industry non-subsidized education have been combined with the industry subsidized education. As a result, it is no longer possible to calculate productivity developments for non-subsidised education. In addition, the activities of real estate developers have now been combined with the construction industry. In the previous editions of the Dutch growth accounts these activities were part of the industry renting, buying and selling of real estate and were therefore not included in productivity figures of the commercial sector. As such, the results for the commercial sector in this edition are slightly different from those published in previous editions.

The complete outcomes of the Dutch growth accounts can be found on StatLine, the statistical database of Statistics Netherlands. For a more detailed methodological description we would like to refer to CBS (2010), CBS (2007 in Dutch)[2] and Van den Bergen et al. (2008).

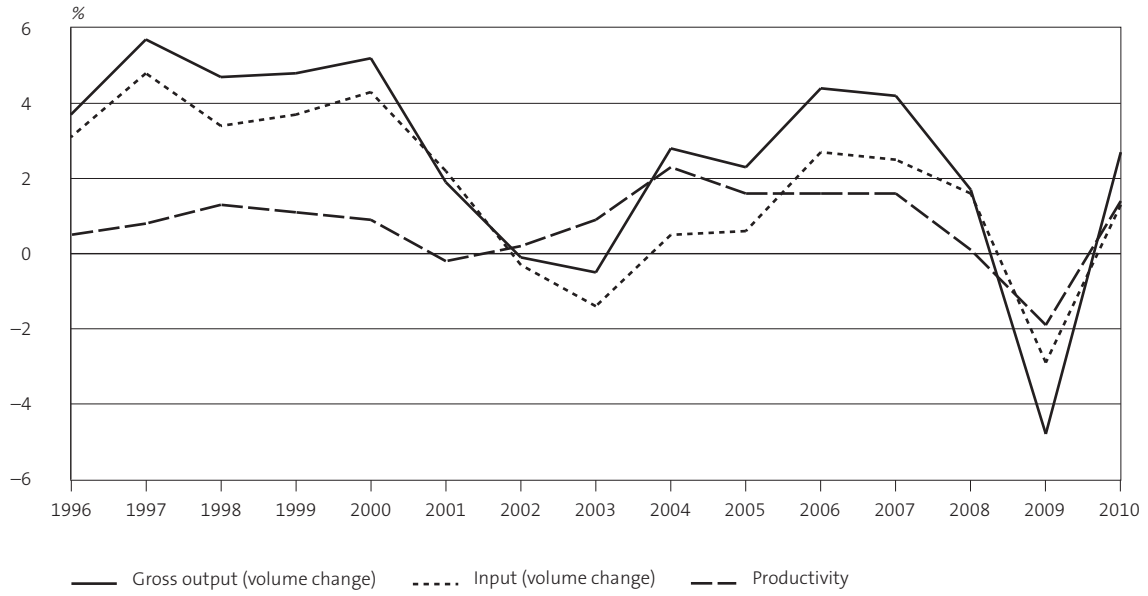
[1] The expression commercial sector is not entirely accurate as commercial activities do take place in the industry branches renting and leasing of tangible goods, activities of households and (in parts of) renting, buying, selling real estate. However, no other appropriate name exists for the part of the economy that is described here.

[2] An English translation of a more detailed description of the methods will be available in 2012.

2 Analysis of productivity growth

Gross output growth[3] in the commercial sector recovered from –4.8 percent in 2009 to 2.7 percent in 2010. The volume of all combined KLEMS inputs increased by 1.3 percent. Productivity therefore increased by 1.4 percent. This productivity rise follows a period of productivity stagnation in 2008 and a sharp productivity decrease of nearly 2 percent in 2009. Clearly, these shocks in output and productivity levels are the outcome of the financial crisis that started in 2008. Although 2010 seemed to be a year of recovery, the economic performance in 2011 is much less promising. The first three quarters in 2011 showed very low or even negative GDP growth rates.

2.1 Annual productivity change in the commercial sector



Source: Statistics Netherlands, national accounts.

Productivity growth can be interpreted as the residual part of output growth that cannot be explained by growth of inputs. As such, productivity growth represents a change in the efficiency of existing production processes. Productivity may change as a result of technological progress, economies of scale, capacity utilisation, and other factors that are not accounted for by input changes. Productivity growth can be seen as the engine for long-term economic growth, as the growth of production factors is often restricted.

