

Macro Measurement and Valuation of the Building Stock

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Abstract: Measurement (m²) and valuation (euro's) of non-residential property suffer from a lack of integral statistical observation. This limits the applicability in market analysis, (spatial) planning and forecasting of building activity. Aim of this research is to obtain on macro and sectoral level more insight in the available stock of buildings, in the stock in use and in the need and demand for expansion and renewal of the building stock in the coming decade.

Fixed Capital Statistics - based on OECD-standards - are concentrated on the historic fixed capital formation (in euro's) and depreciation afterwards, along the life time. This offers limited insight in the actual stock in use and does not provide a base for forecasting future growth and adaptation of the Building Stock. Otherwise - for instance within the context of the Dutch property law - the non-residential property is registered and valued to. This valuation is for marketable buildings based on the market price, which individually reflects the joint value of land and the building on it. The registration of floor area is on macro level incomplete.

In this paper an alternative approach of macro valuation of the stock of buildings will be presented. By combination of the National Accounts 1990-2008 and construction statistics it is possible to split the sectoral capital formation in buildings in an expansion and a renewal component. Additionally cumulated expansion in a certain period is linked to the growth of the sectoral production capacity and if more relevant linked to the growth of the sectoral employment, of the number of users and/or of the accommodation capacity.

The final result is a valuation (in euro's) of the Stock of Buildings and measurement of the Stock in Use (m²), with decomposition in 9 sectoral stocks, with their own typological structure in terms of offices, shops, warehouses, glasshouses, schools and so on. This provides an useful base for – structural - forecasting of non-residential building activity. The framework for macro and sector analysis is also applicable on regional and corporate level, even to integrate and assess partial and specific registrations by real estate agencies and others. This may "colour" what is behind the macro view.

Keywords: building stock; property; measurement; macro valuation; fixed capital statistics; stock in use

Focus and objective

This research focuses on the past and future capital formation of buildings in terms of the annual investment and of the total stock over the years. Statistical information about the Dutch stock of buildings is insufficient. This requires an alternative approach to determine the volume and structure of the available stock and of the stock in use, which will be based on the cumulated investment for expansion of the stock. Though the goal of this research is the systematic description, analysis and modelling of capital formation in buildings in the period 1960-2025. The economic analysis of capital formation and building stock will be combined with functional indicators of the stock in use and with physical registration of the stock (floor space and otherwise). The main research question is how better scientific and social information about the capital formation of buildings – about flows, stock and trends – can be obtained and how this contributes to forecasting and valuation.

Rise and renewal of the built environment

The need for more property – for extension of the building stock – is driven by a combination of population growth and economic growth. The post-war reconstruction activity was insufficient to fill the need for buildings to accommodate a growing population and a growing economy. In the sixties the annual investment in residential and non-residential buildings and in civil infrastructure grew very rapidly. Nowadays the buildings stock originating from the sixties and seventies is object of investment for renewal. In the early 21st century population growth and economic growth are weakening. The social economic context of building activity has completely changed since the sixties.

A better understanding of the historical development of capital formation in buildings offers to some extent insight in the future capital formation to maintain the stock. In that case the historic relation between capital formation and the social and economic context has to be revised for the context of today.

In this study historic and future capital formation in buildings is linked to the combined development of population (users of built environment), employment and economy. The economic approach of the investment for expansion of the building stock is based on the development of the Gross Domestic Product of an observed economic sector and of the economy as a whole. This is confronted with analysis based on functional and physical indicators for the required development of the stock of buildings. The (expected) number of users and (the total) floor area of a sectoral building stock are analysed too. Future renewal of the building stock depends on the life time structure of the present building stock and on the future requirements in terms of needed facilities in relation with economic, social, environmental and technological developments.

The choice between replacement and refurbishment will heavily be influenced by the urge for the most sustainable production and use of built environment.

Analysis of capital formation

Since J.M. Clark presented in 1917 his version of the acceleration between final demand and capital formation economists became familiar with the difference between capital formation for expansion and for replacement of the capital stock (Miltenburg *et al.*, 1992). Investment for expansion is linked to the development of an industrial capital stock and the embedded production capacity.

Industrial buildings provide accommodation for man-machine-activity. In The Netherlands the industrial production of physical commodities embraces nowadays 14% of the Gross Domestic Product. The Clark-concept has to be adapted to the specific characteristics of the more service oriented sectors.

Hendriks (1978) distinguishes the following stock-flow-relations:

- a. constant investment for expansion means linear growth of the building stock,
- b. (linear) increasing expansion means progressive growth of the stock,
- c. (linear) decreasing expansion means degressive growth of the stock,
- d. a turning point from increasing to decreasing expansion means an S-shape development of the stock of buildings,
- e. to avoid a turning point in total new building investment decreasing expansion has to be compensated by more replacement.

Within a stylized model, linear growth of the (demand for) sectoral production has to be facilitated by constant capital formation for expansion. In case of zero-growth the capital formation for expansion would become zero. Progressive growth will raise the investment level and degressive growth leads to a lower investment level.

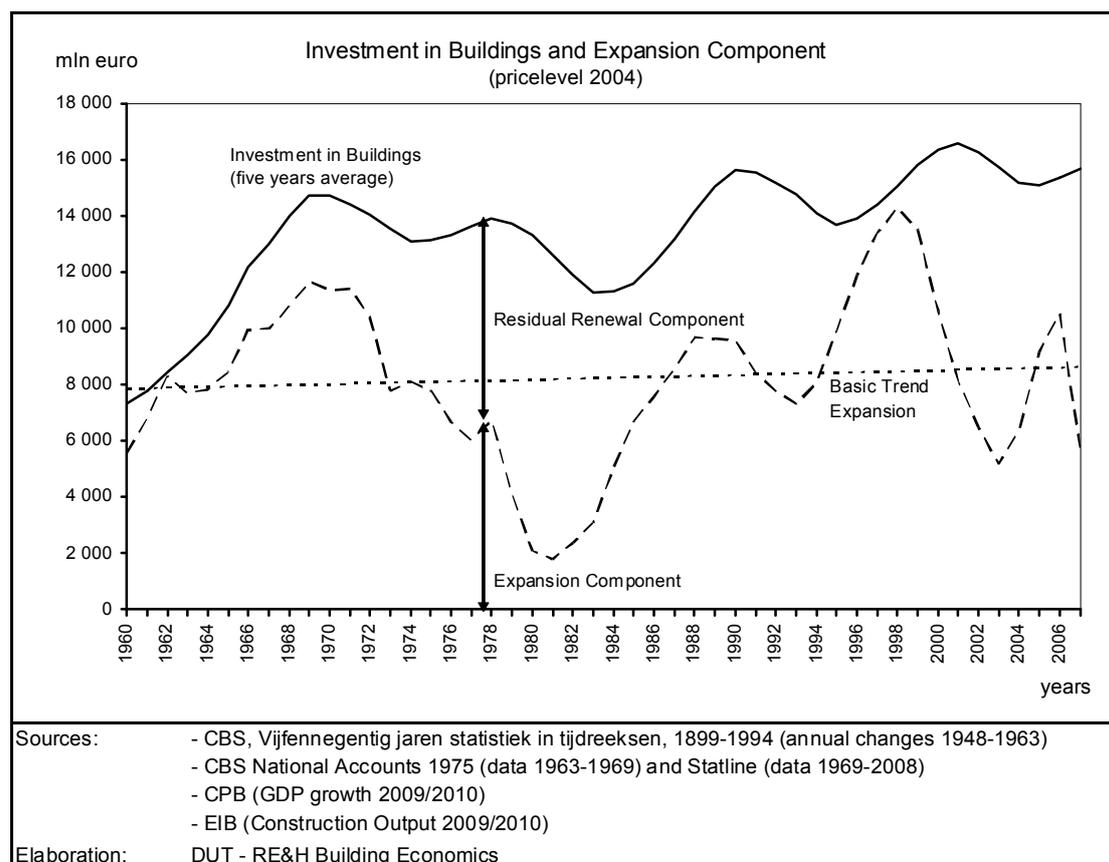
On the other hand investment for replacement of stock depends on total stock, its life time and its functional, technical and economic deterioration.

