Danmarks Nationalbank

Monetary Review 4th Quarter Part 2

2010

DANMARKS NATIONALBANK 2011

4

MONETARY REVIEW 4th QUARTER 2011, Part 2

The small picture on the front cover shows the "Banker's" clock, which was designed by Arne Jacobsen for the Danmarks Nationalbank building.

The Monetary Review is available on Danmarks Nationalbank's website:
www.nationalbanken.dk under publications.

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This edition closed for contributions on 9 December 2011.

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Rosendahls - Schultz Grafisk A/S
ISSN 0011-6149
(Online) ISSN 1398-3865

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Tools for Cyclical Assessment

Esben Hvid Jørgensen, Peter Ejler Storgaard and Jonas Sørensen, Economics

1. INTRODUCTION AND SUMMARY

Up-to-date knowledge about the current cyclical position is a key element in assessing the state of the economy and in economic-policy planning. In the event of an economic slowdown, with lower output growth and higher unemployment, it may be necessary to ease economic policy in order to stabilise the economy, provided that the necessary scope exists. Conversely, if there are indications of excessive pressure on the production resources, entailing a risk of unsustainable wage and price inflation, it may be necessary to tighten economic policy. In both cases a precise picture of the current cyclical position is called for as the basis for possible stabilisation-policy initiatives. This applies especially in connection with strong cyclical reversals, such as after the financial crisis, when major economic-policy measures need to be considered.

Much time is invested in producing an accurate description of the current cyclical position in connection with the preparation of multi-annual economic forecasts. In simplified terms, we need to know where we are before we know where we will go. This includes an assessment of the capacity pressures in the economy. Is there, for example, a labour shortage, and is the production capacity of firms ample or under pressure? In addition, an analysis of the momentum or driving forces of the economy is also needed, for instance growth abroad boosting exports and hence output and employment.

Cyclical assessments may draw on quite extensive statistics, although some economic statistics are available only with a certain time lag. A case in point is the national accounts, as the first version is released around 60 days after the reference quarter. Economic statistics on a monthly basis can be used to draw an earlier, but obviously less complete picture.

The NARES model is a key element of Danmarks Nationalbank's conjunctural analysis. The purpose of this model, which is described in detail in this article, is to summarise economic statistics in a consistent manner.

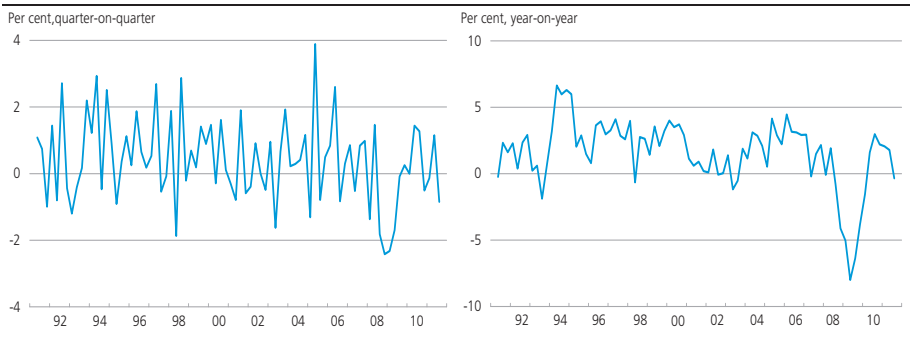
The NARES results provide the foundation for assessing the current economic situation. Moreover, the model also proved its worth when, during the financial crisis in 2009, Statistics Denmark postponed the release of the first version of the quarterly national accounts from 60 to 90 days after the reference quarter. The reason was that the deadline for VAT payments from firms was extended, and VAT data is a central source of input for the quarterly national accounts. At the time there was strong demand for updated assessments of the current economic development, not least for economic policy planning, and models such as NARES were particularly useful in that situation.

The available information about macroeconomic developments range from actual statistics on economic activity, such as the retail sales index, over payment data, e.g. Dankort payments, to sentiment indicators, e.g. the consumer confidence indicator. To this should be added statistics on price and wage developments, interest rates, stock prices and exchange rates, etc.

The focus is often on growth in the gross domestic product, GDP, as a key economic indicator summarising current cyclical developments in one figure, cf. Chart 1.1. Despite quarterly fluctuations, this indicator shows cyclical upturns and downturns, e.g. the weak years immediately after the millennium, the subsequent upswing and the dive in connection with the financial crisis. Besides GDP estimates, other parameters that may be interesting to monitor are e.g. the components of aggregate demand: private and public consumption, investment and exports. Another useful breakdown is to view output by industry.

The necessary extent and degree of detail in a cyclical assessment naturally depend on its purpose. If, for example, the analysis is to be used as the basis for a projection, statistics throwing light on all aspects of the economic situation are called for, corresponding to the quarterly nation-

GDP GROWTH Chart 1.1



Source: Statistics Denmark.

al accounts. Since the analysis is most often summarised as estimates of one or more target variables, it is also relevant to consider whether the estimates should be point estimates or probability distributions.

The analyses in this article show that NARES contains suitable indicators of the most central elements of the national accounts. Consequently, it is possible to produce approximate national accounts on the basis of economic statistics. The positive results are consistent with the experience from regular use of the model at Danmarks Nationalbank.

The article presents a number of other model approaches as alternatives to NARES, and a Real-Time Forecasting System, RTFS, is constructed for estimation of quarterly GDP growth. This model is compared with a technical application of the NARES model and the first preliminary version of the national accounts. A comparison of the three estimates with the final national accounts shows that the smallest deviations are found in the preliminary national accounts, while the greatest are found in NARES. In practice, NARES is not used in this technical manner. Instead, the model's estimates are used as the basis for assessing the components of the national accounts at a detailed level. Overall, the NARES model is regarded as a useful tool for assessments of the current state of the economy and economic projections. At the same time, the NARES results provide a foundation for insight into and analysis of the quarterly national accounts from Statistics Denmark.

Section 2 of this article describes the general principles of Danmarks Nationalbank's NARES system for summarising economic statistics as quarterly national accounts. Section 3 reviews the indicators used for calculating the key national accounts figures and analyses the consistency with Statistics Denmark's official national accounts. Section 4 presents a number of alternative models developed for the purpose of throwing light on the cyclical position on the basis of available statistics. One of these models is used in section 5 to construct an alternative estimate of quarterly GDP growth in Denmark. Section 6 compares the growth estimates produced by this alternative model, the NARES model and the first preliminary version of the national accounts with the final quarterly national accounts.

2. NARES

NARES is a system for constructing indicator-based national accounts. One of NARES's most important objectives is to provide earlier estimates than the official quarterly national accounts from Statistics Denmark. NARES is used at Danmarks Nationalbank in connection with cyclical assessments and as a basis for forecasting.

The original purpose of NARES was to provide quarterly national accounts that were consistent with the national accounts from Statistics Denmark, which were then available only on an annual basis, cf. Christensen (1989). In addition to being used for an overall assessment of the current cyclical position and the economic outlook, the NARES calculations were also used in the preliminary work on MONA, cf. Danmarks Nationalbank (2003). Since Statistics Denmark began to release quarterly national accounts, they have been used in the modelling work.

The statistical information about developments in a given quarter is regularly increased, so it is important to specify when an estimate is made. An assessment of the current cyclical position could, for example, mean the development in the current quarter. But an assessment of the development in the preceding quarter and the coming quarter could also be relevant. Estimates of the current quarter are often called "nowcasts", while estimates of the preceding and coming quarters are called "backcasts" and "forecasts", respectively. NARES is normally used for backcasting, but can also be used for nowcasting.

One of the basic principles of NARES is that it uses only "hard" indicators, i.e. statistics on economic activity. Examples are retail sales and turnover in manufacturing. Thus, the model does not include confidence indicators such as consumer and business confidence indicators, which are based on households' and firms' qualitative *assessments* of their finances.

The absence of estimated relations is another fundamental principle. Instead, indicators are aggregated to produce a national accounts figure based on each indicator's share of the national accounts variable. For example, retail sales are included in the calculation of private consumption with the weight attributed to consumption of retail goods in total private consumption, and household purchases of vehicles are included with the weight attributed to vehicle consumption in total private consumption.

A general problem in the calculation of estimates for the most recently completed quarter is that observations are missing for one or more indicators due to the time lags between the period under review and the publication of the statistics. In NARES, this is overcome by applying a technical projection e.g. based on growth in the most recent quarters. If other information is available, an alternative estimate of the missing observation may be entered manually. The earlier the NARES calculation is performed, the greater the problem of missing data obviously is. This applies especially if the system is used for nowcasting the current quarter.

The choice of scope and degree of detail in NARES should be viewed, inter alia, in the context of the MONA model used for forecasting in Danmarks Nationalbank. The trade-off between the degree of detail and the complexity of a model depends on what is needed and not on a fixed template. It is by no means given beforehand that the choice will be the same for a model for assessment of recent developments, such as NARES, and for a projection model like MONA. But the advantage of coordinating the two models is that the NARES estimate for the most recent quarter can be used as the basis for projections in MONA if the quarter is not yet covered by the quarterly national accounts prepared by Statistics Denmark.

In the practical application of NARES, the focus is on developments in the most recent quarter. The quarterly national accounts are used to the extent that they are available, and the national accounts are projected by one quarter based on the growth in the NARES indicators. Consequently, any differences in levels between the indicators and the equivalent national accounts figures are not essential when it comes to the usefulness of the NARES model.

NARES contains indicators of the demand components of the national accounts, including e.g. consumption and investment. Total output, GDP, is then calculated based on the supply-demand balance, i.e. as the difference between demand and imports. No GDP indicator is calculated from the supply side. The NARES presentation of output on the demand side deviates from the approach of the quarterly national accounts, where GDP is calculated on the basis of indicators on the supply side.

In NARES, the domestic sector is divided into a public and a private section. As regards income and net lending, this division is not applied in the first version of the quarterly national accounts. On the basis of direct and indirect taxes paid, among other things, NARES presents indicators of payments between the private and the public sectors to provide for such division.

The focus in NARES is on seasonally adjusted values. Many indicators show clear seasonal variation; retail sales, for instance, are considerably higher in December than in any other month of the year. That is why the indicators are subject to seasonal adjustment before the actual NARES calculation where the indicators are aggregated to national accounts level.

Basically, the aim is to develop indicators in volume terms, and the NARES calculation in value terms is typically achieved by inflating the volume by a suitable price index. As an example, the volume index of retail sales is included in the indicator of private consumption in volume terms. The value of private consumption is then calculated by inflating

the volume by the consumer price index. In other cases, e.g. for exports and imports, the current statistics are available in value terms only. Volumes are then obtained by deflating by a relevant price index. Also for the price indexes, the level of aggregation is often considerably higher than the level applied in Statistics Denmark's national accounts. This could lead to bias in connection with changes in weights.

In NARES, the aim is for the volume indicators to match the chained values in the national accounts.[1] For aggregation, the chain formula is used, weighting the quantities with the prices applicable in the previous year. The prices applicable in the previous year are sourced from Statistics Denmark's national accounts. Normally, missing data will not give rise to problems when NARES is used solely for calculation on the most recent completed quarter, since prices from the previous year will be available when estimates for the first quarter of a new year are to be calculated.

NARES is a dynamic system, in the sense that it is subject to ongoing adjustment, e.g. when new statistics are released. A case in point is that the use of the statistics of firms' purchases and sales has increased after the change from a quarterly to a monthly frequency. To this should be added the work of developing and improving the model.

3. INDICATORS IN NARES

This section describes the building blocks of NARES, particularly the main components of the supply-demand balance.

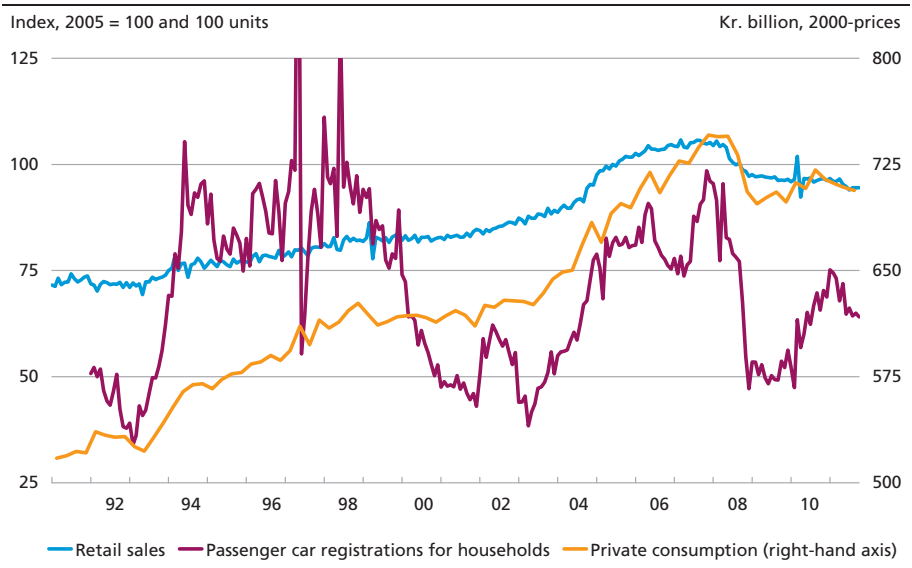
Private consumption

The value of private consumption is roughly equivalent to half of GDP in Denmark. Hence, it plays a key role in analysing the current state of the economy and the economic outlook. Services account for around half of private household consumption, while the remainder is made up of consumption of goods, which is generally well covered by indicators. The retail sales index, new motor vehicle registrations for households and energy supply items have almost identical counterparts in the breakdown of consumption in the national accounts.

The slowdown in 2008-09, which also affected private consumption, was evident in both retail sales and household purchases of vehicles, cf. Chart 3.1. Purchases of vehicles showed a similar pattern in connection with the economic slowdown around the millennium rollover. But the

[1] Chained values mean a calculation in volume terms for which the weighting basis rests on the prices of the previous year.

RETAIL SALES, PURCHASES OF VEHICLES AND PRIVATE CONSUMPTION Chart 3.1



Note: Seasonally adjusted figures. The number of new passenger car registrations for households was 18,535 in May 1997 and 13,366 in June 1998. New registrations in the two months are not indicated in the chart.
Source: Statistics Denmark.

drop in retail sales was unusual. While purchases of vehicles have increased since then, retail sales have remained almost unchanged since the beginning of 2009.

The indicator coverage in NARES of household services consumption, of which housing accounts for just over 40 per cent, is less extensive, although more indicators have been included in the latest version of the model. For instance, parts of the consumption of services are now sourced from VAT statistics, including catering. But some of these indicators are also affected by firms' consumption of goods and services. This presents a potential problem in the event of diverging developments in the consumption of households and firms, respectively.

The sub-components of total private household consumption are aggregated on the basis of fixed weights reflecting the value of the consumption components in 2000, cf. Table 3.1.

The indicators are very different, covering consumption of both goods and services. They have been selected primarily using an empirical criterion, and, generally, an indicator is only included if it improves the estimate of the actual consumption component relative to a simple technical projection. For parts of the consumption of services, no sufficiently good indicators are available, so they are subject to technical projection. Non-residents' consumption in Denmark is subtracted from the estimate of consumption in Denmark, while Danish residents' con-

PRIVATE CONSUMPTION INDICATOR — Table 3.1

Indicator	Value in 2000, kr. billion	Covered by indicator
Retail sales	221.7	Yes
Electricity consumption	14.7	Yes
Heating consumption (degree days)	21.8	Yes
Fuels and lubricants	18.2	Yes
Purchase of vehicles	26.6	Yes
Maintenance and repairs of motor vehicles	14.2	Yes
Catering	27.7	Yes
Accommodation services	3.4	Yes
Post and telecommunications	11.9	Yes
Car rental, etc.	7.0	Yes
Hairdressing salons, etc.	5.8	Yes
Package holidays	5.7	Yes
Housing	125.5	Yes
Other services	114.4	No
Non-residents' consumption in Denmark	-30.3	Yes
Danish residents' consumption abroad	29.0	Yes

Note: If an item is not covered by an indicator, a technical projection has been applied.
Source: Statistics Denmark and own calculations.

sumption in the rest of the world is added. The result is the indicator of Danish residents' total private consumption. The individual indicators are described in more detail in Box 3.1.

INDICATORS FOR THE COMPONENTS OF PRIVATE CONSUMPTION — Box 3.1

Retail sales

Retail sales consist of food and other everyday commodities, clothing, etc. The consumption of these goods accounts for the major share of the consumption of goods. The indicator applied is Statistics Denmark's volume index of retail sales, which is released monthly. Retail sales accounted for just over 35 per cent of private household consumption in 2000.

Electricity consumption

The applied electricity consumption indicator is the monthly statistics of the Danish Energy Agency on electricity supply in Denmark. These monthly statistics are calculated as the net production at Danish plants, including wind power and hydropower, less net exports of electricity and losses. Electricity consumption accounted for just over 2 per cent of private household consumption in 2000.

Heating consumption (degree days)

NARES applies the number of shadow degree days[1] as an indicator of the consumption groups of gas, liquid fuels and district heating, etc. in the national accounts. This number is published in monthly reports from the Danish Meteorological Institute. The concept is that since these consumption groups are primarily associated with heating of homes, they are closely correlated with outdoor temperatures – measured here as the sum of shadow degree days. Part of the energy consumption does not

CONTINUED Box 3.1

depend on outdoor temperatures. This applies to e.g. consumption for heating water, cooking, etc. This is taken into account by adding a constant to the number of degree days in each period. The national accounts consumption groups of gas, liquid fuels and district heating, etc. made up approximately 3.5 per cent of private consumption in 2000.

Fuels and lubricants

The NARES indicator of fuels and lubricants is the Danish Energy Agency's monthly statistics of sales of engine fuels. This item accounted for just under 3 per cent of private household consumption in 2000.

Purchases of vehicles

The indicator of purchases of vehicles is the number of new motor vehicle registrations for households and a share of new registrations for business purposes. A share of new registrations for business purposes is included because household purchases of vehicles from the corporate sector are also included in private consumption. The number of new registrations is published monthly by Statistics Denmark. New registrations are closely correlated with purchases of vehicles in the national accounts, although the number of new registrations does not take into account e.g. the composition of purchases of vehicles, including vehicle size. Purchases of vehicles totalled just over 4 per cent of private household consumption in 2000.

Maintenance and repairs of motor vehicles

The applied indicator of maintenance and repairs of motor vehicles is the Danish Road Directorate's traffic indicator of the number of kilometres travelled on Danish roads. The idea is that the number of kilometres travelled entails some wear and tear on the vehicle fleet, resulting in repairs. This indicator is also used in the quarterly national accounts, cf. Graversen et al. (2008).

Car rental, etc.

The source of car rental, etc. is Statistics Denmark's statistics of firms' domestic sales, also called VAT statistics. NARES uses the sum of sales under *Rental and leasing of cars and light motor vehicles* and *Driving schools* deflated by the relevant item from the consumer price index. Car rental, etc. accounted for just over 1 per cent of private household consumption in 2000.

Catering

The NARES indicator of catering in the national accounts is domestic sales in restaurants, deflated by the corresponding price index from the consumer price index. This item made up approximately 4.5 per cent of private household consumption in 2000.

Accommodation services

The applied indicator of household consumption of hotels is Statistics Denmark's statistics of the number of overnight stays at hotels, holiday resorts, etc. This item accounted for around 0.5 per cent of private household consumption in 2000.

CONTINUED Box 3.1

Post and telecommunications

The indicator of the consumption of postal services and telecommunications, etc. is firms' domestic sales in the categories of *Postal and courier activities* and *Telecommunications*. In the national accounts, the consumption of postal services and telecommunications, etc. accounted for almost 2 per cent of private household consumption in 2000.

Hairdressing salons, etc.

The applied indicator of hairdressing salons, etc. in the breakdown of consumption in the national accounts is domestic sales under *Hairdressers, laundries and other services*. This item accounted for almost 1 per cent of private consumption in 2000.

Package holidays

The indicator is Statistics Denmark's statistics of the number of international charter/taxi flights out of Copenhagen Airports. The consumption of package holidays accounted for just under 1 per cent of private household consumption in 2000.

Housing

The NARES indicator of housing is housing in the preceding quarter deflated by a rate of wear and tear of dwellings plus completed all-year dwellings. The coefficient of completed all-year dwellings is greater than one, reflecting that the quality of newly built dwellings is assumed to be higher than the quality of the existing housing stock. Housing accounted for around 20 per cent of private household consumption in 2000.

Other services

In the absence of suitable indicators of the remainder of private consumption of services, a technical projection is applied. Other services, such as insurance and financial services, made up almost 19 per cent of private household consumption in 2000.

Non-residents' consumption in Denmark

The above indicators cover consumption in Danish territory. Part of this is non-residents' consumption in Danish territory. Since the aim of NARES is the private consumption of Danish households, non-residents' consumption in Danish territory is subtracted. Non-residents' consumption in Danish territory is based on the balance of payments statistics deflated by the total consumer price index, excluding housing and fuels.

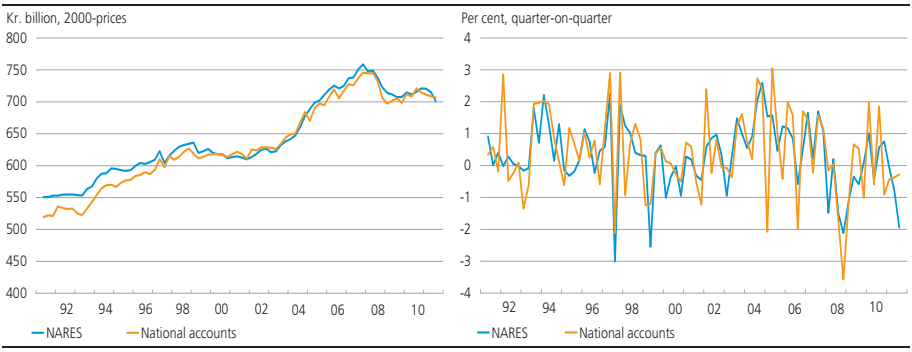
Danish residents' consumption abroad

Correspondingly, the above indicators do not include the consumption of Danish residents in the rest of the world, so this consumption is added in the indicator equation for private consumption.

[1] Shadow degree days = 17 less the mean temperature for a 24-hour period.

Chart 3.2 shows the technical estimate of the development in private consumption achieved after purely mechanical application of NARES, together with private consumption in chained values according to the

PRIVATE CONSUMPTION Chart 3.2



Source: Statistics Denmark and own calculations.

national accounts. The *Other services* item is projected on the basis of the national accounts for the most recent quarter using a growth rate equal to a moving average of the growth rates of the last four quarters.[1] Relative to a constant growth rate the moving average means that there is no significant deviation in growth between the consumption of other services in NARES and the trend in the national accounts viewed over a number of years, such as after the financial crisis. On the other hand, the reversal is captured slightly later due to the high growth rates in the preceding years.

The indicator follows the overall development in private consumption, and substantial deviations from consumption growth in the national accounts are seen only in a few quarters, cf. Chart 3.2. The fluctuations in the private consumption indicator are less pronounced that the fluctuations in the national accounts series.