The decline of productivity growth in 2008 and 2009 and the subsequent increase of productivity in 2010 are mainly cyclical. At the start of a recession productivity usually decreases as capital and labour inputs typically follow gross output changes with a delay (for example due to capital

[3] The growth accounts are based on consolidated gross output and intermediate use. This means that internal deliveries within an industry (or within the commercial sector) have been eliminated from gross output and intermediate use.

retention and labour hoarding). If an economic downturn continues, companies are forced to adjust their inputs accordingly to improve cash-flow positions and retain the profitability of their business. When the economy recovers companies are often still finalising the restructuring of their production processes, leading often to further lay-offs. As gross output rises at the start of an economic upswing and inputs further decline, productivity increases.

The average annual growth rate of productivity in the period 2002–2008 was 1.2 percent. Due to the economic crisis, the growth rates of productivity in 2008 (0.1 percent) and 2009 (–1.9 percent) were well below this longer term average. Labour input and capital input still increased in 2008 (with 2.0 percent and 3.0 percent, respectively) and slightly decreased in 2009 (with –1.6 percent and –0.3 percent, respectively). Apparently inputs were adjusted with a time lag to changes in gross output. As a result, capacity utilisation rates decreased during the economic crisis and productivity fell, creating a gap of more than 4 percentage points in 2009 with the growth path that would have been realised if the average annual productivity growth rate of 1.2 percent had been maintained. The productivity change of 1.4 percent in 2010 is only slightly larger than the average annual growth rate in previous years and therefore hardly makes up this gap. Productivity must grow annually with at least 2 percent in the next five years in order to fully catch up from the economic downturn.

Contributions to gross output

The growth accounts systematically attribute output growth to all production factors. Table 2.2 shows how labour, capital, intermediate consumption and productivity change contribute to gross output growth.

In the period 1996–2001, gross output increased considerably, with an annual average growth rate of 4.3 percent. This growth was primarily driven by an increased use of production factors. In the period 2002–2008, which encompasses a complete business cycle, average annual gross output growth decelerated to 2.1 percent. However, this output growth was to a much smaller extent driven by the increased use of production factors. More than half of gross output growth in this period is explained by productivity growth.

In 2010, productivity change added again greatly to gross output change. Labour input decreased by 1.0 percent, which resulted in a negative labour contribution to output of 0.5 percentage points. This decline in labour input in 2010 was not as strong as in 2009, and also relatively modest compared to the dip in gross output in 2009. Labour shortage in the period before the economic crisis and temporary 'part-time' unemployment benefit schemes by the Dutch government stimulated companies to retain most of their personnel.

Interestingly, in 2010 gross output recovered without extra labour input. This shows that increased demand could easily be met with the existing labour capacity. Apparently, companies retained more personnel than needed during the crisis. As a result, the average unemployment rate in the Netherlands in 2010 was 5.4 percent, which is only 0.6 percentage points higher than in 2009, and still more than 1 percentage point lower than in 2005, when the unemployment rate reached 6.5 percent.

Obviously, a major advantage of the relatively modest labour input adjustments during the last crisis is that unemployment increased only moderately and that companies could easily expand

production levels in 2010. As a downside, maintaining staff during the last crisis may have eroded the financial strength of companies. This may make the labour force more vulnerable to lay-offs in any next crisis.

2.2 Contributions to gross output volume change for the commercial sector

	1996/2001	2002/2008	2008	2009*	2010*
	percentage point				
Labour	1.1	0.2	0.9	–0.8	–0.5
Capital	0.8	0.2	0.5	0.0	0.3
Intermediate use	1.7	0.5	0.1	–2.1	1.5
energy	0.1	0.1	0.1	–0.1	0.3
materials	0.6	0.2	–0.4	–1.5	0.7
services	1.0	0.2	0.4	–0.5	0.4
Productivity	0.8	1.2	0.1	–1.8	1.4
	% volume change				
Gross output	4.3	2.1	1.7	–4.8	2.7

Source: Statistics Netherlands, national accounts.

In 2010, capital contributed with 0.3 percentage points to gross output change. Although total investments in fixed assets decreased by 4.4 percent, the user cost of capital still increased by 2.1 percent. The user cost of capital includes that of previous fixed asset investments, but also cost of non-produced assets such as land and mineral reserves. The positive contribution of capital to gross output change is mainly determined by a 12.5 percent rise in extraction levels of natural gas[4)] in 2010. Due to a relatively cold winter, the demand for gas used for heating went up considerably. As a result, more natural gas was extracted in the Netherlands. In contrast, passenger cars and other vehicles contributed negatively to capital input in 2010. As a result of the economic crisis, companies cut back their spending on passenger cars and trailer trucks.