The lack of applicable statistics about the national building stock and the sectoral spread made it difficult to acquire a usable base for analyzing and forecasting the capital formation in buildings 1960-2025.

Analyzing and forecasting non-residential capital formation is difficult.

The need and demand for new buildings and for refurbishment and repairs principally depends on the shortage of the available stock in terms of quantity (floor space) and quality (technical, physical and functional). The information available is much larger for the residential than for the more heterogeneous non-residential sector. Physical measuring of gross addition, replacement and withdrawal of the building stock is difficult and suffers from a lack of statistics. Measurement of stock is mostly done in monetary terms, but that hides valuation problems.

In this study fixed investment in buildings (the flow) will be divided in a component "Expansion" and a residual component "Renewal" (replacement, refurbishment and major repairs).



Graph 1

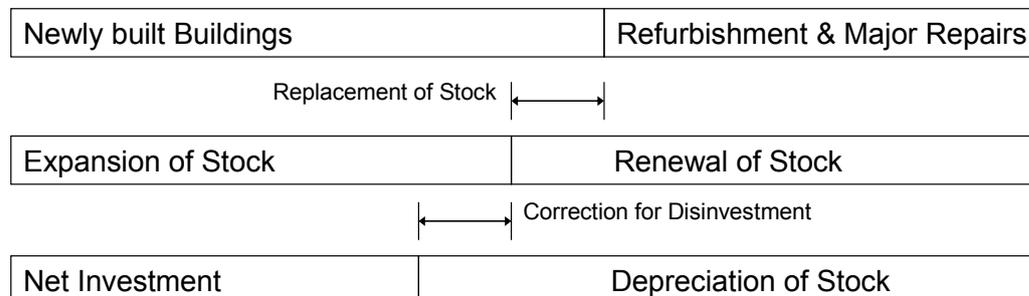
The macro modelling is based on historical analysis of the building market relations. Extreme shortages of building supply were manifest in the early sixties and in the second part of the nineties. This is established in the model by accounting all investment in 1962 as investment for expansion. Furthermore – based on sector analysis – 95% of total investment (5 years smoothed) in 1998 is allocated as investment for expansion. In the previous graph this modelling is rendered.

The initial stock ultimo 1960 grows from year to year with the investment for expansion. The investment for expansion is derived from – in accordance with the Clark-concept – the absolute increase of GDP, and is corrected for growing productivity of buildings. Net investment – normally defined as gross investment minus depreciation – is here defined as GDP-related expansion of stock.

Within this concept Investment for Renewal is not equal to Depreciation of Building Stock. There is more depreciation than renewal because the depreciation of total stock is not

completely covered by renewal activities. Due to technological developments and sectoral shifts in the production structure – from traditional industry to services – older buildings will fall outside the stock in use and outside the production capacity. This requires an additional correction for disinvestment. In a comprehensive scheme:

Scheme: Adaptation of Building Stock



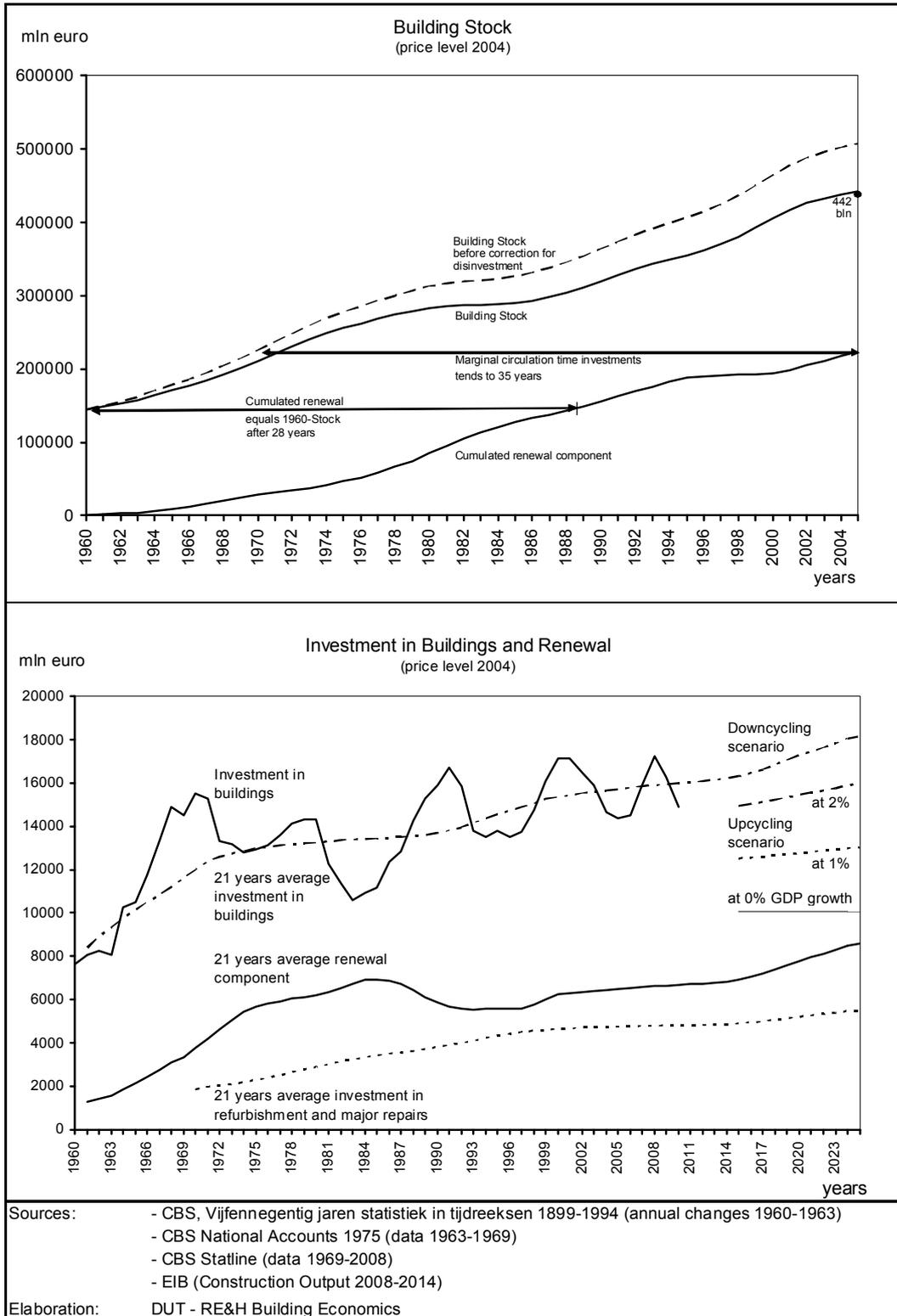
The residual calculation of investment in buildings for renewal is rendered in the following graph 2 as 21 years average and for the period 2000-2025 extrapolated on base of the relative growth of total investment in buildings 25 years before.

