How to Make the Health Care Structure Most Healthy?

Determinants of Health Care structure efficiency in OECD countries.

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Abstract

The current study investigates which policy-relevant institutional characteristics of a health care system provide a more efficient system. This is done because health care spending is increasing dramatically and with an aging population there is a need to make the health care sector more efficient. Efficiency factors are investigating by the use of the stochastic frontier analysis, which determines the level of technical inefficiency of a variable within a system. Institutional characteristics of a health care system are the determinants of efficiency. The study of Wranik (2011) will be followed to find the effect of institutional characteristics on the dependent variable, health outcome represented by HALE, in relation to health expenditure of a country. Panel data of four years for 20 OECD countries are used in the analysis. It turns out that the share of the population covered, and the regulation of the price level billed by providers have a negative effect on efficiency. The public share of total health care expenditures has a positive effect on efficiency in the health care sector as institutional variable. This information contributes to potential reforms of the health care sector by policy-makers.

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Chapter 1 Introduction

The need for a sustainable, effective, and efficient health care system is an ongoing major topic. Almost all nations are trying to find the best way to structure their health care sector. Health care spending in OECD countries is increasing dramatically (André et al., 2010; Hernandez de Cos & Moral-Benito, 2012; Miller, 2009; Müller & Varabyova, 2015). Many causes are behind this trend, including supply factors related with technological change, and an increasing demand for health care services that increases with income (IMF, 2010). Another reason for the growing health care costs in developed countries is the increasing inefficiency of the use of the health care institutions (Worthington, 2004). Furthermore, the problem of rising health care costs may even rise more, because of the phenomenon of aging in the world (Bjornerud et al., 2006). Therefore, policy makers have focused on the efficiency and performance of health care systems. Moreover, many countries have introduced, or considered, reforms to improve the performance of their health care structure (Ali Cengez & Senel, 2016). To accomplish these reforms, policy makers show particular interest in understanding how different factors of the health care system work, and whether the resources invested in the system are producing good outcomes, or whether there is some scope for improving the value for money in health care systems (Müller & Varabyova, 2015).

The efficiency of the health system in developed countries is often questioned (André et al., 2010; Davis et al., 2007; Wranik. 2011; Worthington, 2004). All countries must allocate their resources to address a triangle of health care issues: cost, access, and quality. Health care performance is often generally measured in these terms (Roberts, 2011). Access is also defined as ensuring equity in the field of health economists and health policy analysts (Bevan et al., 2010). So that access is provided by need and not the ability to pay for the service. An example for these terms used in the health care system is given by Roberts (2011). A simulation of the emergency department of a hospital can improve the access, if there are fewer people who *leave without being seen* in that department, by allowing more people to be seen. If the waiting time is reduces at an emergency department, the quality of care that the system achieved is improved to the patient. And if the staff is used more effectively that reduces the cost of the care, the health care system works more efficient, since the costs of the employees are spread over more patients. If one part can be improved, without the decrease of the other parts, the health care systems is more efficient. Efficiency in the health care system has become a concern for policymakers (Evans et al., 2001). Reforms in the health system targeted to improve these triangle issues. As the *World Health Report 2000* described three

intrinsic goals of health systems, the most efficient outcomes are mostly demanded. The three intrinsic goals of the a health system provided by the *World Health Report 2000* are common with the triangle of health care issues as mentioned above but more specific. These goals are: improving health (quality), ensuring that financial burdens are distributed fairly (cost), and increasing responsiveness to the legitimate demands of the population (access). Concerning the triangle of health care and the increasing health care costs health care decision-makers must improve the performance in access and quality with the same input. Or every dollar spent in the health care system must provide an increase in the quality and access to health outcome (Anell & Willis, 2000).

The knowledge about which health system structures and variables are most efficient is inadequate in academic evidence (Wranik, 2011). This research tries to find the variables of the health care structure to optimize a health care system and make it more efficient. This can provide a policy-relevant analysis of health care systems arrangements that contribute to efficiency. André et al. (2010) state that there is no broad type of health care systems which perform systematically better than other systems to improve the health status of a country. An o*ne-size-fits-all* approach is not advisable. However, there are studies which investigate variables to see if these variables have a positive influence on health outcome (Hernandez de Cos & Moral-Benito, 2012; Wranik, 2011). In this way the efficiency of a health care system is broken into smaller factors at which the variables are checked for if it has a positive or negative influence. There will always be differences in the health care structure among countries due to history and culture, but finding factors which are influencing health care positively provide a more efficient structure will be a gain to the literature of health economics.