According to Table 3.2, the average deviation between the consumption growth estimate in NARES and the private consumption figure in the national accounts in the period 1991-2008 is -0.05 percentage points. Consequently, the underestimation of consumption growth in NARES in this period is very modest. The correlation with the private consumption figure in the national accounts is high throughout the period, and the deviation measured in terms of RMSE[2] is less pronounced than if two simple benchmark models had been used: one based on the trend (average quarterly growth) in the period 1991-99 and an AR(4) model[3]. As a result, the precision is higher for the relatively disaggregated calculation of private consumption relative to the simple benchmarks.

1 The same approach has been applied to other variables that are subject to technical projection on the basis of known figures from the national accounts.
2 See the note to Table 3.2.
3 An AR(4) model is an autoregressive model with four lags. This model seeks to explain growth in private consumption in terms of growth in private consumption in the four preceding quarters.

PRIVATE CONSUMPTION — Table 3.2

	1991-99	2000-08	1991-2008
Average error	-0.11	0.02	-0.05
Average absolute error	0.77	0.75	0.76
RMSE	0.98	1.01	1.00
Correlation coefficient	0.64	0.70	0.67
RMSE, trend 1991-99		1.42	
RMSE, AR(4) model		1.51	

Note: The average error is calculated as the growth estimate in NARES less the growth in the national accounts figure. RMSE, root mean square error, is the square root of the average of the squared errors and is also a measure of estimation errors. The estimation period for the AR(4) model is 1991-99. All calculations are made on quarterly growth rates in per cent.
Source: Statistics Denmark and own calculations.

Public consumption

The value of public consumption corresponds to just over one fourth of the value of GDP in Denmark. Quarterly statistics of public finances are released around 80 days after the end of the reference quarter, i.e. after the first version of the preliminary national accounts. In NARES, public consumption is broken down by compensation of employees in the public sector, public purchases of goods and depreciation (consumption of fixed capital).

Wages, etc.

The expenditure for wages, etc. accounts for more than 60 per cent of total public consumption. The NARES indicator of compensation of employees in the public sector is constructed as the number of employees in the public sector multiplied by working hours per employee. The latter figure changes, e.g. in the event of changes in working hours due to collective bargaining. The source of the number of employees in the public sector is Statistics Denmark's employee statistics based on employers' reporting to SKAT (the Danish tax authority). Before 2008, the ATP statistics were used as an indicator of employment in the public sector.

Public purchases of goods, etc.

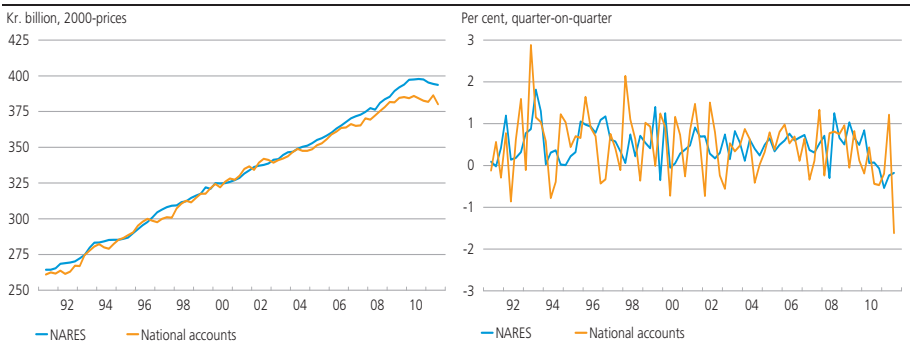
In value terms, public purchases of goods correspond to around one fourth of public consumption. In NARES, purchases of goods are the result of a technical projection based on public purchases of goods in the preceding quarter.

Consumption of fixed capital

In the absence of suitable indicators, a technical projection is applied.

The NARES estimate of public consumption captures the development in the national accounts figure only to a low degree, cf. Chart 3.3. The

PUBLIC CONSUMPTION Chart 3.3



Source: Statistics Denmark and own calculations.

average rate of growth in the indicator is close to that of the national accounts, but the correlation is quite low viewed over the entire period 1991-2008, cf. Table 3.3. In the period 2000-08, the indicator is no more precise than the simpler alternatives, which naturally reflects merely that there are not enough indicators of public consumption.

Gross fixed capital formation

In value terms, gross fixed capital formation accounts for approximately 20 per cent of GDP in Denmark. In NARES, gross fixed capital formation has been broken down by residential investment, building and construction investment excluding residential investment, investment in machinery and equipment and other investment.

Residential investment

The indicator of residential investment includes relative weights for all-year dwellings under construction and other buildings under construction. The source is Statistics Denmark's construction statistics.

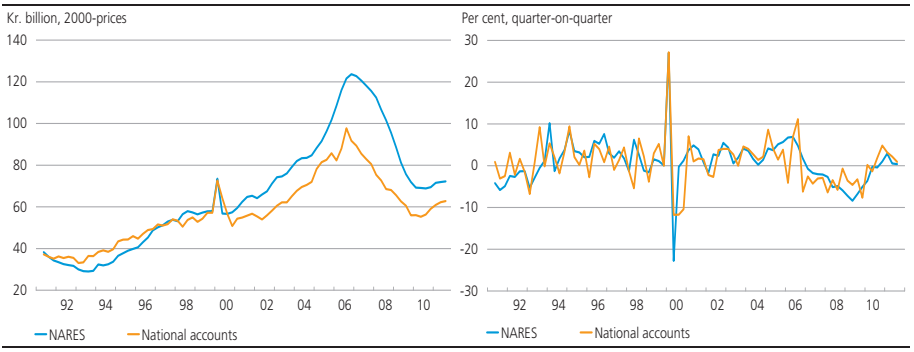
PUBLIC CONSUMPTION Table 3.3

	1991-99	2000-08	1991-2008
Average error	-0.04	0.04	0.00
Average absolute error	0.76	0.51	0.63
RMSE	0.93	0.64	0.79
Correlation coefficient	0.02	0.10	0.05
RMSE, trend 1991-99		0.60	
RMSE, AR(4) model		0.64	

Note: The average error is calculated as the growth estimate in NARES less the growth in the national accounts figure. RMSE, root mean square error, is the square root of the average of the squared estimation errors and is also a measure of estimation errors. The estimation period for the AR(4) model is 1991-99. All calculations are made on quarterly growth rates in per cent.

Source: Statistics Denmark and own calculations.

RESIDENTIAL INVESTMENT Chart 3.4



Note: A dummy has been introduced in the indicator for the 1st quarter of 2000, taking into account that the surge in residential investment in the wake of the storm in December 1999 was not reflected in construction activity to the same extent.
Source: Statistics Denmark and own calculations.

The residential investment indicator overestimates the increase in residential investment since 2000. This reflects a strong rise in dwellings under construction, which is not offset to the same extent by increased residential investment, cf. Chart 3.4. A possible reason is variations in construction time. Moreover, major repairs of dwellings are included in residential investment in the national accounts, but not in the NARES indicator. In NARES, average quarterly growth is 0.91 percentage points higher than in the national accounts in the period 2000-08, cf. Table 3.4. The average absolute error of just over 3 percentage points over the entire period reveals considerable errors in the quarters. But the correlation coefficient is high, and RMSE is lower relative to the simple alternatives.

Building and construction investment, excluding residential investment
Total building and construction investment in NARES is calculated as the sum of indicators of building investment and construction investment,

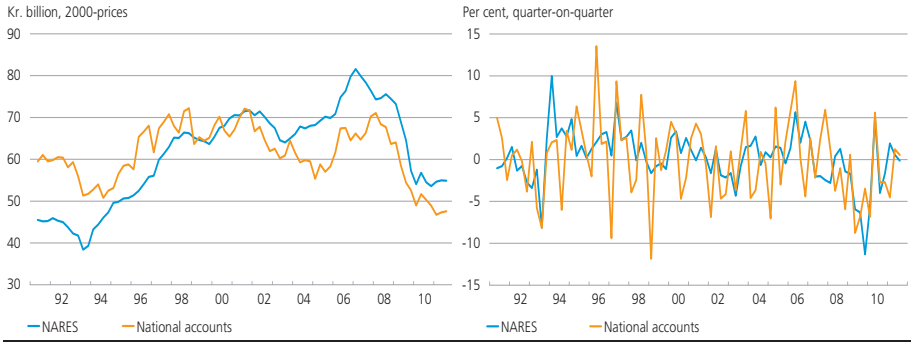
RESIDENTIAL INVESTMENT Table 3.4

	1991-99	2000-08	1991-2008
Average error	-0.19	0.91	0.37
Average absolute error	2.99	3.18	3.09
RMSE	3.90	4.65	4.30
Correlation coefficient	0.46	0.78	0.70
RMSE, trend 1991-99		6.98	
RMSE, AR(4) model		7.79	

Note: The average error is calculated as the growth estimate in NARES less the growth in the national accounts figure. RMSE, root mean square error, is the square root of the average of the squared estimation errors and is also a measure of estimation errors. The estimation period for the AR(4) model is 1991-99. All calculations are made on quarterly growth rates in per cent. The dummy introduced in the indicator for the 1st quarter of 2000 reduces the deviations and increases the correlation in the period 2000-08.
Source: Statistics Denmark and own calculations.

BUILDING AND CONSTRUCTION INVESTMENT, EXCLUDING RESIDENTIAL INVESTMENT

Chart 3.5



Source: Statistics Denmark and own calculations.

respectively. The applied indicator of construction investment is employment in the construction sector. The source is Statistics Denmark's statistics of employees in building and construction. Building investment, excluding residential investment is based on building activity.

In addition to the breakdown by type, investment is also broken down by sector in NARES, i.e. by energy extraction, public and private excluding energy extraction. The distribution between the public and private shares of e.g. construction investment is based on a projection of the public share of total construction investment. A technical projection of the building and construction investment of the energy sector has been applied.

The general trends in building and construction investment are partly captured by the indicator, cf. Chart 3.5, and there is some correlation with the national accounts series throughout the period, cf. Table 3.5. But NARES overestimates the average growth during the period and

BUILDING AND CONSTRUCTION INVESTMENT, EXCLUDING RESIDENTIAL INVESTMENT

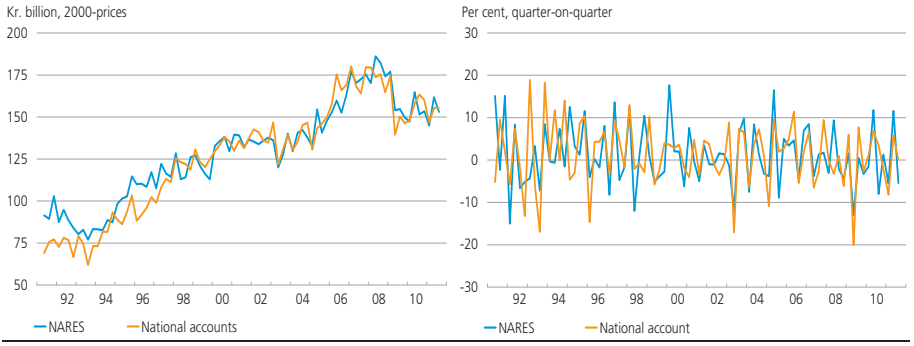
Table 3.5

	1991-99	2000-08	1991-2008
Average error	0.45	0.44	0.45
Average absolute error	3.50	3.39	3.44
RMSE	4.75	4.08	4.43
Correlation coefficient	0.39	0.29	0.35
RMSE, trend 1991-99		4.14	
RMSE, AR(4) model		4.70	

Note: The average error is calculated as the growth estimate in NARES less the growth in the national accounts figure. RMSE, root mean square error, is the square root of the average of the squared estimation errors and is also a measure of estimation errors. The estimation period for the AR(4) model is 1991-99. All calculations are made on quarterly growth rates in per cent.

Source: Statistics Denmark and own calculations.

INVESTMENT IN MACHINERY AND EQUIPMENT, ETC. Chart 3.6



Source: Statistics Denmark and own calculations.

produces considerable average absolute errors, as was also the case for residential investment. However, this indicator performs marginally better than simpler alternatives.

Investment in machinery and equipment, excluding vessels and aircraft

This indicator consists of the sum of investment in transport equipment, machinery and fixtures and investment in software, etc. Investment in transport equipment is broken down further by purchases of lorries, vans and passenger cars for business purposes as well as investment in railway equipment and drilling rigs. As regards vehicles, the source is Statistics Denmark's statistics of new motor vehicle registrations. As regards investment in railway vehicles and drilling rigs, one of the sources is net imports thereof according to the external trade statistics, deflated by a relevant sub-index from the price index of turnover in manufacturing as compiled by Statistics Denmark.

The indicator of investment in machinery, etc. is made up of both direct imports of machinery and supplies from the domestic manufac-

INVESTMENT IN MACHINERY AND EQUIPMENT, ETC. Table 3.6

	1991-99	2000-08	1991-2008
Average error	-0.61	0.46	-0.07
Average absolute error	7.79	4.61	6.17
RMSE	9.66	5.81	7.94
Correlation coefficient	0.31	0.57	0.40
RMSE, trend 1991-99		6.08	
RMSE, AR(4) model		5.33	

Note: The average error is calculated as the growth estimate in NARES less the growth in the national accounts figure. RMSE, root mean square error, is the square root of the average of the squared estimation errors and is also a measure of estimation errors. The estimation period for the AR(4) model is 1991-99. All calculations are made on quarterly growth rates in per cent.

Source: Statistics Denmark and own calculations.

turing sector. The relative weights of these elements reflect the import share of investment in machinery and equipment according to the input/output tables of Statistics Denmark. As regards domestic supplies, which are covered by e.g. the index of turnover in manufacturing, it is taken into account that investment goods account for only a minor share of turnover in manufacturing, while a major share can be attributed to semi-manufactures, etc.

The indicator of investment in software, etc. is based on Statistics Denmark's statistics of employees based on employers' reporting to SKAT. Employment statistics were previously based on ATP statistics.

In line with building and construction investment, investment in machinery and equipment is broken down by sectors. The distribution on public and private investment is based on a projection of the public sector's share of total investment in machinery and equipment.

The indicator of investment in machinery and fixtures matches the national accounts figure well in level terms, cf. Chart 3.6. In terms of growth rates, there is reasonable correlation in the period 2000-08, cf. Table 3.6. However, the indicator has a positive bias in that period, and there are substantial absolute errors in the entire period 1991-2008. In terms of RMSE, the indicator does not perform any better than a simple AR(4) model.

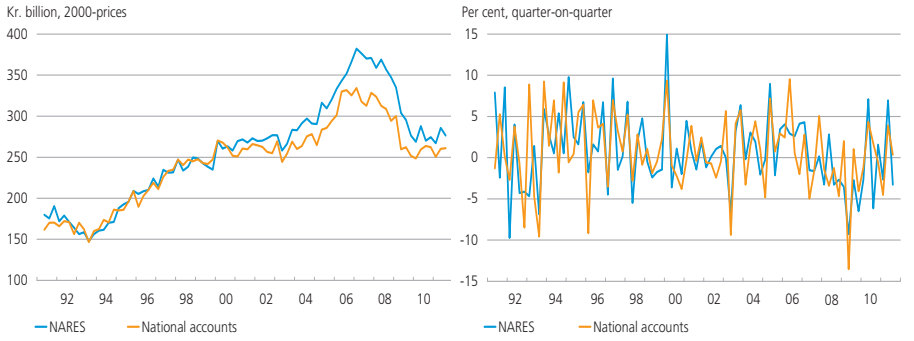
Other investment

In NARES, investment in livestock is based on changes in the stocks of sows and cows, etc. The indicator of investment in vessels and aircraft, etc. is sourced from Statistics Denmark's statistics of sales by Danish iron shipyards deflated by a relevant series for the price index from turnover in manufacturing as well as net imports of vessels and aircraft, etc. deflated by projected price indexes from the national accounts.

Together, the above types of investment make up gross fixed capital formation. Chart 3.7 shows the developments in gross fixed capital formation in NARES and the national accounts. NARES's overestimation of residential investment and building and construction investment in the late 2000s naturally materialises in total gross fixed capital formation.

The overestimated gross fixed capital formation in NARES after 2000 represents an average deviation of 0.59 percentage points per quarter over the period 2000-08, cf. Table 3.7. However, the correlation between this indicator and the national accounts series is relatively high in this period, and in terms of RMSE the indicators are more accurate than the simple alternatives.

GROSS FIXED CAPITAL FORMATION Chart 3.7



Source: Statistics Denmark and own calculations.

Inventory investment

The value of inventory investment is very low compared with the other components of demand, but the contribution from inventories to GDP growth is often quite substantial. Moreover, the national accounts figures may be subject to considerable revision from the first to the final version. NARES breaks down inventory investment by agriculture, energy extraction and inventory investment excluding energy and agriculture. Inventory investment in energy is compiled as the change in a calculated fuel store achieved by weighting various fuel components. As regards agriculture, inventory investment is calculated as a weighted average of changes in pig and cattle stocks from Statistics Denmark. Inventory investment in the private non-agricultural sector constitutes the remainder of inventory investment, as the public sector has no inventory investment. Inventory investment in the private non-agricultural sector is sourced from Statistics Denmark's value-based inventory statistics for manufacturing and wholesale trade.

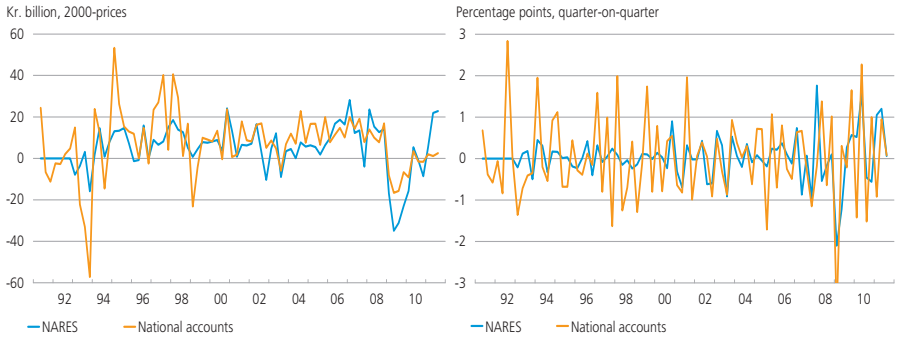
GROSS FIXED CAPITAL FORMATION Table 3.7

	1991-99	2000-08	1991-2008
Average error	-0.20	0.59	0.20
Average absolute error	4.32	2.71	3.51
RMSE	5.39	3.25	4.44
Correlation coefficient	0.39	0.68	0.51
RMSE, trend 1991-99		4.16	
RMSE, AR(4) model		4.43	

Note: The average error is calculated as the growth estimate in NARES less the growth in the national accounts figure. RMSE, root mean square error, is the square root of the average of the squared estimation errors and is also a measure of estimation errors. The estimation period for the AR(4) model is 1991-99. All calculations are made on quarterly growth rates in per cent.

Source: Own calculations.

INVENTORY INVESTMENT Chart 3.8



Note: The right-hand chart shows contributions to quarterly GDP growth. Before 1993, in the absence of inventory value statistics for the manufacturing and wholesale sectors, inventory investment is equal to zero in NARES.
Source: Statistics Denmark and own calculations.

The indicator captures only to a low degree the substantial fluctuations in the national accounts series in the 1990s, cf. Chart 3.8. The two series show more similar patterns in the 2000s.

Exports

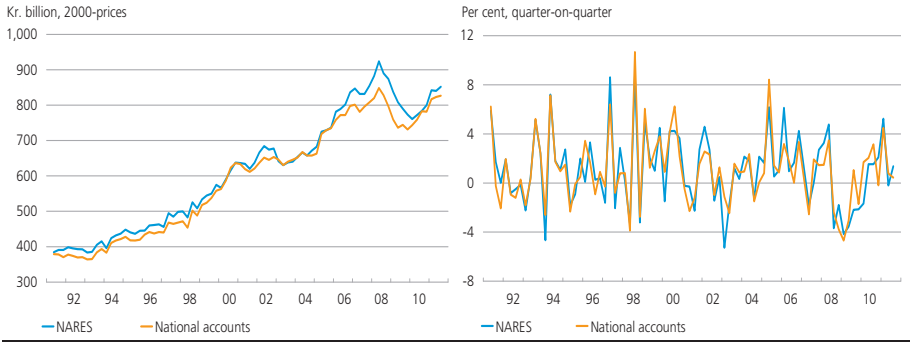
In value terms, exports of goods and services correspond to just over half of GDP in Denmark. NARES breaks down total exports into goods and services.[1] The indicator of total exports of goods is calculated on the basis of the external trade statistics. The calculation incorporates the sum of total exports of goods, excluding vessels and aircraft, exports of vessels and aircraft and a transition item accounting for differences between the compilations of exports of goods in the external trade statistics and the national accounts.[2] Each sub-item is deflated by a relevant price index – primarily unit value indexes. Exports of services are calculated as the value of exports of services from the balance of payments statistics, deflated by a price index reflecting container freight rates. The indicator value of freight rates should be viewed in light of sea freight's large share of total exports of services in value terms.

The most important difference between NARES and the national accounts as regards compilation of exports is the higher degree of simplicity in the price indexes used as deflators in NARES. In summary, exports of goods and services are generally well covered by indicators, as illustrated by the precision of the indicator in Chart 3.9. Both levels and quarterly growth are captured well by the indicator.

1 Exports of goods are broken down by types, e.g. manufactured exports and exports of fuels, etc. on the basis of the external trade statistics.

2 The transition item takes into account the different definitions of goods in the external trade statistics and the national accounts. On the export side, the external trade statistics add repairs, etc., but subtract returned goods. On the import side, general trade in the external trade statistics is supplemented with victualling, bunkering and repairs, while returned goods and freight are subtracted.

EXPORTS Chart 3.9



Source: Statistics Denmark and own calculations.

The difference in levels in the second half of the 2000s is attributable to errors in estimating the deflators of exports of both goods and services. On the goods side, this reflects lower growth in the unit value indexes relative to the deflator of the national accounts during the period. On the services side, the collapse of freight rates in late 2008 results in a considerably stronger fall in the services exports deflator in NARES relative to the national accounts. The overall result is an average deviation, relative to export growth in the national accounts, of just under 0.2 percentage points per quarter in the period 2000-08, cf. Table 3.8. Export growth in NARES shows hardly any bias before 2000. The average absolute error is somewhat greater over the entire period, but RMSE is considerably lower than would have been the case with the more simple benchmarks, and the correlation is very high.

Imports

In value terms, imports of goods and services correspond to almost half of GDP in Denmark. The indicator of imports is compiled using the same template as for exports. Imports of services from the balance of pay-

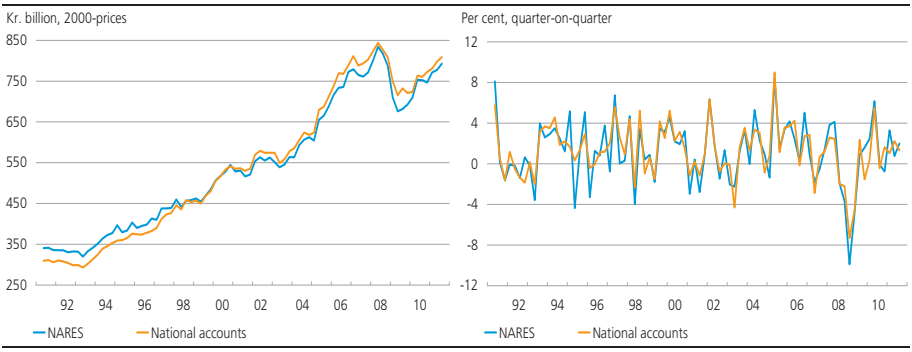
EXPORTS Table 3.8

	1991-99	2000-08	1991-2008
Average error	0.04	0.18	0.11
Average absolute error	0.97	1.26	1.12
RMSE	1.26	1.53	1.41
Correlation coefficient	0.92	0.82	0.88
RMSE, trend 1991-99		2.44	
RMSE, AR(4) model		2.77	

Note: The average error is calculated as the growth estimate in NARES less the growth in the national accounts figure. RMSE, root mean square error, is the square root of the average of the squared estimation errors and is also a measure of estimation errors. The estimation period for the AR(4) model is 1991-99. All calculations are made on quarterly growth rates in per cent.