The development of the Building Stock is rendered in graph 2 (upper part). The initial stock – valued ultimo 1960 on 140 billion euro's – is from year to year increased with the annual expansion. After sectoral analysis of investment for expansion – which will be reported further on – Total Building Stock ultimo 2005 is valued on 442 billion euro. The correction for disinvestment is effected by linear correction for the period 1961-2005.

In additional analysis the cumulative investment for renewal is compared with the original capital formation and that leads to a marginal circulation time of investment of circa 35 years in 2005. This is rendered in graph 2 (upper part)..

The Building Stock before correction (the upper dotted line) has to be used for determination of this circulation time of investments. After 28 to 29 years cumulated renewal investments equal the ultimo 1960 Stock. This is a starting position for analyzing the marginal circulation time of investment in buildings, which tends to 35 years in 2005. This implies that on average after 35 years investments are done – in the divergent mix of replacement, refurbishment and major repairs on divergent moments – that equal the original investment for expansion (+ a third of investment for renewal 35 years before). A substantial part of investment for renewal is investment for refurbishment and major repairs. The difference between total investment for renewal and investment for refurbishment and major repairs is indicated as replacement by new buildings.

After a first peak in the early seventies non-residential building has a cyclical loop with an overall top in 2001 (see graph 2, lower part). The strongest dip was in the early eighties. At that time investment shrunk heavily. In the meantime the economic growth diminished and the nominal interest got above 10%.



Graph 2

The Dutch economy suffered from an international economic crisis and from a financial crisis. The government budget deficit grew and this led to a growing government debt and an increasing interest on that debt. Direct and indirect labour costs got higher and became an obstacle for growth of export of goods and services. The balance of payments (export minus import) nevertheless did not create further problems because the Dutch economy has an export surplus from growing natural gas export in combination with rising energy prices since the seventies.

From 1983 on a rapid growth of non-residential building was part of a broad recovery of the Dutch economy. A better control and a strict limitation of the government deficit and debt and of labour costs contributed to growing economic initiatives and capital formation by the market sector.

After 1995 especially office construction was booming until 2001. This links with the growth of investment in ICT (computers, databases, software). After 2001 Total Investment declined and revived in the period 2006-2008.

Total investment is registered as the upper line in graph 2 (lower part) and the dotted line is the 21-years average. This line is forecasted for the period 2000-2025 as the sum of the investment for renewal line and the basic trend of the investment for expansion.

This determination of total investment is labelled as Downcycling Scenario, because investment in new buildings in the last decades was higher than what was strictly required as addition of stock. In practice this is expressed by high vacancy of office buildings (nearly 15% in 2009) and disfunctional and vacant other buildings and built areas.

Market allocation tends to overinvestments in new buildings, especially in the nineties when high economic growth was combined with low capital costs.

Recent decline – due to the world wide financial and economic crisis in 2008 and after – creates the conditions for an alternative scenario. This is introduced in graph 2 (lower part) as Upcycling Scenario.

The quantitative base of this scenario is steady 2% GDP-growth after recovery from the actual crisis. This has to be combined – within a normative scenario for a sustainable investment policy – with less investment in new buildings, a more intensive use of the existing stock and a shift from downgrading and withdrawal to upgrading of the building stock.

Long run zero growth would mean that – on base of regression on past investment – that investment in buildings would collapse to about 10,000 million (euro's 2004), and would reach the 1983 level. The approach here is limited to trend analysis and trend forecasting. The year-to-year development of investment in buildings requires more information behind the conjunctural deviation of the trend.

Sectoral decomposition of capital formation in buildings

In a first decomposition the macro capital formation in buildings is split up in four economic sectors (see graph 3).

Since the nineties Industry and Agriculture are less important investment sectors in terms of buildings. Commercial Services definitely became the most important sector and investment in this sector increased due to a shift from investment in owner-occupied buildings to commercial development & lease.