In the current study eight determinants of efficiency are estimated for health care systems of OECD countries. These determinants are influenced by the discretionary of health policy actions. So these dimension can be directly influenced by policy-makers. The dimensions consist of: financial system type, cost-sharing requirements, gatekeeping arrangements, primary physician payment methods, specialist payment methods, extent of public expenditures, extent of insurance coverage of the population, and the price level regulation billed by providers. It is tested if these factors have a positive or negative influence on the efficiency of a health care system, which provides a guidance in the selection for policy instruments. The current study tries therefore to find which of these characteristics of the structure of a health care system are contributing to an efficient system. This research uses a

stochastic frontier analysis to estimate the inefficiency of these variables on health outcome, which is healthy-adjusted life expectancy.

It turns out that the share of the population covered and the regulation of the price level billed by providers have a negative influence on the efficiency. The public share of total health care expenditures has a positive significant influence on efficiency in the health care sector. This is valuable information for policymakers to optimize the health care structure and characteristics. The envisioned structure of the master thesis hereafter will look as follows: The next chapter contains the written literature of the subject. Then the research method is explained in chapter three. The next fourth chapter is the result part. Thereafter the conclusion and discussion are given in chapter five.

Chapter 2 Theoretical Framework

Health care outcomes and its efficiency are already a frequent topic for investigation. Since the health care expenditures are increasing and the expectation is formed that this will continue in the future, a more efficient health care structure is preferable. The contribution of various determinants of health outcomes of a population are already investigated in previous studies. This chapter will discuss these previous results including the determinants used in their studies. First the theory behind this topic, *health economics* is given. Followed by the various ways of efficiency is provided. Thereafter studies regarding the efficiency of the health care structure will be discussed. Then the eight dimensions that are used in the current study will be described, afterwards the results of previous studies regarding these issues are elaborated, and expectations for these variables are provided by the hypotheses.

2.1 Health Economics

This research is in the research area of health economics. This area is sometimes symbolized as *abnormal economics* (Hsiao, 1995). Hsiao (1995) provides three reasons for this abnormality. First, health care consists of private, merit, and public goods. Merit and public goods provide the role of the government, while private goods provide the role of market. This can conflict incentives in the health care market. Second, there are market failures among all markets of the health care sector at which there are interconnections. Consumers are the demand perspective and are willing to buy insurance or pre-payment plans, because they are risk-adverse and optimizing intertemporal utility. In the other hand, insurance alters consumer's demand for medical services, because the patients have lower costs to use services. This affects also the supply side in two ways. First, physicians and hospitals feel less hampered by psychological and ethical considerations to raise their charged prices, since the bills are paid by depersonalized institutions. The second effect concerns the payment plans drafted by the insurance companies, this determines which services are most lucrative to perform. Nations which rely on the market system to deliver and finance health care have to correct for these market failures. Experiences demonstrate that some market failures are correctable by governments action while others are not. Market failures are inefficiencies in the structure of a system. The third abnormality in the economics of the health sector is the complex interrelationships among the various markets in the health sector, which makes it difficult to coordinate the market sectors to reach the greatest benefits for the most people.

Moral hazard plays also a role in the health care insurance market, since patients who do not pay the treatment fully may demand treatment inefficiently. In this way the cost of the treatment exceeds the benefits (Ma & Riordan, 2002). Moral hazard is recognized as one of the most important distortions in health care markets (Gaynor et al., 2000). In health care markets moral hazard leads to excess consumption due to health insurance, because insured will consume medical services beyond the marginal cost. So health care spending increases with insurance, but the care is less valued than its cost. This inefficiency is called *moral-hazard welfare loss* (Nyman, 2004). Conventional insurance theory provides a policy solution for this loss: Imposing deductible and coinsurance payment to increase the price to the insured consumers. However, Nyman (2004) argues that moral hazard in the health care sector implies no welfare loss, but a welfare gain. This is due because insurance coverage causes a redistribution of income from the those consumers who stay healthy to the consumers who become ill. Consumers who become ill use this extra income either to purchase more care, which they otherwise were not able to afford without insurance, or to cover costs of health care they otherwise purchase. The healthy consumer pay into the system, while the ill consumers value the extra income more than they value the income they lose when not becoming ill. In this theory every consumer has the same probability to become ill. This redistribution of income from the healthy consumers to the ill consumers increases the welfare of society and is efficient.

