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The price-tag of long-term care

An empirical study on the characteristics and implications of price-development in long-term care

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Research Report

Summary

The substantial rise of health care expenditures in the Netherlands is for a large part attributable to long-term care. The ageing population cannot solely explain the increase in long-term care spending. These additional costs, on top of the demographic shift, provide ground for concerns about the sustainability of public finances because there is a relatively comprehensive social insurance system for providing long-term care in the Netherlands.

The sharing of risk is essential for the provision of long-term care. Price is important in terms of risk sharing, as it strikes all individuals at once. This means the risk of an unexpected price-increase cannot be shared within a group. Whether risks can be shared between groups, depends on the persistency of unexpected costs. The development of private insurance policies is complicated when possibilities for risk sharing are limited. Social insurance is still possible, but might not be desirable from an intergenerational perspective in terms of redistribution.

In this thesis, I assessed the behaviour of price in the past, the persistency of price shocks, and the consequences of persistency in terms the sustainability of government finances and risk sharing. Analysis is based on data of Statistics Netherlands and The Netherlands Institute for Social Research.

Resulting from time-series analysis, prices grow faster than previously assumed, pressing sustainability. Regression shows that prices extend for 78% into the next year. A prediction based on expected demographic changes shows that expenditure will increase with 1.5% of GDP from 2012 to 2040. Sensitivity analysis shows that the effect of a price shock has a long-term effect but is not persistent, indicating a more limited effect on government sustainability. These findings might reduce uncertainty around future expenditures, creating possibilities for alternative ways of financing long-term care in terms of insurance.

Table of Content

List of Abbreviations

ADF	Augmented Dickey Fuller
AWBZ	Exceptional Medical Expenses Act
CBS	Statistics Netherlands
CIZ	Centre for Need Assessment
GDP	Gross Domestic Product
HCE	Health care expenditure
LTC	Long-term care
NZa	The Dutch Healthcare Authority
SCP	The Netherlands Institute for Social Research
SPE	Squared Prediction Error
WLZ	Long-term Care Act
WMO	Social Support Act
ZVW	Health Care Insurance Act
ZZP	Burden of Care

Chapter 1 **Introduction**

The Western population is ageing. In coming years, the share of elderly people will continue to grow in both absolute and relative numbers. In the light of this ageing population, expenditures on long-term care (LTC) are of great concern in many OECD countries. Especially in the Netherlands, given the relatively high public LTC spending[1]. Projected demographic changes[2] induce a much larger increase in LTC spending than observed for total health care expenditures (HCE), as LTC is far more concentrated among the elderly (Oliveira Martins & de la Maisonneuve, 2006). In contrast to curative care, LTC does not intend to treat or prevent illnesses. Its chronic and supportive nature meets the needs of the elderly population, generating a strong linkage between age and LTC-utilization (Wouterse & Smid, 2015); 97% of spending in elderly care takes place above the age of 70 (van Ewijk et al., 2013). Sustainability of government finances infers that public services can be maintained in the future, and all generations benefit equally from social services (Van Ewijk et al., 2013). Solely based on expected demographic changes, government expenditures seem manageable. Yet when prices continue to develop like they did during the past decades, affordability of solidarity-based health care systems like ours might be jeopardized (Smid et al., 2014).

Additional growth in the form of a price-increase is not unlikely to occur in future years. Estimating the magnitude of the persistence of such a price shock is of big societal relevance, as the degree of persistence bears consequences for future expenditures and the sustainability of government finances. When the effect of a price shock is temporary, the effects of long-term sustainability of government finances is limited. Yet when the effect is persistent, the effect on national spending and rationing of budgets extends further in the future. When we get insight in the persistence of the price shocks in LTC we thus get insight in one of the major risks facing the sustainability of government finances.

The persistence of price shocks is also important for intergenerational risk sharing. Insurance is based on the concept of minimizing risks by sharing them (Cutler, 1993). Insurance is not possible if risks are – both inter- and intragenerationally - undiversifiable. The risk of price shocks cannot be diversified across members of one single generation, since these shocks affect the *average* costs for the generation as a whole. Sharing of these risks among different generations might be possible, but only when price shocks are not persistent and fade out over

[1] OECD average was 1.2% of GDP in 2012, while the Netherlands spent 2.9% of GDP. The share of elderly inhabitants was similar (Bakx, 2015).
[2] In 2016, 17% of the Dutch population was older than 65 year. In 2040, this will be almost one third (CBS, 2014a).

time, so that not all generations are affected. The (im)possibility of intergenerational risk sharing is relevant for both private and public LTC insurance. The difficulty to diversify risks across generations might be an important explanation why the private insurance market for LTC is so small (Cutler, 1993). Undiversifiable price shocks do not impede the possibility of social insurance, since participation is mandatory, but these shocks then do lead to (unintended) redistribution of income across generations.

Gaining insight in the development of LTC-price is the main aim of this thesis. The development of prices in the past will be investigated using empirical data of The Netherlands Institute for Social Research (SCP) and Statistics Netherlands (CBS). Secondly, a projection on price-development in coming years will be made, including the range of uncertainty surrounding it. Demographic trends will subsequently be integrated to quantify the effect of price on national expenditure. Lastly, a sensitivity analysis, based on a recently proposed increase in LTC spending, will be provided to gain insight in the long run effect of an actual cost-shock on government finances.

In short, the study aims to answer the following research questions:
a) How has the price of long-term care developed over the last decades?
b) To what extent are price shocks persistent over time?
c) What does this persistency mean in terms of government sustainability and risk sharing?

This thesis thus should provide a better understanding of the price development and the effect of unexpected price shocks in LTC, including their consequences for sustainability of government finances and risk sharing. The remainder of this report is structured as follows: chapter 2 provides a theoretical background on the drivers of LTC expenditure. In chapter 3, a model will be set up to estimate trends in LTC price and spending over the years. Chapter 4 addresses the datasets of CBS and SCP in more detail. In chapter 5 the results of the analyses will be described. Chapter 6 will discuss the results, and finally form a conclusion.

Chapter 2 **Theoretical background**

In this chapter, a theoretical background on LTC expenditure will be provided, starting with shortly clarifying the current system of LTC in the Netherlands. Subsequently, the determinants that make up LTC expenditures will be explained, namely price and volume. Lastly the concept of risk sharing will be discussed.

2.1 Structure and financing of LTC in the Netherlands

From 1968 until 2015 a broad range of LTC services was covered by the Exceptional Medical Expenses Act (AWBZ), a social insurance scheme. The scheme covers mainly elderly and chronically ill[3], but also mentally or physically disabled persons, and chronic psychiatric patients. Access to LTC facilities and services can only be granted by the Centre for Need Assessment (CIZ). The CIZ operates independently of other players in the health care field, such as health insurers, to guarantee objective health state assessments.

In 1968, 0.8% of gross domestic product (GDP) was spent on LTC. By 2005, this had raised to 4%. Yet expenditure was thought to be fairly stable at that time, considering coverage of the AWBZ had also gradually expanded over the years (Schut & Van Den Berg, 2010). In the 1980s and 1990s cost-containment policies were implemented, successfully limiting public spending. However, this resulted in growing waiting lists and perceived quality deterioration. At the beginning of the new millennium budgetary controls were lifted to reduce waiting lists, known as the period of '*laissez faire*'. Consequently, expenditures grew rapidly and already in 2005, budgetary controls were reinforced.

In 2007 some services were transferred from the AWBZ to the Social Support Act (WMO) with the underlying expectation that these services would be more efficiently carried out by municipalities. A complete health care reform was implemented in 2015, abolishing the AWBZ scheme. Continuous residential care and full homecare were transitioned to the Long-term Care Act (WLZ). This act is aimed at the most vulnerable group, needing supervision 24 hours a day. The Health Care Insurance Act (ZVW) now provided non-residential care formerly covered by the AWBZ via health insurers. The remaining AWBZ was accommodated at the WMO (Maarse & Jeurissen, 2016).

[3] In 2007, elderly and chronically ill made up 69% of total AWBZ beneficiaries (Schut & van den Berg, 2012).

2.2 Determinants of LTC utilization

In order to forecast future development of LTC costs, the driving determinants behind costs need to be distinguished. Increasing expenditure is either a result of increasing volume or increasing price. Price consists of labour costs and fixed costs. Volume is determined by the number of people in need of LTC, and the burden of care per person (Smid et al., 2014). Although both determinants contribute to the rise of total expenditure, this thesis will mainly focus on the changes and trends of the price components.

2.2.1 Volume

What factors influence the utilization of health care? To differentiate between determinants that play a role in this, Andersen and Newman (2005) constructed a model. The model distinguishes individual and social determinants. Individual determinants are divided in three categories: predisposing, enabling and need factors. The relationship between these determinants is dynamic. *Predisposing factors* influence the probability of an individual using healthcare in the future without directly causing it's use, including demographic factors as gender and age. *Enabling factors* involve the ability to access the health services needed. These include among others; income, ability to obtain informal care and coverage of health insurance (de Meijer et al., 2013). *Need factors* consider a person's level of disability or illness that directly generate the need to use health care facilities (Andersen & Newman, 2005). Social determinants concern the use of medical technologies and features of the health care system.

Predisposing determinants

An important demographic predisposing factor is age. While age in itself is not an argument to use care, it does influence the relationship between health and HCE growth. This effect is mainly accountable to LTC. LTC dependency strongly increases with age. Below the age of 60-65y, demand is practically negligible. Yet when ascending on the age-ladder LTC-utilization steeply increases. This age-effect holds even after accounting for disability. When controlling for 'time to death' (the time that remains of life until death) the effect of age diminishes but still exists (de Meijer et al., 2013; Schut & van den Berg, 2010). Given the projected growing share of the elderly population, increase in national HCE trough a rise in LTC utilization is to be expected. Other predisposing factors such as gender and household composition are left outside the scope of this thesis.