Source: Statistics Denmark and own calculations.

IMPORTS Chart 3.10



Source: Statistics Denmark and own calculations.

ments statistics are deflated by a projected price index from the national accounts for the most recent quarter, as no suitable indicator is available for this deflator. On the goods side, imports are divided into imports of goods excluding vessels and aircraft, bunkering, imports of vessels and aircraft and a transition item. The deflators for imports of goods correspond to those for exports of goods.

The indicator of imports is very precise, cf. Chart 3.10, with only a small deviation in the average quarterly growth rate relative to the national accounts series, cf. Table 3.9. The correlation is high, and in terms of RMSE the indicator performs considerably better than the simple benchmarks.

GDP

After compilation of the individual demand components and imports, total output can be determined. Compiled in chained values, GDP is calculated on the basis of the preceding year's prices in the national accounts. Consequently, the deviations between the GDP estimate in

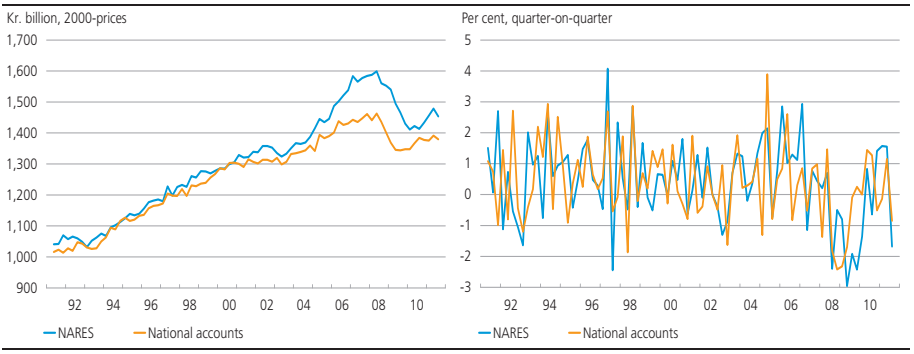
IMPORTS Table 3.9

	1991-99	2000-08	1991-2008
Average error	-0.17	-0.09	-0.13
Average absolute error	1.31	1.03	1.16
RMSE	1.71	1.26	1.50
Correlation coefficient	0.82	0.89	0.85
RMSE, trend 1991-99		2.60	
RMSE, AR(4) model		2.80	

Note: The average error is calculated as the growth estimate in NARES less the growth in the national accounts figure. RMSE, root mean square error, is the square root of the average of the squared estimation errors and is also a measure of estimation errors. The estimation period for the AR(4) model is 1991-99. All calculations are made on quarterly growth rates in per cent.

Source: Statistics Denmark and own calculations.

GDP Chart 3.11



Source: Statistics Denmark and own calculations.

NARES and the final GDP figure in the national accounts are the result of the inaccuracies in the estimates of the individual demand components and imports.

The left-hand side of Chart 3.11 shows that GDP in 2007-08 is markedly higher in NARES than in the national accounts. This reflects the overestimation in NARES of gross fixed capital formation, particularly in those years. The same applies to exports in volume terms, as the deflators for exports of both goods and services are lower, cf. above. The difference in levels is, as such, not a determining factor for the model's usefulness in practice, given the focus on developments in the most recent quarter only, as mentioned earlier, but the difference reflects the accumulated errors.

The right-hand side of Chart 3.11 shows large errors in a few quarters, but the GDP indicator in NARES is reasonably successful in capturing the general economic trends over the entire period. A positive bias is observed in the period 2000-08, cf. the average errors in Table 3.10. In terms of RMSE, the deviations in the period 2000-08 are slightly less

GDP Table 3.10

	1991-99	2000-08	1991-2008
Average error	-0.03	0.27	0.12
Average absolute error	1.16	0.95	1.05
RMSE	1.49	1.26	1.38
Correlation coefficient	0.35	0.48	0.41
RMSE, trend 1991-99		1.33	
RMSE, AR(4) model		1.37	

Note: The average error is calculated as the growth estimate in NARES less the growth in the national accounts figure. RMSE, root mean square error, is the square root of the average of the squared estimation errors and is also a measure of estimation errors. The estimation period for the AR(4) model is 1991-99. All calculations are made on quarterly growth rates in per cent.

Source: Own calculations.

GROWTH CONTRIBUTIONS Table 3.11

	Average, NARES	Average, national accounts	Average error	Average absolute error
Private consumption	0.18	0.20	-0.02	0.38
Public consumption	0.15	0.15	0.00	0.16
Gross fixed capital formation	0.17	0.12	0.05	0.70
Inventory investment	0.02	0.04	-0.02	0.71
Exports	0.47	0.42	0.05	0.49
Imports	-0.40	-0.45	0.06	0.46
GDP	0.59	0.48	0.12	1.06

Note: All figures are based on the contributions to GDP growth. The average errors are calculated as growth estimates according to NARES less growth according to the national accounts. The period is Q2 1991-Q4 2008.
Source: Statistics Denmark and own calculations.

pronounced than for the simple benchmarks. The correlation between GDP growth in NARES and the national accounts is relatively high throughout the period.

Table 3.11 shows descriptive statistics of the contributions from the main components of the supply-demand balance to GDP growth. The decomposition reveals the impact of the errors in estimating e.g. private consumption on the precision of the total GDP estimate. The average errors in the growth contributions of the components are generally modest, reflecting the mutually offsetting effect of positive and negative errors. The absolute errors for the growth contributions are thus considerably greater. Although in NARES public consumption is covered by indicators only to a very limited extent, and, as mentioned, the errors are not lower than those resulting from the simple alternatives, this component has less of an impact on errors in the GDP estimates, cf. the modest average absolute error. Private consumption, imports and exports are sources of greater errors, even though these components are well covered by indicators in NARES. But the largest contributions to errors in the GDP estimates are attributable to gross fixed capital formation and inventory investment despite the relatively small shares of these components in overall demand.

The performance of NARES in a purely mechanical run is illustrated above. It is important to emphasise that these technical estimates are used as an early element of the cyclical assessment process, which also involves a number of other elements. For example, supplementary information can be used in the determination of the technical projections in order to improve the model estimates. But the most significant difference relative to actual application of NARES is that the model results are not used directly, but rather as the basis for a detailed assessment of the national accounts components, cf. the example in Box 3.2.

APPLICATION OF NARES IN THE 2ND QUARTER OF 2011 Box 3.2

This box illustrates how the final estimates for the 2nd quarter of 2011, produced before the release of the quarterly national accounts at the end of August 2011, were determined on the basis of the NARES calculations.

Calculated on the basis of the NARES indicators, cf. Table 3.12, quarterly growth in private consumption was -0.8 per cent. A review of the individual indicators disclosed receding growth in retail sales and some of the minor consumption items. But in light of a considerable fall in consumption of services in the 1st quarter of 2011, the technical projection of consumption of other services was found to be too negative. For this reason, among others, the estimate of private consumption was increased to quarterly growth of -0.1 per cent. The national accounts figure for private consumption in the 2nd quarter of 2011 also shows a moderate decline, cf. the last two columns of Table 3.12.

As regards public consumption, the NARES calculations resulted in quarterly growth of -0.3 per cent. A key contributing factor was that the technical projection was affected by declines in previous quarters, and, in view of such factors as the Finance Act and local and regional government budgets, growth in public consumption was estimated at 0.8 per cent. This estimate is slightly lower than the figure in the national accounts.

On the basis of the indicators, NARES estimated quarterly growth in gross fixed capital formation at 9.3 per cent. A review of the indicators prompted a lowering of private investment in building and construction relative to the NARES result. The estimated quarterly growth of just over 7 per cent is somewhat higher than the national accounts figure.

The growth contribution from inventory investment was estimated at 0.3 per cent in the 2nd quarter of 2011. According to the NARES indicators, the growth contribution from inventory investment was 1.4 percentage points. This figure was not found to be credible, however. The revised national accounts figure is a negative growth contribution of 0.1 percentage points.

The export estimate was unchanged from the previous quarter, i.e. slightly higher than the NARES figure, where the indicators pointed to a small decline. The national accounts showed a good increase in exports in the 2nd quarter of 2011.

ESTIMATES FOR THE 2ND QUARTER OF 2011 Table 3.12

Per cent, quarter-on-quarter	NARES	Estimate	Flash NA	NA
Private consumption	-0.8	-0.1	-0.3	-0.4
Public consumption	-0.3	0.8	0.9	1.2
Gross fixed capital formation	9.3	7.3	4.5	3.9
Inventory investment[1]	1.4	0.3	0.4	-0.1
Exports	-0.2	0.0	0.2	0.8
Imports	0.8	2.4	1.4	2.2
GDP …	2.0	0.5	1.0	1.2

Note: "Flash NA" is the first preliminary version of the quarterly national accounts. "NA" is the latest version of the national accounts, released at the end of November 2011. The NARES estimates in the table are actual real-time predictions.

Source: Statistics Denmark and own calculations.

[1] Contribution to GDP growth.

CONTINUED Box 3.2

Import growth was 0.8 per cent according to the indicators. The review of the NARES result gave rise to adjustment of the import price development, and the estimated increase in volume terms was determined at 2.4 per cent. This estimate is in line with the latest version of the national accounts.

Overall, GDP growth was estimated at 0.5 per cent in the 2nd quarter of 2011, which was considerably lower than the NARES estimate of 2.0 per cent. This reflects the significant element of assessment in the calculation of the estimates. The adjusted estimates of the components of the supply-demand balance are, in general, closer to the national accounts figures than the mechanical NARES estimates. Quarterly GDP growth is estimated at 1.2 per cent in the latest version of the national accounts.

Wages and income

In addition to the items of the supply-demand balance, NARES also calculates a number of wage and income items. Indirect taxes are subtracted from output at current prices, and subsidies are added in order to produce an estimate of the gross domestic product at factor cost. Indirect taxes are primarily VAT income, published monthly by SKAT with a lag of approximately 60 days. Total residual income is determined residually as gross domestic product at factor cost less wages and salaries. Compensation of employees is compiled including employer contributions to various social schemes. The wages and salaries items as such are broken down by the private and the public sector. In both cases, wages are determined as a weighted wage rate multiplied by the number of employees. The development in the number of employees is based on Statistics Denmark's statistics of employees from reporting to SKAT. Employer contributions are determined on the basis of developments in the ATP rates and employer contributions to unemployment insurance.

Private disposable income is calculated as the private gross domestic product at factor cost plus private net interest income and private net transfers less contributions to social schemes and direct taxes. Transfers are based on e.g. data on the number of recipients of unemployment benefits and early retirement benefits. The indicator of direct taxes is sourced from SKAT.

Sectoral balances

NARES also calculates net lending for the private sector, the public sector and in relation to the rest of the world. The balance of goods and services is given as the value of exports minus imports, cf. above. If investment income and current transfers are added, the result is the current account of the balance of payments. Addition of capital trans-

fers, net, results in net lending in relation to abroad, which is thus covered directly by the balance of payments statistics.

Net lending for the public sector is the sum of public sector revenue less expenditure for public investment, public consumption, subsidies and transfers. The value of public consumption and investment is given by the indicators in volume terms, cf. above, together with the relevant prices. As regards public transfers, the information, besides indicators of early retirement and unemployment benefits, includes EU transfers and development aid from the balance of payments statistics. The main items on the revenue side are direct and indirect taxes, which are partially covered by indicators.

Net lending for the private sector is determined as private disposable income, cf. above, less private consumption expenditure, the value of private investment and capital taxes, plus net capital expenditure and net capital transfers.

4. ALTERNATIVE MODELS

There are various other approaches to assessing the current economic situation. Like NARES, they apply information from economic statistics with a view to mapping general economic trends. Statistical models are typically used to summarise relevant cyclical indicators, resulting in an estimate of recent developments in major variables of interest, such as GDP growth or other national accounts components. This section gives an overall description of some of the models, while the next section contains a description and an analysis of a Real-Time Forecasting System.

A simple approach is to use models that explain e.g. quarterly GDP growth in terms of monthly indicators – or "bridge equations". The name refers to the bridge-building in such models between the different frequencies of the target variables and indicators. Rünstler and Sédillot (2003) present an example:

$$\rho(L)\Delta y_t = \sum_{j=1}^{k} \delta_j(L)\Delta x_{j,t} + \varepsilon_t, \qquad (4.1)$$

where Δy_t is GDP growth and $\Delta x_{j,t}$ is (changes in) the monthly indicators. $\rho(L)$ and $\delta_j(L)$ are lag polynomials to enable GDP growth in previous quarters or previous changes in the monthly indicators to contribute to explaining the current GDP growth.

The monthly variables are often aggregated to a quarterly frequency before model estimation, in order to keep the lag structure simple, among other reasons. In the aggregation, the same weight is usually applied to the three months. A highly relevant practical problem is that

data may be missing for one or more months as regards the indicators. If that is the case, it is not possible to perform the aggregation to quarterly data, so the model cannot be used for estimation in the first instance.

The solution is to incorporate estimates of the observations that are missing for the indicators. One approach is to construct "auxiliary models" to generate an estimate for a third month based on data for two months for a variable.[1] This provides for calculation of a (partially estimated) quarterly observation for the indicator, and the model (4.1) is used for estimation on the quarterly variable in question.

For the euro area, Rünstler and Sédillot (2003) find that bridge equations based on quantitative activity indicators, such as industrial production, retail sales and vehicle registrations, improve the estimate of GDP growth in the relevant quarter relative to benchmark models that do not include the information from the indicators.

The basic concept of bridge equations – to use early monthly indicators for calculating relevant quarterly data – is the same as in NARES. The most important difference is that bridge equations use estimated coefficients for aggregation of indicators, while NARES is based on aggregation of indicators for the sub-components of a variable using weights reflecting the relevant indicator's share of the variable. While estimated weights per construction provide for better aggregation of indicators in the historical period (estimation period), it is an empirical question which method is better for nowcasting and forecasting.

Bridge equations are typically single-equation models that explain a quarterly variable in terms of one or more indicators. A different model approach – vector autoregressive, VAR, models – describes the dynamics of the quarterly variables and indicators in one model. A simple example is a VAR model with GDP and monthly industrial production aggregated to a quarterly frequency.

It is possible to include more indicators by estimating a number of bivariate VAR models, and then use the average estimate, or by expanding the VAR model. However, many parameters often need to be estimated in multivariate VAR models with a rich lag structure. Bayesian estimation methods based on an *a priori* parameter distribution may reduce the dimensionality problem and improve the efficiency of the estimates, cf. Banbura et al.

Recent years have seen considerable focus on models that use the information from a very large number of indicators for producing a nowcast or forecast of e.g. GDP growth. Stock and Watson (2002) argue that

[1] Such auxiliary models are typically univariate autoregressive models.

it may be more useful to summarise the information in a large number of indicators rather than applying e.g. VAR models for which the number of indicators is limited to perhaps 10.

The Stock and Watson model describes the variable, y_{t+1}, to be forecast, as explained by a number of dynamic factors f_t:

$$y_{t+1} = \beta(L)f_t + \gamma(L)y_t + \varepsilon_{t+1}, \tag{4.2}$$

where $\beta(L)$ and $\gamma(L)$ are lag polynomials. The relation between the indicators X_i and the factors is given as:

$$X_{it} = \lambda_i(L)f_t + e_{it}, \quad i = 1,...,N. \tag{4.3}$$

The fundamental idea is that cyclical developments are driven by a limited number of factors that are not directly observable. At the same time, these factors are assumed to explain the development in the indicators, cf. equation (4.3), and they can be determined by exploiting the information contained in a large number of indicators. The estimated factors – called *diffusion indexes* by Stock and Watson – are then used in the forecast equation (4.2).

Dahl et al. (2005) use this model type with Danish data to predict unemployment, turnover in manufacturing and net retail prices 6 and 12 months ahead on the basis of diffusion indexes. The results are not as good as those produced by other studies for other countries, but the use of filtered data reduces forecast errors compared with the use of a standard autoregressive model. To our knowledge, no institutions in Denmark are using diffusion indexes for forecasting or nowcasting on an ongoing basis.

The wealth of information included in diffusion indexes is at the same time both an advantage and a disadvantage of the model. The advantage is that all indicators are taken into account, including soft ones such as confidence indicators. The weakness is that inclusion of all indicators also results in substantial noise, and that the model may be perceived as a "black box", because an economic interpretation based on the diffusion indexes is not easily given.

More recent literature contributions have sought to address these weaknesses of the model framework, now mostly referred to as factor models. Bai and Ng (2008) demonstrate that the model estimates can be improved by selecting indicators in advance on the basis of the variable to be predicted. This removes noisy indicators and indicators driven by factors with only a weak correlation with the relevant variable.

Another improvement is related to the use of factor models for ongoing nowcasting and backcasting of e.g. GDP as more and more indicators become available. In order to ease interpretation, Banbura et al. (2010b) decompose the ongoing changes in the GDP estimate into the extent of the innovation in the indicator and the importance of the indicator in relation to the GDP estimate. Given the model's simultaneous descriptions of the GDP estimate and the indicators, the innovation in the indicator can be calculated on the basis of the model. Intuitively, this is done by using the model to estimate the expected indicator value, on the basis of the existing information, before the release. The difference between this expected value of the indicator and its realised value is the novelty in the indicator. Using this decomposition as the foundation makes it easier to determine the drivers of changes in the GDP estimate.

It is often possible to improve the precision of the estimates by combining estimates from several models. This would also increase the robustness against instability in the individual models, cf. Timmermann (2006). An example of a system that combines many of the different models mentioned above is SAM at Norges Bank, cf. Aastveit et al. (2011). This system includes e.g. more than 200 models for estimation of GDP growth. In addition to point estimates of GDP growth, SAM is also used to derive distributions of growth estimates, providing for an assessment of the uncertainty associated with the central estimate.

5. THE RTFS MODEL

As an alternative forecasting tool in the cyclical assessment process, this section sets out a Real-Time Forecasting System, RTFS, which was developed and used by the US Department of the Treasury, cf. Kitchen and Monaco (2003). The Ministry of Economic and Business Affairs (2007) uses a Danish version of RTFS for nowcasting GDP growth in Denmark.

RTFS uses a number of early monthly indicators for nowcasting quarterly real growth in GDP. As opposed to NARES, which applies only hard indicators, RTFS also includes soft indicators.[1] The relation between each of these indicators and GDP growth is given as:

$$\Delta GDP_t = \alpha^j + \beta_0^j \cdot X_t^j + \cdots + \beta_4^j \cdot X_{t-4}^j + \varepsilon_t^j \,, \qquad (5.1)$$

[1] The following 19 indicators are currently used: Unemployment (net), vehicle sales to households and firms, short-term interest rate (3-month), long-term interest rate (10-year), spread between long-term and short-term interest rates, consumer confidence, confidence indicators for construction, services and manufacturing, effective krone rate, job vacancies advertised on the Internet (Jobindex), OMXC20, imports and exports of goods, industrial production, new orders, retail sales and Dankort payments.

where it applies to all *j* indicators that *X* is the indicator (or a transformation thereof), α is a constant, βs are the coefficients of the indicator and their lags, while ε is the error term. *ΔGDP* indicates quarterly growth in seasonally adjusted real GDP. The optimal number of lags is determined for each indicator separately by means of the Akaike information criterion[1], which weighs higher explanatory power against increased complexity. Estimation of (5.1) using the method of ordinary least squares results in estimated parameters for α and β and thus an estimate of quarterly GDP growth for each indicator as well as an R^2, which is a measure of the explanatory power. The system's growth estimate is an R^2-weighted average of the predictions of the individual indicators. This means that the growth estimate of each relation is given a weight that reflects the relation's ability to explain historical GDP growth.

The system bridges the gap between indicators with a monthly frequency and GDP with a quarterly frequency by generating simple averages of the indicators on the basis of data for the months available. As a result, e.g. an (estimated) quarterly figure for consumer confidence in the 1st quarter of the year is available already when the consumer confidence indicator for January is released. Data for more and more months is included in step with the releases.

Each time a new statistic is released, the system is re-estimated and the weights are updated. This usually gives rise to adjustment of the GDP estimate. The revision impacts the predicted GDP growth through two channels – a direct contribution from the new information in the statistic and an indirect contribution from re-estimation of (5.1) for the individual indicator. The re-estimation causes the weights between the individual indicators to shift if the explanatory power of the indicator in question changes. Re-estimation may also imply a change in the coefficients of the relation for the indicator.

RTFS is different from NARES in several respects. The RTFS model also uses soft indicators, which can presumably e.g. capture economic reversals earlier than the hard indicators can. Moreover, the system allows free estimation of coefficients, meaning that the weight of an indicator corresponds to its explanatory power.

The ongoing re-estimation means that the system is continuously using the available information for determining data relations. But re-estimation also has certain drawbacks. The ongoing adjustment of the coefficients in the individual relations and of the relative weights between the indicators could make it more difficult to identify the reasons for a change of the GDP estimate, cf. above. This makes it potentially more

[1] No more than four lags are allowed.

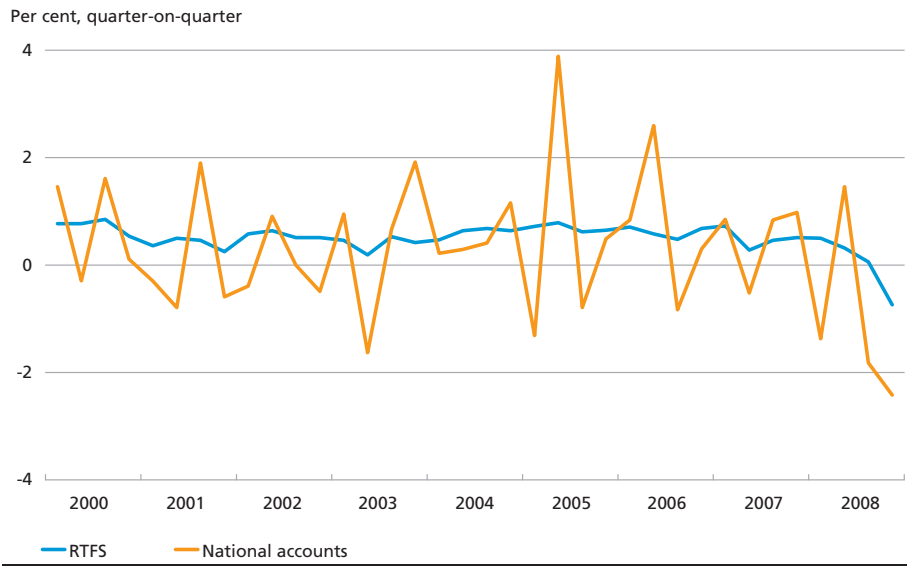
difficult to communicate the results of the system to the outside world. A case in point is the effect of revisions of the national accounts, cf. the illustration of use of the model in Box 5.1. Revisions of the GDP series will change the estimated relations and thus the growth estimate for the quarter in question even though no, as such, new updated information has been released.