Intermediate use had a contribution of 1.5 percentage points to gross output change in 2010. The increase of intermediate consumption by 4.4 percent outweighed the volume change of gross output. The use of energy inputs increased by 5.9 percent, material inputs by 5.3 percent, and service inputs by 3.0 percent. The increased use of gas and chemical products mainly determined the positive volume change of energy and materials. Overall, the largest economic recovery took place in industries (such as manufacturing) with a high share of intermediate use in total cost. As a result, in 2010 the efficiency of intermediate inputs decreased in the commercial sector as a whole.

Contributions to value added

As mentioned earlier, productivity can also be determined on the basis of value added as the measure of output. Whereas gross output based productivity takes all KLEMS inputs of the

4) In the Dutch growth accounts the use of natural oil and gas reserves and other subsoil assets is considered a capital input in the production process.

production process into account, value added based productivity is logically restricted to the components labour and capital. Value added based growth accounts particularly focus on how much the primary production factors in the economy, labour and capital, and productivity contribute to the generation of income.

Table 2.3 shows a breakdown of the volume change of value added into the contribution of hours worked and labour productivity for the commercial sector. The labour productivity index is calculated as the value added volume index divided by the volume index of labour input, measured by changes in hours worked. In the period 2002–2008, the annual volume growth of value added increased on average by 2.4 percent. The annual increase in hours worked was on average quite moderate: 0.4 percent. The increase of value added is therefore mainly determined by higher labour productivity, which increased by an average of 2.0 percent.
In a subsequent step, labour productivity can be broken down into two determinants: capital deepening and value-added based *mfp*[5]. This way of presenting clarifies to what extent an increase in labour productivity is explained either by augmented use of capital or by efficiency improvements. First, labour productivity increases when companies replace labour input by machinery or automated processes. This substitution of labour by capital is called capital deepening. It can be measured as the volume change of capital services per hour worked. Second, labour productivity can improve as a result of a more efficient production process, for example led by technological advancement. This part of labour productivity growth is mfp growth.

2.3 Contributions to value added volume change for the commercial sector

	1996/2001	2002/2008	2008	2009*	2010*
	% volume change				
Value added	4.0	2.4	2.3	–4.2	2.0
Hours worked	2.3	0.4	1.7	–1.8	–0.7
Labour productivity	1.6	2.0	0.6	–2.4	2.7
of which					
	percentage point				
Capital deepening	0.5	0.2	0.4	0.4	0.7
Multi-factor productivity [1]	1.1	1.8	0.2	–2.9	2.0

Source: Statistics Netherlands, national accounts

[1] The contribution of mfp to labour productivity is slightly different from the contribution of mfp to valued added growth due to the fact that hours worked of employees and self-employed receive similar weights here.

On average capital deepening in the Netherlands increased in the entire 1996–2010 period. This implies that capital input has been subject to higher growth rates than hours worked. However, the contribution of capital deepening to labour productivity varies considerably from one year to the next. Between 1996 and 2001, capital deepening explains 0.5 percentage points of labour productivity growth, whereas in the period 2002–2008 only 0.2 percentage points of

[5] Besides capital deepening and *mfp*, labour productivity can also be broken down into the contribution of labour characteristics such as education, age and gender. The subdivision of labour based on these characteristics is not yet available for the complete time-series in the Dutch growth accounts. Therefore, labour characteristics are not shown as a separate item and their contribution is included in *mfp*.