Enabling determinants

LTC expenditure is strongly associated with the shares of relatively inexpensive informal care and relatively expensive formal care. Availability of informal care decreases the use of formal

LTC. In all OECD countries, the majority of LTC is provided informally. The Netherlands are among the countries that supply the least informal care per caregiver annually (Oliveira Martins & de la Maisonneuve, 2006). Still, the availability of informal care providers is expected to decrease even more as the labour-force is projected to decrease in coming years. As a result, the need of informal care may not meet its supply. This development is likely to cause substitution of formal care for informal care, which drives up expenditures even more (Schut & Van Den Berg, 2010).

Need determinants

Life expectancy is expected to rise from 80 years in 2014 to 88 in 2060 (van Duin en Stoeldraijer, 2013). To what extent this rise in age will cause additional utilization is unknown, since it is unclear how age and care utilization are interrelated. There are three hypotheses in this; the expansion hypothesis, the compression hypothesis and the postponement hypothesis. The expansion hypothesis presumes that an increase in life expectancy will extend time lived with disability. Compression theory presumes that time lived with disability will be shortened. Postponement theory presumes period of disability will shift to older age, while duration does not increase (de Meijer et al., 2013). These theories all have different consequences for LTC expenditure, as disability is one of the main determinants for LTC usage. Empirical evidence on this is mixed. Smit et al. (2014) assumes that half of the additional life years are spent in good health.

2.2.2 Price

The price component of LTC expenditure is comprised of both material costs and labour costs. Both wages and productivity determine the total labour costs. Labour costs are the most important driver of LTC spending, for it is a highly labour-intensive sector (Smid et al., 2014). Labour cannot readily be substituted by technology, this is much easier in the curative sector. Productivity in health care, especially in LTC, falls behind compared to other economic sectors. It is still almost equal to what is was 25 years ago (Smid et al., 2014). Over the period 1985-2005 productivity even decreased by 0.3%, according to the study of Schut & van den Berg (2010), while growth in the remaining economic sectors was 1.8%. Yet, waged in LTC are equalized with other sectors to attract skilled workers. Since productivity lags behind, but wages are pressured upward following other sectors, the relative price of LTC increases. This is a phenomenon well known as the 'Baumol effect'. If productivity fails to grow, this can cause additional spending to just the demographic effect (Smid et al., 2014). Due to the increase of people in need of LTC but a decrease of the working population, serious labour force shortages are still expected in the future (de Meijer et al., 2013). Additionally, price elasticity of LTC is likely to be low in the presence of insurance. There are no marginal costs for the consumer, so they are insensitive to changes in price. As a result total LTC-expenditure relative to GDP will increase (Oliveira Martins & de la Maisonneuve, 2006).

2.3 Risk sharing

The sharing of risk, through either private or public insurance, is essential for LTC provision. LTC expenditure can be a large share of household income (van Ewijk et al., 2013). With the prospect of further rising LTC spending in the future, insurance against these costs becomes even more important. There will be less of a buffer in the average household to bear unexpected shocks (van Ewijk et al., 2013). Price shocks, and especially the persistence of these shock over time, are an important issue for both private and public insurance.

In most countries without public insurance, the market for private insurance of LTC is deficient (van Ewijk et al., 2013). Several reasons are proposed for the absence of a functional private insurance market in LTC, namely excessive costs, unattractive reimbursement, ignorance or denial of dependency or trust in family solidarity (Pestieau & Ponthière, 2011). Cutler (1993) however, states in his work that the *nature* of risk is the main reason for the deficient market in private insurance of LTC. Intratemporal risk involves cross-sectional hazards, and can be diversified in a certain (age-)cohort. Every individual is subject to the cross-sectional risk, but when pooled, this risk will diminish with pool size: a shock will not hit all individuals at the same time, so the loss of one unlucky individual can be absorbed by the group. The pool, when large enough, faces only the average risk of the cohort (Cutler, 1993). Thus, for an insurer is it beneficial that many people 'join' the pool.

Price as a determinant of expenditure, is a so called common risk. A shock in price, strikes all individuals using LTC at the same time. Such a risk does not diminish with pool size, and a pool cannot be insured for the average costs. Now, not average use but rather the costs of LTC over time are the primary risk in insuring for LTC. In the presence of aggregate risk an insurer could try to pool risk across different (age-)cohorts (Cutler, 1993). However, when costs are serially correlated – and previous values influence future values - the potential of diversifying risk declines with the level of correlation. When serial correlation is high, risk cannot completely be diversified across cohorts; a shock in the price today will not only affect the average costs of the current cohort, but also that of future cohorts. This has two main consequences for private insurances policies. Firstly, private insurers will be forced to request very high premiums, because high costs (paid for by the insurance company) of current generations will not be compensated by lower costs of future generations as they will be facing equally high costs.

Whether such an expensive insurance policy is attractive enough for individuals to obtain is rather doubtful (Cutler, 1993). Secondly, insurance companies might choose to grant only a predetermined limited payment instead of full service coverage, since generous policies are naturally more at risk for price shocks (Cutler, 1993). Such restrictions imply a risk for the insured though, as they will have to pay part of their (future) LTC bills out of pocket when costs increase. Again, the question rises whether people will opt for such a restricted policy voluntarily. An insurance policy that covers all costs of care is more attractive for individuals, but demands upfront decisions regarding these costs from insurance companies. As costs continuously develop over time, this is very complicated.

The same concept applies to social insurance. When unexpected costs are persistent through time, this will result in unbalanced costs and benefits between generations. In contrast to private insurance, rising costs of LTC can be more easily be covered by raising compulsory premiums of future generations. Consequently, future generations will pay for additional costs of previous generations on top of their own extra spending, causing undesirable redistribution of wealth from the young to the old. Growth of expenditure will put extra pressure on this concept of solidarity (Van Ewijk et al., 2013). Insight in the behavior and persistency of a price shock through time might provide valuable information for LTC financing alternatives in the future (van Ewijk, 2012).

Chapter 3 **Methods**

In this chapter a time series model in built to determine the correlation between LTC costs in a given year (y_t, dependent variable), and its lagged value (y_{t-1}, independent variable). The model allows for estimating best and worst case scenario's through a prediction interval. These estimates will eventually support the appraisal of the effect of future LTC-price in the on sustainability of government finances. The first part of this chapter introduces the concept of time series analysis, to provide ground for the calculations that follow. The second part will explain the model that is used for the analysis. The third part describes the approach towards making a demographic projection based on the findings. All analysis is performed with Stata 14.0.

3.1 Time series analysis

Time series data is sequentially collected at evenly spaced intervals, in this case yearly. Its sequence is always chronological. This means it is plausible that y_{t-1} to some extent influences y_t. Time series analysis is used to predict the degree in which y_{t-n} contributes to its next value y_{t-n+1}. In other words, to what extent they are serially correlated (Franses, 1998).
Data is transformed to logarithmic series, so that y_t is the logarithm of the observed price.
The following equation represents a model where y is the dependent variable at time t, depending on the prior (lagged) value y_{t-1}, ρ the auto-regression coefficient, ϵ_t is the random error term, normally distributed with mean zero and variance σ^2**,** and α is a constant.

$$y_t = \alpha + \rho y_{t-1} + \epsilon_t \qquad (3.1)$$

When y_t and y_{t-1} are indeed serially correlated, the degree of correlation can be used for out-of-sample forecasting. Auto-regression coefficients can be extrapolated into the future to estimate future values. Time series data regularly shows specific patterns. In macro-economic data, an upward trending pattern is not uncommon (Franses, 1998). When there is such a trend apparent, the model is adjusted to;

$$y_t = \ a + \rho y_{t-1} + \delta t + \epsilon_t \qquad (3.2)$$

Here δ is the coefficient of the time trend.

3.1.1 Unit Root test

When series contain a unit root, or are said to be non-stationary, its statistical properties such as mean, variance and autocorrelation are a function of time. Stationarity is important for the validity of a time-series model because when its statistical properties are stable through time, one can predict they will be the same in the future as in the past. In other words, that future values are equivalent to the mean of observed values (Franses, 1998). When this is not the case, the data is said to have a unit root. The unit root test provides insight in the degree of persistency of an unexpected price increase. When there is a unit root apparent, a shock will have a permanent effect on future values. When there is no unit root, the effect of a shock dies out over time (Franses, 1998). Following from equation (3.2), when $|\rho|$ equals 0, y_{t-1} has no role in defining y_t. Contrarily, when $|\rho| \geq 1$, shocks in y_{t-1} will have a permanent effect and y will not revert to the mean over time. I test for a unit root using the Augmented Dickey Fuller (ADF) test. The null-hypothesis that the series contain a unit root (and $|\rho|$ is equal to 1 in equation (3.2)), is tested against the alternative hypothesis that there is no unit root present ($|\rho|$ is significantly smaller than 1). P-values obtained from the test will provide insight in the behaviour of the data.

An important type of non-stationarity is a time trend, a long-term tendency in the data. In trended data, mean and variance will increase over time. When running a normal regression, correlations will be poorly estimated due to unstable statistical characteristics on which they are based. Upward trends are not uncommon in long-term economic data (Franses, 1998). When however, the series moves stationary around a trend, the series will revert to the trend after a shock. I will therefore also perform the test with adjustment for a time trend.