In NARES, the more disaggregated GDP estimation method ensures a kind of consistency between the weights of the various indicators. This is not necessarily the case in RTFS, given the principle of free estimation, because the individual estimations do not take into account any correlation between two series. For example, if there is strong correlation between two indicators because they have roughly the same coverage, their individual explanatory power will be almost the same. This would almost correspond to including only one of these indicators but with twice the weight

Chart 5.1 shows quarterly GDP growth according to the final national accounts and the estimates produced by the RTFS model in the period 2000-08. In general, RTFS is unable to capture the strong fluctuations in the highly volatile GDP pattern, including especially in the mid-2000s. However, it does, to some extent, capture the economic reversals towards the end of the period.

QUARTERLY GDP GROWTH, ESTIMATES FROM RTFS AND FINAL NATIONAL ACCOUNTS

Chart 5.1



Note: For each RTFS estimate of GDP growth, the underlying data set includes only information available at the time. Revisions of indicators have not been taken into account, however, so the predictions are not actual real-time predictions.

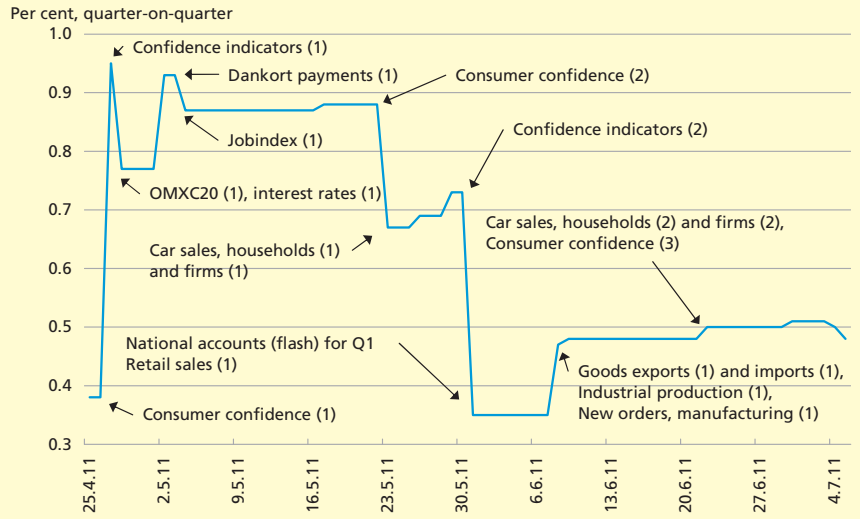
Source: Statistics Denmark and own calculations.

THE DEVELOPMENT IN THE RTFS MODEL ESTIMATE OF THE 2ND QUARTER OF 2011 — Box 5.1

This box illustrates the dynamics of the RTFS estimate of quarterly GDP growth for the 2nd quarter of 2011. Data releases are systematic during a quarter. At the beginning of the quarter, the model primarily consists of confidence indicators and high-frequency financial series, including e.g. interest rates and stock prices, but also Dankort payments. The harder data is released from the middle of the quarter, e.g. car sales and retail sales.

Until the middle of the 2nd quarter, confidence indicators and data with higher frequencies pointed to good GDP growth of just under 1 per cent, cf. Chart 5.2. A drop in the number of new motor vehicle registrations in April then led to a reduction of the model estimate by approximately 0.2 percentage points. Subsequently, the flash estimate of GDP in the 1st quarter of 2011, among other factors, led to a change in the estimated relations of a magnitude that resulted in a further reduction of the GDP estimate for the 2nd quarter by 0.4 percentage points to just over 0.3 per cent. This was not changed to any significant degree after the subsequent releases, and at the end of the quarter, the model estimate of GDP was around 0.5 per cent. According to the most recent national accounts, released at the end of November 2011, GDP growth was 1.2 per cent in the 2nd quarter of 2011. This is slightly higher than the first indications of the RTFS model at the beginning of the quarter, but quite far from the final model estimate.

REAL-TIME DEVELOPMENT IN ESTIMATE FOR THE 2ND QUARTER OF 2011 — Chart 5.2



Note: The figures in brackets indicate the month of the quarter that is covered by the release.
Source: Own calculations.

In connection with the strong drop in GDP growth in 2008-09, the relative weights of the individual indicators shifted. The weights of the indicators that demonstrated explanatory power in respect of the down-

RTFS Table 5.1

	2000-08
Average error	0.22
Average absolute error	0.95
RMSE	1.17
Correlation coefficient	0.54

Note: The average error is calculated as the growth estimate according to RTFS less growth according to the national accounts. RMSE, root mean square error, is the square root of the squared estimation errors and is also a measure of estimation errors. All calculations are made on quarterly growth rates in per cent.
Source: Own calculations.

turn increased, while the weights of other indicators with no explanatory power were reduced. A notable feature is that interest rates have lost almost their entire weight in the model in recent years, while the weights of e.g. stock prices, confidence indicators and consumer confidence have increased. Otherwise, the indicator weights in the model have been relatively stable, with no strong fluctuations from quarter to quarter. The experience with the RTFS model since 2009, in a period of large fluctuations in GDP, is described in Box 6.1 on p. 35.

The average deviation between GDP according to the national accounts and the RFTS estimate of GDP is 0.22 percentage points, cf. Table 5.1. Consequently, the model tends to overestimate growth. Despite the less volatile GDP growth according to RTFS, compared with the national accounts, the correlation coefficient is still reasonable at 0.54.

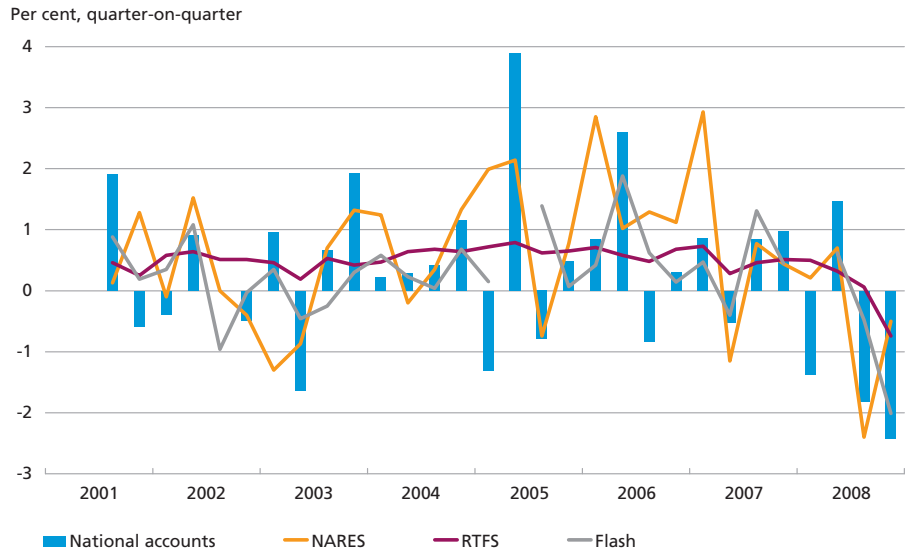
6. COMPARISON

This section compares a technical application of the NARES model with the RTFS model and Statistics Denmark's flash release of the quarterly national accounts. The basis for comparison is the final national accounts that are available around three years from the reference year.

From time to time there are strong deviations between quarterly GDP growth according to the final national accounts and the three estimates, cf. Chart 6.1. The NARES estimates show stronger fluctuations than the final national accounts and also stronger fluctuations than the other two estimates. In most quarters, the RTFS estimates are between 0 and 1 per cent, i.e. they are considerably more stable than quarterly GDP growth according to the final national accounts.

Table 6.1 compares the precision of the three estimates. In terms of RMSE, the flash estimate of the national accounts shows the smallest deviations from the final national accounts. In the period under review, the technical application of the NARES model shows the greatest deviations. The average error is close to zero for the flash estimate, while

QUARTERLY GDP GROWTH, MODEL ESTIMATES AND FINAL NATIONAL ACCOUNTS 2001-08 Chart 6.1



Note: "Flash" means the first preliminary version of the quarterly national accounts. Statistics Denmark did not release flash estimates for the 2nd quarter of 2005 and the 1st quarter of 2008.
Source: Statistics Denmark and own calculations.

both RTFS and NARES have a positive bias. The correlation between the estimates and the final national accounts is positive for all three estimates, and higher for RTFS and the flash estimate than for NARES.

The data basis of the quarterly national accounts is considerably more extensive and detailed than the basis of the NARES and RTFS models. Moreover, there is a very high degree of methodological overlap between the compilation of the flash estimate and the final national accounts. Therefore, it is no surprise that the flash estimate and the final national accounts are more consistent.

QUARTERLY GDP GROWTH, THREE MODEL ESTIMATES RELATIVE TO FINAL NATIONAL ACCOUNTS Table 6.1

	NARES	RTFS	Flash
Average error	0.29	0.25	0.06
Average absolute error	0.96	0.87	0.74
RMSE	1.29	1.07	0.89
Correlation coefficient	0.43	0.53	0.65

Note: The period is 2001-08. For reasons of comparability, quarters not covered by flash estimates are excluded here. The flash estimate is the first version of the preliminary national accounts. The average error is calculated as the growth estimate according to NARES, RTFS and flash less growth according to the final national accounts. RMSE, root mean square error, is the square root of the average of the squared estimation errors and is also a measure of estimation errors. All calculations are made on quarterly growth rates in per cent.
Source: Statistics Denmark and own calculations.

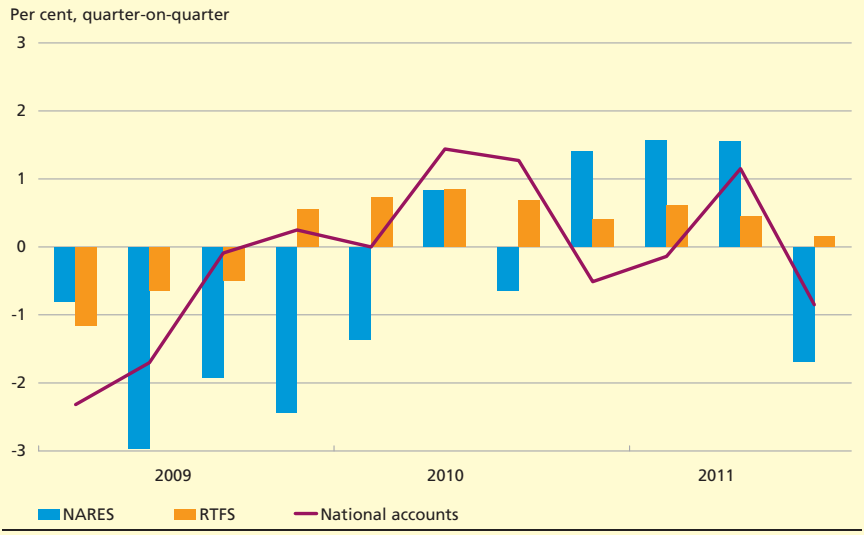
MODEL PERFORMANCE IN RECENT YEARS Box 6.1

Recent years have seen large fluctuations in GDP growth, and, as already mentioned, Statistics Denmark postponed for a period the release of the flash version of the quarterly national accounts from 60 to 90 days after the end of the reference quarter. This box takes a closer look at the ability of the NARES model and the RTFS model to capture the large fluctuations in GDP. The basis for comparison here is the preliminary quarterly national accounts released at the end of November 2011.

Both RTFS and NARES point to considerable declines in GDP in the first two quarters of 2009, which is consistent with the national accounts, cf. Chart 6.2. The models fail to capture the reversal from the 2nd to the 3rd quarter of 2009. In NARES, one of the reasons is that the technical projection is based on developments in previous quarters. In the two subsequent quarters, NARES underestimates growth, while the RTFS model is more consistent with the preliminary national accounts. For the two quarters around the turn of the year 2010/11, for which the national accounts show a fall in GDP, the two models indicate positive growth. Finally, in the two most recent quarters, NARES is closer to the national accounts figure than RTFS is.

Overall, the reversal from negative to positive growth is reflected in the two models, while the weakening of the economy at the end of 2010 and the beginning of 2011 according to the national accounts is less clear in NARES and RTFS.

QUARTERLY GDP GROWTH, ESTIMATES FROM NARES AND RTFS AND PRELIMINARY NATIONAL ACCOUNTS Chart 6.2



Source: Statistics Denmark and own calculations.

One of the key differences between NARES and RTFS concerns the use of estimated coefficients.[1] As described above, the weighting of indicators in NARES reflects each indicator's share of the national accounts

[1] As mentioned, the RTFS model is re-estimated on an ongoing basis in step with the release of new economic statistics.

variable. This implies a restriction on NARES, which does not exist in statistical models like RTFS, where parameters are estimated freely. The fixed coefficients in NARES are a possible reason why the NARES GDP estimates are less precise than the RTFS estimates. Box 6.1 describes the experience with the two models in recent years with large GDP fluctuations, for which final national accounts are not yet available.

The practical use of NARES differs from the technical application illustrated here. A key difference is that the NARES result for a given quarter is not regarded as the final estimate, but as the basis for a detailed assessment of the national accounts components. It is thus possible to include supplementary information or estimates in the technical projections.

The NARES model provides estimates of a large number of variables, which distinguishes it from the RTFS model and many other models. At the same time, the system ensures that the estimates are consistent and in accordance with the definitions and relations in the national accounts. Both the wide extent and inherent consistency of the NARES model are regarded as great advantages in the ongoing cyclical assessment and projection work.

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Household Balance Sheets and Debt – an International Country Study

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1. INTRODUCTION AND SUMMARY

As in most advanced economies, the net wealth of Danish households has grown considerably over the last 15 years. In an international perspective, household net wealth is at an average level. However, the development in net wealth masks a steep increase in both gross wealth and gross debt – known as balance-sheet build-up – which is somewhat higher than in other advanced economies. This article analyses the extent to which household balance-sheet build-up can be explained by underlying structural factors, including the institutional and economic-policy framework. Furthermore, it analyses whether such balance-sheet expansion in the household sector has any particular consequences.

The access to raise debt – the basic element of financial development – is a positive factor. It channels funds from those who desire to save, e.g. for consumption after retirement, to those who wish to invest or consume now. It thus facilitates productive investment and consumption smoothing at varying incomes. Similarly, it may be expedient for individual households to borrow and invest at the same time. In a Danish context, typical households save for pensions while having housing debt. Higher growth and welfare will therefore be associated with a certain level of gross debt.

Higher gross debt also entails a certain risk – especially if credit management is inadequate. Despite having net wealth as a result of housing and pension wealth, households may find it difficult to service their debt in a recession or in the event of large interest-rate increases, because such wealth is relatively illiquid and sensitive to value adjustments. Consequently, high gross debt may, in some cases, pose a risk to financial stability and lead to higher volatility in private consumption.

It is therefore important to assess the possible consequences of financial balance-sheet build-up by households. At the same time, it is relevant to examine the extent to which household savings, financial bal-

ance sheets and gross debt can be explained by underlying structural factors, including the institutional and economic-policy framework.

Section 2 reviews household net wealth and financial balance sheets across a number of OECD countries and describes the above development. In terms of the net wealth structure, it is worth noting that while Danish households, as well as Dutch and UK households in particular, have high pension wealth, their other net financial wealth is lower.

As regards balance-sheet build-up, Danish households' balance sheets are distinguished by large assets and liabilities. The highly developed Danish mortgage-credit and pension systems have facilitated a higher level of gross debt. In an international perspective, the Danish institutional framework with its well-developed financial system, notably the mortgage-credit and pension systems, enables households to make relatively sophisticated decisions regarding the accumulation and composition of their assets and liabilities.

The household sector should not be viewed in isolation from the rest of the economy due to the cross-sector interaction between savings, wealth and gross debt. If the public sector accumulates debt, households will, to a certain extent, see this as a sign of higher future taxes (or lower public benefits) and raise their net wealth accordingly by increasing their savings.

In order to assess the sustainability of household financial balance sheets across countries, it is necessary to apply a wider perspective and include the other sectors of the economy and the economy as a whole. Hence, section 2 also discusses the financial balance sheets of the other sectors and Denmark's overall external debt. In Denmark, the public sector has positive net wealth, unlike many other countries which have net debt. Moreover, the Danish economy overall has net external assets. This means that, in an international perspective, Denmark has a favourable financial balance-sheet position, particularly as a result of efforts in recent decades to improve its government finances and turn the sustained current-account deficits into surpluses.

Household net wealth, i.e. the difference between household assets and liabilities, is a result of accumulated savings and value adjustments. Section 3 analyses household savings. In an international context, the Danish household savings level is low. The same applies to the other Nordic countries, although to a lesser extent. Based on an econometric analysis, we find that the low savings level in Denmark and the other Nordic countries should be viewed against the backdrop of the high level of corporate savings and can be explained by larger public sectors, better government budget balances and higher levels of tax deduct-

ibility of interest expenses (the latter seemed to play a more important role in the 1980s than in the subsequent decades).

Developments in household gross debt are analysed in section 4 based on an econometric analysis. It demonstrates that the strong increase in the gross debt of Danish households is, to a large extent, offset by substantial growth in their pension wealth. Since the prevalence of labour-market pensions is a significant contributing factor behind the rise in pension wealth, this indicates that Danish households have not been as interested in increasing total savings as envisaged by the labour-market pension schemes. One reason is that more people want to have gross debt for a longer period, and that they save up for their retirement rather than bringing down their debt. This has resulted in balance-sheet build-up with higher assets and liabilities. Lower real interest rates and structural unemployment have also contributed to expanding household gross debt as a result of better opportunities to service and obtain higher debt.

The consequences of high gross debt are analysed in section 5. On the face of it, high gross debt entails more pronounced household sensitivity to interest-rate changes and shocks to the economy. Our results indicate greater fluctuations in private consumption in countries with a high level of household gross debt. Greater fluctuations in private consumption amplify cyclical fluctuations.

Based on an econometric analysis covering a number of EU member states, we find that there is no statistical link across countries between the level of gross debt and household arrears. Danish household arrears are very low. But the low level of household arrears indicates that household debt is offset by assets to such an extent that it has not led to major financial-sector losses on direct lending to the households. The low level of losses on lending to the households should be seen in the light of the current low level of interest rates. The high interest-rate sensitivity means that households will be more vulnerable to interest-rate increases, especially if such increases occur at a time of high unemployment and weak growth. Consequently, due to the substantial expansion of household balance sheets, it is essential for the robustness of the economy to ensure appropriate framework conditions for low interest rates, particularly robust government finances and current-account surpluses.

A comprehensive analysis of vulnerabilities with a view to assessing financial stability would require detailed data on the distribution of wealth and gross debt across individuals and the exposure of individual financial institutions. Hence, the vulnerability depends on the extent to which gross debt is distributed on those households that have assets. A

data set sufficient to compare housing wealth, financial assets and debt as well as pension wealth across individuals has not yet been developed. This is a task for future analyses.

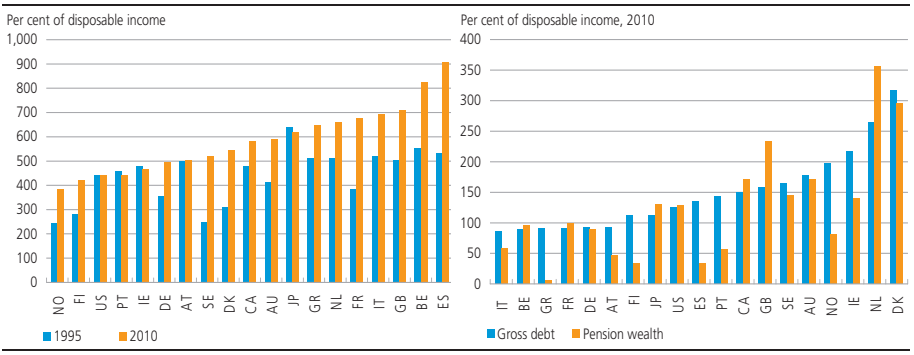
Labour-market pensions will be further extended for the next many years, which, viewed in isolation, will contribute to sustained growth in the household gross debt ratio. Such balance-sheet build-up will increase household sensitivity to interest-rate changes and cyclical fluctuations, thereby in itself amplifying such fluctuations. Conversely, the reduction of the marginal value of interest deductibility in the event of high interest expenses to 25 per cent in the period up to 2019 will increase the costs of having debt for some households, thereby reducing the tendency for sustained balance-sheet expansion. It may also contribute to a higher household savings ratio.

2. HOUSEHOLD WEALTH AND DEBT

In most OECD countries, households have expanded both their balance sheets (wealth/assets and debt/liabilities) and net wealth (wealth less debt) over the last 15 years, cf. Chart 2.1. The net wealth of Danish households rose by approximately 250 percentage points of disposable income from 1995 to 2010, while in Sweden, France and Spain it increased even more. In a few countries, including the USA, Japan, Portugal and Ireland, the net wealth remained almost unchanged, however.

The development in gross wealth, gross debt and net wealth cannot be viewed in isolation. Household wealth consists mainly of housing

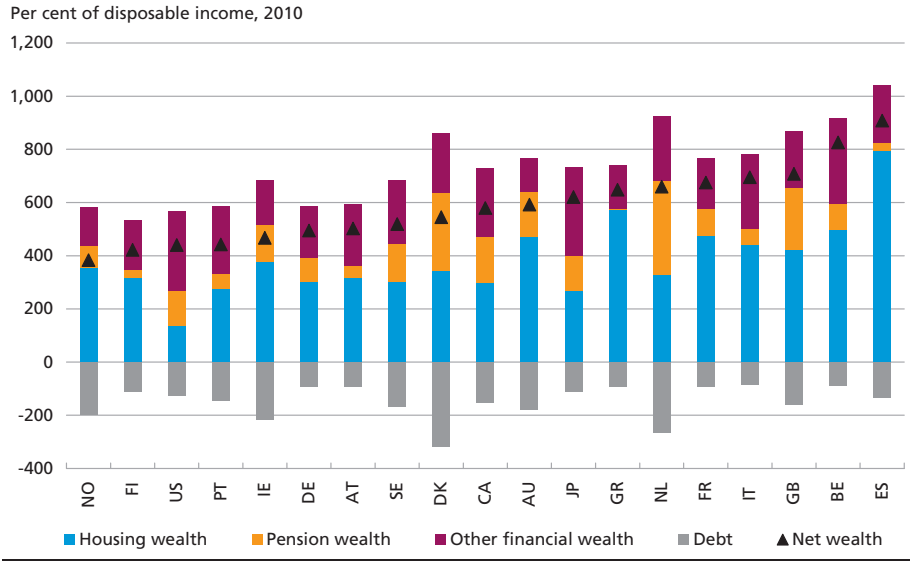
HOUSEHOLD NET WEALTH (LEFT-HAND SIDE), GROSS DEBT AND PENSION WEALTH (RIGHT-HAND SIDE) Chart 2.1



Note: Data for 2010 are partially estimated. In some countries, tax payments on pension savings pay-out reduce pension wealth after tax. The above data are shown before tax, as the current tax rate will not necessarily apply at the time of pay-out. Moreover, household wealth cannot be isolated from the rest of the economy, including government net wealth. Calculating net wealth after tax reduces the Danish households' net wealth by around 100 per cent of disposable income, resulting in a level that only just exceeds the level in Portugal. Conversely, the public sector's net wealth increases accordingly.