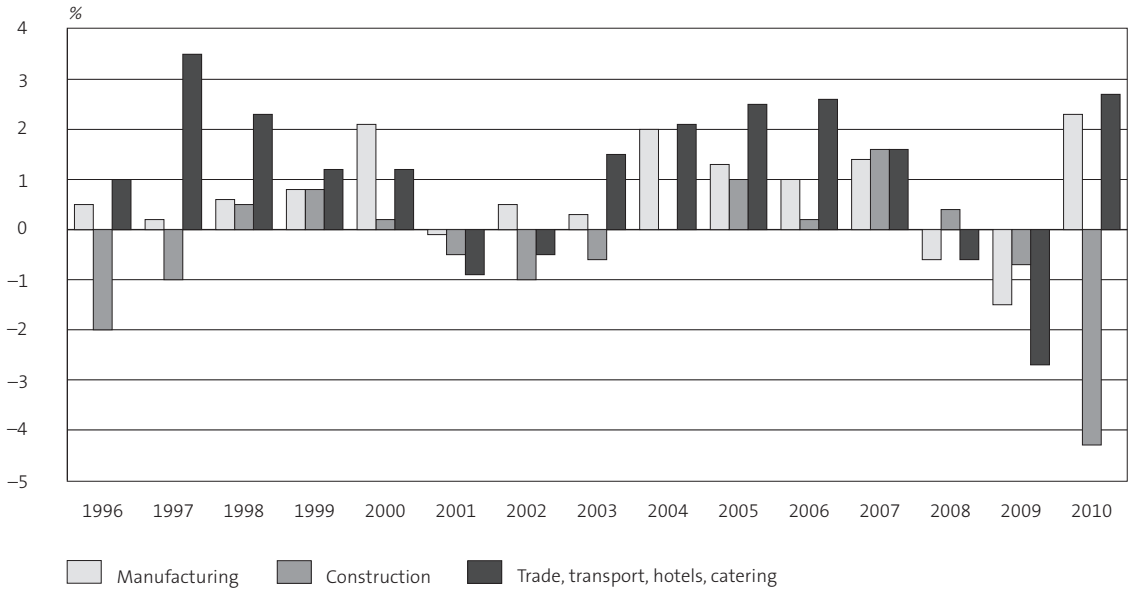
labour productivity growth originates from capital deepening. The late nineties, 2000 and 2001, the years preceding the dotcom crisis, were characterised by rapid capital expansion. The annual volume increase of capital input increased on average by 4.4 percent. In the same period, the annual labour volume increased only by an average of 2.3 percent. The strong growth of capital in these years is mainly explained by high ICT capital investments (computers and software). In the period 2002–2008, capital services grew annually by an average of 1.2 percent. This growth rate is more in line with that of hours worked. As a result, capital deepening was less significant in the period following the dotcom crisis.

In 2010, output growth was largely driven by multi-factor productivity growth. The increase of value added is completely determined by a more efficient use of the primary inputs. The reduction in hours worked of 0.7 percent is exactly offset by the volume change of capital services per hour worked. This means that without attracting more combined inputs, value added increased by 2 percent. Apparently, there was so much overcapacity after the economic crisis that output growth could easily be realised with existing capacity.

Performance of some industries

After a massive decline of gross output in 2009, the manufacturing industry made a strong come-back in 2010. Gross output increased by 6.4 percent. Productivity increased by 2.3 percent mainly because of further cutbacks in hours worked and a more efficient use of intermediate services. Within manufacturing, especially the manufacture of machinery, electric equipment and transport equipment has contributed to this productivity resurgence. Interestingly, the reduction of hours worked in 2010 was accompanied by a small increase of temporary staff hiring in manufacturing. Thus, manufacturing companies used more flexible labour input and produced more efficiently to answer increased demand.

2.4 Annual productivity change by industry



Source: Statistics Netherlands, national accounts.

In 2010, the construction industry was the worst performing industry with the largest decrease in gross output and productivity. After a decrease of almost 5 percent in 2009, gross output further declined by 11 percent in 2010. Productivity growth in construction has been weak for a long time, but reached an extreme low of –4.3 percent in 2010. The poor performance in this industry is a direct result of the extremely negative situation on the housing market and the market for commercial property. In addition, civil engineering also went down considerably in 2010, which reinforced the negative developments of gross output.

The sharp decrease in demand is taking its toll, as almost twice as many construction companies went bankrupt in 2010 than in 2008. The total number of hours worked decreased by almost 2 percent in 2009 and nearly 3 percent in 2010. Interestingly, in 2010 the hours worked of self-employed persons in the construction industry increased by 1 percent while the hours worked of employees decreased by 4.1 percent, bringing the share of self-employed in total hours worked to almost 30 percent. Since 1996, this share has increased by nearly 10 percentage points. Apparently, some employees who lost their jobs started their own company as a self-employed person in a time of great economic uncertainty.

In 2010, intermediate consumption in the construction industry fell by 11 percent, which corresponds with the decrease of gross output. Productivity in the construction industry slowed down significantly due to the relatively low decrease of labour input, and a small increase of capital input. Intermediate inputs had the largest share in input cost (over 50 percent). However, compensation of labour had the second most important share in input cost (over 40 percent). The strong decline in output that was not accompanied by a similar reduction of labour input had an adverse effect on productivity.

The industry trade, transport, hotels and catering had a strong productivity improvement in 2010. This industry faced the largest negative productivity change in 2009. International trade developments had a huge influence on the performance of this industry. In 2010, capital and labour only made a minor contribution to gross output growth. Intermediate use explained about one fifth of gross output change. The major part of gross output change was therefore accounted for by productivity growth.

3 Intellectual property in the Netherlands

Introduction

This chapter presents the extended Dutch growth accounts. In these accounts the capital component is expanded by a range of intellectual property asset categories that are beyond the scope of the System of National Accounts. The purpose of this extension is to enhance the analytical strength of the Dutch growth accounting framework, particularly in the area of the knowledge-based economy. In this way the growth accounts will provide relevant information regarding the 'Knowledge Investment Agenda' of the Netherlands. This agenda is a joint effort involving the Dutch government, employer organisations, and labour unions to enhance the knowledge orientation of the Dutch economy.