3.2 Predictions of price levels

Based on the regression model in equation (3.2), I will make predictions of future values. This model is an auto-regressive model with one lag, AR(1): autoregressive means the values are regressed on their own lags (in this case 1). The predicted values of y thus depend on the past values of y. Understandably, prediction errors (ϵ) and auto-regression coefficients from a more recent past have more effect on y_t than predictions from a less recent past (Franses, 1998). In other words, ϵ_{12} has more effect on γ_{13}, than ϵ_3 has. Therefore, I make out-of-sample 'dynamic' predictions. Dynamic refers to the fact that prediction for y_t is made based on the previously predicted value of y_{t-1}. So, let y_t be the last observation of y, I first make a prediction of y_{t+1} using the coefficients from the model

$$\hat{y}_{t+1} = \alpha + \rho y_t + \delta(t+1) \qquad (3.3.1)$$

Then I use this prediction to predict y_{t+2};

$$\hat{y}_{t+2} = \alpha + \rho y_{t+1} + \delta(t+1) \quad , \qquad (3.3.2)$$

and so forth.

Because the predictions of y are dynamic, the uncertainty in these predictions (the squared prediction error (SPE)) will also be dynamic. The SPE for the first predicted value (y_{t+1}) is equal to the standard deviation of the error term epsilon, which is equal to σ. The prediction of y_{t+2} is based on the prediction for y_{t+1} and the error thus also depends on the error of this prediction. For the first four predictions, the SPE looks like this:

$$\text{SPE}y_{t+1} = \sigma \qquad (3.4.1)$$

$$\text{SPE}y_{t+2} = (1+\rho)\,\sigma \qquad (3.4.2)$$

$$\text{SPE } y_{t+3} = (1+\rho + \rho^2)\,\sigma \qquad (3.4.3)$$

$$\text{SPE } y_{t+4} = (1+\rho + \rho^2 + \rho^3)\,\sigma \qquad (3.4.4)$$

Following from these equations, SPE will keep increasing for more distant predictions, but will do so at a decreasing rate (ρ^n decreases with n when $\rho < 1$), which means the more in the past, the less influence an SPE has on the current value of y. Using the SPEs, I construct 95% confidence intervals to assess the uncertainty around the future predictions. I will also use this interval for constructing a best- and worst case scenario of price development.

Finally, I transform the logarithmic series back to levels by exponentiating y_t, shown in equation 3.5. A smearing-factor ($\frac{1}{2}\sigma^2$) is added, aimed at accurately retransforming log-scaled predictions to the original scale.

$$y_t = \exp(\log(y_t) + \tfrac{1}{2}\sigma^2) \qquad (3.5)$$

3.3 Projection of expenditures

Based on the predicted price, combined with the demographic effect, a projection on national LTC expenditures is made. To calculate the demographic effect, age profiles on LTC utilization are applied (Smid et al., 2014). These numbers on LTC usage per age-group consists of both WMO and WLZ usage, but the ZVW is excluded as this would muddle the impact of solely elderly care. Profiles are multiplied by the expected (age-group) size (CBS, 2014c), and related to baseline year 2012 to make in a volume-index. As shown in equation (3.6), multiplying the price-index ($P_{i,t}$), the volume-index ($V_{i,t}$) and national LTC expenditure in baseline year 2012 (E_b), presents the predicted expenditure in year t (E_t).

$$E_t = E_b * P_{i,t} * V_{i,t} \qquad (3.6)$$

This is done in threefold, using predicted price and subsequently price of best respectively worst-case scenario prices.

To show the impact of national expenditures on GDP, E_t will be expressed as a percentage of predicted GDP. GDP is expected to annually rise with 2% (including the effect of general inflation) (Smid et al., 2014). So, projected GDP in year t (GDP_t)will be;

$$GDP_t = GDP_b * 1{,}02^{(t-b)} \quad , \qquad (3.7)$$

with baseline year (b) set to 2012.

Chapter 4 **Data**

This thesis analyses two datasets of yearly macro-level data on nominal expenditure, volume and prices of LTC. This first dataset comes from The Netherlands Institute for Social Research (SCP) (2010), the second from the Statistics Netherlands (CBS) (2014a). They differ on several aspects, which will be discussed later in this section.

4.1 SCP dataset

Data from the SCP originates from the Database Public Sector. The set contains information about 'nursing and care' over the period 1985-2008. 'Nursing and care' includes care and supervision to functionally limited individuals, aimed at enabling them to live their daily life. They receive care either at home, called non-residential care, or in a nursing- or care home labelled residential care (Pommer, 2012). Both types of care are mainly utilized by people above the age of 65. For residential and non-residential care this applies to respectively 94% and 82% of beneficiaries. Care that is obtained through personal budgets (which was also covered by the AWBZ) is not included (Pommer, 2012). LTC provided to physically and mentally disabled non-elderly was not included by the SCP.

Both categories (residential and non-residential) contain further information on production, total- and labour costs and number of jobs. Note, production is usually measured in terms of hours or days of care-provision. Yet market prices of provided products during this time are not readily available. Consequently, both categories must be weighted before they can be summed. (Chessa, 2012)

Prices can be deducted from the data. Price indices are calculated with the baseline year set to 1985. To construct a total LTC price index that consists of both residential and non-residential care, expenditure is weighted against this baseline year. This shows in the following formula;

$$p_{w,t} = p_{nr,t} * \frac{e_{nr,1985}}{e_{nr,1985}+e_{r,1985}} + p_{r,t} * \frac{e_{r,1985}}{e_{nr,1985}+e_{r,1985}} \quad , \qquad (4.1)$$

where $p_{w,t}$ is the weighted price of care at time *t*, $p_{nr,t}$ is the price of non-residential care at time *t*, $p_{r,t}$ is the price of residential care at time t, $e_{nr,1985}$ is the expenditure non-residential care in 1985 and $e_{r,1985}$ the expenditure on residential care in 1985. The same formula is applied to calculate weighted volume.

4.2 CBS dataset

The second dataset contains information of more recent years and over a longer period of time (1969-2012). The CBS distinguishes only price and volume without further specification. Therefore, predictions made based on this set will be will be less detailed, but are still interesting for gaining insight in future spending. The definition of LTC is also slightly broader compared to the SCP definition; it includes care with and without overnight stay, and additionally 'social services'[4]. Also, the CBS takes into account the introduction of new care-products and their influence on total production, this in contrast to the SCP. Volume and price indices are calculated, with baseline year set to 1969.

Several differences exist between both datasets, based on time-span, definitions and collection methods. These differences might cause divergent results. These characteristics and their possible consequences will be discussed in more detail in chapter 6.

4.3 Other data

To distinguish between real expenditure growth and expenditure growth due to inflation, deflators displayed in percentage change provided by CBS Statline (CBS, 2014b) are used. These mutations are transformed to indices and applied to correct for the effect of general inflation.
To examine the demographic effect of the price projections, age specific (0-99y) information on the population usage of LTC is applied[5]. (Smid et al., 2014) The CBS provides prognosis per age group (0-99y) of the population size extending to 2060. (CBS, 2014c). Information on GDP is also obtained from the CBS (CBS, 2014b).

[4] Available online: https://www.cbs.nl/NR/rdonlyres/2183EAC5-3F8C-4889-BC54-DD8F89C131A5/0/sbi2008versie2013.pdf.
[5] These profiles include WMO and WLZ use, but exclude the ZVW.

Chapter 5 **Results**

In this chapter, I will firstly show the development of LTC expenditure in the past based on both CBS and SCP datasets, and make a decomposition of costs. Secondly, I will perform unit root tests on all cost series. Thirdly, I will make a prediction for future development of price and expenditure including an uncertainty range. Finally, I will perform a sensitivity analysis based on a recently suggested policy change (Scherp op Ouderenzorg, 2016) to assess the effect of a cost-shock.

5.1 Descriptive results

CBS

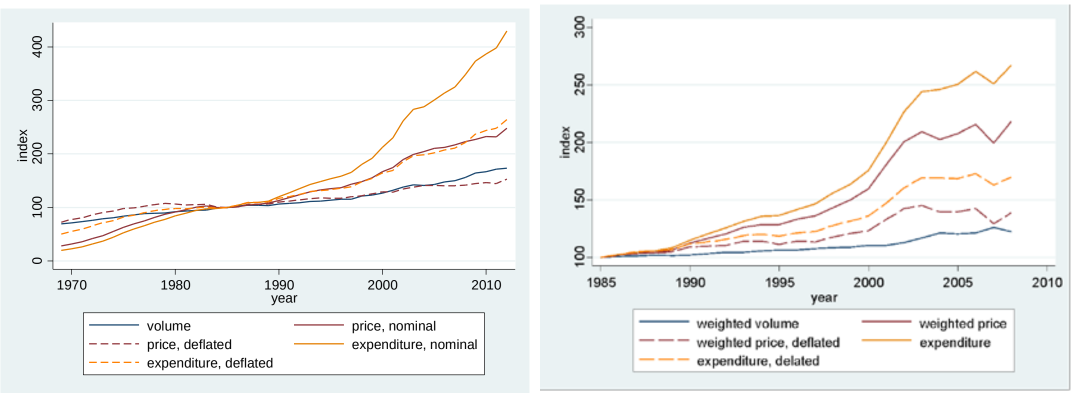
First, the CBS-dataset is examined. Figure 5.1a shows the development of price, volume and expenditure. Data is displayed in indices with baseline year 1985. The effect of general price inflation is eliminated using additional CBS data on deflators (dashed lines) (CBS, 2014b). Total nominal expenditure on LTC was 25.7 billion euro in 2012, which is a more than 20-fold increase compared to 1969. Annually, expenditure grew with 7.5%. However, when the effect of general inflation is removed, the increase is weakened to an annual increase of 4%. When looking at real price, a rise of 110% during this 33-year period is observed. Over the same period, volume increased with 149% which equals a 2.2% increase annually. The rise in expenditure is especially steep at the beginning of the millennium. Due to the earlier mentioned period of loosening budget restrictions aimed at improving access to health care by, among other measures, reducing waiting lists. Both datasets show this period of '*laissez faire*'. After already a few years this policy was revoked, because spending proved untenable. Going further back in time, the period of 1985-2000 was characterized by relative restrictive health care budgets, in an attempt to dampen the continuous rising of healthcare budgets in the years before 1985 (Schut & Van Den Berg, 2010).