Source: OECD, national central banks and own calculations.

HOUSEHOLD WEALTH AND GROSS DEBT Chart 2.2



Note: See the note to Chart 2.1.
Source: OECD, national central banks and own calculations.

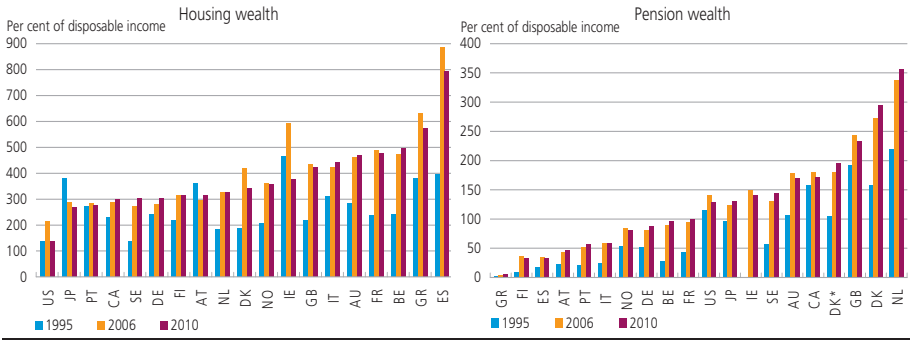
wealth, pension wealth and other financial wealth, cf. Chart 2.2. Gross debt can be broken down into short-term and long-term debt, with long-term loans against the home as collateral making up the majority of total gross debt. A comparison of household debt across countries shows a clear correlation in that countries with large gross debt typically also have large assets in the form of pension savings, cf. Chart 2.1 (right-hand side).

The growth in housing wealth has been a key factor contributing to the development in net wealth since 1995, cf. Chart 2.3.[1] Comparisons of housing wealth across countries are subject to some uncertainty, however. The housing wealth data structure is described in Box 2.1.

Concurrently with the growth in housing wealth, household gross debt has also risen due to reduced costs of having debt and expanded credit facilities. This is partly attributable to falling interest rates and structural unemployment as well as considerable financial development and liberalisation in many countries. Housing wealth and gross debt have thus increased at the same time, thereby contributing to balance-sheet expansion (an increase in both assets and liabilities) in the household sector.

[1] In Spain, housing wealth doubled from approximately 400 per cent of disposable income in 1995 to around 800 per cent in 2010. We have been unable to break down the housing wealth into resident and non-resident households. Part of the immense housing wealth in Spain is owned by non-resident households.

HOUSING AND PENSION WEALTH — Chart 2.3



Note: Left-hand chart: See Box 2.1. Right-hand chart: DK* is pension wealth after tax.
Source: OECD, national central banks and own calculations.

Denmark differs from most other OECD countries by having a highly flexible, well-developed and robust home loan market. For example, it is easy to borrow against home equity in Denmark. Hence, a well-functioning home-financing market provides easy access to mortgage financing, which has contributed to balance-sheet build-up in the household sector. There is a clear correlation between the degree of financial development and the gross debt ratio, cf. Chart 2.4 (left-hand side).

In some countries, including Denmark and the Netherlands, pension savings account for a large part of the wealth. In Denmark, this can be attributed to the widespread use of labour-market pensions, among other factors, cf. Box 2.2. Having substantial pension savings reduces the need to be free from debt before retirement. To the extent that households sustain a high level of gross debt for a prolonged period of life, e.g. in order to save for their retirement rather than reducing their

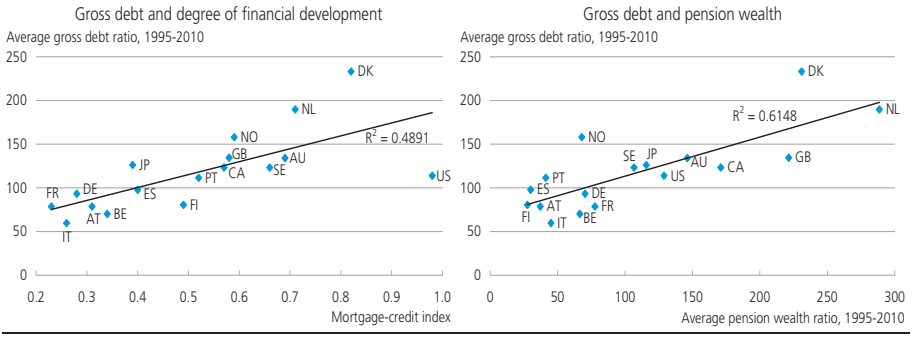
CALCULATING HOUSING WEALTH — Box 2.1

There are considerable differences in the amount of housing wealth across countries, cf. Chart 2.2. Housing wealth is calculated exclusive of empty building sites and agricultural land. Commercial properties owned by households are included. Homes owned by non-resident households are recognised in the country in which the home is located. Consequently, housing wealth in Spain is overestimated (many non-residents, including Danes, own homes in Spain), while housing wealth in Denmark is underestimated, as it is difficult for non-residents to purchase homes in Denmark.

The data are based on information from national central banks and in some cases have been adjusted to facilitate, wherever possible, comparison of housing wealth across countries[1]. In case of gaps in the data set, we have constructed data by forward and/or backward projection by means of an index based on accumulated real gross investment less 2.5 per cent annual depreciation multiplied by a house price index.

[1] Housing wealth in Norway is subject to additional uncertainty, since data are only available for a single year, i.e. 2008. Data for Ireland in 1995 are 2002 figures.

FINANCIAL DEVELOPMENT, PENSION WEALTH AND GROSS DEBT — Chart 2.4



Note: Data for 2010 are partially estimated. Left-hand chart: For a more detailed description of the mortgage-credit index, see Box 4.1 below. Right-hand chart: Pension wealth is calculated before tax. See the note to Chart 2.2.
Source: OECD, national central banks, IMF (2008) and own calculations.

housing debt, the debt ratio will increase for the household sector as a whole. For individual households, however, the peak level of debt over their lifetimes will not necessarily rise. Finally, pension savings are typically tax-advantaged, while interest expenses are tax deductible (in Denmark, the tax value of interest deductibility is 33 per cent, while pension yields are taxed at 15 per cent). This may provide incentives for some households to borrow to finance their pension savings. The accumulation of substantial pension wealth has thus contributed to balance-sheet build-up in the household sector, cf. Chart 2.4 (right-hand side).

PENSION SAVINGS IN DENMARK — Box 2.2

The use of savings-based pension schemes organised by employers (labour-market pensions) in Denmark has increased considerably over the last 20 years. In 2005, just over three fourths of the population between the ages of 35 and 55 contributed to a pension scheme. At the same time, labour-market pension contribution rates have gone up. According to an estimate by the Danish Economic Councils, pension wealth measured as a percentage of the gross domestic product, GDP, will have doubled by around 2045 compared with the 2005 level. Moreover, the Danish Economic Councils' analyses show that the coverage of many employees will actually exceed 100 per cent if other wealth such as housing wealth is included.[1]

Compulsory pension savings schemes are tax-advantaged, which has contributed to their growing popularity. The tax benefits mainly consist in capital yields being taxed at only 15 per cent, while the value of interest deductibility is 33 per cent (in most other countries, yields on pension savings are not taxable). This should also be seen in relation to the fact that other positive capital income is taxed at either 37 or 48 per cent. Moreover, contributions are deductible to the extent that income tax is not payable until pay-out. Further tax benefits are achieved if the income tax rate is lower at the time of pay-out than at the time of contribution (e.g. for those who do not pay top-rate tax after retirement).

CONTINUED Box 2.2

The degree to which it is possible to speculate in tax asymmetries between contribution and pay-out is uncertain, however, because the effective rate of marginal tax at the time of pay-out is often quite high due to the set-off of pensioner credit, among other factors. Besides, the tax benefits for younger employees are distributed over a large number of years. The difference between the highest and lowest marginal tax rates is currently around 15 per cent. Spread over e.g. 15 years, the tax savings correspond to an excess return of around 1 per cent per year in simplified terms. Allowing for the fact that the return is reduced by the administration costs to the pension company, while the borrowing costs are increased by contribution rates to the mortgage bank, it will not be particularly advantageous for many households today to borrow to finance pension savings, e.g. by choosing deferred-amortisation loans and placing the extra liquidity in a pension savings scheme. There used to be more incentive to borrow to finance contributions to pension schemes when the tax value of interest deductibility was higher, and the difference between the highest and the lowest marginal tax rate was bigger, which may have contributed to the expansion of Danish household balance sheets.

But the pension systems and their reforms may affect the total household savings level. In the estimate of the Danish Economic Councils, the crowding-out effect of labour-market pensions in Denmark is only around 15-30 per cent. This means that additional savings of kr. 1 in a labour-market pension increases the net wealth by kr. 0.75-0.80. However, according to the Danish Economic Councils, the estimates are subject to considerable uncertainty, and the future crowding-out effect may increase as a result of greater wealth.

Given that the Danish household savings ratio has not increased in the last 20 years, the Danish Economic Councils' estimate of the crowding-out effect is very low. Instead, the combination of a substantial expansion of labour-market pensions and a relatively constant savings ratio indicates that households have increased their balance sheets, which is confirmed by the corresponding development in gross wealth and gross debt.

[1] The coverage indicates the income in the first year after retirement relative to the income in the last year before retirement, adjusted for pension contributions.

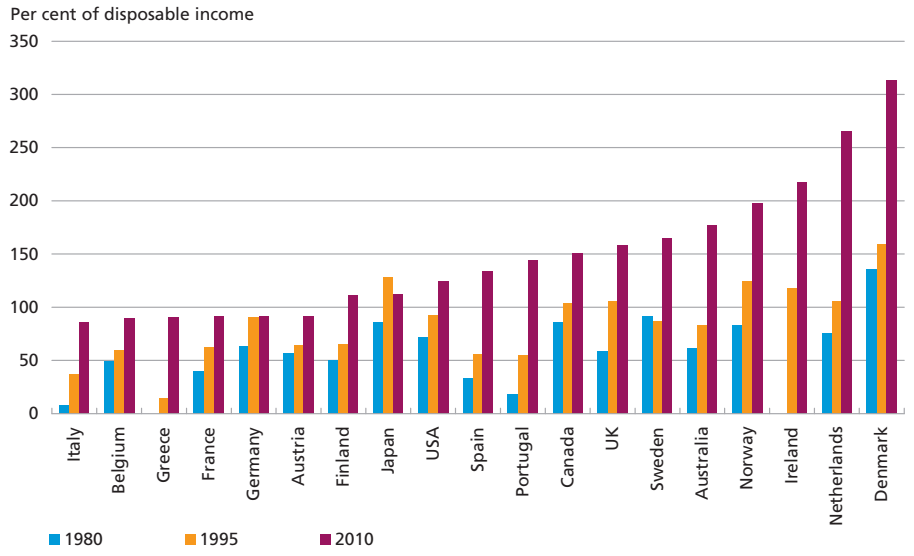
As a consequence, growing housing and pension wealth and financial development have contributed to the expansion of household balance sheets.

Gross debt has risen considerably over the last 15 years, reflected in doubling of the gross debt ratios in many countries, although to a lesser extent than wealth. The gross debt ratio is particularly high in Denmark, the Netherlands and Norway, while Italy, France and Germany are in the low range, cf. Chart 2.5. Japan and Germany are the only countries in which the households have not increased their gross debt ratio over the last 15 years.

Household net wealth and the rest of the economy

Household net wealth cannot be viewed in isolation from the rest of the economy. If the public sector has substantial net debt, households must

HOUSEHOLD GROSS DEBT Chart 2.5



Note: For Germany 2010: The data refer to 2009. For Norway 1980: The data refer to 1987.
Source: OECD, Cecchetti et al. (2011) and national central banks.

expect higher taxes and/or poorer public service in the future, while large corporate debt means that households must expect lower future dividend payments. Both of these factors point to households building up greater net wealth through savings.

Net wealth for all sectors taken as one equals a country's net external assets, also called external debt.[1] A country will accumulate external debt if it has sustained current-account deficits as a result of a savings deficit in the economy overall (investments exceed national savings).[2]

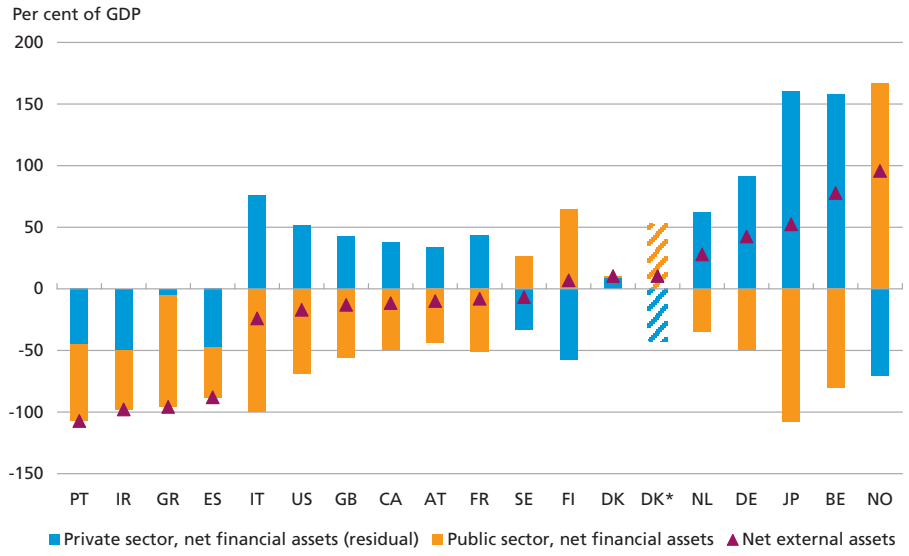
Among the OECD countries, Norway, Belgium, Japan and Germany, among others, have substantial net external wealth, while Portugal, Ireland, Greece and Spain, among others, have considerable external debt. Denmark has gone from having considerable external debt in the 1980s to having net external wealth of around 10 per cent of GDP in 2010, cf. Chart 2.6 and Table 2.1. This reflects a long period of sustained current-account surpluses.

In most countries, the public sector has net debt, while the private sector has net wealth. The Nordic countries are unique in that their public sectors have net financial wealth. In Denmark, the public sector has

[1] It should be noted that external debt is a net figure. On the other hand, household debt usually refers to gross debt.

[2] A high level of external debt may entail a risk that non-resident lenders suddenly lose confidence. Substantial external debt is especially problematic if it consists mainly of loans. If external debt consists primarily of inward foreign direct investment, the vulnerability is normally deemed to be far less pronounced.

EXTERNAL DEBT AND NET FINANCIAL ASSETS AT SECTOR LEVEL (2010) Chart 2.6



Note: Due to lack of data, statistics for Italy, France, Germany, Japan and Ireland are from 2009. DK* indicates sector balance sheets for Denmark, adjusted for deferred tax on household pensions.
Source: IMF, Eurostat, OECD.

moderate positive net financial wealth when including holdings in various funds. Allowing for the fact that part of household pension savings are deferred tax accruing to the public sector on pension pay-out, however, the public sector's net wealth is considerably higher, cf. Table 2.1.[1]

Non-financial corporations in all countries have negative net financial assets. This is natural, since they invest in real assets, buildings, machinery, etc. But it is difficult to interpret the development in net financial wealth for the firms, and to compare the levels across countries. If, for example, a firm has a large surplus that is not distributed, its net financial wealth will not increase. The reason is that while the firm's financial assets will increase if the surplus is deposited in a bank account, its equity capital and thus its liabilities will also increase. This means that the net financial wealth remains unchanged.[2] Moreover, non-financial corporations will normally not have large portfolios of shares, so stock price fluctuations will only have a minor impact on the asset side. The liabilities side, on the other hand, includes a large portfolio of stocks (stock issued by the non-financial corporation), resulting in much

[1] In the Netherlands, the public sector also has net wealth when allowing for deferred taxation of household pension wealth.
[2] If, instead, a surplus is used to finance a new machine, the net financial assets will actually fall, since the financial assets remain unchanged, while the financial liabilities increase as a result of retained surplus.

FINANCIAL ASSETS AND LIABILITIES AT SECTOR LEVEL AND NET EXTERNAL ASSETS IN 2010 Table 2.1

Per cent of GDP	Denmark	Sweden	Nether-lands	Germany	UK	Spain
Households						
Financial assets	250.5	202.9	298.4	187.3	298.3	169.2
Deferred tax on pension (liability)[1]	52.4	22.8	53.6	20.4	25.6	4.1
Liabilities	153.2	87.1	132.7	62.1	106.2	91.7
Net financial assets	97.3	115.8	165.7	125.2	192.1	77.5
Net assets excl. deferred tax[1]	44.9	93.0	112.2	104.8	166.5	73.5
Financial corporations						
Net financial assets[2]	1.5	13.6	0.8	10.5	-25.5	13.4
Non-financial corporations						
Financial assets	190.6	286.4	201.7	129.5	153.5	206.4
Liabilities	281.1	455.3	257.5	189.5	277.1	342.6
Net financial assets	-90.5	-169.0	-55.9	-60.0	-123.6	-136.2
Public sector						
Financial assets	66.0	78.7	43.7	37.6	33.3	36.4
Liabilities	64.7	52.6	78.1	88.2	89.3	76.6
Net financial assets	1.3	26.1	-34.4	-50.6	-56.1	-40.3
Net assets incl. deferred tax	53.7	48.9	19.2	-30.2	-30.5	-36.2
Total economy						
Net financial assets	9.6	-13.5	76.3	25.1	-13.0	-85.6
Net external assets[3]	10.4	-6.7	28.0	42.5	-13.0	-88.0

Source: OECD, Eurostat.

[1] Adjustment is made for deferred tax on pension contributions using average pension tax rates from OECD (2011).

[2] Only net financial assets for the financial sector are shown, since the financial assets and liabilities in this sector are very high, constituting to a high degree outstanding accounts within the sector.

[3] The net financial assets for the total economy and the net external assets may differ. The net financial assets are calculated on the basis of the financial accounts, while the net external assets are calculated in the balance-of-payments statistics. As those statistics are not always reconciled, there may be major differences.

stronger fluctuations. A strong decrease in corporate net assets may thus be attributable to a large increase in the prices of domestic shares.

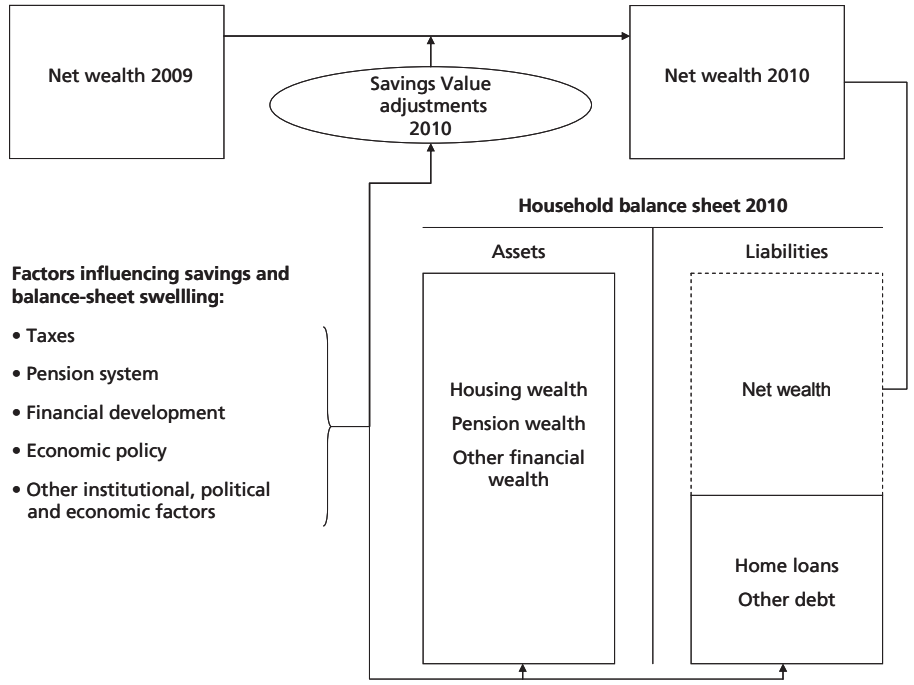
In most countries, the financial sectors have moderate, but positive net financial assets.[1]

Further analyses

As mentioned earlier, households have increased their net wealth and balance sheets considerably over the last 15 years. Chart 2.7 shows a stylised relation between the households' net wealth, balance sheets, savings and price fluctuations. The development in net wealth is determined by price fluctuations and household savings. Net wealth is merely an expression of the difference between the value of household assets (including homes) and liabilities. The assets and liabilities are larger than

[1] The central bank is included as part of the financial sector shown in Table 2.1.

NET WEALTH, BALANCE-SHEET EXPANSION AND SAVINGS Chart 2.7



the net wealth, as households have raised loans that are placed in various assets. This balance-sheet expansion reflects factors such as taxes, financial development, economic policy, etc.

The amount of household savings also depends on several factors, including wealth, business cycles, the tax system and other economic-policy and institutional factors. If households obtain large capital gains, it will reduce their savings needs. Similarly, higher corporate savings will implicitly lead to higher household savings, as private firms are ultimately owned by the households, thereby reducing the households' savings needs. Conversely, large government deficits may imply higher future taxes and thus a need to save. In addition, a large variety of other factors may affect household savings. Section 3 analyses household savings in more detail, based on an econometric analysis of the net savings ratio, among other factors.

Viewed in isolation, net wealth is not affected by balance-sheet build-up due to e.g. borrowing to finance investments in home purchases or in financial assets such as private pension schemes. Large asset/liability balance sheets potentially imply more significant value adjustments, e.g. as a result of interest-rate changes. The incentives for borrowing and balance-sheet expansion are also affected by the tax system, the pension

system and the financial system. All other things being equal, interest deductibility combined with tax-advantaged savings in owner-occupied homes or pensions provides an incentive to raise debt with a view to purchasing a home or boosting pension contributions. Similarly, a more well-developed financial system enables a more sophisticated balance-sheet composition with better wealth distribution on several assets, rather than savings in a single asset, e.g. a home. Besides, there will be an impact from other economic factors, e.g. interest rate and inflation levels, which will, all other things being equal, also affect the households' ability to raise debt. Household gross debt and balance-sheet build-up will be analysed further in section 4, based on the above factors.