One of the main issues in measuring the knowledge-based economy is to identify capital related to intellectual property. Intellectual property includes items such as literary and artistic originals, inventions and scientific discoveries, industrial designs, trademarks and service marks. Ownership of this intellectual property may be enforced by copyright or patents. However, patents or copyrights are not a prerequisite for their recording in the national accounts or in this expanded growth accounting framework. A crucial precondition is whether the company is the economic owner receiving the current and future benefits from investments in intellectual property. This means an asset can be identified and accounted for even when its ownership is not legally enforced. Economic ownership may for example be secured by secrecy.

Market prices for intellectual property are not always available. Investments in intellectual property are often on own account. This means that their value cannot be obtained from market transactions and must therefore be valued as the sum of investment costs. This is based on the assumption that, overall, investment costs are a reasonable approximation of the current and future benefits received. In reality, however, investments in intellectual property are not without risks. Some investments may be very successful, while others may not. Nonetheless, on average, taking the sum of investment costs seems a reasonable assessment of intellectual property developed on own account.

The extended Dutch KLEMS-based growth accounts include the following intellectual property categories:

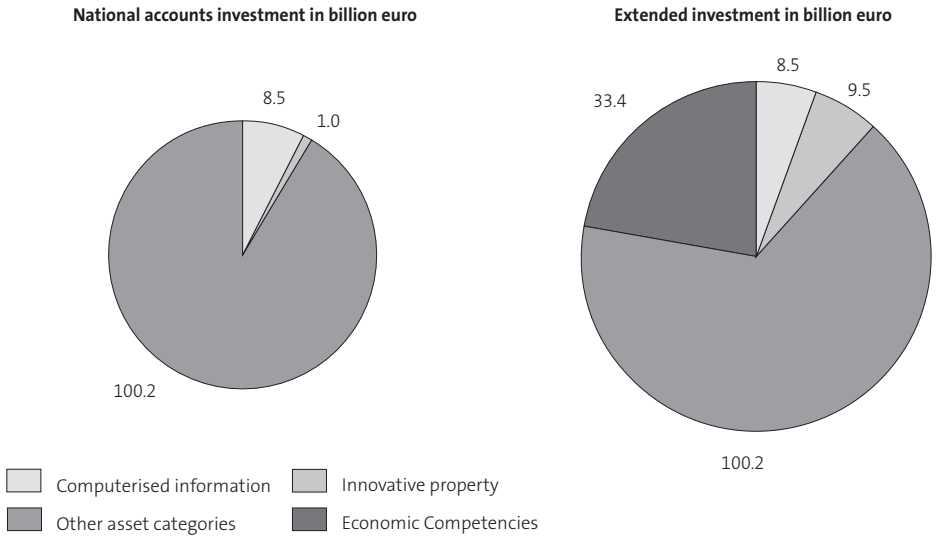
1. Computerised information
2. Innovative property
   a. R&D*
   b. Mineral exploration
   c. Other innovative property*
3. Economic competencies
   a. Brand equity*
   b. Firm-specific human capital*
   c. Organisational structure*.

These categories are derived from those proposed by Corrado, Hulten and Sichel (CHS) (2004, 2005 and 2006). Intellectual property categories indicated with an asterisk are (partly) beyond the capital boundary of the standard Dutch national accounts. According to the new international guidelines for national accounts (SNA 2008), expenditure on R&D will no longer be recorded as current costs but as investment instead. However, this change has not yet been adopted in the Dutch national accounts.

The effects of this broader capital concept are highlighted in figure 3.1. Gross fixed capital formation in the extended growth accounts framework is upwardly adjusted by 41.9 billion euro to 152 billion euro compared to the standard national accounts. In the latter, all expenditure on economic competencies is recorded as current costs of production. In the extended growth accounts part of these expenditures are considered as investment as they are expected to improve competencies of firms over the years. R&D expenditure represents another significant part of this upward adjustment of investment.

The standard national accounts provide a prudent, but also a somewhat conservative, picture of investment in intellectual property by showing a total share of intellectual property in total investment of close to 9 percent. This picture changes substantially when taking into consideration investment in R&D and in economic competencies. Consequently the share of intellectual property in total investment is upwardly adjusted to almost 34 percent.

3.1 Investment according to international guidelines and extended growth accounting framework, 2010



Source: Statistics Netherlands, national accounts.