SCP

Next, the SCP-data is examined to explore what underlies this price increase in more detail. Figure 5.1b shows development of nominal total expenditure, volume and price development over the period 1985-2008. Deflated series are obtained, applying the same CBS-deflators. Again, all values are displayed as indices. SCP data shows a more moderate growth than CBS data does. There is no clear explanation for this difference (Smid et al., 2014). It shows the same pattern in the first years after 2000. Looking more closely (figures can be found in Appendix A) non-residential care was subject to a 105% increase in real expenditure and a 68% increase in volume. This showed to be only 58%, and respectively 12% for residential care. These differences indicate a shift towards home-care utilization. Data also points out that labour costs make up 65% of the price for residential care, and 85% of the price for non-residential care. There percentages fluctuate minimally over the period, indicating that productivity has not increased during these years. Development of price and expenditure on labour and capital is not displayed here, but can be found in Appendix A and B.

Figure 5.1 Index of price, volume and expenditure on LTC

a. CBS (2014a) *b. SCP (2010)*



5.2 Decomposition

An increase in expenditure is either due to volume growth, or price increase. The decomposition allows us to see the contribution of each of these components to the rise of total spending. Figure 5.2a shows the annual growth percentages based on CBS series, 5.2b displays the decomposition of SCP data. Percentages are displayed over the period 1985-2008 to make an adequate comparison with SCP data, as annual percentage changes are influenced by the chosen period of observation. Over the period 1969-2012 they prove 2% higher than when only the years after 1985 are considered.[6] This might be due to the fact that from 1985 until the beginning of the new millennium, expenditure was relatively limited due to strict policies. Yearly percentage changes of the different SCP cost series can be found in Appendix D.

The observed increase in expenditure can only be partly explained by the rise in volume of LTC, though. Real expenditure increased with 1.5% more than would be expected based on only volume growth. This means a relevant share of rising LTC expenditure is attributable to price. Both nominal and deflated price are shown, to represent the effect of general price inflation.

[6] Based on CBS data.

Figure 5.2. Decomposition of the growth in LTC expenditure, average annual percentages

a. CBS (1985-2008) *b) SCP (1985-2008)*

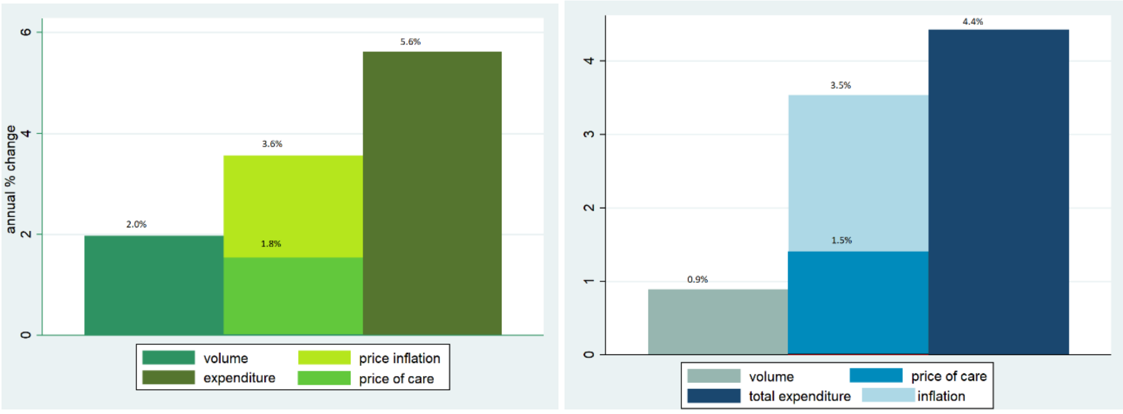


Table 5.1 shows nominal annual price increases per type of costs based on SCP data. For total expenditure and costs per unit (price), the deflated annual percentage growth is also calculated. Total expenditure rose 73% over the whole period, while volume grew with only 22%, attributing a large share of expenditure growth to price-growth. Nominal price grew with an average yearly percentage of 3.5%, and price development of residential care contributed relatively more to this increase than non-residential care.

Table 5.1. Decomposition of annual expenditure growth

Type of care	***Non-Residential***	***Residential***	***Total***
Total Expenditure			
nominal	5.3%	4.1%	4.4%
deflated	3.3%	2.1%	2.4%
Price			
nominal	2.9%	3.6%	3.5%
deflated	1.0%	1.6%	1.5%
Volume	2.4%	0.5%	0.9%

(Source: SCP (2010))

5.3 Results Unit Root Test

The ADF-test is performed before proceeding with forecasts. The aim of this test is to assess the degree of persistency of shocks. The test is done twice for both datasets, the first ADF-test does not include a time trend in the regression, but as the graphs (see previous paragraph) show a clear upward movement the test is repeated to account for a trend. P-values for ADF-test inclusion of trend are displayed in Table 5.2. Results of all cost-series can be viewed in Appendix C.

Table 5.2. Results ADF-test including trend on deflated logarithmic series, p-values.

CBS					**SCP**	
Period	**1969-2012**		**1985-2008**		**1985-2008**	
	y_t	$\Delta_1 y_t$	y_t	$\Delta_1 y_t$	y_t	$\Delta_1 y_t$
Expenditure						
Nominal	**0.000**		0.675	0.183	0.729	0.192
Deflated	0.169	**0.013**	0.772	**0.014**	0.814	**0.040**
Price						
Nominal	**0.000**		0.619	0.188	0.614	**0.020**
Deflated	**0.035**	**0.001**	0.665	**0.001**	0.554	**0.001**
Volume	0.855	**0.000**	0.868	**0.000**	0.606	**0.001**

- Significant findings are displayed in **bold**
- For all other SCP cost-series the results can be found in Appendix C.

Looking at the nominal expenditures and price over the period 1985-2005 for both datasets, the test fails to reject the hypothesis that y_t contains a unit root. Thus, these series are non-stationary: single price shocks have a persistent effect on future prices that does not die out over time (Franses, 1998). The p-value for nominal price[7] is 0.62. When excluding the adjustment for any present trends, this increases substantially (Appendix B). Looking at the deflated series, similar results are observed. Both price and expenditure show the presence of a unit root. When considering the period 1969-2012 on price (and nominal expenditure), the hypothesis of a unit root is rejected. Thus, these series are stationary.

Differencing is applied to see whether the transformed series $\Delta_1\ y_t$ show a unit root.[8] Differencing yields stationarity for almost all series except nominal expenditure in both datasets, and nominal price in the CBS dataset. This information is provided as a context, I did not use differenced series in the subsequent analyses because the interest does not lie in price-differences but in price itself and its relationship with expenditure. It does mean however, that regression on a non-stationary process will cause prediction intervals to be too narrow, and predictions to be too optimistic. Prediction on price is performed using CBS deflated price series, which did show stationarity over the full period, however.

One drawback of the ADF-test to keep in mind is that it has little power in small samples. The SCP datasets consists of 24 observations, while the CBS-set has 44. This may partly explain the differences in their p-values (Franses, 1998).

5.4 Price prediction

Estimates of autocorrelations for observed cost series are shown in Table 5.3. The cost

[7] Based on CBS data over the period 1985-2008.
[8] Differencing is a common method to yield stationarity. Although analysis will be done with raw data instead of differenced data, it provides insight in the amount of unit roots present in the data (Franses, 1998).

series display a large degree of autocorrelation, and prices persist for 78% into the next year (CBS, 2014a). Total expenditure correlates even more with the next year. Note, that there is a correction for a time trend included in the model. When regression is done without considering a trend, all coefficients are extremely close to 1, or even exceed one.[9] Based on the regression models in Table 5.3 I make predictions of future values of y_t, where y_t is the price in year t. To obtain results in levels I transform the predicted values using equation (3.5).

Tabel 5.3 Regression results on price

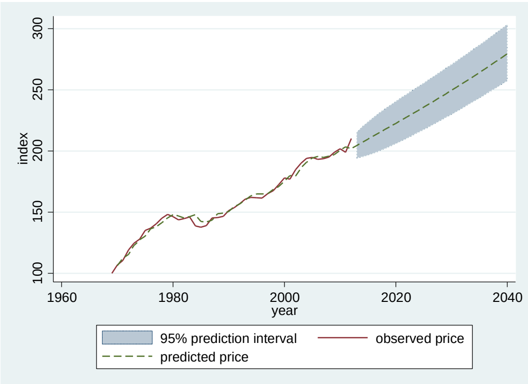
Price (y_t)	N	α	$\rho(y_{t-1})$ (P>|t|)	σ_ϵ	Time Trend (P>|t|)	*Model fit*	F-statistic (Prob > F)	R²
CBS 1969-2012	*43*	-3.85	.778 (.000)	.020	.003 (.007)		1406.2 (.000)	0.98
SCP 1985-2008	*23*	-10.36	.626 (.002)	.032	.006 (.078)		116.2 (.000)	0.92

Table reports regression in the form of $y_t = \alpha + \rho(y_t) + \delta t + \epsilon_t$, where y_t is logarithmic price.
N is number of observations

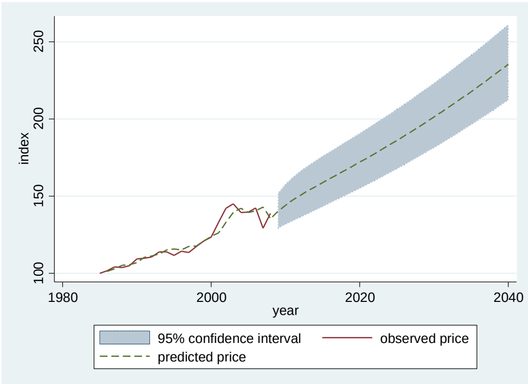
Predictions on price can be viewed in figure 5.3 (5.3a for the period 2008-2040, 5.3b for the period 2012-2040). The further in the future, the wider the prediction interval and the more uncertain the predictions are. When looking at SCP data with regard to price, an increase of 70% is predicted over the total forecasted period. The confidence interval ranges from an increase of 89% in worst case scenario, to 53% in the most favorable case. Based on CBS data, price is predicted to increase with 33% over the period 2012 to 2040. The uncertainty around this prediction ranges from an increase of 44% to 22% in worst and best case.