3. ANALYSIS OF HOUSEHOLD SAVINGS

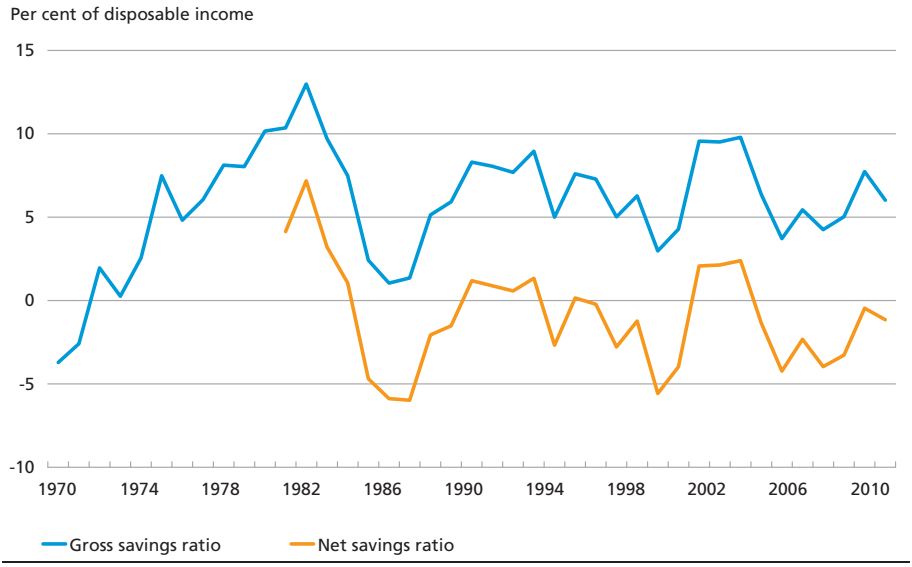
As described in the previous section, household savings are among the factors that impact household balance sheets.

We look into the household savings ratio, i.e. household savings relative to household disposable income. Household gross savings are compiled in the national accounts (ESA 95) as income (including pension contributions) after tax, less private consumption.[1] Hence, the gross savings ratio is gross savings relative to income (including pension contributions) after tax. Savings can also be compiled as net savings, i.e. gross savings less depreciation (impairment due to wear and tear) of the capital stock (mainly the housing stock). In the econometric analysis later in this section, we use the net savings ratio for data availability reasons, since the gross savings ratio is not available for all countries. The gross savings ratio is more closely related to the households' liquidity position, however, as depreciation affects asset values rather than liquidity. The development in gross and net savings is more or less identical over time, cf. Chart 3.1, since the size of the capital stock and thus depreciation change slowly over time.

In the vast majority of countries, the gross savings ratio has either declined or remained unchanged since 1980, cf. Table 3.1. In Denmark, the gross savings ratio has generally been very low compared with the other OECD countries. The other Nordic countries and the Anglo-Saxon countries are also in the low range as regards household gross savings ratios.

[1] In the national accounts (ESA 95), household disposable income is defined as income, excluding pension contributions, after tax. Accordingly, disposable income less private consumption is not equal to savings.

DANISH HOUSEHOLDS' NET AND GROSS SAVINGS RATIOS Chart 3.1



Source: Statistics Denmark.

Can the household-related differences be explained?: An econometric analysis

OECD (2004) points to a number of statistical factors which may impede the comparison of savings ratios across countries. Firstly, the size of the public sector affects the savings ratio measured. In some countries, the

AVERAGE SAVINGS RATIO Table 3.1

Per cent	1980-85	1985-90	1990-95	1995-2000	2000-05	2005-10
Australia	20.6	17.3	14.0	12.2	9.1	13.2
Austria	15.0	17.1	17.1	14.1	13.7	15.6
Belgium	16.7	17.0	19.8	17.9	16.5	16.6
Canada[1]	17.1	13.2	11.6	5.8	3.5	3.6
Denmark	8.9	4.0	7.6	5.6	7.2	5.4
Finland	9.7	8.4	12.4	9.0	8.5	8.9
France	16.0	12.2	14.4	15.3	15.5	15.3
Germany	16.8	17.2	17.5	15.9	15.7	16.9
Italy	30.5	28.3	24.2	18.6	15.8	14.9
Japan	22.6	20.2	20.1	17.1	11.9	10.4
Netherlands	17.9	19.5	19.7	16.2	13.2	12.5
Norway	10.2	5.9	10.1	9.2	11.6	10.1
Portugal	24.4	21.5	14.9	10.7	10.4	8.8
Spain	12.7	12.6	13.4	12.7	11.4	12.9
Sweden	11.5	6.1	9.9	7.1	9.3	12.0
UK	10.7	6.8	10.1	7.8	4.7	3.9
USA	14.4	11.4	10.4	8.5	7.2	8.2

Note: Gross household savings ratio.
Source: OECD, national central banks and statistical agencies.
[1] For Canada, the net savings ratio is shown due to lack of data.

households bear the costs of health and education, while in other countries those services are offered by the public sector and financed through household income taxes. Assuming identical household savings in monetary terms, the savings ratio will, all other things being equal, be higher in countries that finance such costs through taxes, as the heavier tax burden reduces disposable income (the numerator in the savings ratio).[1]

Savings ratio fluctuations can also be difficult to compare across countries. For example, disposable income in the national accounts does not include capital gains. This affects e.g. the savings ratio in Denmark, since the compilation of household disposable income in the national accounts does not include capital gains on pension wealth, while pension-yield tax is registered as a household expense.

In addition to such compilation-related factors, there will also be a number of impacts from fundamental behavioural, institutional and economic-policy aspects which may cause cross-country differences in the household savings ratios. In order to assess the importance of these aspects, we will use an econometric analysis to explain the development in household savings ratios.

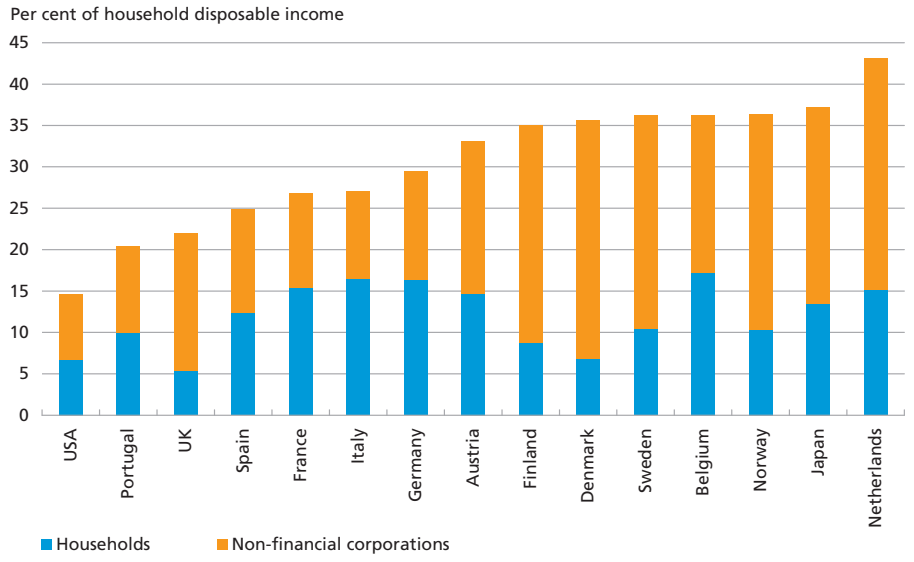
The theoretical approach to describing household savings and debt is the *Life Cycle Hypothesis Model*, which was originally designed by Modigliani and Brumberg. The basic idea is that throughout their lives, people will seek to obtain a steady development in consumption. Rather than being constant over time, their income will normally follow a life cycle. Young people's income will be low due to their need for education. As they get established on the labour market, their income will rise. When they get older, their income will decline again, e.g. due to retirement.

The desired consumption does not necessarily fit this income pattern. Consequently, a typical pattern is that households initially raise debt, e.g. for purchases of consumer durables, then they save up, e.g. through a labour-market pension scheme and/or by repaying a home loan, and finally they draw on their wealth, e.g. by having their pension savings paid out.

According to this basic idea – that households want to even out consumption over time – several factors influence household savings and indebtedness, cf. Hüfner and Koske (2010), among others. In addition to the variables included in the life cycle model, a number of variables for

[1] Similarly, if a country's public sector is financed through indirect taxes (e.g. VAT and excise duties) to a higher degree than through income taxes, the savings ratio of that country will, all other things being equal, be lower, since the disposable income is higher due to lower income taxes.

HOUSEHOLDS' AND NON-FINANCIAL CORPORATIONS' GROSS SAVINGS Chart 3.2



Note: Average for 1995-2009. For Spain: average for 2000-09, and for Japan: 1995-2008.
Source: OECD.

the size of the public sector are used, as inspired by Koskela and Virén (1994) as well as Tanzi and Zee (1998), among others.

In addition, we include corporate savings as an explanatory variable. Firms are ultimately owned by households (apart from foreign-owned firms) and, in principle, the corporate sector might also be recognised in the household balance sheet. Therefore, it makes sense to include corporate savings as an explanatory variable, since corporate savings can be seen as a substitute for household savings.[1] It is remarkable that the savings level of non-financial corporations in Denmark – and to a slightly lesser extent the other Nordic countries – is quite high compared with other countries, cf. Chart 3.2.

This difference may reflect taxation differences. Depending on the tax system, it may be an advantage for households owning firms to leave the surplus in the firm and be taxed according to the corporation tax rate, which is lower than the capital gains tax rates. But the high level of corporate savings may also be attributable to other factors. For example, the corporate or ownership structure may be of importance, as it may provide different incentives for ordinary private investors and funds that are subject to special mandates and regulations.

[1] Alternatively, total private-sector savings should be examined.

A selection of the variables that may affect household savings ratios are presented in Box 3.1. A detailed bibliography of different studies of household savings ratios is found in Hüfner and Koske (2010).

VARIABLES WHICH MAY AFFECT HOUSEHOLD SAVINGS RATIOS Box 3.1

Real interest rates, taxation of capital income, and interest deductibility

The relation between real interest rates and savings is not clear. Real interest rates constitute the relative price of consumption today rather than in the future. High real interest rates imply a high price of consumption today relative to future consumption, which encourages savings. This is called the *substitution effect*.

There is also an *income effect*, which may potentially point in the opposite direction. All other things being equal, higher interest rates imply higher yields on savings. This will increase the future consumption opportunities for persons with positive wealth, thereby reducing the savings motive.

Taxation of capital income, which reduces effective interest rates on savings, will reduce the savings incentive based on the same reasoning as for real interest rates. Similarly, interest deductibility encourages borrowing (and spending of savings) by reducing effective costs.

Corporate savings

A considerable number of firms are owned by the households. If firms retain their surpluses rather than disbursing them as dividend, households will obtain a capital gain instead, which, according to the national accounts, is not included in their income or savings. If households prefer to let the corporate surpluses remain in the firms, e.g. for tax reasons, this will cause their real savings to be underestimated.

Wealth

According to the life cycle model, household wealth will have a negative impact on savings. Increased wealth implies more resources available for consumption (including future consumption), thereby reducing the incentive to save. The impact on savings will depend on whether they are regarded as temporary or permanent. While temporary (uncertain) wealth gains as a result of e.g. fluctuations in stock prices, will not lead to any major changes, permanent (certain) wealth gains will lead to changes in consumption and thus in savings. Several studies find that housing wealth is considered to be more certain and thus has a greater impact on household consumption and savings.

Uncertainty and the size of the public sector

Households have a precautionary savings motive, as the savings can be used as a buffer against unexpected losses of income or to cover unforeseen expenditure. Hence, growing uncertainty will lead to increased savings. A stable macroeconomic situation will reduce the precautionary savings motive. Besides, a more extensive social safety net will reduce the need for savings to cover unforeseen losses of income. Countries with a large public sector typically have a more developed safety net, which reduces the uncertainty of the individual households and thus their savings. Likewise, in countries with a large public sector, income inequalities will, to a higher degree, be

CONTINUED Box 3.1

evened out through taxes, and since the savings ratio increases with the level of income, such redistribution may contribute to reducing savings. Conversely, a higher tax level will entail lower disposable income, which would, in monetary terms, lead to a higher savings ratio at the same level of savings.

Demographics

The savings ratios of young people and the elderly will typically be lower compared with those of the middle-aged, since young people typically raise debt, the elderly spend their savings, and the middle-aged, who have the highest income, save up for their retirement. Consequently, a larger share of the population outside the labour force means a lower savings ratio.

Government deficit and debt

There will typically be a negative relation between the net borrowing/net lending of the public and private sectors. One reason is that a forward-looking household will, to a certain extent, see a government deficit as an expression of higher taxes and/or lower public consumption in future. Growing government deficits thus encourage increased private savings. Such a response is called Ricardian equivalence.[1] Full Ricardian equivalence rests on a number of strong assumptions which will not be met in practice. For example, credit restrictions will lead to a number of households not responding as assumed. Household savings are therefore likely not to be fully adjusted to larger government deficits.[2]

Financial development and credit restrictions

In practice, it is not possible for all households to borrow as much as they want. The extent of such credit restrictions is determined especially by developments in the country's financial markets. A more developed financial sector will provide more savings opportunities that are better suited to individual needs, and lead to increased competition. In theory, this will also result in better resource allocation and thus potentially higher returns. On the other hand, a more developed financial sector often leads to fewer credit restrictions and thus a reduced precautionary savings motive, since it makes it possible to raise debt to cover unforeseen expenditure and loss of income.

[1] The term originates from Barro (1974). This topic is still being discussed, as it is of particular relevance when assessing the efficiency of fiscal-policy stimulus.

[2] Nickel and Vansteenkiste (2008) find indications that the degree of Ricardian equivalence may be dependent on the level of government debt. While they find a positive relation between government deficits and current-account deficits at low levels of debt, a similar relation is not found at high levels of debt. This indicates that at high levels of government debt, there is a higher degree of household awareness of the potential consequences of government finances.

The analysis estimation method is elaborated on in Box 3.2. For data availability reasons, we use household net savings relative to household disposable income as an expression of the household savings ratio. Our data set is constructed on the basis of data from the OECD, Eurostat and the World Bank and contains annual data for 17 OECD countries: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Italy,

PANEL ESTIMATION WITH COUNTRY-SPECIFIC CONSTANTS Box 3.2

The econometric models used to describe household savings and debt are based on panel estimation with country-specific constants. Panel estimation makes it possible to use the information in the development over time across several countries at once, thereby obtaining more accurate estimates of the explanatory variables than if using the development over time in a single country. To allow for inexplicable permanent differences in the level of savings and debt across countries, we include country-specific constants, also called *fixed effects*. Because of the use of country-specific constants, major permanent differences in the levels of savings and debt across countries are not necessarily explained by the explanatory variables.

The basic specification is expressed as follows:

$$Y_{it} = \alpha_0 + \theta_i + \sum_{k=1}^{K} \beta_k X_{kit} + \varepsilon_{it}$$

where Y_{it} is the endogenous variable for country i at time t, calculated in years. α_0 is a common constant, and θ_i is a vector with country-specific constants. β_k is a vector of k estimated coefficients, X_{kit} is a vector of k explanatory variables, and ε_{it} is an error term. Y_{it} and X_{it} are specified in more detail in individual analyses.

The estimations of the level of debt include lagged values of the explanatory variable (i.e. the debt ratio) in order to avoid autocorrelation, which means that we set up a dynamic panel estimation. To check its robustness to endogeneity problems, we have used a 1-step Generalised Method of Moments, GMM, cf. Arellano and Bond (1991).

Japan, the Netherlands, Norway, Portugal, Spain, Sweden, the UK and the USA. The period analysed is 1980-2008 for the majority of the countries, including Denmark.

Table 3.2 presents the results of the estimated relation between the household net savings ratio and the potential explanatory variables. In addition to the explanatory variables in Table 3.2, we have made a number of estimations using other explanatory variables. For example, we have attempted to include variables for household wealth (housing wealth and stock prices) and a financial development index (Abiad et al. (2008)). Our estimation showed no significant impact from those variables, however. One reason may be that the variables used did not adequately reflect the underlying conditions we wanted to describe in the model. Another reason may be that the effects of the variables are not captured by the model due to cross-country variations.[1]

By and large, the results of the econometric analysis of the preferred model provide the expected signs. The demographic variable, i.e. the

[1] In a Danish context, the difference between estimated and actual net savings ratios may indicate that the development in household savings is affected by the development in property prices and the price of other assets, cf. Chart 3.3. This is also consistent with the fact that the variation in private consumption increases with higher gross debt, cf. Section 5.

ESTIMATED MODEL OF HOUSEHOLD SAVINGS RATIOS — Table 3.2

	Estimated coefficient
Constant	0.283***
Elderly people aged 64+ as a share of the population aged 15-64	-0.678***
Cyclically adjusted government budget balance (ratio of GDP)	-0.593***
Cyclically adjusted government current disbursement (ratio of GDP)	-0.133***
Corporate savings (ratio of GDP)	-0.452***
Real interest rate after tax	0.234***
R^2	0.83
Durbin Watson statistic	0.35

Note: The real interest rate after tax is based on a marginal income tax rate, a 10-year government bond yield and a smoothed inflation series as a proxy for inflation expectations. In addition to the variables in Table 3.1, the model includes a dummy for Germany in 1995, a trend for Germany in the period 2004-08, and a trend for Sweden in 2007-08 to ensure normally distributed error terms. The results are robust when allowing for heteroskedasticity. *** (**) (*) indicate that the estimate is significant at a 1, (5), (10) per cent level of significance.

Source: Own calculations.

share of elderly people in the population, has the expected negative sign. According to the life cycle model, the savings ratio will decline when a person retires, which is consistent with similar analyses, cf. Hüfner and Koske (2010).

According to the estimated model, a better government budget balance is linked to lower household savings. Conversely, a deterioration will lead to higher savings. This indicates partial[1] Ricardian equivalence, i.e. households to some extent factoring in future changes in taxes and expenditure. The coefficient of the cyclically adjusted government budget balance is 0.59, so a government deficit increase of 1 pct of GDP will cause the household savings ratio to rise by 0.59 percentage points.[2]

Cyclically adjusted government expenditure also has the expected negative sign. According to Koskela and Virén (1994), income taxes contribute to explaining the lower level of household savings in the Nordic countries relative to other OECD countries in the period 1970-91. Haque et al. (1998) also conclude that public expenditure as a ratio of GDP and the government deficit are the most important factors explaining savings ratio differences across OECD countries. Tanzi and Zee (1998) find that the tax burden is a key factor explaining the savings level across OECD countries in the period 1970-94, and a heavy tax burden entails lower savings.

[1] The economic literature refers to various factors, including credit restrictions and limited rationality, which would make full Ricardian equivalence unrealistic. Another factor might be that under well-planned countercyclical fiscal policy, a deterioration of the cyclically adjusted government budget balance would not be seen as an expression of higher future taxes.

[2] As household disposable income constitutes only a percentage of GDP, this means that the impact of household savings on national savings is less than indicated by the coefficient. In Denmark, household disposable income constitutes around 50 per cent of GDP, so higher household savings as a result of an increase in the government deficit of 1 per cent of GDP would amount to around 0.3 per cent of GDP.

The effect from the real interest rate after tax is positive, so a higher real interest rate after tax leads to higher savings. In general, according to the literature, there is also a positive relationship between real interest rates and the savings level, see e.g. Hüfner and Koske (2010), and at micro level, cf. Attanasio and Weber (2010), among others. Unlike the literature, our analysis seeks to allow for the effect of interest deductibility against income tax by calculating the real interest rate after tax based on the tax value of interest deductibility when financing home purchases.[1] A positive interest deductibility value reduces effective after-tax real interest rates and thus savings, which is in accordance with the theoretical relation described in Box 3.1.

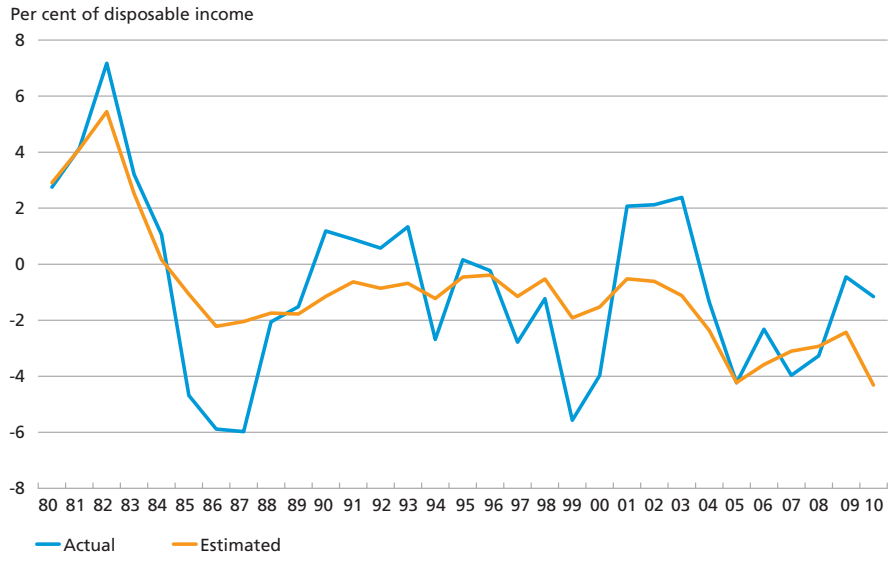
We also find a strong significant negative relation between corporate savings as a ratio of GDP and the household savings ratio. Our model differs from most similar studies (see e.g. the bibliography in Hüfner and Koske (2010)) by including corporate savings as an explanatory variable. One exception is Callen and Thimann (1997), who also find a negative relation. Based on the estimated coefficients, the actual values of the explanatory variables and country-specific constants, the result is the model-calculated (estimated) savings ratio, cf. Chart 3.3. To a reasonable extent, the model captures the development in the household savings ratio over time, but it shows less fluctuation than the actual level, which also changes due to cyclical fluctuations and other temporary factors.

The estimated savings ratio in Denmark is substantially lower than the average estimated savings ratios in the other countries. Throughout the period, the estimated savings ratio is outside the scope of two standard deviations relative to the average for the non-Nordic countries, although the difference is slightly reduced over the period. If we look at the average for all the Nordic countries, the savings level is also lower, but the deviation is less pronounced, and an approximation is seen over the period, cf. Chart 3.4.

We can determine the factors which, according to our model, cause the difference in savings ratios by decomposing the differences in estimated savings ratios into contributions from individual variables included in the model, cf. Chart 3.5. As mentioned, we have allowed country-specific constants in the estimated model. For Denmark, this unexplained effect contributes negatively to the savings level relative to the non-Nordic countries, while the contribution for the Nordic countries as a whole constitutes a smaller, negative ratio of the total difference.

[1] For countries where interest is not deductible, the tax value is zero. For countries where interest is fully deductible, the tax value equals the marginal tax rate for an average employee, except in the Nordic countries where limitations in the interest deductibility value as a result of tax reforms are taken into account. An estimate based on data from Hilbers et al. (2008) and IBFD (various volumes) is used for countries with partial interest deductibility.