Another market failure in health care markets and a higher consumption is adverse selection. Insurance is taken by the consumers with a high medical expenditures (Goddeeris & Wolfe, 1991). So consumers who spent more in any case find it more advantageous to get an insurance coverage. An insurance buyer can better predict its future health care needs than the insurer can. The consumers have better information about their illness probability, asymmetric information, therefore the free market in the health care sector will be inefficient (Neudeck & Podczeck, 1996). If the adverse selection is large, it might destroy the market of health care insurance. A healthy person would prefer to not have an insurance program, to keep subsidizing the less healthy people (Culter & Reber, 1998). When all citizens in a country are insured, the problem of adverse selection might withdraw, since all people can pay the medical bill, however this can cause other problems in terms of the financial obligation.

Market failures are sources of inefficiencies. The structure of the health care system might be a policy solution to overcome these failures. Finding the right institutions that have the best outcome to prevent these market failures might provide a more efficient health care sector.

Many studies provide information about efficiency in the health care sector and to beat the issues regarding this theories of moral hazard and adverse selection. Efficiency in the health care sector is a vague term and will therefore explained in more detail in the next part.

2.2 Efficiency health care structure

Efficiency is an important conception in economics. Since health care is a market in economics, efficiency plays also an important role. Therefore, efficiency can and is tried to reach in the health care market. However, there must be some caution, since the health care market is part of health economics and there are some imperfections in this market which can led to market failure, and therefore inefficiency. Efficiency in economics will therefore explained in this part, to first understand this concept completely. Efficiency in economics refers to the best use of resources in production (Hollingsworth et al., 1998). There are three types of efficiency to reach in the systems of health care. The first type of efficiency is technical efficiency and means that the output of the production is the maximum amount from a given amount of input. Or the other way around, a given amount of outputs with a minimum quantities of inputs (Hollingsworth et al., 1998). In the health care sectors this means that an efficient health care system has the highest preferable outcome per dollar spent or by a set goal with the lowest cost. Concerning the triangle of health care, as mentioned before in the introduction and the increasing health care costs, health care decision-makers must improve the performance in access and/or quality with the same input. Or every dollar spent in the health care system must provide an increase in the quality and access to health outcome to be more efficient (Anell & Willis, 2000). So when a firm, in the health care case a hospital, is technically efficient, it operates on its own production frontier. The second type of efficiency is allocative efficiency or welfare efficiency. This means that the preferences of consumers can be fulfilled by the production of an economy. So every good produced in a country ends up with the consumer who has the highest marginal gain of this product. For the health care sector the outcome are distributed among the whole community, which makes the call for an efficient system more serious (Palmer & Torgerson, 1999). Consequently, the resources are allocated to maximize the welfare of the community. The third efficiency is production mix efficiency. This means that the input mix is minimizing cost given input prices. Or the other way around, when the output mix is maximizing revenue given output prices (Hollingsworth et al., 1998). Choosing different combinations of input resources and achieving the maximum health benefit for a given cost (Palmer & Torgerson, 1999).

It is preferable that an economy is Pareto efficient, so when all efficiencies are reached. When an economy is Pareto efficiency, it is not possible to make someone in the economy better off, without making at least one person worst off. Pareto efficiency is mostly used in health economics. A Pareto optimum is a position of the state of the economy where it is not possible to make anyone better off, without anyone else worse off with the allocative resources. So Pareto efficiency is an umbrella for the other kinds of efficiency about how resources should be allocated at a societal level. This kind of efficiency is preferred to use in the current study.