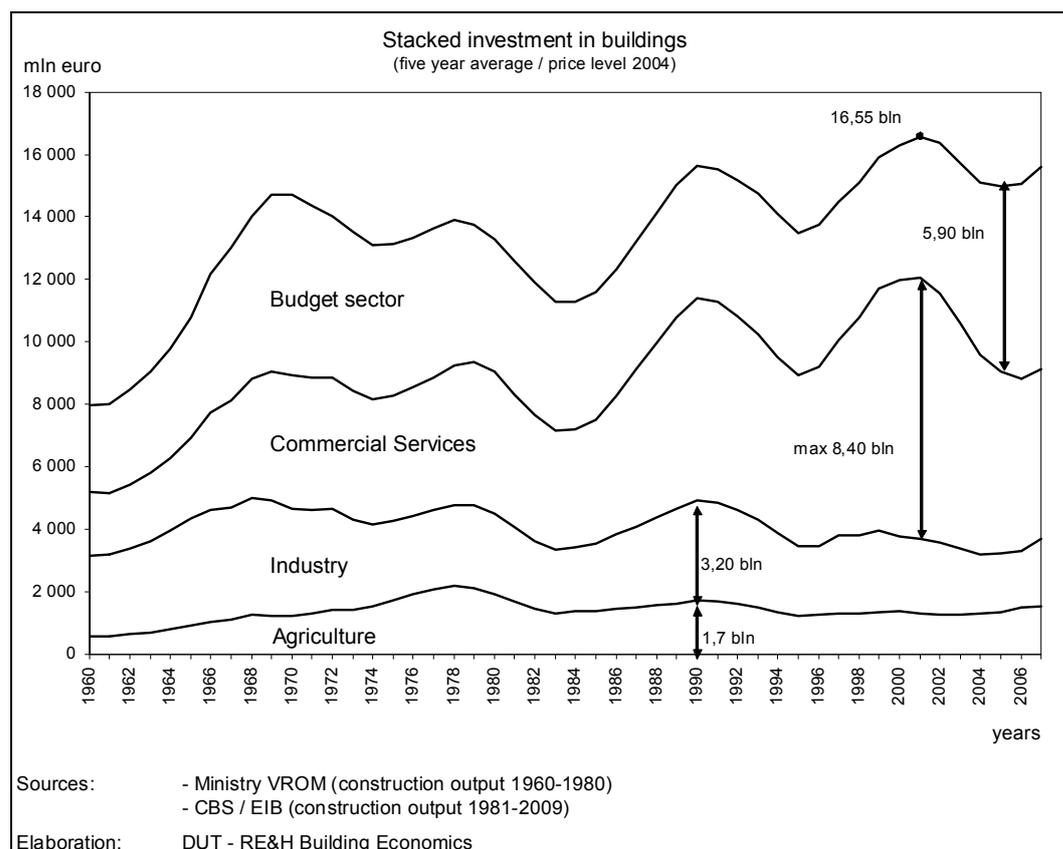
The table and the graph show that investment in buildings in the nineties is driven by a growing Commercial Services sector. After 2001 the decline is tempered by again growing investment for the Budget Sector, especially for Health, Care and Education.

Table 1: Output Growth & Investment Peak Buildings 1989-2005

Sector	Peak Absolute Output Growth (5 years smoothed)	Corresponding 5 years average (%)	Investment Peak in Buildings (5 years smoothed) year	Investment Peak in Buildings (5 years smoothed) in prices 2004
Agriculture	1990	+5,4%	1990	€ 1,70 bln
Industry	1998	+2,4%	1990	€ 3,20 bln
Commercial Services	1998	+6,0%	2001	€ 8,40 bln
Σ Market Sector	1998	+4,6%	2001	€ 12,05 bln
Σ Budget Sector	2001	+2,3%		
Σ Total Economy	1998	+4,0%	2001	€ 16,55 bln

Source: CBS/EIB Elaboration: RE&H Building Economics

The first sector is Agriculture. Investment in buildings in this sector (mostly barns & sheds) lost importance in the eighties and in the nineties. Recent investment is mostly for renewal and is economic and technological driven.



Graph 3

The second sector is the Industry. Since the sixties economic activity shifted from industry to services. Traditional industrial sectors – like Textile – mainly disappeared. Others like Chemicals and Food became of more importance.

Capital formation in industrial buildings gradually declined, with an ICT-linked revival in the eighties. The investment in renewal is market and technologically driven.

The third sector – the Commercial Services – became the most important sector, also in terms of capital formation. This sector embraces Trade, Hotel & Catering, Transport, Storage, Communication and Financial & Business Services. Capital formation in this sector is including Commercial Development & Lease of office buildings, is including Buildings for Retail & Leisure and Commercial Development & Lease for Industry and Trade. In the period 1960-2000 the annual capital formation quadrupled. In the peak period 1999-2001 circa 45% of all building activity for the Commercial Services sector was commercial office development.

The fourth sector – the Budget Sector – consists of Health & Care, Education, Government and Non-profit services. In relation with demographic developments capital formation for Education became less important in the seventies and is nowadays mostly dependent on investment for renewal.

Health & Care also lost importance in the seventies and eighties, but is nowadays a sector with growing need for investment in relation with an ageing population and its need for health and care.

Macro valuation of the sectoral building stocks

Measurement and valuation of the non-residential Building Stock suffer from a lack of integral statistical observation. Most complete in The Netherlands is the regulated valuation based on the Property Law WOZ (“Wet Waardering Onroerende Zaken”). Relevant Measurement and Valuation Indicators for the Buildings Stock are:

- a. *Measurement based on physical characteristics.* Most applied as gross and net floor area of (parts of the) building stock. This is outside the Dutch cadastral measurement of the building stock, which only measures the footprint of buildings. Measurement in terms of square meters is only available on base of building permits and for distinctive sectors like the commercial office sector (Bak, 2008).
- b. *Valuation based on market prices.* This is applied in the WOZ-valuation for all dwellings and for marketable buildings. Market prices of dwellings and buildings reflect the joint value of land and the building on it. A separate valuation of buildings (superstructures) is not available.
- c. *Valuation based on the replacement value.* Here the investment costs of new buildings (of the superstructures) are leading for the valuation. Existing buildings are compared with new buildings and depreciation of them will be based on lower functional or economical performance in relation with new buildings, added up with the economic loss due to complementary operating costs of the building and the product process in it.
- d. *Measurement based on accommodating capacity and/or use of the stock of buildings.* For instance: the number of beds in hospitals; the number and the occupancy of classrooms; the floor area capacity of an office stock and the use of it in terms of fulltime equivalents and square meter per fte; and so on.

Due to a lack of integral statistics of the building stock the general valuation principle here is the replacement value. The building stock is valued on base of the implicit contribution to the sectoral and total production (gross added value).

The expansion of the Building Stock in a recent period is linked at the sector output growth in that period. The correction for complementary operating costs remains outside the analysis.

In Real Estate Finance buildings are mostly *valuated on base of the Discounted Cash Flow* of the building linked future revenues (rental income and exit value) and costs (management and maintenance). The DCF-value varies – in a reverse relation – with the discount factor

(1+interest percentage). In this study is assumed that the capital value of newly constructed buildings is higher than or equal to the buildings costs. Otherwise the investment would not be economically rational.

In the period 1989-2005 interest rates became lower. This contributed to positive capital growth for the investors and on macro level this compensates financial losses due to economic deterioration of after 1988-buildings.

For non-marketable buildings – especially for the budget sector – is assumed that the quasi capital value initially equals the building costs. For marketable and non-marketable buildings it is reasonable tot value on base of replacement costs. The replacement value of the dated building stock – in this case from before 1989 – has to be corrected for economic deterioration. In case this is done by an implicit correction of the replacement value of the dated stock of buildings on base of the residual contribution to the Gross Domestic Product.