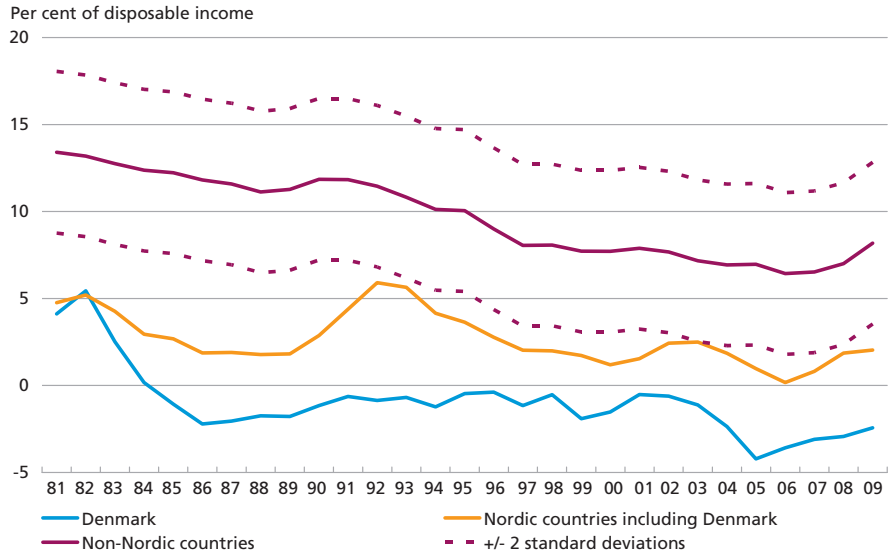
ESTIMATED AND ACTUAL NET SAVINGS RATIOS FOR DANISH HOUSEHOLDS — Chart 3.3



Note: The estimated savings ratios for 2009 and 2010 are based on an out-of-sample forecast.
Source: Own calculations.

Similarly, the demographic differences also contribute only to explaining a smaller part of the differences in the estimated savings ratio. This factor had the strongest impact in the 1980s when the large shares of

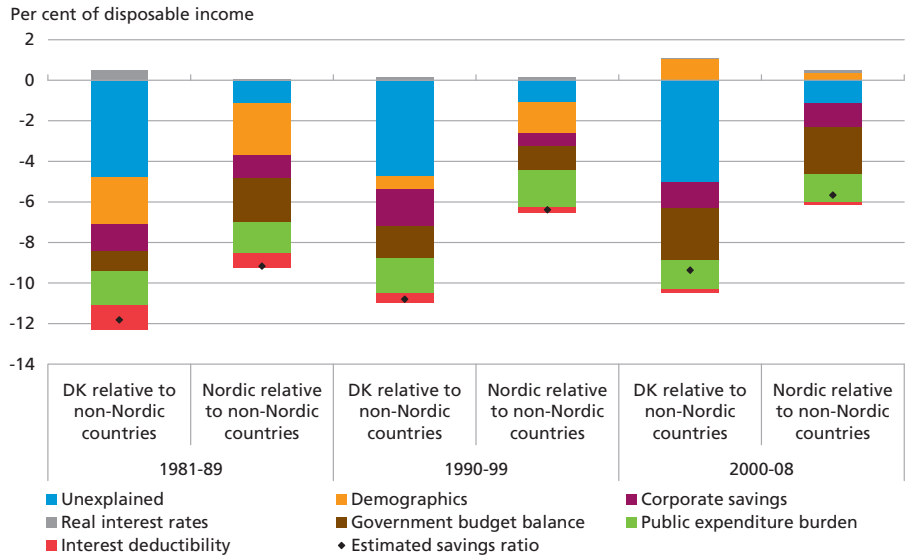
ESTIMATED NET SAVINGS RATIOS FOR THE HOUSEHOLD SECTOR — Chart 3.4



Note: Australia is not included in the estimate for the savings ratios of non-Nordic countries, since government expenditure data is only available from 1989. Statistics for 2009 are based on an out-of-sample forecast.
Source: OECD, Eurostat, IMF, and own calculations.

DECOMPOSITION OF THE DIFFERENCE IN HOUSEHOLD SAVINGS RATIOS FOR DENMARK AND THE NORDIC COUNTRIES

Chart 3.5



Note: The decomposition of the difference between the estimated savings ratios in the two (groups of) countries is estimated as the difference between the contributions of the individual variables in the two (groups of) countries. The contribution from the individual variable is estimated by multiplying the variable's average value for the different periods by the estimate in Table 3.1. The unexplained part consists of the country-specific constants as well as a dummy for Germany in 1995, a trend for Germany in the period 2004-08, and a trend for Sweden 2007-08.

Source: Own calculations.

elderly people in the Nordic countries contributed to explaining a savings ratio difference of just over 2 percentage points. The effect subsequently reversed, but it is now much less influential as an explanatory factor.

One of the most important sources in the model to explain the lower savings ratios in Denmark and the Nordic countries compared with the other OECD countries is the higher corporate savings as a ratio of GDP. According to the model, the household savings ratio is reduced by 1.5-2 percentage points as a result of the relatively higher level of corporate savings.

Another very important factor is the size of the public sector measured by its expenditure as a ratio of GDP. According to the model, it contributes to reducing the savings ratio of the Nordic countries by an average 2 percentage points relative to the other countries. As described in Box 3.1, there may be several reasons for this relationship. A more extensive public safety net reduces the need to save up for precautionary reasons. Besides, the high level of expenditure is financed by high income taxes and a more progressive tax system. In relative terms, this reduces the income of people with high incomes more, thereby reducing

the average savings ratio, since people with high incomes typically have a higher propensity to save.

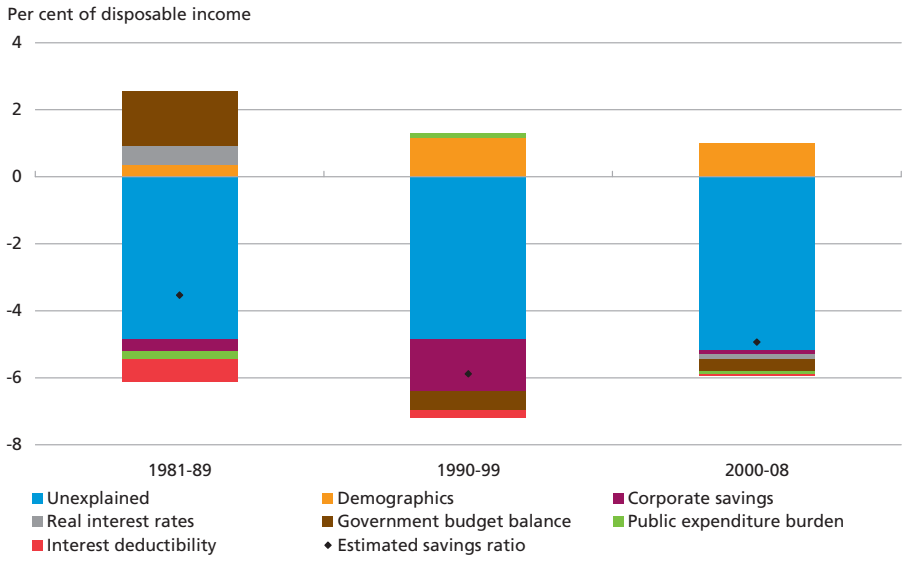
Differences in the strength of public finances are also important. Denmark and the Nordic countries have generally had better public finances than the non-Nordic countries. Even if the model shows only partial Ricardian equivalence, this difference has a major impact on the estimated difference in savings ratios. For Denmark, this factor contributed to reducing the estimated savings ratio by just over 1 percentage point in the 1980s compared with the non-Nordic countries, but the relative improvement in public finances subsequently contributed to explaining a difference in savings ratios of just over 2 percentage points in the period 2000-08. The impact is the same for the Nordic countries taken as one, even though the change compared with the 1980s is greater for Denmark.

A third economic-policy factor of major importance is the value of interest deductibility. In the calculation of this effect, we have used the coefficient on the real interest rate after tax and examined the interest deductibility value measured as the interest rate multiplied by the tax value of the interest deductibility. It appears that interest deductibility played an important role in the 1980s when interest rates were high and the tax value of interest deductibility particularly so, especially in Denmark, where the average tax value of interest deductibility exceeded 60 per cent in the mid-1980s (peaking at just over 73 per cent in 1984-86). In the 1990s and the 2000s, interest deductibility contributed somewhat less to explaining the difference, partly because of the decrease in the level of interest rates, partly because the tax value of interest deductibility was reduced by tax reforms in the Nordic countries (in Denmark as a result of the tax reforms in the 1980s and the "Whitsun Package"). Denmark is still in the upper range, since interest is not tax deductible in a number of countries (cf. Table 4.3).

The above discussion shows a number of possible reasons why the household savings ratio in Denmark and the Nordic countries in general is lower than in the rest of the OECD countries in our survey. It should be noted, however, that our model has difficulty explaining the difference between Denmark and the other Nordic countries where the differences in the estimated savings ratio are attributable mainly to unexplained country-specific constants, cf. Chart 3.6. Accordingly, the Danish savings ratio is lower than warranted by the structural factors of the model.

The results should be interpreted with some caution, however. In addition to statistical uncertainty, there is a risk that other important factors are not included in the model. It is worth noting that our model does not include household wealth. We have attempted to use indicators of the households' housing wealth and financial wealth, but they

DECOMPOSITION OF THE DIFFERENCE IN HOUSEHOLD SAVINGS RATIOS BETWEEN DENMARK AND THE OTHER NORDIC COUNTRIES Chart 3.6



Note: The decomposition of the difference between the estimated savings ratios in the two (groups of) countries is estimated as the difference between the contributions of the individual variables in the two (groups of) countries. The contribution from the individual variable is estimated by multiplying the variable's average value for the different periods by the estimate in Table 3.1. The unexplained part consists of the country-specific constants as well as a trend for Sweden in 2007-08.
Source: Own calculations.

are not significant in the estimations. There is a strong theoretical assumption that household wealth affects household savings, cf. the initial discussion in this section. Besides, we know from other contexts, e.g. consumption relations in macroeconometric models[1], that the households' propensity to consume is positively dependent on their wealth. Only a limited number of panel data studies are available which analyse household wealth in terms of its impact on savings across countries, but according to Hüfner and Koske (2010), the literature does not provide any unambiguous results. It is evident, however, that household wealth will explain the low level of savings, since the review in section 2 showed that the net wealth of Danish households is at an average level compared with the other countries in our data set.

Furthermore, the effect of the tax system on household savings is only partially taken into account by our analysis. In this context, it is not possible to take into account all channels through which the tax system affects the household savings ratio. For one thing, the tax systems vary quite considerably across countries, e.g. in terms of whether capital income is taxed as personal income or as other income. For another, there are typically many different tax rates and limits which change over time.

[1] Including Danmarks Nationalbank's MONA model.

This is why there are no available data to analyse the importance of different forms of capital income taxation.

Conclusion

Our results indicate that structural factors account for a considerable share of the difference in savings levels in Denmark and the other Nordic countries compared with the other advanced economies. Notably, they indicate that a larger public sector and a better structural government budget balance contribute to explaining the lower savings ratio in Denmark. This is consistent with previous studies, including Koskela and Virén (1994), Callen and Thimann (1997), and Haque et al. (1999). Moreover, the results indicate that interest deductibility may previously have played a role, especially for Denmark in the 1980s, but that it is not likely to be of key importance in relation to the current difference.

4. ECONOMETRIC ANALYSIS OF HOUSEHOLD GROSS DEBT

In the previous section, we analysed household savings which affect household net wealth. In this section, we take a closer look at the factors that drive household gross debt, which, together with net wealth, make up the total balance sheet.

As already described, there has been strong growth in household gross debt relative to disposable income, i.e. the gross debt ratio, in most OECD countries over the last 15 years. The gross debt ratio has increased particularly strongly in Denmark and the Netherlands, and both countries' gross debt ratios are now substantially higher than those of other OECD countries. As described in section 2, the gross debt developments and the cross-country differences are primarily attributable to the expansion of household assets and liabilities; a balance-sheet expansion that does not necessarily affect the amount of net wealth. Concurrently with the growth in gross debt in most countries since 1995, net wealth has generally increased over the same period.

The first section describes a number of theoretical relations that may contribute to explaining the development. We subsequently estimate a panel model in order to be able to assess the importance of individual factors.

Possible explanations of rising debt

Based on the life cycle model, the literature points to various factors possibly contributing to explaining the development in the gross debt ratio. To a large extent, these factors are identical to those influencing the savings ratios, but the transmission mechanisms differ, cf. Box 4.1.

POTENTIAL IMPACT OF VARIABLES ON HOUSEHOLD DEBT RATIOS Box 4.1

Real interest rates

Lower real interest rates make it possible to service larger debt, as they reduce the costs of having debt. Presumably, the main channel for this contribution is balance-sheet expansion.

Inflation

Declining inflation and thus declining nominal interest rates may reduce credit restrictions. The reason is that in the first years, payments on e.g. a 30-year mortgage loan are very much affected by the level of interest rates. Higher inflation and thus interest rates mean that the first-year payments will constitute a larger share of disposable income than is the case when inflation is low. Since it is a requirement by many banks that first-year payments are limited to a certain percentage of household disposable income, lower nominal interest rates will expand credit facilities. Another factor with a similar effect is that a lower level of inflation is typically associated with higher macroeconomic stability, thereby facilitating a higher level of gross debt, all other things being equal.

Structural unemployment and uncertainty

Lower structural unemployment (Nairu) means that the risk of becoming unemployed is reduced. Consequently, fewer households will be subject to credit restrictions. Moreover, the uncertainty is reduced. Less uncertainty will reduce risk premiums and the volume of asymmetrical information. Reduced uncertainty is due to, inter alia, lower structural unemployment and lower inflation. Presumably, this contributes through both balance-sheet expansion and a desire to reduce net wealth (less need for a large financial buffer).

Private pension savings

As described in section 2, the accumulation of large pension wealth may contribute to increasing gross debt. This contributes mainly through balance-sheet expansion.

Government debt

As described in section 2, high government debt may lead to a desire to increase net wealth, thereby reducing gross debt.

Financial development

The degree of financial development and financial innovation may affect the level of debt in several ways. Firstly, new financial products may reduce the debt-related costs. For example, deferred-amortisation loans reduce first-year payments. Secondly, financial development will reduce the extent of credit restrictions. Under the Danish mortgage-credit system, almost all households have access to cheap home loans. Reduced credit restrictions will increase debt, because more households will be able to raise loans (balance-sheet expansion), and because the need to have a large financial buffer for precautionary reasons to cover unforeseen expenditure and loss of income is reduced (desire to reduce net wealth).

The index for the degree of financial development used in the analysis below is the *Financial Reform Index* constructed by Abiad et al. (2008). The index is based on a weighting of seven parameters: credit regulation, interest-rate regulation, competition

CONTINUED Box 4.1

barriers, financial supervision, privatisation, international capital flows and securities markets. The index is normalised to lie between 0 and 1 and is available for the period 1973-2005. In 2005, nine of the 17 countries included in the estimation have an index of 1, and the lowest score is 0.81 (Finland). As seen, there are only limited cross-section differences in the last years. Since the impact of financial liberalisation on debt is likely to be subject to a certain lag, the index is lagged by five years, thereby maximising the correlation coefficient between the debt ratio and the financial index.

Other indices have been constructed for the degree of financial development, e.g. the IMF's Mortgage Market Index from 2008, which is, unfortunately, only available for one year. This index is estimated on the basis of six variables: mortgage-equity withdrawal, possibility of debt conversion, loan-to-value ratio, typical term, covered bond issues as a ratio of home loans outstanding, and mortgage-backed security issues as a ratio of home loans outstanding. It shows that there continue to be considerable differences across countries. The index is strongly correlated with the debt ratio, cf. Chart 2.4 (left-hand side).

In addition to the factors in Box 4.1, the development in house prices is often mentioned as a significant factor behind the development in gross debt, since rising house prices make it necessary and/or possible to raise more debt, thereby contributing to balance-sheet expansion. It is not clear, however, whether the debt increases due to house prices alone, or whether gross debt and house prices are driven by the same underlying factors. For example, falling interest rates and financial innovation have reduced user cost and first-year payments on homes, see Dam et al. (2010), thereby contributing to both rising house prices and increased gross debt. To the extent that house prices were, during the estimated period, driven mainly by the factors described in Box 4.1, inclusion of house prices may cause the estimated importance of the other factors to be underestimated. Viewed in isolation, this speaks in favour of not including house prices in the model to be estimated.

House prices are also affected by other variables, e.g. household expectations of future developments in house prices and taxation of real property. Besides, it is notoriously difficult to estimate accurately differences in the degree of financial development across countries and financial innovation. To the extent that house prices, and thus housing wealth, primarily measure financial innovation, house prices can be interpreted as an indicator of such innovation. Furthermore, a number of countries have experienced a housing bubble, which is not captured by the underlying factors, but may affect the development in debt levels. Viewed in isolation, this speaks in favour of including house prices in the model to be estimated. Accordingly, we estimate the model both with and without housing wealth as an explanatory variable.

Econometric analysis

We estimate a panel data model to get a better understanding of the extent to which various factors have contributed to driving the development in the household gross debt ratio. Our data set consists of annual data for 17 OECD countries for the period 1995-2010.[1]

Since the gross debt ratio is a stock measure, its development is sluggish. For this reason, the lagged value of the gross debt ratio is also included as an explanatory variable (for the periods *t-1* and *t-2*). Gross debt is defined as a percentage of disposable income, cf. Table 4.1.

We have made two estimations, including and excluding housing wealth, respectively. All variables have the expected sign and are significant, cf. Table 4.2.

The model's explanatory power is not substantially improved by including housing wealth, although it is significant. As expected, the importance of the other explanatory variables decreases when housing wealth is included. This is consistent with the fact that housing wealth is, to a large extent, determined by some of the variables that determine the level of gross debt. Presumably, rising house prices have also contributed independently to increasing gross debt ratios, e.g. where parts of a housing bubble have been mortgaged.

When decomposing the gross debt ratio change from 1995 to 2010 based on the estimated long-term relation described in model 1, it can be seen that the rise in cross-country gross debt ratios reflects several different factors, cf. Chart 4.1.

According to the estimated model, financial developments have only had a relatively moderate effect on the increase in the gross debt ratio. The estimated model applies the Financial Reform Index, cf. Box 4.1. According to that index, the degree of financial development varies only relatively moderately across countries. In reality, the cross-country differences are probably much bigger, cf. Chart 2.4 (left-hand side). For example, the Danish mortgage-credit system is one of the most developed, robust and flexible lending markets in the world. The mortgage-credit system has been highlighted as a home-financing system that has performed relatively well during the financial crisis, cf. e.g. Shin (2010). The US system, like the Danish one, is highly flexible, but the crisis has demonstrated that it is far less robust.

The large increase in the gross debt ratios in Denmark and the Netherlands mainly seem to be the result of higher pension wealth. The estima-

[1] The 17 countries are: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Japan, the Netherlands, Norway, Portugal, Spain, Sweden, the UK and the USA. The time period is limited, because, for a number of countries, data on household financial assets are only available from 1995.

VARIABLES USED IN THE DEBT RATIO ESTIMATION Table 4.1

Variable	Definition
Gross debt ratio	Gross debt, per cent of disposable income
Short-term real interest rate	Short-term nominal interest rate less inflation, per cent
Inflation	Annual growth in consumer price index, per cent
Nairu	Structural unemployment, per cent of labour force
Public sector's net assets	Government net assets, per cent of disposable income
Pension wealth	Pension wealth before tax, per cent of disposable income
Housing wealth	Housing wealth, per cent of disposable income
Financial development	Index between 0 and 1

Note: The public sector's net assets are measured as a percentage of household disposable income, thus making it easier to compare the parameter estimates.
Source: OECD, national central banks and statistical agencies. Data for 2010 for pension wealth and the public sector's net assets are partially estimated. Financial development based on Abiad et al. (2008).

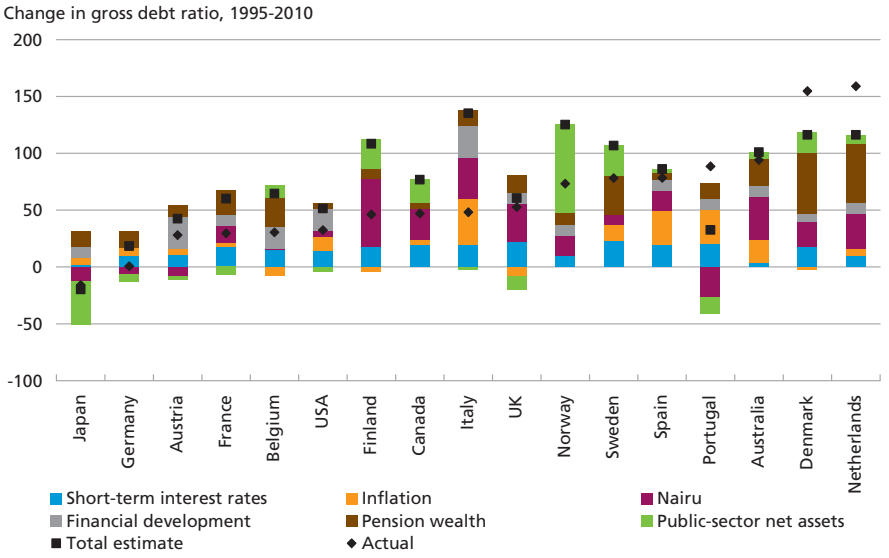
tion shows that when the pension wealth rises by 1 per cent of disposable income, the debt will grow by approximately 0.4 per cent of disposable income. Viewed in isolation, this results in a crowding-out effect of 40 per cent. It is possible, however, that in addition to increasing their gross debt, households will also reduce other savings, thereby amplifying the total crowding-out effect. This rules out direct comparison with the crowding-out effect of 15-30 per cent estimated by the Danish Economic Councils, cf. Box 2.2.

REGRESSION ESTIMATES FOR THE DEBT RATIO Table 4.2

Explanatory variables	Model 1	Long-term	Model 2	Long-term
Gross debt ratio (*t-1*)	1.19***	---	1.17***	---
Gross debt ratio (*t-2*)	-0.30***	---	-0.28***	---
Short-term real interest rate	-0.35*	-3.30	-0.29	-2.49
Inflation	-1.15***	-10.83	-1.12***	-9.58
Nairu	-1.49***	-13.96	-0.95**	-8.12
Financial development (*t-5*)	19.43*	201.30	22.49*	192.56
Pension wealth	0.04**	0.39	0.04**	0.31
Public sector's net assets	0.03***	0.27	0.03***	0.25
Housing wealth	---	---	0.01**	0.10
R^2	1.00	---	1.00	---
Durbin-Watson statistic	1.96	---	1.93	---

Note: * 10 per cent significance level, ** 5 per cent significance level, and *** 1 per cent significance level, based on "Panel Corrected Standard Errors", which are robust to variance differences across countries. The estimates include fixed effects and a dummy for Norway 2006. The latter does not affect the estimation results, but provides normally distributed error terms, cf. specification tests. We used a GMM estimation as a robustness check, cf. Arellano and Bond (1991). The models are quite robust to the choice of instruments, and, based on the GMM estimations, the bias in the OLS estimation of the basic model is deemed to be modest. We also estimated the model including period-specific effects to capture any timing trends in the variables. The results vary only slightly. The effect of inflation and, particularly, real interest rates (will not be significant) decreases, while the effect of pension wealth and, particularly, government net assets increases.
Source: Own calculations. Data sources: See above.

CHANGE IN HOUSEHOLD GROSS DEBT RATIO FROM 1995 TO 2010, MODEL 1 Chart 4.1



Note: Calculations based on model 1 above. The chart is based on the long-term relation. The explanatory power of the long-term relation is lower than for the estimated short-term model. The estimated and actual changes differ accordingly.