To reach this efficiency various study tries to find the best way to structure a health care section in a country. In the health care market, technical efficiency is mostly investigated. Technical efficiency is very often looking for efficiency for firms. Therefore, the countries investigated in this studies are considered as a firm, which tries to reach the highest efficiency possible. However, it is important to keep in mind that a health care structure of a country is more complicated than a firm, because of reasons mentioned in section 2.1. However, a large multinational is for example also a complex institution. In the next part, a few study are elaborated to get insights in this type of research and the variables which give significant answers for the architecture of a health care structure.

An important paper in the research area of efficiency in health care is the work of Wranik (2011). Her focus of the efficiency is on policy-relevant characteristics of a health care system and provide specific characteristics that makes a health care structure more efficient. This paper is interested in the technical efficiency. If this kind of efficiency is not at its maximum level, Pareto efficiency is not reached. She used a stochastic frontier approach for 21 OECD countries between 1970 and 2008. The health measurement used in this study is life expectancy. She finds significant contributors to efficiency in policy instruments that directly target patient behavior, such as insurance coverage and cost sharing. So she finds that health expenditures are more efficiently used in health production in a system that insurance coverage to a bigger amount of the population. The other directly patient behavior which is significant is that the population carry some of the cost burden of the health care. In this way individuals stay aware of the costs of health care and pay a part of the services, which reduces pressure on government budgets. This is also due to the moral hazard reduction that occurred with it, since the people have to pay a part of the bill if they use medical services. Moreover, the positive impact on efficiency favors the proposition that cost sharing reduces unnecessary

use of health care services. So most important contributors to policy are the instruments which target consumer behavior, such as insurance coverage and cost sharing.

Rubio (2011) used panel data to see the relationship among health expenditures, health outcomes, and efficiency. He used data for the several provinces in Canada for the period 1979 to 1995. The health measurement used, so the dependent variable, was infant mortality. The most important outcome was that fiscal decentralization of health services in Canada has a substantial and positive influence on the efficiency of public policy in improving the health of the population. The explanation given for this outcome is that a local policy maker wishes to maximize the utility in its own community, more than a policy maker higher in hierarchy. In order to obtain maximum utility, the local policy maker constrains to determine the optimal amount of health care expenditure. There were other factors influencing the health status in Canada significantly, but with a lower economic impact. Those were health spending by the Canadian federal government and education. Education is seen as a social capital, such as life style and social class. For education it is explained that more educated people are better able to select for healthier diets and better jobs, than less educated individuals.

Hernandez de Cos and Moral-Benito (2012) find that a reduction of the degree of gate keeping can generate more efficiency gains across national health care systems, which is contrary of the findings of Wranik (2011). They also find that an increase of the regulation of prices billed by providers has a positive effect on the efficiency of the health care expenditures on health outcome. This variable summarizes the information on the degree of regulation in the prices charged by the hospitals/doctors/pharmaceuticals to a private health insurance company or to its users. So, the regulation of prices billed by doctors and hospitals and drug prices are set by the providers. Health outcome was represented by life expectancy and disability-adjusted life expectancy. Their investigation aimed to find ways to improve health care efficiency in OECD countries in the way of how health system arrangements can contribute in the provision of health care services at the country level and/or to improve efficiency.

The study of Ali Cengiz and Senel (2016) found six factors which improves health care efficiency. One of the factors is just like the previous mentioned work of Hernandez de Cos and Moral-Benito (2012), which is the prices charged by health care providers. The other variables which have a positive effect on health care efficiency, are regulation of the workforce and equipment, patient choice among providers, price signals on users, degree of decentralization (number of main decisions adopted at the level of sub-national governments),

and the scope of basic insurance coverage (range of health care products and services covered by basic medical insurance). These factors were related with the health system efficiency. It is advised to low effective countries to reconsider the health system policy and to take precautions to improve their health care system efficiency by paying attention to the six factors mentioned as related factors of efficiency.

To improve the structure of the health care in developed countries specific organizational arrangements are required to increase the efficiency. Wranik (2011) answers to this call by providing these organizational arrangements to decision-makers. Therefore the current study will follow the work of Wranik (2011), but with another outcome measure of health outcome than used by Wranik (2011). She used life-expectancy. This study is used because this specific study is able to generate specific political factors to reach a higher level of efficiency. With this information a country is able to change the health care structure explicitly to be more efficient. Wranik (2011) gives seven dimensions that shape a health care system. These dimensions are characterized by discretionary health policy actions. So decision-makers are able to have influence on these factors with these selection of policy instruments. The focus in the current study is like Wranik (2011) on technical efficiency to reach Pareto efficiency, by using the parametric approach of stochastic frontier modeling, which is more extensively explained in chapter 3. The reason that Wranik's (2011) is preferred to use over other studies is because her focus is on institutional arrangements of health systems. She provides a way to improve efficiency in policy instruments and institutions that directly or indirectly target patient behavior. These variables are politically easier to implement than changes to the foundational financing structure of the health care system.