The principle of macro valuation and forecasting of the buildings stock based on replacement value is applied in the next modelling and calculation for the period 1988-2025

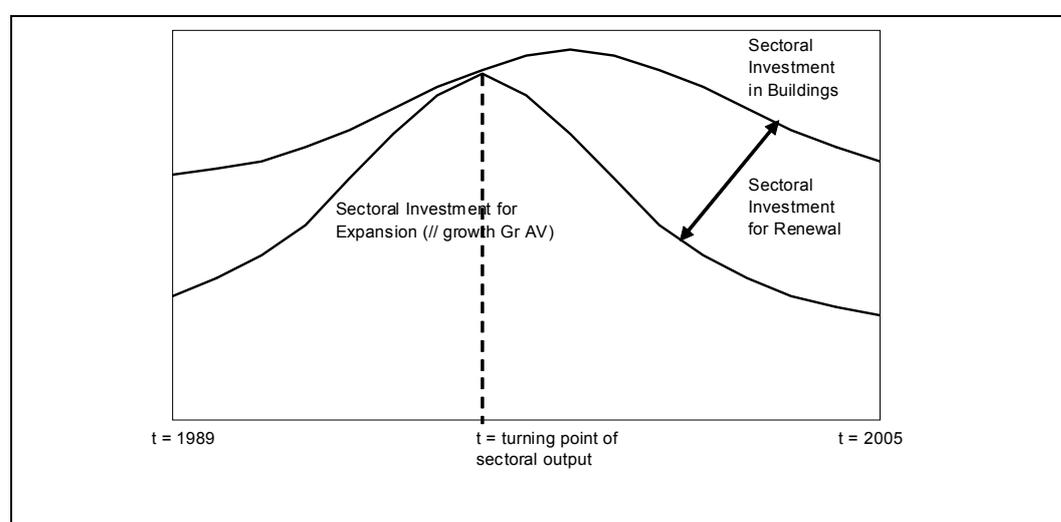


Figure 1 Determination sectoral investment for expansion

The valuation of the 1988-2005-growth of the Sectoral Building Stock is based on analysis of the annual absolute growth of the sectoral output (in terms of Gross Added Value).

Normally at the turning point of the sectoral output-growth all investment is allocated as investment for expansion (figure 1). Other years are interpolated based on the annual Δ Sectoral Output (five years smoothed). The surface of the expansion figure is indicated as the total expansion of the Sectoral Building Stock in the period 1989-2005. The whole Stock of Buildings ultimo 1988 is valued as:

$$\text{Building Stock}_{1988} = \frac{\text{GDP}_{1990}}{\text{GDP}_{2007} - \text{GDP}_{1990}} \times \text{Stacked Sectoral Investment for Expansion 1989-2005}$$

$$= \text{€ 288 bln (prices 2004)}$$

In the following tables this valuation approach is gathered for the Agriculture, Industry, Commercial Services and for the complete Budget Sector (Government, Health & Care, Education and Non-profit Services) and for the Total Dutch Economy.

Table 2

Sectoral Capital Formation and Output growth (in bln. euro's)	Gross Added Value (prices 2004)				Capital Formation in Buildings 1960 - 1988 (prices 2004)	
	1990	2007	Δ(%)		Σ 1960-1988	Total =100%
	a	b	b-a			
Agriculture	8.899	11.322	2.422	27,2%	38.976	11,0%
Industry	88.121	111.950	23.829	27,0%	81.400	22,9%
Commercial Services	134.043	251.180	117.137	87,4%	108.771	30,6%
Budget sector	80.981	103.676	22.695	28,0%	126.636	35,6%
Total	312.043	478.127	166.084	53,2%	355.783	100,0%

In table 2 the input-information is gathered:

- Sectoral Output (Gross Added Value) 1990 and 2007 and its growth.
- Capital Formation 1960-1988 and its sectoral division. To be used further for sectoral division of the Building Stock ultimo 1988.

Table 3

Macro Valuation Building Stock ultimo 1988 & 2005 (in bln. euro's)	Capital Formation in Buildings 1989-2005 (prices 2004)			Macro Valuation of Building Stock ultimo 1988 & 2005 (prices 2004)		
	Total	for Expansion	for Renewal	Stock 1988	Stock 2005	Renewed(%)
	c	d	c-d	e	e+d	(c-d)/V1988
Agriculture	23.724	12.784	10.940	31.595	44.379	34,6%
Industry	43.085	25.807	17.278	65.986	91.792	26,2%
Commercial Services	113.779	70.729	43.050	88.173	158.902	48,8%
Budget sector	78.148	44.185	33.962	102.655	146.841	33,1%
Total	258.735	153.505	105.230	288.410	441.915	36,5%

((a/(b-a))*d)

In table 3 first the Sectoral Capital Formation in Buildings (c) is split in Expansion (d) and Renewal (c-d), in accordance with the before described procedure. The Macro Valuation starts with the macro valuation of the Building Stock₁₉₈₈.

$$\text{Building Stock}_{1988} = \frac{a_{\text{total}}}{b_{\text{total}} - a_{\text{total}}} \times \text{Expansion 1989-2005 (d total)} = \text{€ 288 bln (e total)}$$

The sectoral division of this stock is in accordance with the sectoral division of the Capital Formation 1960-1988.

The Sectoral and Total Stock of Buildings ultimo 2005 is the sum of the 1988-Stock and the Expansion 1989-2005 (in the table e+d).

In the period 1989-2005 total renewal varies from 26% of the Industrial Stock of Buildings to 48% of the Commercial Services Stock of Buildings. The average is 33%.

The high percentage in the Commercial Sector is influenced by intersectoral replacement. Former owner-occupied buildings in the industrial sector and in the budget sector are replaced by new buildings, which are now leased from Commercial Developers & Lessors, and registered under Commercial Services.

Moreover the huge development for the free market in earlier years contributed after 2001 to a high vacancy of second hand (office) buildings and underutilization of existing industrial and commercial plants.

Typology of the building stock 2005

In order to apply the integral approach on sectoral capital formation in buildings it is wise to combine the analysis and forecasting on base of an economic indicator, with those based on physical and functional indicators. For instance: the investment for expansion in the agricultural sector is more dependent on the live-stock which has to be accommodated in stables and on the horticultural capacity of the glass houses. Otherwise the progress of agricultural technology urges for relative high investment in replacement.

Handler (Handler, 1970) states that quantitative facility needs have to be formulated for communities and for society as a whole. The number of class rooms should be based on the number of school-age children and the optimum number of children per class room. A shopping area will be based on the number of shopping people, their per capita retail expenditures and the optimum store area per dollar.

In The Netherlands functional indicators are developed for educational services (comparable to Handler), for the agricultural sector (Economic Institute for the Agricultural Sector LEI) and for the health sector (in relation with the number of beds and clinical functions).

A complete configuration for the office sector is dependent on sufficient statistical information. As economic indicator, the sector output of the Financial and Business Services isn't identical to production in offices. The gross lettable floor area of offices functions as physical indicator. The number of people which have to be employed in offices in combination with the average square meters per fulltime equivalent functions as functional indicator.