Figure 5.3 Predicted price development, deflated series

a. CBS (2014a)



b. SCP (2010)



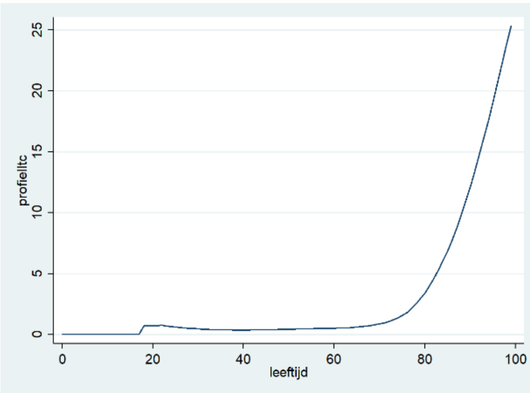
[9] These results can be found in Appendix E. Including all SCP-cost series.

5.5 Expenditures

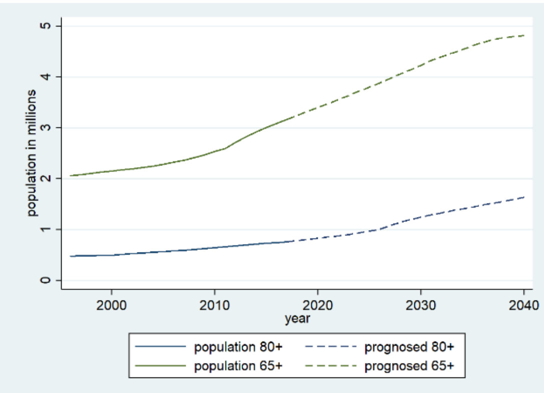
In previous paragraphs a prediction of LTC-price for future years was made. Now, I will use this prediction combined with the demographic effect, to make a prediction for national LTC-expenditures. LTC usage strongly increases with age, as can be seen in Figure 5.5a. The stepwise increase around the age of 18y is caused by the transfer from the Child and Youth Act[10] (CYA) to the WMO at that age. The profile does not include the CYA. The utilization profile per age group is subsequently combined with their prognosed sizes (CBS, 2014c), as explained in chapter 3. Figure 5.5b displays the increase of older age groups as there is a steep increase in the use of LTC with age, especially around the age of 80. In 2040, the number of individuals aged above 80 years is predicted to be four times larger as compared to 2012. Price and volume are related to the baseline year, 2012 to make it an index (figure 5.5c and 5.5d).

Figure 5.5 Components of the demographic effect

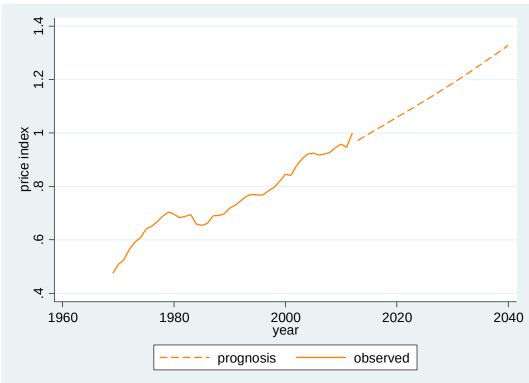
a. Age profiles of LTC costs



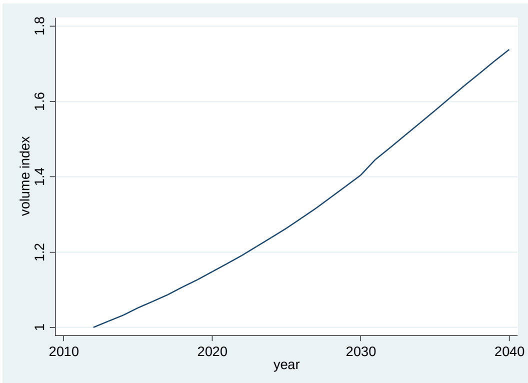
b. Size prognosis oldest age groups



c. Price index



d. Volume index



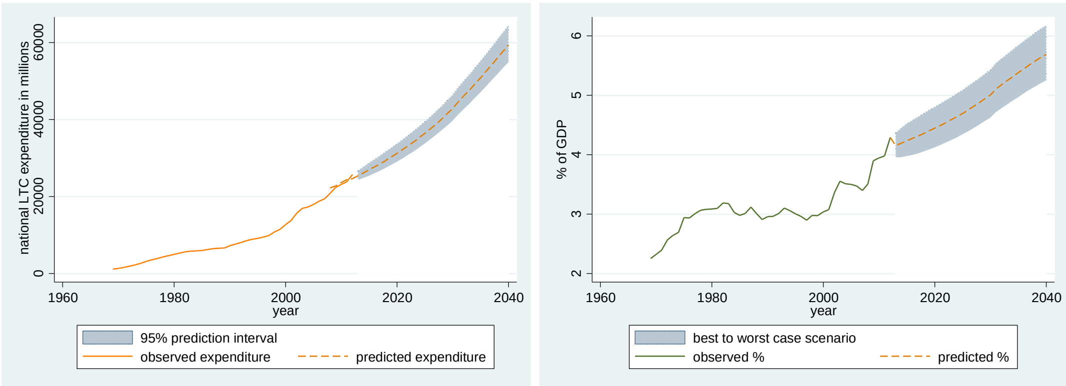
Expenditures can now be calculated by applying equation (3.6). Based on price predictions, a best- and worst case scenario is constructed. The actual effect on government finances can be quantified. This is displayed in figure 5.7a. In the predicted case, government expenses increase with 131%, from 25.7 billion to 59.3 billion euro's. LTC expenditure is not only increasing in

[10] In Dutch: Jeugdwet.

monetary terms, but also as percentage of national income (Figure 5.7b). In 2012, LTC expenditures covered 4.2% of GDP. In 2040 this is predicted to be 5.7%, with uncertainty ranging from 6.2% to 5.2%.

Figure 5.6 Projection of demographic effect

a. Expenditure and GDP b. Expenditure as % of GDP



5.6 Sensitivity analysis of a price shock

Previous analyses show that shocks in price are highly persistent through time. Considering the demographic effect, a prediction with regard to national expenditure was made. At this moment, it is interesting to assess the influence of a price shock on predicted national expenditure. Recently, a policy change has been suggested to allocate higher budgets to elderly care (Scherp op Ouderenzorg, 2016). I will use this proposed policy to demonstrate the effects of shocks on long-term government spending on LTC.

The manifesto 'Scherp op Ouderenzorg' recently pleaded for a norm on minimum requirements in residential elderly care to guarantee sufficient care for all. The main reason for the policy proposal is that people residing in nursing homes are currently not receiving the care they need and deserve. Government budgets should be adjusted to meet this standard of care, and must be assigned immediately, it states. The norm referred to is known as the '*four eyes, four hands*' concept. This means that on a group of eight people, there should be two qualified caretakers available during 16 hours a day. The plea also states that money in nursing homes is not meant for management, or improving the market position of the organization itself, but should be spent on improving the care that is provided. Hence, overhead cost should be set to a maximum of 10% and reserves to max 25% (Scherp op Ouderenzorg, 2016).

The Dutch Healthcare Authority (NZa) conducted a study to assess the impact of such a policy change (NZa, 2017). The NZa calculated that to meet the norm, an extra 45.000 fte[11] of qualified

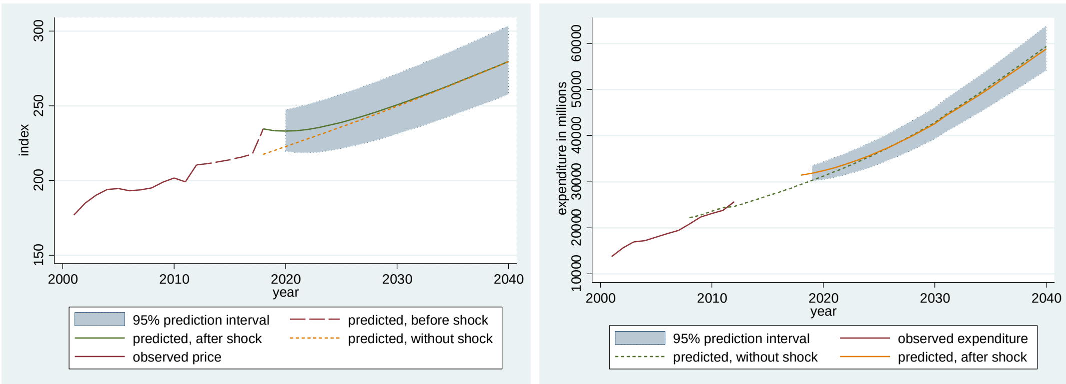
[11] Full-time equivalent.

staff is needed. Executing this policy would mean a budgetary increase of 2 billion euro's according to the impact-analysis. For this sensitivity analysis, I administered a 'shock' of 2 billion euro's in 2018[12] to estimated government expenditure, in order to examine what this would mean for the long-term. This is an abstraction, because practically it would not be possible to close the gap between the current and the desired situation instantly.