The dimensions are the characterization of institutional arrangements developed by Kutzin (2001). This paper facilitates a comprehensive description of a health care system, and therefore identifications of reform options. The starting point of any reforms of the health care structure is the existing organizational and institutional arrangements of the health care structure. Kutzin (2001) has been structured the institutional arrangements, organizational arrangements, and financial flows for the health care sector. In this way policy makers get a better view of these arrangements and a good understanding of the content of health policies. Analyzing various policy options in insurance structure options and the efficiency which is administrated, provides a useful manner to operationalize the objectives for health care financing policy. The information obtained by Kutzin (2001) about the policy tools of

institutional arrangements is used by Wranik (2011) and the current study builds therefore on their work.

2.3 Political factors of the health care structure affecting health outcome

Wranik (2011) uses seven factors to see the influence on efficiency of the health care structure. These factors are: Financial system, cost-sharing requirements, gatekeeping arrangements, primary physician payment methods, specialist payment methods, extent public expenditures, and extent of insurance coverage of the population. However, there are more institutional factors that influence the efficiency on health care structure. Therefore an eighth factor is added in the current study. This is the factor of regulation of prices billed by providers. In the study of Hernandez de Cos and Moral-Benito (2012) and Ali Cengiz and Senel (2016) this factor turned out to be significant efficient on the health care structure regarding the health care expenditures. Therefore, it is tested if this factor is also of significance in the current study.

However, there is some complexity in this research area. A reason of the complexity given by Nixon and Ulmann (2006) is the imperfect process of measuring the health status. This complexity is due to the fact that efficiency in health outcome is hard to define. In this sector of investigation, it is easy to end up in a circular reasoning and must be kept in mind. The discussion and variation for this variable appears in the variation in representing efficiency of the health care structure and health outcome, since this is often represented in a different way. This is also a reason way some variables (mostly the institutions) have in some studies a positive effect and on some studies a negative effect. The contradictory outcomes can also be explained by the simplification of the institutions used in the analyses. For example, in many studies dummy variables are used to represent the various institutions which can cause these different outcomes. In the following part the formal institutions and its influences that are used in the current study are explained and the hypotheses of these institutions are given. There are sometimes some contradictory outcomes, therefore the hypotheses are made regarding the outcome that is most often obtained.

2.3.1 Financial system

The first factor that is investigated is the financial system a country has. In the work of Wranik (2011) a distinction is made between two financial systems because these are the two most common fund collection and pooling systems in OECD countries. The systems are

extreme systems and in practice many countries have a mix of the two systems. By the work of Wranik (2011) information is obtained by surveys in the OECD countries to which system participants think their country belongs more. These systems are the Beveridge style single payer tax-funded and the Bismarck style multi-payer social insurance system funded through employer and employee contributions. The single-payer system is known for its potentially ability to lower costs. This is possible because of lower administrative costs, general ability for the payer to limit its resources in regard to health care, and it has a monopsony power which can lead to control over public provider costs (Glied, 2009). Disadvantages are that single-payer systems might have lower access to health care and a restriction of consumer choice. The Bismarck model is financed by multiply insurances, with providers which are privately owned. In this model people have a compulsory insurance and/or insurers are obligated to accept all insured.