The problem of valuation and forecasting in monetary values is that it hides the constructional and functional diversity of buildings. The prices per square meter invested in offices, hospitals and schools are a 5 to 10 fold of the price of a square meter glass house.

Statistical information about square meters per type of building is only available based on macro registration of building permits. The following table with the Building Stock in Use 2005 is constructed by combination of:

- Σ Building permits 1990-2004 in square meters gross floor area per type (minus 12% revoke)
- The sectoral division of building permits 1996-2000 per type.
- Sectoral Output & Employment Growth 1991-1996-2005.
- Additional information about 1991-1996-2005-development of stock of cattle, stock of glasshouses, stock of shops, stock of offices, beds in hospitals and number of scholars.
- Pre-1990 information about sectoral investment and building permits per type, to correct for the historical structure of the nowadays building stock.

The resulting total floor areas are indicative.

Table 4.

Estimated Stock in Use 2005 (in mln square meters Gross Floor Area per ultimo 2005)	Barns & Sheds	Glass Houses	Industry Buildings & Warehouses	Shopping Stores	Offices	Schools	Other
Agriculture	70 mln	105 mln					5 mln
Industry			81 mln		6 mln		3 mln
Transport & Communication			18 mln		2 mln		3 mln
Trade & Catering			38 mln	26 mln	2 mln		10 mln
Financial & Business Services			26 mln		33 mln		3 mln
Health care					1 mln		24 mln
Education						20 mln	13 mln
Government			2 mln		12 mln		12 mln
Non-profit			5 mln		2 mln		13 mln
Total (535 mln)	70 mln	105 mln	170 mln	26 mln	58 mln	20 mln	86 mln

Macro forecasting building stock 2005-2025

After 1995 more detailed Sectoral Output, Employment and Investment information is available and applicable. In table 4 and 5 the Commercial Services are split in three subsectors: Transport & Communication, Trade & Catering and Financial & Business Services. The Budget Sector is split in Healthcare, Education, Governance and Non-profit Services. The investment for expansion in the period 1996-2005 is for the market sectors – like before – determined on base of sectoral output growth. This is completed for the Budget Sectors by calculation on base of employment growth in the distinctive sectors, which is in that sector the primary determinant of output growth.

Table 5

Macro Forecasting Building Stock Downcycling Scenario (in mln euro's)	Ultimo 1995	Expansion 1996-2005	Ultimo 2005	Expansion 2006-2025	Ultimo 2025
Agriculture	40.427	3.953	44.379	9.370	53.749
Industry	75.498	16.294	91.792	31.700	123.492
Transport & Communication	19.361	8.791	28.152	13.200	41.352
Trade & Retail / Hotel & Catering	45.479	16.283	61.762	34.440	96.202
Financial & Business Services	46.318	22.669	68.987	29.200	98.187
Σ Commercial Services	111.160	47.742	158.902	76.840	235.741
Healthcare	32.499	13.765	46.264	39.227	85.491
Education	26.600	4.698	31.298	8.400	39.698
Government	25.484	5.424	30.908	8.000	38.908
Non-profit	30.418	7.953	38.371	9.600	47.971
Σ Budget Sectors	115.000	31.840	146.841	63.682	210.523
Total economy	342.085	99.829	441.915	181.592	623.507

Ultimo 2025 is given without disinvestment correction.

The expansion in the period 2006-2025 is based on the expectations of continuing output growth:

- Agricultural investment for expansion is low, with a slight progressive growth-trend.
- a constant growth-trend – with tendency to decline – of investment for expansion by the Industry, the Trade & Catering, the Transport & Communication and by the Financial & Business Services
- a constant growth-trend – with tendency to decline – of investment for expansion by the Budget Sector. Exceptionally the need for investment for expansion in the health care is growing in relation with an ageing population

These expansion figures are based on continuation of the 1995-2005 expansion pattern, with tendency to over-investment in new buildings for expansion and replacement. This is labeled as the Downcycling Scenario. After the 2008 financial crisis and the ongoing economic crisis a structural decline in the investment trends must be expected.

Sectoral capital formation 1995-2025

The year-to-year Capital Formation 1995-2008 is split into five market sectors and four budget sectors. The Total of 9 Sectors equals the Investment in Buildings in graph 2 (lower part). The dotted lines reflect the expected total investment per sector (expansion and renewal). The Downcycling Scenario is based on the economic investment conditions in the period 1995-2007.

Based on construction data and the National Accounts 1995-2007 sector figures are constructed (graph 4 (solid lines), be aware of the differences in scale of the vertical axis).

In additional analysis trends based on sectoral production links are compared with trends based on physical indicators (for instance stock in square meters) and with trends based on functional indicators (for instance office employment x square meters per fte).

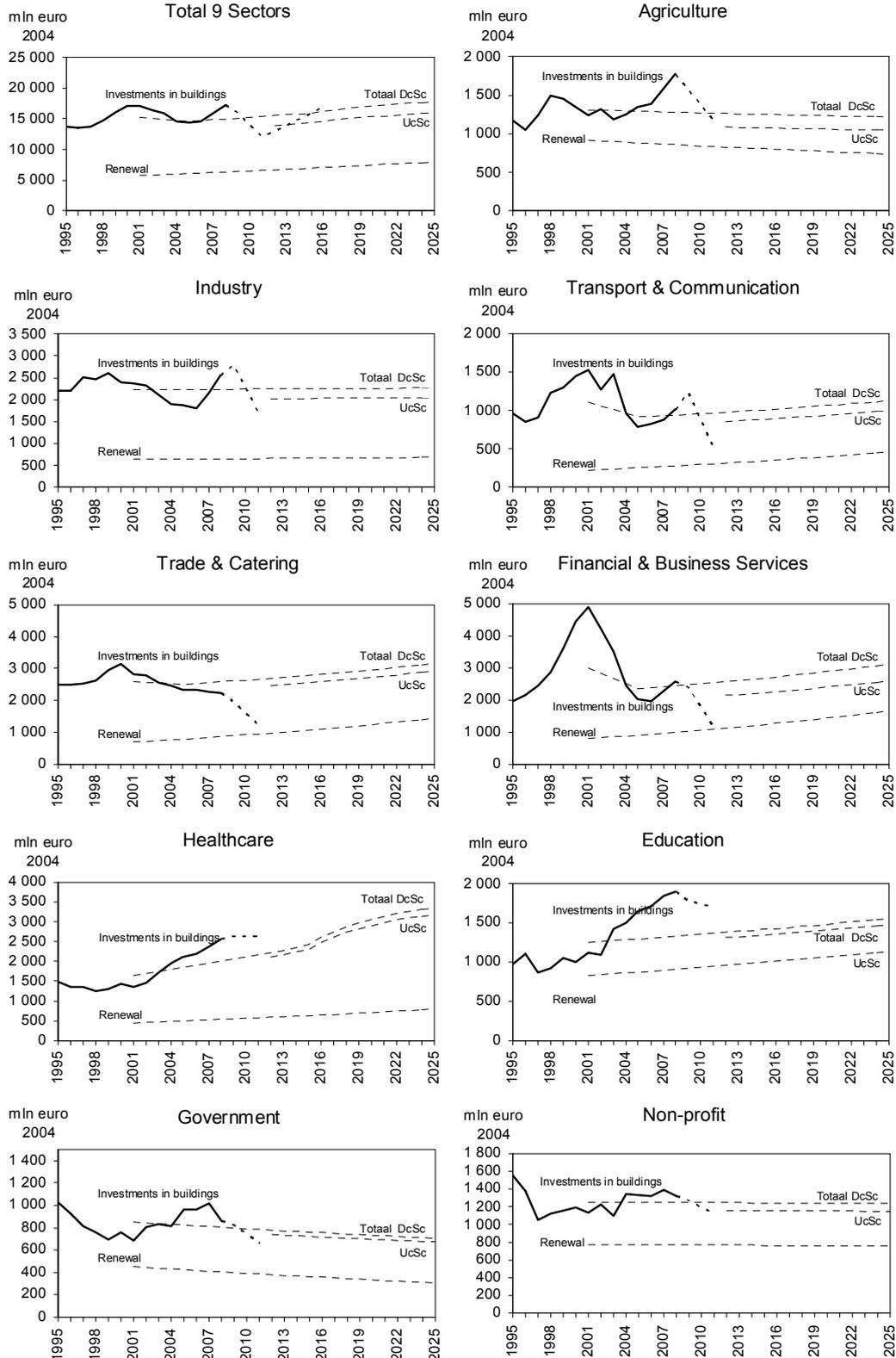
The stock of buildings is permanently in transition due to a thrive for economics of scale and rising productivity, in relation with embedded ICT investments and due to a shift of economic activity within the sectors agriculture, industry, commercial services and non-market and shifts between these sectors.