After raising expenditure by 2 billion euros in 2018, a new price is calculated by multiplying the predicted 'old' price by a load-factor (the relative increase in expenditure). Using dynamic prediction from 2019 on, a new prediction for price in generated. Price seems to recover from the shock (Figure 5.7a). After 2030, price has reverted closely to its predicted level in the absence of a price shock. Subsequently, the new price substitutes the old price in equation (3.6), and indices of price and volume are calculated relative to 2018 to constitute predicted expenditure after the policy change (figure 5.7b).

Figure 5.7. Impact of 2 billion euro shock

a. Predicted price b. Predicted national expenditures



When looking at the effect of the shock on expenditure, a similar situation is observed. Predicted expenditure based on the 'new' price certainly seems to recover from the price shock by returning to its previous pattern.

Thus, when injecting the 2 billion euros needed to implement policy changes as proposed, this does not have a permanent effect on government LTC expenditure. As a result, LTC expenditures will increase with 1.0% of GDP, from 4.7% in 2018 to 5.7% 2040[13] which is equal to projection solely based on demographic changes. Price is set at a higher level but will revert to the situation without shock within roughly 15 years, showing a long-term, but not irreversible effect. There is however a substantial range of uncertainty surrounding this prediction. In this sensitivity

[12] Based on CBS dataset.
[13] Uncertainty ranges from 5.2% to 6.1%.

analysis, I assumed the ‘monetary injection’ was merely a price effect, and was not expressed in higher quality of care[14]. Nonetheless this limitation might be of minor influence, as the input of more staff not necessarily enhances quality.

[14] Quality would be phrased as volume instead of price.

Chapter 6 **Discussion and Conclusion**

The expected increase in LTC spending is an important issue for the sustainability of government finances. The ageing of the population contributes to this spending. Yet, if expenditure would grow solely in line with demographic developments, sustainability of government finances is not in danger (Smid et al., 2014). However, this is not true in case of growth beyond demographics.

The role of the price-component has remained relatively underexposed in prior research, compared to the attention that has been paid to increase in the volume of LTC. Price is, however, of utmost importance for two main reasons; its influence on government sustainability and its consequences with regard to risk-sharing. To this aim I examined development of price in past years and estimated the future price including surrounding uncertainty. I additionally combined these estimations with the demographic impact of projected population trends to appraise the effect on national LTC-expenditure. In this chapter, the results will be interpreted in a broader perspective to point out their significance and potential application in practice.

6.1 Main results

The decomposition of expenditure made in paragraph 5.2 points out that not all increase in expenditure can be attributed to increased volume, but a significant share is due to increased prices. These findings are similar to the findings in the report of Smid et al. (2014), which showed over the last decades, expenditure rose 1.6% more than would be expected based on wage- and demographic development. The level of growth differs substantially between the two data-sets, the next paragraph will discuss some explanations for these differences.
When testing the series for the presence of a unit root, none of the series show stationarity when considering the period 1985-2008. Over the longer period however, deflated price[15] is stationary. This series is used for subsequent analyses.

When the predicted price is combined with the projected demographic trend, national expenditure appears to rise with 1.5% of GDP from 2012 to 2040. This rise in expenditure is higher than previously found by other studies (Smid et al., 2014). Subsequent sensitivity analysis showed that in case of a price shock[16], expenditures return to their previous growth level. A price shock does not seem to have a permanent effect. National LTC-spending will in this

[15] Obtained from CBS-dataset.
[16] Assuming the increase in costs is merely result of price-increases.

case increase with 1% of GDP from 2018 to 2040.

6.2 Limitations

.. of data

Adequately collecting data is subject to several challenges. SCP and CBS took a different approach in measuring volume and price, which possibly has consequences for the results of analyses. Measuring volume is not easily done. Usually, time[17] is used as an indicator of the amount of care provided. However, different types of care are provided during one period which all differ in terms of quality and price. Prices of these products cannot readily be summed up but must be weighted in some way. To this end, CBS and SCP use a different approach. (Pommer, 2012) Also, in measuring volume they use different techniques. The CBS considers the introduction of new products over time. The SCP does not, which might result in an underestimation of total volume[18]. Indeed, volume based on SCP calculation is 1.1% lower. Cost prices on the other hand, are likely to be overestimated when care-products are considered similar while they are not. SCP decomposition indeed shows a bigger price-impact on expenditure compared to the CBS data.

The differences between the two data sources seem to have little effect on the outcomes of my analysis. The regression shows that the time trend of both data-sets is similar (column 5 of Table 5.3). Predicted prices (Figure 5.3) practically follow the same trend as well. So, despite differences between both datasets derived from measurement dissimilarities, the main findings of this research are robust.

.. of predictions

Forecasts on future national LTC-expenditure are based on CBS deflated price series over the longer period. Justification for this choice can be found in the results of the ADF-test. As pointed out before, stationarity influences the reliability of predictions. When there is a unit root, shocks have a permanent effect and series do not revert to the mean. In that case, there is more uncertainty about future values (Cutler, 1993). The CBS-price series over the longer period do not indicate the presence of a unit root. This means uncertainty around the prediction is less likely to be underestimated. Additionally, CBS price-series are not burdened with possible overestimation of price-levels that concern the SCP price-series, as described in the previous paragraph.

[17] Measured in hours, of care provided, or number of days institutionalized (Pommer, 2012).
[18] This is because new products usually have a higher price. Ignoring this higher price as indicator for volume, results in a lower volume-measurement.

In this thesis, spotlights were set on the price-component in predicting expenditure. The effect of volume can however not be dismissed. Variability in volume is subjected to a wide range of factors[19]. Volume is not only determined by the supply-side but also the demand-side. Supply-side involves policy changes. The implementation of these future policies has unknown effects on government expenditure. The demand-side too, is surrounded with uncertainty. When longevity gains are spent in ill health, volume-expansion will be much larger than when additional lifetime is spent in good health (de Meijer et al., 2013). It is not unthinkable that new technologies or treatments will evolve in the field of LTC, that will allow people to live longer in good health. When for example a cure for Alzheimer's disease (Van Ewijk, 2013) would be found, this will strongly reduce the number of years lived in disability.

Focusing on price has however been a conscious choice. Volume and price essentially differ in their relation to redistributions across generations. When future generation wish more or qualitatively better care, this likely results in higher expenditure. It seems sensible that the burden of costs should be borne by the benefitting generations as well. When the younger generations who benefit from additional care also contribute, the distribution of net benefits (benefits minus contributions) across generations is not affected (Smid et al, 2014). When spending increases due to price shocks, it is less clear that this burden should only be borne by the generations affected by the shock. In this case, intergenerational risk sharing might thus be more important.

Lastly, predictions based on the past always contain uncertainty. When new technologies allow for more productivity, a drop in prices is not unthinkable. This could substantially constrain future prices and thereby expenses, positively affecting financial sustainability.

6.3 Implications

..for sustainability of government finances

The projection of this study shows that LTC expenditure in the Netherlands will keep rising as a percentage of GDP. Until 2040, expenditure will increase with 1.5% of GDP. Price is estimated to rise faster than is supposed by the study of Smid et al. (2014). So, sustainability is likely to be less maintainable due to higher than expected price increases. Also, when an unexpected price shock occurs its affects the price of future years. However, based on the sensitivity analysis of a price shock, its effect seems to decline in time, making is less of a threat for the sustainability of Dutch government expenditures.

[19] Predisposing, enabling and need determinants. See chapter 2 for more details.

.. for social insurance

The Dutch collective health care system is relatively generous. Collective LTC services are provided through comprehensive social insurance schemes. These costs are collectively shared within generations[20], but mainly between generations. A rise in expenditure is not a problem by definition. The question is, how these costs should be distributed. Normally, pooling risk would involve welfare gains, as people are risk averse. Insurance frees them of uncertainty about high unexpected expenses. (Van Ewijk et al., 2013) This is only true when risks can be diversified within or between groups (Bovenberg & van Ewijk, 2011). The sensitivity analysis based on the manifesto 'Scherp op Ouderenzorg' suggests that a price shock has a long-term, but not a permanent effect. As a consequence, younger generations will for several years be facing higher costs compared to their predecessors. These higher costs do however decline yearly, and eventually return to their original level. Currently, younger generations contribute to the care of elderly generations. Since the chance that prices will return to their 'pre-shock' levels is plausible, generations more or less equally contribute to the costs of unexpected price shocks (younger generations will face the same (trend)level of costs later in life). This might suggest that the current system is feasible for financing additional LTC spending growth. However, since there still is a reasonable long-term effect, and substantial uncertainty surrounding the prediction, other systems are worth considering.

.. private insurance

Although the Netherlands have an extensive social insurance system, ideas about insuring LTC privately have been put forward. In practice, it seems difficult to establish these private LTC insurance policies. Even in countries with a sober social system, the private sector for LTC insurance is small. The USA has with 7% of residential care privately insured, the biggest private market. Japan follows with 5% (Van Ewijk et al., 2013). An important reason why private LTC insurance is so limited according to Cutler (1993), is the inability to share risks intergenerationally. Yet, my findings show a subtly more optimistic result. The risk of a price shock is serially correlated and its effect resonated into future years, yet is not infinite. The lower degree of persistency I found, opens the door for diversifying risks intergenerationally. When insurance companies can forecast future costs more accurately and risk sharing between age-groups is possible, they might be able to offer individuals more attractive policies. Thus, the possibilities for private insurance of LTC in the Netherlands might be more viable than previously thought.