Macro trends

The economic recession in 2008 caused a downturn of investment in intellectual property. Adjusted for price changes, investment in intellectual property dropped by more than 6 percent in 2009 and remained unchanged in 2010. The poor performance of intellectual property

investment over the last two years is, however, less dramatic than that of total investment, which shrunk by almost 15 percent. Looking at a wider range of years, one may conclude that investment in intellectual property is generally less influenced by business cycles than other types of investment.

Table 3.2 shows that most components of intellectual property have slowly declining investment trends in recent years. The gradually declining GDP shares of intellectual property investments, suggest that the Dutch economy is becoming less knowledge oriented. GDP shares of both innovative property and economic competencies show a gradual decline since 2000. Only computerised information (i.e. software) displays a rather stable trend of investment levels compared to GDP. Of all intellectual property investments only software investments kept up with GDP-growth.

3.2 Gross fixed capital formation in the Netherlands based on the extended definition

	1990	1995	2000	2003	2007	2008	2009*	2010*
	billion euro							
Dwellings, buildings and infrastructure	29.2	34.4	49.6	53.3	66.4	70.3	66.0	59.3
Transport equipment	6.5	7.4	9.9	10.3	11.8	12.7	10.2	10.2
Machinery	10.6	12.0	14.8	12.7	15.8	17.2	15.4	16.6
Computers	2.4	2.7	4.3	4.3	4.9	4.6	4.7	5.9
Other tangible assets	3.3	3.4	5.3	5.4	6.9	7.5	6.6	6.8
Cultivated assets (e.g. trees and livestock)	0.4	0.4	0.4	0.3	0.4	0.4	0.4	0.4
Transfer costs of ground	0.6	0.8	1.4	1.0	1.7	1.3	1.1	1.2
Total investment in intellectual property	21.0	26.3	41.3	44.6	50.8	54.0	51.3	51.3
Computerised information	2.1	2.3	6.1	6.1	8.3	9.1	8.6	8.5
Innovative property	5.6	6.0	8.1	9.0	9.7	10.3	9.3	9.5
R&D	2.8	3.3	4.2	4.8	5.5	5.0	4.8	5.1
Mineral exploration	0.5	0.2	0.2	0.2	0.2	0.3	0.3	0.3
Other innovative property	2.3	2.5	3.7	4.0	4.0	5.1	4.2	4.2
Economic competencies	13.3	18.0	27.0	29.4	32.8	34.6	33.5	33.4
Brand equity	5.5	7.2	10.8	11.3	12.5	12.8	12.1	12.3
Firm-specific human capital	2.6	4.2	5.2	5.9	6.5	6.8	6.7	6.7
Organisational structure	5.2	6.7	11.0	12.3	13.8	14.9	14.7	14.3
Total (extended) gross fixed capital formation	74.0	87.5	126.8	132.0	158.7	167.8	155.6	151.6
	percent of GDP							
Computerised information	0.8	0.7	1.5	1.3	1.5	1.5	1.5	1.4
Innovative property	2.3	2.0	1.9	1.9	1.7	1.7	1.6	1.6
R&D	1.2	1.1	1.0	1.0	1.0	0.8	0.8	0.9
Mineral exploration	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Other innovative property	0.9	0.8	0.9	0.8	0.7	0.9	0.7	0.7
Economic competencies	5.5	5.9	6.5	6.2	5.7	5.8	5.9	5.7
Brand equity	2.3	2.4	2.6	2.4	2.2	2.2	2.1	2.1
Firm-specific human capital	1.0	1.4	1.2	1.2	1.1	1.1	1.2	1.1
Organisational structure	2.1	2.2	2.6	2.6	2.4	2.5	2.6	2.4
Total investment in intellectual property	8.6	8.6	9.9	9.3	8.9	9.1	9.0	8.7
	percent of other fixed assets							
Total investment in intellectual property	39.6	43.0	48.2	51.0	47.1	47.4	49.2	51.2

Source: Statistics Netherlands, national accounts.

Table 3.3 shows the average annual growth rates in the periods 1992–2001 and 2002–2010. In the first period, gross fixed capital formation in intellectual property for the commercial sector was very high (4.6 percent) and even surpassed the equally substantial average annual volume growth of GDP (3.1 percent) and that of other fixed assets (3.6 percent)[6]. Quite remarkably, this performance was not continued in the second period. In recent years, average annual volume growth of GDP has been substantially lower while investment in intellectual property has even decreased by 0.7 percent. Other fixed assets remained unchanged in this period. Substantial investment growth in the period 1992–2001 was led by great investments in computer software. In more recent years, investment in software has decelerated to a more modest yearly average growth of almost 1.1 percent. Also investment in other categories of intellectual property such as R&D, brand equity, firm-specific human capital and organisational structures were subject to substantially lower growth rates in recent years.