Or et al. (2010) try to find systematic differences in performance of Beveridge and Bismarck-type systems. The result of their study does not suggest that one of the two system type perform consistently better than the other. This is the case since there is some heterogeneity in organizational design and in government across and within countries and systems. Wranik's (2011) research found no statistically significant difference on efficiency between the two systems. However, the study of Zee and Kroneman (2007) found evidence that the Bismarck system performed better than the Beveridge system. This evidence was found in the way that the Bismarck system showed a slightly favorable infant mortality rate over time in OECD compared to the Beveridge system. This was also the case for life-expectancy in countries with a Bismarck system. Over time both variables improved in a more favorable direction, but the Bismarck system was always slightly better than the Beveridge system in their time series research. Therefore the first hypothesis is as follows:

H1: *Countries with a more Bismarck financial system have a higher efficiency of their health care structure.*

2.3.2 Cost-sharing requirements

The next political factor in the present study and Wranik's (2011) study are cost-sharing requirements. Is can be a solution against moral hazard in health economics. When the patient also has to pay a part of the bill when visiting the doctor it reduces pressures on governmental budgets. Moreover, it restrains unnecessary use of health care. A big moral disadvantage is that the access might have a burden to people who are not able to pay it easily. It is said that

health care should be based on need and not on ability to pay, this issue is taken into account in the number of coverage insured, which is the seventh factor in the current study. Furthermore cost-sharing requirements can result in underuse of primary care, since patient will wait until the problem is really serious and the health care is more expensive than when the issue was prevented in an earlier stage. However, cost-sharing requirements can be a solution for moral hazard in the health care sector. Manning and Zweifel (2000) state consumers use less health care when the level of copayment of cost sharing by the consumer increases.

The result of Wranik's (2011) study in regard of cost-sharing requirements the outcome was statistically significant on the efficiency of health care structure. In her work a distinction is made with a dummy variable between countries which has cost-sharing requirements and which has not. It compensates the negative impact of the inability to access health care due to financial constraint. Cost-sharing requirements reduced outpatient medical use according to Lohr et al. (1986). This is due to the deterrence of seeking any health care at all. The size or intensity of such requirement did not influence the health care provided if a patient did visit the physician once a patient entered the medical care system. Physicians did not adjust their treatments patterns to the insurance status of the patient treated. So the overall treatment did not change when patients had to share in the costs of their care, but the number of medical requests did decline.

H2: *Countries with cost-sharing requirements have a higher efficiency on their health care structure.*

2.3.3 Gate-keeping arrangements

Gate-keeping arrangement is another factor of which the efficiency on health care is investigated. A health care system with gate-keeping means that a patient needs a referral from a general practitioner for nonemergency access to a specialist or hospital (Bhat, 2005). Patient do not have direct medical access to secondary care of a medical specialist. There are two reasons for gate-keeping arrangements in health care systems given by Brekke et al. (2005). The first is that it contributes to cost control, because it filters unnecessary visits to the specialist. Second, it is argued that the secondary care works more efficient, since general practitioners have better information than patients to go to the accurate secondary care providers. Gate-keeping arrangements are in principle a restriction in consumer choice and access to specialism. On the other hand, gate-keeping arrangements can lead to coordination

of care in the health care system and overuse of specialty care services (Gusmano et al., 2009). Coordination is achieved by general physicians because of the guarantee of continuity of care over time and coordination of patients to specialty care services (Masseria et al., 2009). The gate keeper works as a coordinator to ensure that the use of necessary resources is fulfilled by refundable and acceptable time frames. If this is not met, the gate keeper must plan an alternative service. They must coordinate health care in a timely and cost-effective manner, so moral hazard is tackled by the demand side. Bodenheimer et al. (1999) argue that general practitioner should only coordinate and not work as a gatekeeper. They should integrate both specialty and primary care to improve quality. A primary physician assists patients as coordinator in receiving full range of medical services form the versatile team of specialist. So the general practitioner should not play as a judge in the medical service sector.

In Wranik's (2011) study there are no significant outcomes on gate-keeping arrangements. Berk and Monheit (2001) neither found a significant difference between systems with a gate-keeping arrangements compared to systems with a health care structure without a gate-keeping arrangement. In the study of Or et al. (2005) there was also no evidence found to make gate-keeping arrangements a factor of importance on the efficiency of a health care structure. So the effect of a gate-keeper was not significantly proved.

Hernandez de Cos and Moral-Benito (2012) found that reducing the degree of gate keeping might increase the efficiency across national health care systems. Health expenditures are most efficiently used in a system with a lower degree of gate keeping. Brekke et al. (2005) analyzed the competitive effects of gate-keeping in the manifestation of hospital non-price competition. An example for this case is in the Netherlands. They found that strict gate-keeping may reduce social welfare and efficiency of the health care sector, especially if a mismatch exists in the costs and the diagnosing accuracy are both low, when the price is exogenously given. This is an inefficient outcome for the health care structure (Brekke et al., 2005).