[20] Distribution from high to low incomes (Smid et al., 2014).

Conclusion

To sum up, the price of LTC is estimated to grow faster than previously presumed. Based on this estimation, national expenditure on LTC will continue to grow as a percentage of GDP. An unexpected price shock causes a long-term additional rise in expenditure, but eventually its effect dies out. Hence, the negative effect of a price shock on the sustainability of government finances is mitigated. The degree of persistency I found leaves room for the possibility of intergenerational risk sharing, which creates possibilities for insurance alternatives. The ability to more accurately forecast costs over the long run, might generate opportunities for the field of private insurance. This study provided insight on the role of price in the debate on LTC spending, but financing and distribution of costs in the end remains a choice pertaining to society.

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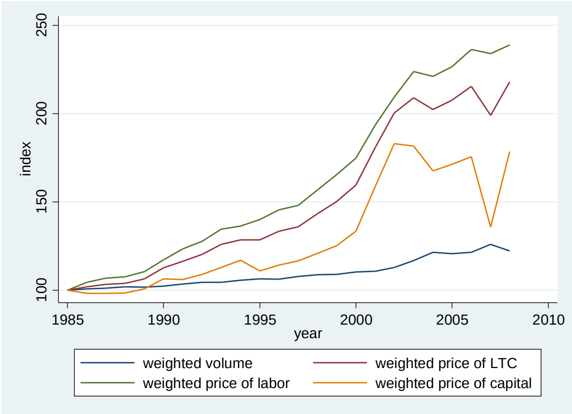
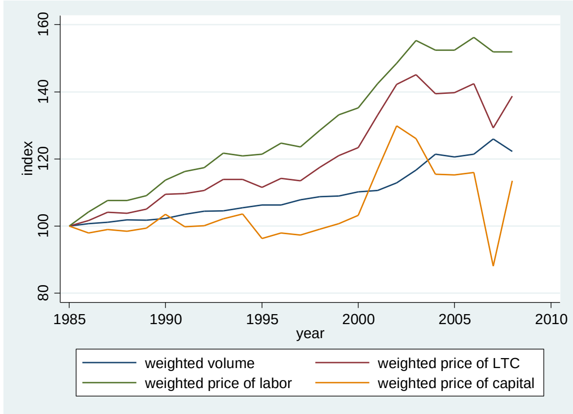
Appendix

A. Price of care (SCP, 2010)

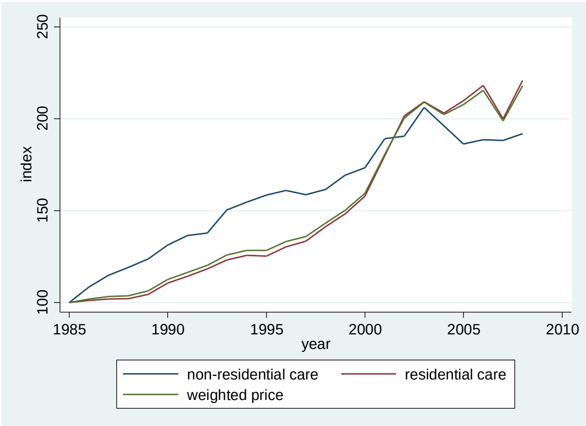
a. Weighted price per category, nominal



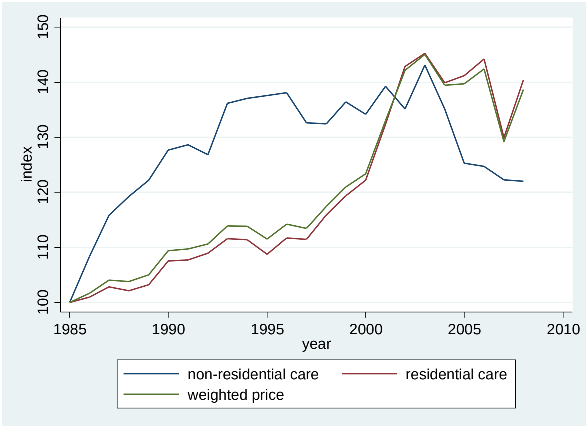
b. Weighted prices per category, deflated



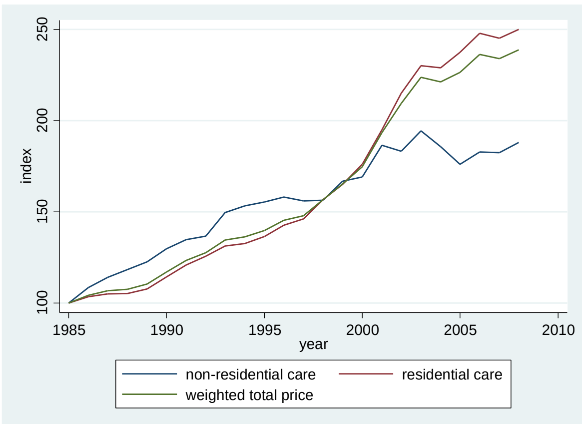
c. Weighted total nominal price



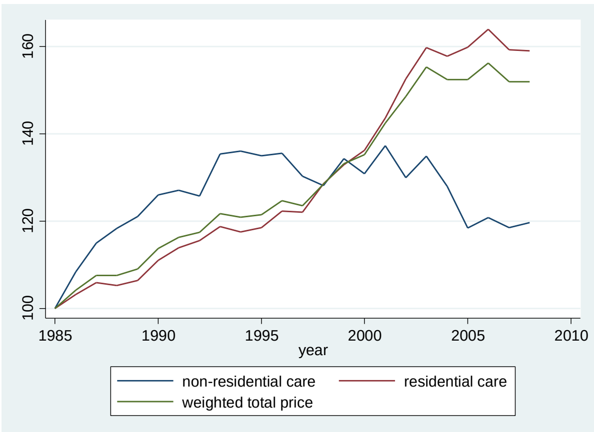
d. Weighted total deflated price



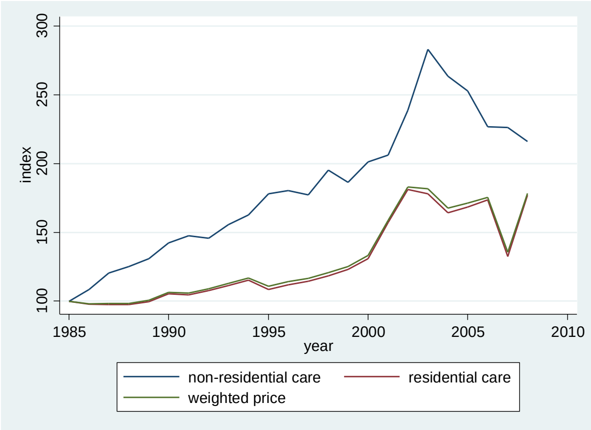
e. Labour costs per unit, nominal



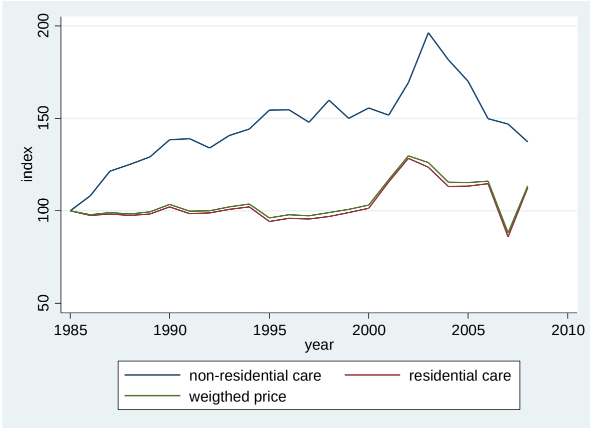
f. Labour costs per unit, deflated.