All individual sectors have in common a high demand for modernization by replacement and renewal refurbishment and major repairs.

In terms of investments in buildings Agriculture and Industry became shrinking sectors. A slight growth of total agricultural production does not encourage further growth of total investment in buildings (barns, sheds, glass houses and so on). Most future investment is for modernization and a more sustainable agricultural sector.

Investments in Buildings and Renewal per sector 1995-2025

Downcycling & Upcycling Scenario



Source: CBS/EIB (1995-2008 data)

Elaboration: RE&H Buildingeconomics

Graph 4

The industry invests in growth of especially the food and chemical industry. Other parts of industrial production are declining. New investments are related to a combination of new industrial technologies, embedded ICT-investments and a more sustainable production.

Investment in new buildings - to replace existing production capacity – prevails. Advanced new production processes are facilitated with rather rational designed new production halls.

Commercial services nowadays claim roughly half of the investment in non-residential buildings. Around 2000 the investment was a fourfold of the investment in the early sixties. Commercial services embraces:

- Trade, Hotels & Catering
- Transport and Communication
- Financial and Business Services

In this sector the investment activity is related to growing production and distribution activity in relation with ICT and logistics. Commercial services and especially office buildings are most volatile under the stagnating economic growth after 2000. Investment for replacement is becoming more important.

The need for growing investment in buildings for health care is derived from increasing growth of the 65+ population. The turning point of the 65+ growth is about 2015 and in the 75+ growth about 2025. The latter is reflected by an up to 2025 growing need for investment in buildings.

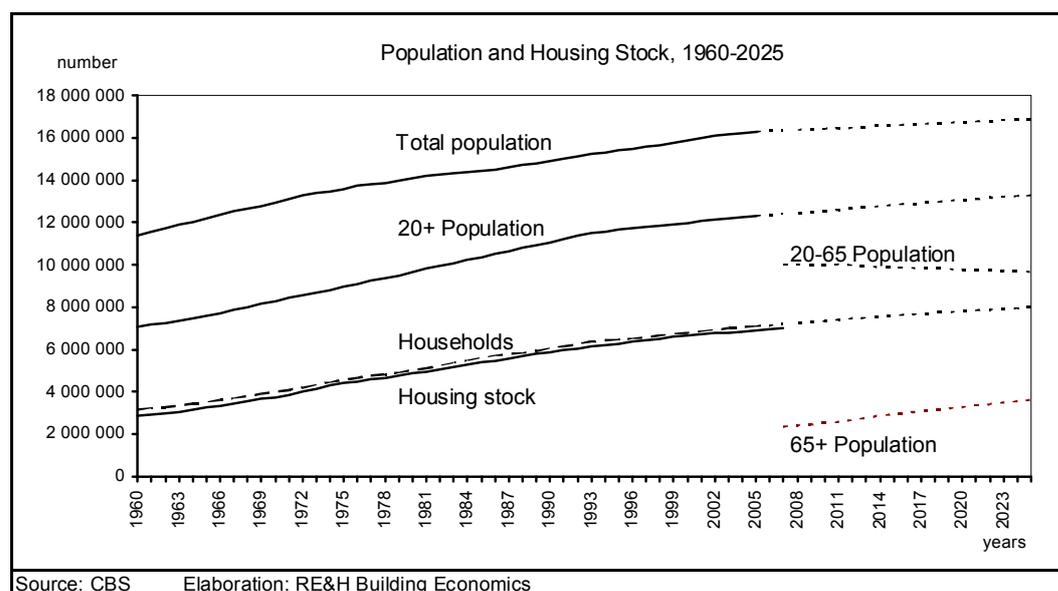
Health care has a growing investment activity due to an ageing population. Further growth of investment is to be expected. In recent years Education gets a new priority. This in relation with higher social requirements for knowledge and job training. Government and other non-profit are not growing because of less non-profit services and less government-linked jobs.

Due to the financial and economic crisis the economic conditions for investment are expected to change radically and a downward shift of the long run investment trend becomes a real possibility.

This is established in analysis and forecasting as the Upcycling Scenario. In this Upcycling Scenario the lower investment levels fit with a more sustainable investment scenario, with longer building cycles and less investment for replacement.