H3: *Countries with gate-keeping arrangements have a lower efficiency on their health care structure.*

2.3.4 Primary physician payment methods

Payment methods to a primary physician are a next factor researched on its efficiency on health care structure in the current study. Miller (2009) argues that there exist some serious problems with the quality and cost of health care. He designates one major cause of this

problem as the current payment systems, which is encourages by volume-driven care rather than value-driven care. This is a system called fee-for-service payment system. Medical care providers receive more gain when the volume is as large as possible. The main categories of payment used to compensate primary physicians are salary, capitation, and fee-for-service (Gosden et al., 2000). The first is the salary payment. Under a salary payment system general practitioners are paid an annual salary, typically to work a set number of hours during a week or year. In this system the doctor is not encourage to provide as much medical service as possible, since its salary is given. In the second system, capitation, general practitioners are paid an amount per patient registered with them. Holding longer patient list sizes to increase income is a consequence of this system and this can result in shorter consultations and a higher workload. In salary and capitation systems, the general practitioners are paid in advance before any care is provided. This is a prospective payment and it can encourage primary physicians to keep the costs as low as possible. Under the last system, the fee-for-service payment system, the physician is paid for each item of service provided, of which the fee depends on the type of service. The fee is received after the treatment. Therefore the primary physician is encouraged to provide more care to increase its income. This incentive can lead to more care to the patient than they would normally have chosen.

In the results of Wranik (2001) there is a statistically significant difference for this factor. She used a distinction between a fee-for-service payment system and an alternative system, since the fee-for-service system gives other incentives than the other most commonly used systems. It turns out that a country with a fee-for-service payment system to primary physicians are more efficient than a country with an alternative system. The result of the statistical test was that the life-expectancy is 1.03 years higher for countries which offer a fee-for-service payments to primary physicians given a level of health expenditures. Or et al. (2005) support this finding. In their research they found a positive relationship between fee-for-service payment for doctors. However, there was only a weak significant relation in the case of male life expectancy. So if all else being equal, paying a doctor in a fee-for-service way, it appears to be more successful in reducing mortality. Another more specific study is performed by Campbell et al. (2007) regarding this issue. They performed a longitudinal cohort study that measured the quality of health care in a sample of primary care physicians in England at two points in time. The quality of care was represented by three categories of coronary heart disease, type 2 diabetes, and asthma. Two of the three conditions suggest that the introduction

of pay per performance was associated with a modest acceleration in improvement: Diabetes and asthma.

H4: *Countries with fee-for-service payment system for primary physicians have a higher efficiency on their health care structure.*

2.3.5 Specialist payment methods

Besides the payment methods regarding primary physician also the effect of payment methods for specialist physicians is investigated. The most frequent payment methods for specialist are the same as for primary physicians. They have the same incentives. However, if the payment method is a fee-for-service for specialist in an hospital, the specialist has a decisive role in hospital reimbursement, if the specialist get paid in a payment per patient-day method (Jegers et al., 2002). The specialist determines the length of stay of patients and hence the income of the hospital by their discharge policy and admission.

Just like in the case of the primary physician payment methods Wraniks (2011) finds a statistically significant difference in payment methods among countries. It proves that a fee-for-service payment method for specialists is more efficient than alternative payment methods. The average life-expectancy is 1.02 years higher in countries that offer a fee-for-service method.

H5: *Countries with fee-for-service payment system for specialists have a higher efficiency on their health care structure.*

2.3.6 Extent public expenditures

A next factor of an increasing health care outcome investigated by Wranik (2011) is the extent of public expenditures on health care. This is an important factor for decision-makers to regulate the expenditures on public health and more often a topic of investigation in health economics. Nixon and Ulmann (2006) are providing an overview of the studies which investigated the relationship between health care expenditure and health outcome. The studies are investigating therefore very often the efficiency of health care spending on health outcome. For all methodological approaches and outcomes of the researches discussed by Nixon and Ulmann (2006) see table 1 in their work about health expenditures and outcomes of studies in OECD countries.