g. Capital costs per unit, nominal

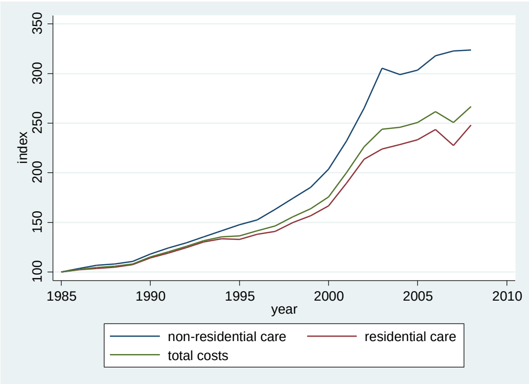


h. Capital costs per unit, deflated

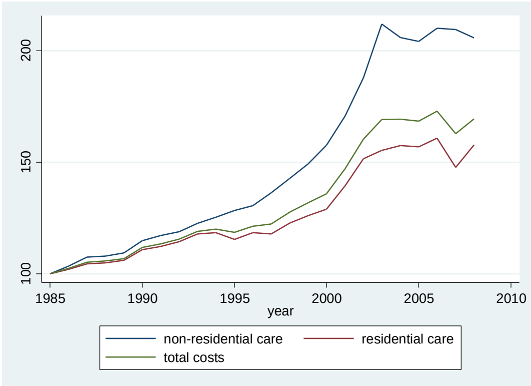


B. Expenditure (SCP, 2010)

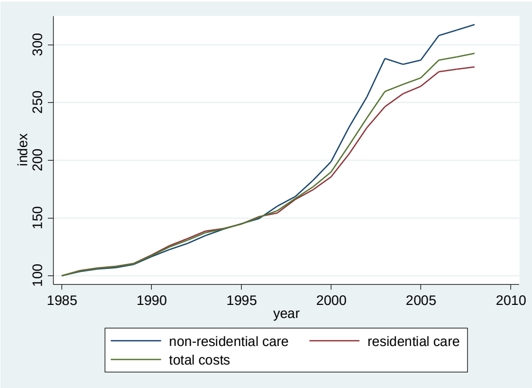
a. Total expenditure growth, nominal



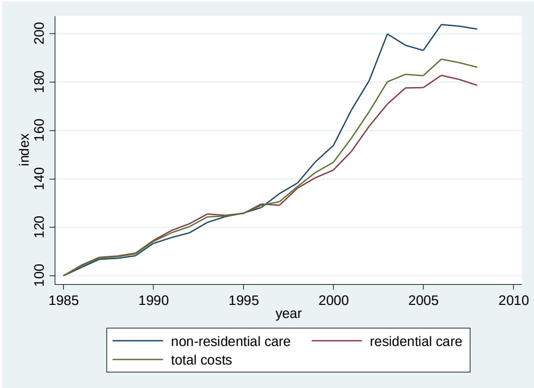
b. Total expenditure growth, deflated



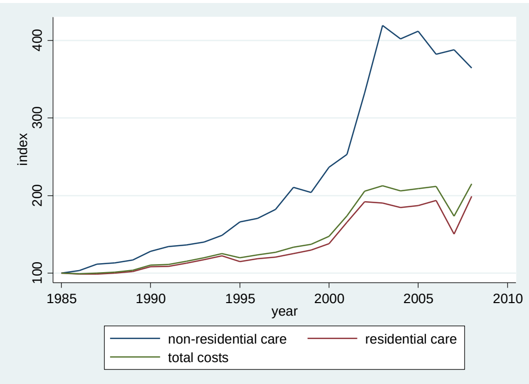
c. Total labour costs, nominal



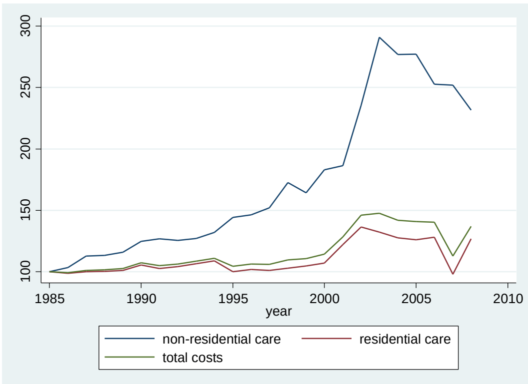
d. Total labour costs, deflated



e. Total capital costs, nominal



f. Total capital costs, deflated



C. Results of ADF-test

a. SCP (2010), trend included, p-values

	Non-residential care		Residential care		Total Care	
	y_t	$\Delta_1 y_t$	y_t	$\Delta_1 y_t$	y_t	$\Delta_1 y_t$
Expenditure						
Labour	0.704	0.255	0.797	0.633	0.773	0.683
Capital	0.834	**0.043**	0.212	**0.000**	0.429	**0.003**
Total – nominal	0.773	0.436	0.657	**0.039**	0.729	0.192
Total – deflated	0.877	0.258	0.644	**0.001**	0.814	**0.040**
Price						
Labour	0.644	**0.000**	0.744	0.279	0.811	0.175
Capital	0.959	**0.007**	0.193	**0.000**	0.218	**0.000**
Total – nominal	0.831	**0.000**	0.574	**0.019**	0.614	**0.020**
Total – deflated	0.454	**0.000**	0.542	**0.001**	0.554	**0.001**
Volume	0.190	0.187	0.506	**0.000**	0.606	**0.001**

b. SCP (2010), trend not included, p-values

	Non-residential care		Residential care		Total Care	
	y_t	$\Delta_1 y_t$	y_t	$\Delta_1 y_t$	y_t	$\Delta_1 y_t$
Expenditure						
Labour	0.983	0.063	0.974	0.254	0.980	0.289
Capital	0.864	**0.007**	0.891	0.000	0.927	**0.000**
Total – nominal	0.972	0.131	0.976	0.007	0.979	**0.051**
Total – deflated	0.911	0.066	0.894	0.000	0.914	**0.006**
Price						
Labour	0.076	**0.000**	0.970	0.075	0.945	**0.040**
Capital	0.196	**0.006**	0.840	**0.000**	0.845	**0.000**
Total – nominal	0.042	**0.001**	0.967	**0.002**	0.954	**0.003**
Total- deflated	**0.003**	**0.001**	0.850	**0.000**	0.777	**0.000**
Volume	0.996	**0.049**	0.784	**0.000**	0.965	**0.000**

c. CBS (2014a), trend included, p-values

	1969-2012		1985-2008	
	y_t	$\Delta_1 y_t$	y_t	$\Delta_1 y_t$
Expenditure				
Nominal	**0.000**	0.554	0.675	0.183
Deflated	0.169	**0.013**	0.772	**0.014**
Price				
Nominal	**0.000**	**0.568**	0.619	0.188
Deflated	**0.035**	**0.001**	0.665	**0.001**
Volume	0.855	**0.000**	0.868	**0.000**

d. CBS (2014a), trend not included, p-values

	1969-2012		1985-2008	
	y_t	$\Delta_1 y_t$	y_t	$\Delta_1 y_t$
Expenditure				
Nominal	**0.000**	0.197	0.995	0.064
Deflated	0.376	**0.001**	0.979	**0.002**
Price				
Nominal	**0.000**	**0.177**	**0.981**	**0.037**
Deflated	**0.096**	**0.000**	**0.696**	**0.000**
Volume	0.944	**0.000**	0.997	**0.001**

D. Annual percentage changes

a. SCP annual % change

	Non-Residential Care	***Residential Care***	***Total***
Expenditure			
Labour	5.2%	4.6%	4.8%
Capital	6.2%	3.5%	3.7%
Total care - *nominal*	5.3%	4.1%	4.4%
Total care - *deflated*	3.3%	2.1%	2.4%
Price			
Labour	2.9%	4.1%	4.0%
Capital	3.7%	3.0%	3.0%
Total care - *nominal*	2.9%	3.6%	3.5%
Total care - *deflated*	1.0%	1.6%	1.5%
Volume	2.4%	0.5%	0.9%

b. CBS annual % change

	1969-2012	*1985-2008*
Expenditure		
Nominal	7.5%	5.6%
Deflated	4.0%	3.5%
Price		
Nominal	5.3%	3.6%
Deflated	1.8%	1.5%
Volume	2.2%	2.0%

E. Regression results

a. SCP (2010), logarithmic series, including trend

	Non-residential care			Residential care			Total		
	Constant α	Coëfficiënt y_{t-1}	Variance σ	Constant α	Coëfficiënt y_{t-1}	Variance σ	Constant α	Coëfficiënt y_{t-1}	Variance σ
Expenditure									
Labour	-22.31	.808	.034	-16.98	.823	.025	-17.75	.827	.027
Capital	-30.14	.766	.078	-63.05	.475	.078	-28.64	.615	.069
Total – nominal	-21.41	.819	.038	-21.14	.753	.036	-18.98	.800	.033
Total – deflated	-11.38	.826	.033	-10.99	.690	.031	-9.20	.788	.028
Price									
Labour	-7.20	.755	.032	-18.12	.799	.027	-16.85	.794	.025
Capital	-4.04	.847	.061	-4.04	.847	.061	-30.91	.480	.079
Total – nominal	-4.84	.816	.031	-23.14	.714	.040	-22.20	.710	.038
Total – deflated	4.97	.792	.028	-10.95	.639	.035	-10.36	.626	.032
Volume	-16.22	.828	.029	-1.52	.621	.011	-4.82	.709	.013

b. SCP (2010), logarithmic series, not including trend

	Non-residential care			Residential care			Total		
	Constant α	Coëfficiënt y_{t-1}	Variance σ	Constant α	Coëfficiënt y_{t-1}	Variance σ	Constant α	Coëfficiënt y_{t-1}	Variance σ
Expenditure									
Labour	-.019	1.01	.037	.012	1.00	.027	-.008	1.01	.029
Capital	.188	.976	.082	.354	.957	.092	.170	.982	.078
Total – nominal	.017	1.00	.040	-.025	1.01	.039	-.028	1.01	.036
Total – deflated	.115	.989	.034	.217	.976	.033	.140	.986	.029
Price									
Labour	.033	.897	.544	.022	1.00	.029	.053	.997	.026
Capital	.135	.895	.061	.233	.927	.098	.202	.932	.093
Total – nominal	.310	.901	.031	.019	1.00	.044	.040	.998	.0411
Total- deflated	1.45	.703	.030	.955	.231	.038	.230	.939	.035
Volume	-.213	1.05	.039	.342	.928	.011	-.010	1.00	.014

c. CBS (2014a), trend included

1969-2012	Constant α	Coëfficiënt y_{t-1}	Variance σ
Price			
Nominal	-7.08	.858	.025
Deflated	-3.85	.778	.020
Expenditure			
Nominal	-13.21	.852	.031
Deflated	-8.43	.841	.025
Volume	-3.24	.902	.014

d. CBS (2014a), trend not included

	Constant α	Coëfficiënt y_{t-1}	Variance σ
Price			
Nominal	.376	.946	.028
Deflated	.271	.950	.022
Expenditure			
Nominal	.314	.962	.036
Deflated	.141	.981	.027
Volume	.028	.999	.014