Source: Own calculations.

Assuming a doubling of the Danes' pension wealth ratio by 2045 compared with the 2005 level, as estimated by the Danish Economic Councils, this will, according to the estimated relation and all other things being equal, lead to an increase in the gross debt ratio of around 100 percentage points relative to the 2010 level, i.e. a debt level of around 400 per cent of disposable income.

The surge in government debt in the wake of the financial crisis implies a reduction of the households' gross debt ratio. In a number of countries, the government net financial debt has increased by more than 30 per cent of household disposable income since 2007. According to the estimated relation, this will result in a reduction of household gross debt by around 8 per cent of disposable income. In Denmark, the government net financial wealth has decreased by around 10 per cent of household disposable income since the end of 2008, and according to the estimated model, this results in a reduction of household gross debt of around 3 per cent of disposable income.

We have included various tax rates in the model estimations during the process, but they have not been significant. However, there is no doubt that Denmark, like most other OECD countries, has strong tax incentives to save through pension schemes rather than free financial wealth, cf. Table 4.3. Moreover, the level of interest deductibility con-

COMPARISON OF THE TAX VALUE OF INTEREST DEDUCTIBILITY AND CERTAIN TAX CONDITIONS FOR SELECTED COUNTRIES Table 4.3

Unit	Interest deductibility[1]		Housing tax[2]	Tax on current pension yields[3]	Effective tax over time[4]		
	Home loan	Other			Pension savings	Other savings	Difference
Denmark	33.7	33.7	1.05	15	23.4	44.1	20.7
Sweden	30.0	30.0	1.4	15	17.5	28.8	11.3
Norway	28.0	28.0	0.5	0	10.1	29.2	19.1
Finland	30.0	28.0	0.2	0	15.2	33.0	17.8
Netherlands	33-52	0.0	0.5	0	15.4	27.2	11.8
France	20.0	0.0	0.7	0	1.3	15.8	14.5
Germany	0.0	0.0	1.5	0	11.5	28.7	17.2
UK	0.0	0.0	1.0	0	6.2	22.3	16.1
USA	29.4	0.0	1.7	0	7.5	22.4	14.9
Japan	0.0	0.0	1.7	0	1.4	11.9	10.5

Source: Danmarks Nationalbank, OECD, IBFD (European Tax Handbook 2011), Hilbers et al. (2008), and Yoo and de Serres (2005).

[1] For the Nordic countries, the tax value of interest deductibility is set at a maximum limit. For other countries, interest is typically deductible at the marginal tax rate. A range is used for the Netherlands, while an average marginal tax rate is used for the USA. For France, interest on home loans is subject to a 20 per cent tax relief or a maximum amount of 3,750 euro (this limit is raised by 500 euro per dependant).

[2] In Denmark, housing tax is a weighting of property tax and property value tax. For other countries, it is typically a local tax. Data are not available for the Netherlands, France, the UK and the USA.

[3] Yoo and de Serres (2005). Few countries tax pension savings on an ongoing basis. In addition to those mentioned, they include Australia (7.1 per cent), New Zealand (33 per cent) and Italy (12.5 per cent). Belgium taxes the balance (0.17 per cent).

[4] The effective savings tax rates are estimated in Yoo and de Serres (2005). A comparison is made with the average effective tax rate for a one-off investment in either pension savings or other savings over the period from the investment is made until the age of 65 when the savings are disbursed (average for nine age groups). For pension savings, deductibility of pension contributions and taxation of pension yields (PAL taxation) are taken into account. For the benchmark portfolio, the average marginal tax is used as a proxy for capital yields tax.

tinues to be high in Denmark. Presumably, the combination of interest deductibility, which continues to be in the upper range in an international context, and which used to be even higher, and the strong tax incentives to save through pension schemes has contributed to the substantial balance-sheet expansion seen in Denmark over the last 15 years.

5. CONSEQUENCES OF HIGH GROSS DEBT

In Denmark, household gross debt is high compared with other countries. The reasons for the high debt were analysed in the previous section. This section examines the macroeconomic consequences of high debt.

The focus is on the more pronounced vulnerability associated with high gross debt, e.g. to interest-rate changes and unemployment. More pronounced vulnerability may lead to increased household arrears and ultimately to losses for banks and mortgage banks, and it may amplify fluctuations in private consumption and cyclical fluctuations in general. A proper assessment of the impact on financial stability requires detailed

information on the distribution of debt on borrowers and lenders, which is outside the scope of this study.

The relationship between gross debt and economic growth is discussed at the end of this section.

Debt and losses in the financial sector

One concern as regards the high level of gross debt in Denmark is that it may lead to the financial sector suffering increased losses on lending to households during an economic slowdown or in the event of rising interest rates. Among other things, higher gross debt means that the Danish household sector will be more sensitive to interest-rate changes, especially if interest rates rise at a time of high unemployment and weak growth. But over the last 15 years, during which period the gross debt ratio has doubled, the financial sector in Denmark has only suffered moderate losses on lending to the household sector compared with the situation during the crisis in the early 1990s.

Even after the financial crisis, the losses of banks and mortgage banks on lending to the household sector have been relatively small, reflecting, among other factors, relatively low unemployment, very low interest rates and great household wealth. Viewed in isolation, low loss rates cannot be taken to indicate that the level of gross debt does not affect the loss rates. A comprehensive analysis of the impact on financial stability of a large household debt ratio requires detailed data on the distribution of debt and wealth on individual households and on the exposure of individual financial institutions.

Households with high gross debt will typically have high gross wealth (both housing and pension wealth), since their homes are collateral for a large part of the gross debt. Besides, part of the increase in the gross debt ratio in Denmark may be attributable to the fact that households have debt for a longer period of time, e.g. because they save through pension schemes rather than reducing their housing debt, and because a larger number of households have debt as a result of an easing of credit restrictions, cf. section 4 above. This indicates that the peak of the individual household's gross debt ratio over its life cycle did not rise as much as the gross debt ratio for the household sector as a whole. For this reason, the households' vulnerability probably did not increase to the degree warranted by the household sector's gross debt ratio alone.

In the following, we analyse whether a high gross debt ratio increases the number of households in arrears on their home loans or rent. This analysis may give an indication of the extent to which high gross debt in the household sector affects financial stability when viewed in isolation.

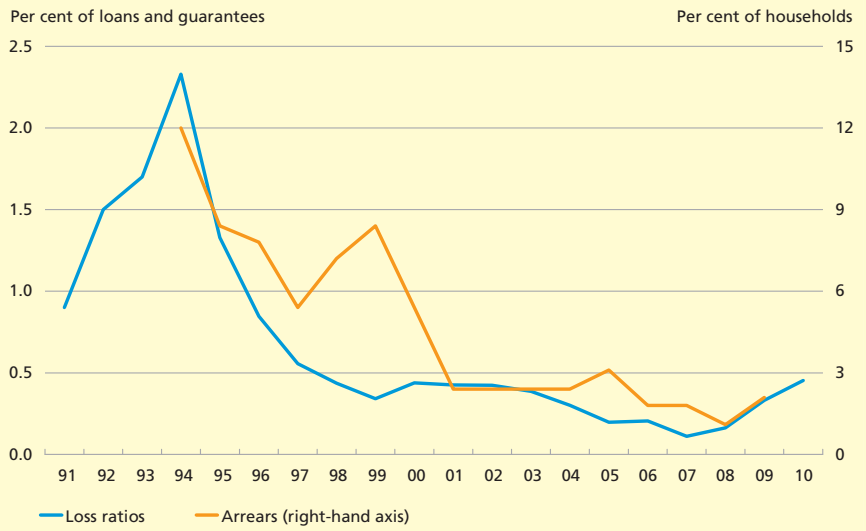
DATA FOR HOUSEHOLDS IN ARREARS Box 5.1

Data for the share of households stating that they have been in arrears with either their home loans or their rent over the previous 12 months are based on two questionnaire surveys, European Community Household Panel, ECHP, covering the period 1994-2001, and European Union Statistics on Income and Living, EU-SILC, covering the period 2004-10.

The levels of the two questionnaire surveys do not seem to be directly comparable, since all countries experience a considerable increase in the number of households in arrears from 2001 to 2004. This is inconsistent with e.g. the trend in the banks' losses during the same period. Accordingly, we have chosen to link the two questionnaire surveys by maintaining the 2004 level in the period 2001-03, after which the trend is determined in arrears using ECHP.

We have thus constructed a data set for nine countries (Austria, Belgium, Denmark, France, Italy, the Netherlands, Portugal, Spain, and the UK) for the period 1995-2009. Given the uncertainty associated with data and a number of data breaks, the results should be interpreted with caution. For Denmark, the constructed series for the share of households in arrears is fairly consistent with the trend in the loss ratios of the Danish banks, cf. Chart 5.1, although there is a certain amount of deviation in the period 1997-2000.

THE LOSS RATIOS OF DANISH BANKS AND THE SHARE OF HOUSEHOLDS IN ARREARS WITH HOME LOANS OR RENT Chart 5.1

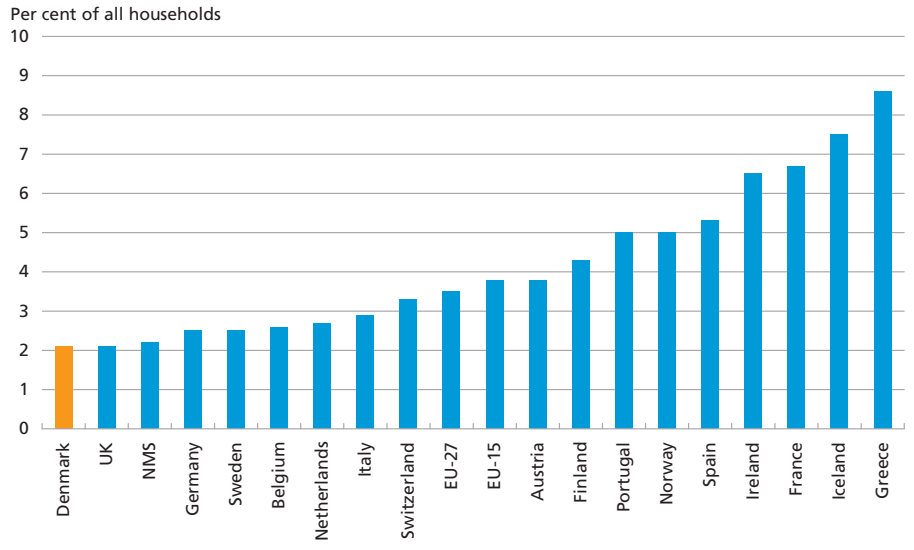


Source: Danmarks Nationalbank, Eurostat and own calculations, cf. the above description of the data construction.

We have chosen to base our analysis on data on the percentage of households in arrears. They are comparable across countries.[1] Specific-

[1] Alternatively, we might analyse the banks' losses on lending to the household sector, but such data are publicly available for very few countries. Data on bad loans are available, but they are not comparable across countries for two reasons. Firstly, calculation methods vary across countries. Secondly, due to legislation differences, the period during which a loan is registered as bad, varies across countries. In countries where a loan is registered as bad for a long period of time, the holdings of bad loans will be larger without this reflecting larger losses.

ARREARS WITH HOME LOANS OR RENT, 2009 Chart 5.2



Note: NMS: New member states.
Source: European Union Statistics on Income and Living Conditions.

ally, comparable data across countries are available for the percentage of households stating that they have been in arrears with either their home loans or their rent over the previous 12 months. The data set is constructed on the basis of two European questionnaire surveys, cf. Box 5.1.

The percentage of households in arrears with home loans or rent in 2009 is very low in Denmark compared with other European countries, cf. Chart 5.2. This indicates that the high Danish level of gross debt does not contribute significantly to the size of the losses on lending to the households. As a consequence of Danish mortgage credit and insolvency legislation, Danish households will probably go to great lengths to avoid payment problems in relation to their home loans. The Danish mortgage credit system and its performance during the crisis are described in more detail in the article entitled "Danish Mortgage Credit" in Part 1 of this Monetary Review.[1]

In the estimation below, we examine whether the gross debt ratio may contribute to explaining the development in the percentage of households in arrears with home loans or rent across countries. Changes in unemployment and in the short-term interest rate are included as control variables. In addition, we include country-specific effects to capture structural differences across countries and period-specific effects

[1] Gundersen et al. (2011).

REGRESSION ESTIMATES FOR THE SHARE OF HOUSEHOLDS IN ARREARS WITH HOME LOANS OR RENT — Table 5.1

Explanatory variables	Short-term
Arrears (*t-1*)	0.616***
Δ Unemployment	0.284***
Δ Short-term nominal interest rate	0.143
Level of gross debt	-0.006
R^2	0.825
Durbin-Watson statistic	1.898

Note: Estimates based on a panel estimation including both country-specific and period-specific effects. * 10 per cent significance level, ** 5 per cent significance level, and *** 1 per cent significance level, based on "Panel Corrected Standard Errors", which are robust to variance differences across countries, among other factors. We also estimated an alternative model, multiplying the gross debt ratio by the changes in unemployment and interest rates. This did not alter the conclusions, but had lower explanatory power.
Source: Estimates based on data from the OECD and national central banks.

to capture the general cyclical position in the euro area. Finally, the lagged value of arrears is included to avoid autocorrelation. The only significant explanatory variable is the change in unemployment where rising unemployment increases the percentage of households in arrears, cf. Table 5.1.

Despite the fact that household balance sheets, by their nature, seem to prevent the high gross debt ratio from directly affecting the losses of the financial sector, there may be indirect effects. The reason is that high gross debt amplifies fluctuations in private consumption, cf. the analysis below. This may result in increased losses on lending to firms whose output is aimed at domestic private consumption. It is also possible that the high gross debt ratio has amplified the fall in house prices, thereby increasing the losses on lending to the construction sector.

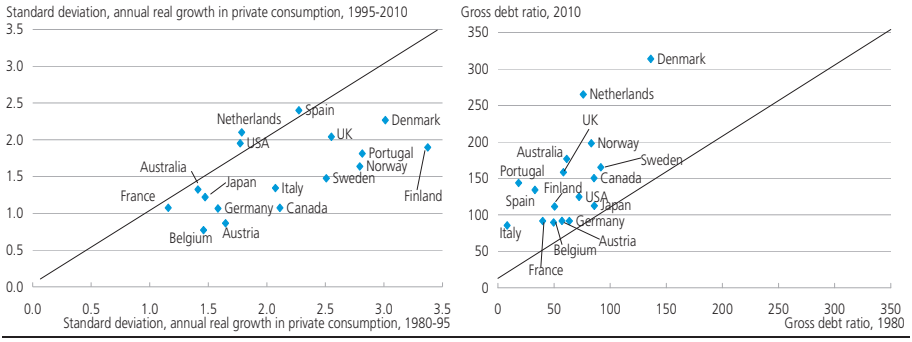
Cyclical fluctuations and debt

Households influence the business cycle through private consumption, which accounts for the largest share of domestic demand in nearly all countries. Viewed over the last 30 years, private consumption fluctuations have declined while gross debt has increased, cf. Chart 5.3.

The generally more stable growth in the last decades before the crisis – called "The Great Moderation"[1] – is typically explained by improved economic policies, both monetary and fiscal policies, and/or a decline in the variability of the shocks to the economy. Despite the increasingly stable development in general, private consumption growth varies across countries. The variations are most pronounced in countries with high household gross debt, cf. Chart 5.4.

[1] Bernanke (2004).

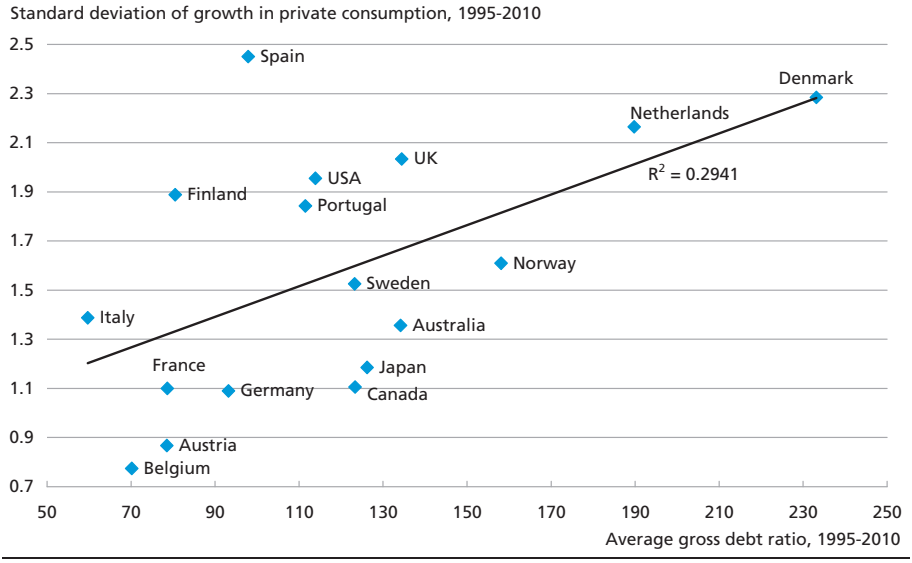
STANDARD DEVIATION OF ANNUAL REAL GROWTH IN PRIVATE CONSUMPTION AND THE DEVELOPMENT IN GROSS DEBT Chart 5.3



Note: An alternative might be to plot the so-called z-scores where the standard deviation is divided by the mean value. This takes into account that the standard deviation may decline as a result of lower structural growth. However, z-scores indicate the same result, i.e. a more stable level of consumption growth.
Source: OECD, national central banks and own calculations.

Comparison of fluctuations in private consumption across countries is impeded by cross-country variations in the composition of household consumption. In countries with a large public sector, household consumption will, in effect, to a large extent be paid by the government. Typically, this includes healthcare services, childcare, care for the elderly, and education. These consumption components – particularly healthcare services – are less volatile than other consumption components. Moreover, the households' need to have large holdings of liquid assets is reduced.

HOUSEHOLD GROSS DEBT AND CONSUMPTION VOLATILITY Chart 5.4



Note: Data for 2010 are partially estimated. If Spain is excluded, R^2 will increase to 0.45.
Source: OECD, national central banks and own calculations.

Consequently, countries with a large public sector will experience higher variability in that part of consumption which is paid by the households themselves. Inclusion of individual public consumption reduces fluctuations in consumption across countries, but the countries with the highest level of gross debt still experience the largest fluctuations.

The relation between the level of gross debt and the fluctuations in private consumption may be attributable to the fact that a high level of debt amplifies the effect of shocks to the economy, because households with a high level of gross debt change their consumption patterns more than households with a lower level of gross debt, or they sell some of their assets, e.g. their homes. A number of transmission channels through which the level of gross debt affects cyclical fluctuations can be pointed out.

Interest-rate increases reduce the disposable income of households with debt, especially those with a high level of short-term debt, thereby reducing consumption. For households with net assets, interest-rate increases will reduce the market value of bonds and the value of homes. The net effect of interest-rate increases must be expected to be lower disposable income (and in the short term reduced wealth) and thus lower consumption, and the effect is reinforced the larger the individual household gross debt and the larger the number of households with gross debt.

For households with high gross debt that are temporarily hit by unemployment, consumption smoothing through increased borrowing will not be possible to the same degree as for households with low gross debt. Alternatively, the households may try to sell their assets, e.g. their homes, in order to reduce their gross debt. This may lead to falling house prices, thereby reducing private consumption.

In order to better assess the impact of a high gross debt ratio in the household sector, we examine the fluctuations in private consumption using a panel data model. The model takes into account exogenous shocks, structural differences across countries and general cyclical fluctuations.

Panel estimation

Private consumption is often described as a function of household disposable income and net wealth. Accordingly, fluctuations in private consumption can often be attributed to fluctuations in income and wealth in particular. The development in private consumption will also affect income, however.[1] Consequently, fluctuations in private consumption

[1] Wealth may also be affected by the development in private consumption, but the relation is much weaker. Here, we choose to assume that wealth is exogenous and therefore not affected by the development in private consumption.

cannot be estimated directly as a function of income fluctuations, as this is not an exogenous variable (which results in non-consistent coefficient estimates).

Instead, we include country and period-specific effects adjusting for structural differences across countries and global cyclical fluctuations. In addition, the standard deviation of growth in net assets is included.

The standard deviation of consumption is calculated for five 3-year periods over the period 1995-2009 for the same 17 countries as in the above estimation of the debt level. By defining each time unit as a 3-year period, we seek to avoid that we, by construction, create problems with autocorrelation between observations.

All variables have the expected sign, and the gross debt ratio is strongly significant, cf. Table 5.2.

The estimation indicates that higher gross debt leads to greater fluctuations in the economy, even when taking into account structural differences, general cyclical fluctuations and fluctuations in net asset growth. This indicates that the high level of household gross debt has contributed to a larger decline in private consumption during the financial crisis in Denmark than in other countries.

Other consequences of gross debt

In addition to the high level of gross debt affecting macroeconomic and financial stability, a higher level of gross debt will, all other things being equal, lead to interest-rate changes having a stronger impact. Hence, there are many indications that the interest-rate pass-through has increased over time. For Denmark, this can also be attributed to changes in the home-financing structure, cf. Drejer et al. (2011). High gross debt may also reduce the pass-through of fiscal policy stimulus in a slump, since households increasingly need to reduce their gross debt, resulting in a higher savings ratio.

REGRESSION ESTIMATES FOR FLUCTUATIONS IN PRIVATE CONSUMPTION

Table 5.2

Explanatory variables	Estimated coefficient
Standard deviation in net asset growth	0.027***
Gross debt ratio	0.009***
Constant	-0.372
R^2	0.820
Durbin-Watson statistic	1.896

Note: Estimates based on a panel estimation including both country-specific and period-specific effects and a dummy for Spain. * 10 per cent significance level, ** 5 per cent significance level, and *** 1 per cent significance level, based on "Panel Corrected Standard Errors", which are robust to variance differences across countries.

Source: Own calculations.

In the current situation, households in several advanced economies have tried to consolidate their financial balance sheets and reduce their debt. This has led to low growth in private consumption. The question is whether it is possible to find a threshold level determining when the gross debt is too high, thereby having a negative impact on growth as a result of increased instability.[1]

Presumably, it is difficult to determine such a threshold level, especially because there are considerable institutional differences across countries, including in pension systems and the degree of financial development[2]. Furthermore, in order to assess the private sector's gross debt, it is necessary to view the gross debt in relation to the assets (for the households e.g. pension wealth and housing wealth). So, as described earlier, the high household gross debt ratio in Denmark is accompanied by substantial pension and housing wealth.

It should be noted that growth is not the only relevant potential negative effect of high gross debt. For example, a high level of household gross debt is associated with greater fluctuations in private consumption, as described previously. A higher variability of private consumption may result in lower household benefits if a more stable development in private consumption is preferred, which economic theory often assumes to be the case.

[1] In principle, the relationship between debt and growth is positive, since debt enables productive investment. In general, the economic literature also finds a positive relation between financial development (and thus debt) and growth.

[2] The literature has found it difficult to define when the level of private-sector gross debt is too high across countries. In a study of OECD countries, Cecchetti et al. (2011) find that high government gross debt (more than 85 per cent of GDP) is associated with lower growth. On the other hand, they find no statistical evidence of a corresponding threshold value for private-sector gross debt.

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