In the 1996–2001 period the annual average contribution of intellectual property to output growth was 0.4 percent. After 2001, this expansion of intellectual capital was interrupted, leading to a zero contribution to output growth. This development is not very promising given that building up intellectual property is generally considered an important prerequisite for an economy's innovative capacity, and therefore its future growth potential.

3.3 Investment for the commercial sector and GDP, average changes in two periods

	1992/2001	2002/2010*
	% volume changes	
Investment in intellectual property	4.6	–0.7
Software	12.3	1.1
R&D, including social sciences and humanities	1.9	–1.4
Mineral exploration and evaluation	–8.6	–3.1
Other innovative property	–1.7	2,8
Brand equity	4.3	–1.1
Firm-specific human capital	4.5	–0.5
Organisational structure	5.1	–1.1
Investment in other fixed assets	3.6	0.0
Gross domestic product (market prices)	3.1	1.3

Source: Statistics Netherlands, national accounts.

Industry trends

The largest investors in intellectual property are the business services industry, the industry trade, transport, hotels, catering, and the manufacturing industry. In 2008[7], these industries accounted for almost 65 percent of total investment in intellectual property in the commercial sector. In the business services industry, intellectual property investment accounted for more

[6] For analytical purposes it is better to compare two complete business cycles, namely 1992-2001 and 2002-2008. However, comparing business cycles instead of the periods shown in table 3.3 does not change the findings as presented in this publication significantly.
[7] Data on industry branches are available from 1987 to 2008 inclusive, while data on the years 2009 and 2010 are only available for the total economy.

than 80 percent of total investment. For the total commercial sector, this percentage is on average about 50 percent.

The largest share of intellectual property in the business services industry consists of investment in economic competencies, the largest intellectual property category. Another industry that invests substantially in economic competencies is the trade, transport, hotels, and catering industry. Together these two industries make up almost 56 percent of investment in economic competencies. While in 2008 the volume growth of investment in economic competencies was positive for both industries (4.9 and 2.6 percent, respectively), their average investment growth in the period 2002–2008 was around zero. The third largest investor in economic competencies, the manufacturing industry, even showed negative investment trends (on average –2.4 percent in the period 2002–2008). Preliminary estimates for 2009 and 2010 also show negative volume growth rates for total investments in economic competencies.

The manufacturing industry is the main investor in innovative property. After an increase of 8.2 percent in 2007, investment in innovative property, measured in volume terms, fell by more than 11 percent in 2008. On average, investment in innovative property shrunk by almost 2 percent a year in volume during the period 2002–2008. Preliminary estimates for 2010 show a slight recovery.

Investment in software is mainly driven by the following industries: financial institutions; manufacturing; information and communication; and trade, transport, hotels, catering. In all these industries, software investments increased on average more than 2 percent a year during the period 2002–2008.

In 2008, both economic competencies and software saw the highest volume growth since 2000. However, preliminary estimates indicate that these growth rates will be negative in 2009 and 2010 for most industries as a result of the worldwide economic crisis.

The Netherlands in an international context

Measuring intellectual property is a relatively new field of research. Although Corrado, Hulten and Sichel (2004, 2005 and 2006) provided a broadly-accepted framework for intellectual property measurement, this method is still evolving and relatively new for most countries. An international comparison of intellectual property estimates for the year 2006 was presented in the *Dutch growth accounts 2009*. At present, data is not available for more recent years. However, the World Intellectual Property Organization (WIPO) collects statistical information on intellectual property indicators, which are indicative for developments in intellectual property investment. Two of the most relevant indicators in this regard are patent and trademark applications data.

To obtain an impression of the performance of the Netherlands with respect to intellectual property investments, an international comparison was carried out using WIPO data (WIPO, 2011) on patent and trademark applications. Patent applications are considered a good approximation for R&D-output while trademark applications are assumed to be representative for the building up of brand equity. The increase in patenting is a sign of accelerated technological progress that may lead to greater economic output and prosperity. It is also a sign of increased international commerce, leading to the urge to protect knowledge assets. The WIPO report also

mentions patent grants and trademark registrations. Patent or trademark applications are requests for patents and trademarks submitted by companies to patent offices. Patent grants and trademark registrations relate to patents and trademarks that are approved and provided to companies by patent offices.

There are different non-economic reasons for the increase and decrease of patent grants and trademark registrations. For example, in some years patent agencies have attracted more personnel to make up their arrears in granting or registering patents and trademarks. Therefore, patent and trademark applications are more suitable when examining economic trends.