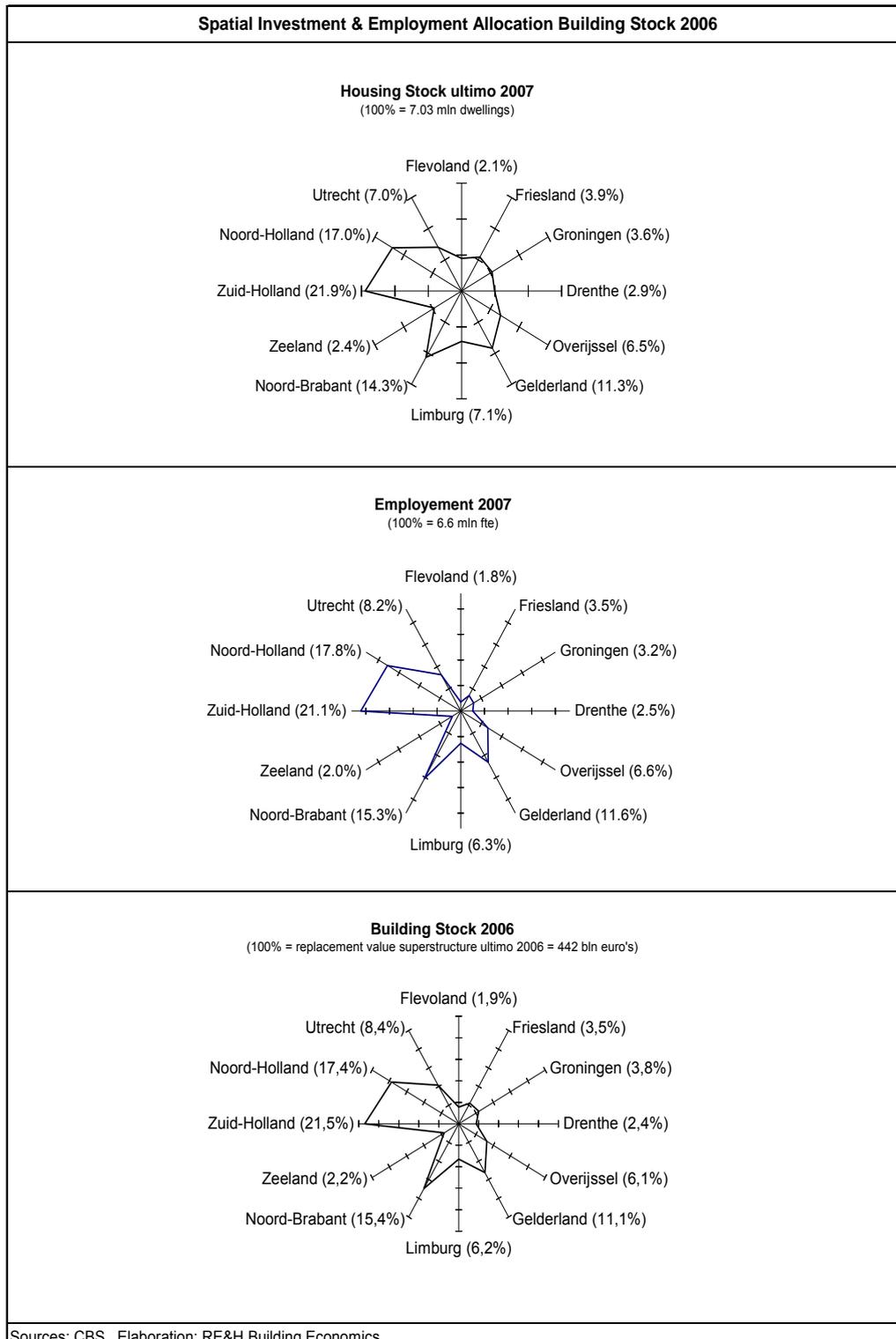
The conjunctural development of sectoral investment in buildings is represented by solid lines 1995-2008. The recent financial and economic crisis leads to an investment collapse in the years 2009-2011. The dotted forecasts for these years are the consequences of the economic decline. Total investment in buildings recovers after 2011 (Upcycling scenario).

Social-economic and spatial context of property allocation



Graph 5

Graph 5 shows the development of Dutch population. For the years 2005-2025 the 20+ population is split up in 20-65 population (potential labour force) and the 65+ population. Net growth completely depends on the growth of the 65+ population. The 20-65 population shrinks and this limits the growth of the macro labour capacity and indirectly the potential growth of the GDP.



Graph 6

Nowadays, economic activity, employment and consequently non-residential building initiatives are dominated by the services sector.

The regional spread of the Building Stock (graph 6) is based on:

- Regional capital formation in non-residential buildings 1995-2006
- Regional division of employment 2006
- Regional division of Gross Domestic Product 2006

One spectacular aspect of job creation is that employment in The Randstad is heavily depending on the growth of the office sector (Finance and Business Services and Government). The share in the Dutch office stock is 66% (Zuid-Holland, Noord-Holland, Utrecht, Flevoland). The slogan 'jobs follow people' is misleading. In the four Randstad provinces 47% of the population lives and 51% of employment is concentrated. The recent concentration of office stock creates a pull effect on housing facilities in The Randstad. The growth of The Randstad housing stock lags behind the growth of employment and behind the potential growth of population, especially in the Amsterdam-Utrecht-zone. In the coming decade the potential labour force (20-65 population) decreases. Consequently, further concentration of jobs and population in The Randstad means disproportional decline in other provinces, where locally the existing property may lose function and value.

The spatial unbalances between working and living are growing and the existing residential and non-residential building stock limits the possibility for better regional balances of population, housing, employment and real estate linked facilities.

The Dutch population and its economic activity is concentrated in The Randstad especially in the Amsterdam Utrecht region.

The concentration in The Randstad creates growing problems in terms of housing shortage and congestion. Undersupply of housing facilities in The Randstad will be compensated partly by alternative supply in other regions, especially for an ageing population. Within a spatial balance scenario not all problems of The Randstad can be solved outside. Some outer regions have to "shrink in balance", The Randstad will extend.

To conclude

After an historical peak in 2001, the Dutch development and construction market became more volatile. Decreasing growth of population, stagnating growth of the working population and lower economic growth characterise the present and coming decades.

Consequently, demand for non-residential building activity depends more and more on modernisation, replacement and concentration of the stocks of office, industrial, commercial, public and other buildings.

Economic growth has a strong influence on investment in buildings. Future investment in buildings is otherwise heavily depending on the renewal of the stock.

Investors, developers and construction firms need a strategy for dealing with the structural shift, conjunctural volatility and growing risks of operations on the real estate market and its different segments.

Investment growth is concentrated in the health & care sector, due to expansion of demand in relation with an ageing population. Further growth of refurbishment and repair is in accordance with a more sustainable building strategy, but heavily restricted by a limited labour capacity in the construction sector.

After a long period with attractive financial conditions the relations between revenues, costs, finance and returns on investment become more critical. This is strengthened by the actual financial and economic crisis. The recent financial and economic crisis offers an opportunity for transition of the investment process into a more social-efficient and sustainable growth and adaptation of the stock of buildings.

In the long run the future construction market is characterised by a slight upward trend, which is primarily quality driven. A downfall of demand and production in the next years will be followed again by a growing urge for replacement and renewal of the non-residential stock of buildings.

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