According to data of the World Intellectual Property Organization the number of worldwide patent applications increased by 7.2 percent in 2010 after a decline of 3.6 percent in 2009. In terms of country of origin, the Netherlands is one of the few countries in which recovery in patent applications did not take place in 2010. In fact, the performance of the Netherlands in the period 2006–2010 was relatively poor: the average decrease in patent applications of the Netherlands in other countries was 3.8 percent[8)], while in the same period patent applications abroad increased in Germany (1.7 percent), United Kingdom (2.6 percent) and France (4.5 percent). It is likely that, due to the openness of the Dutch economy, the worldwide economic downturn had a larger negative effect on patent applications in the Netherlands. The adverse economic conditions also had a negative impact on the growth rate of R&D expenditure during the past few years. As a percentage of GDP, R&D spending has decreased since 1999. However, there was a positive change in the R&D-to-GDP ratio in the extended growth accounts in 2010. R&D spending is measured at the moment costs occur, whereas the patent application takes place at the end of an R&D project. Given this time lag, some improvement in patent applications in 2011 is expected.

Although patent applications are increasing worldwide, the number of first patent applications as a percentage of a money unit of R&D expenditure corrected for price changes, the so-called R&D-productivity, has generally declined since 2001[9)]. The Netherlands is one of a few countries for which the contrary is true. That means that business sector R&D spending has grown at a slower rate than first patent applications. An important reason for increased R&D-productivity is that in one of the main R&D specialisation areas in the Netherlands, audio visual technology, technological advancement is continuously increasing. Products increasingly consist of more separately patentable parts, leading to more patent applications. In addition, several Dutch industries invest largely in R&D applied to product innovations abroad. There seems to be a growing incentive to protect knowledge property by way of patenting. Apparently, besides innovative activity levels, other factors such as changing product technologies and increased focus on foreign markets also influence patenting behaviour.

The number of worldwide trademark applications increased by 11.8 percent in 2010 after a decrease of 2.6 percent in 2009. When considering trademark applications by origin, the Netherlands showed a positive annual growth of 10.8 percent in 2010. In 2008 and 2009, there was a negative growth of 8 and 14 percent, respectively. The main cause for this decline was the

8) Data on total patent applications, as given in the WIPO report, are not up-to-date for the Netherlands. Therefore, patent applications of the Netherlands in other countries (also called patent applications abroad), which are a large part of total patent applications, are used here.

9) R&D-productivity is defined as the number of first patent applications as a percentage of a money unit of R&D expenditure corrected for price changes. First patent applications may consist of domestic applications or applications in other countries, depending on the patenting behaviour of the country in question. In the Netherlands, first patents in most cases refer to applications in other countries.

worldwide economic downturn. Although the WIPO 2011 data differ in concept from the brand equity growth estimates in the extended Dutch growth accounts, the WIPO data still provide a rough indication of the knowledge orientation of the Netherlands in contrast to other economies.

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Annex 1. Classification of industries in the growth accounts

A 1.1

SBI 2008	Description
A	Agriculture, forestry and fishing
B–E	Industry (no construction), energy
B	Mining and quarrying
C	Manufacturing
10–12	Manufacture of food and beverages
13–15	Man. of textile-, leatherproducts
16–18	Man. of paper-, wood prod.,print.
19	Manufacture of coke and petroleum
20	Manufacture of chemicals
21	Manufacture of pharmaceuticals
22–23	Man. of plastic and building mat.
24–25	Man. of basic metals and -products
26	Manufacture of electronic products
27	Manufacture of electric equipment
28	Manufacture of machinery n.e.c.
29–30	Transport equipment
31–33	Other manufacturing and repair
D	Electricity and gas supply
E	Water supply and waste management
F	Construction
G–I	Trade, transport, hotels, catering
G	Wholesale and retail trade
H	Transportation and storage
I	Accommodation and food serving
J	Information and communication
58–60	Publishing, movie, radio and tv
61	Telecommunications
62–63	IT- and information services
K	Financial institutions
L	Renting, buying, selling real estate
M–N	Business services
69–71	Management, technical consultancy
72	Research and development
73–75	Advertising, design and other
77	Renting and leasing of tangible goods
78–82	Other business support
O–Q	Government and care
O	Public administration and services
P	Education
86	Human health activities
87–88	Care and social work
R–U	Culture, recreation, other services
R	Culture, sports and recreation
S	Other service activities
T	Activities of households
U	Extraterritorial
A–K; 69–75; 78–82; 86–88; R–S	Commercial sector