Starting with the outcomes of the several studies regarding this topic with the study of Wranik (2011). In this study this was also an explanatory variable. In her study there was no

statistically significant association between the share of public expenditures with efficiency of the health care system.

The study of Crémieux et al. (1999) are using gender-specific infant mortality and gender-specific life expectancy as the dependent variables as the outcome of health. Health care spending was an independent variable. They find a significant effect in Canada among the provinces of the total health care spending, private and public. Infant mortality decreases with a higher total health care spending, while the life expectancy increases for males and females. The same applies for a higher income in the provinces.

In the study of Leu (1986) there are significant results on the dependent variable of post-neonatal mortality rate by a regression analyses using lagged variables in 19 OECD countries. The explanatory variables on post-neonatal mortality are found on public spending on health care. Other significant results were found for GDP per capita and education.

Nixon and Ulmann (2006) also have performed an analysis to see the influence of health expenditures on health outcomes. They find that an increase in health care expenditures are among the most important factors in the lowering of infant mortality. For an improvement for male and female life expectancy the contribution of an extension of health care expenditures have only a marginal effect.

However, there are also studies which found a negative influence after an extension on health expenditures on health outcomes. This was for example found by Berger and Messer (2002). In their examinations the outcome was an increases in the publicly financed share of health expenditures are resulting in higher mortality rates. There are also more studies that were not able to find a significant relationship between health care expenditures and health care outcomes. Self and Grabowski (2003) did not find a significant result of health care resources on the health life expectancy of the population. This was measured with the dependent variable of DALE representing health outcome.

H6: *Countries with a higher extent of public expenditures have a higher efficiency on their health care structure.*

2.3.7 Extent of insurance coverage of the population

The last factor investigated in the study of Wranik (2011) is the extent of insurance coverage of the population. In many health care reforms an expand in health insurance coverage is becoming a significant issue (Cozad & Wichmann, 2012). Decision-makers can consider to

make insurance mandatory for every citizen. Enlarging health insurance coverage improves access to medical care because of a reduction in costs borne by the consumer. This in turn causes many benefits, including a possibility of better health outcomes. Another benefit according to Cozad and Wichmann (2012) is a possible reduction of health care costs by allowing care to be more distributed in lower cost settings by economy of scale. Though, newly insured consumer might increase health costs if demand for their care increases and health care delivery is not efficient enough, since these consumers expect that their health care expenditures are higher than the premium they have to pay to the insurance company. Cozad and Wichmann (2012) did find a negative relationship between share of population covered by insurance and efficiency of the health care sector. This is explained that the technical efficiency decreases because of systems increase input consumption generating increasing costs, and in the short term this is not accompanies by improvements on health outcome, however it is always the question how long it will take to see the effect on the health outcome of a country.

Wranik (2011) find a significant result for a more efficient use of health expenditures in health production in systems with an insurance coverage to a larger percentage of the population. This elasticity of insurance coverage in this study was 2%, which indicates that an increase in percentage of insurance coverage of the population leads to a 2% higher life expectancy given the health expenditures. Berger and Messer (2002) also find a positive effect for insurance coverage on the health outcome of a country. They find that an increase in inpatient and ambulatory insurance coverage are associated with reduced mortality.

H7: *Countries with a higher extent of insurance coverage have a higher efficiency on their health care structure.*

2.3.8 Regulation of prices billed by providers

In the current study an eighth institutional factor is added regarding Wranik's (2011) study. This indicator summarizes the information on the degree of regulation in the prices/fees billed by hospitals/doctors/pharmaceutical to patients or to private health insurance companies (Hernandez de Cos & Moral-Benito, 2012). So this is how the reimbursement fees for health care services are established. It is the regulation of drugs prices by the suppliers and the prices billed by hospitals and doctors. When there is market regulation by the suppliers, this result in pricing by the suppliers, which in its turn can result in market failures by market imperfections. Price setting by the suppliers can lead to a monopolistic position of the

supplier, which has a negative effect on the efficiency of the health care sector. This is also possible by maximum prices set by the government. It is argued that the greater price regulation can result in a substitution effect. So if the prices are set low, the service of treating patients is not very lucrative, and the number of consultations would fall (Hernandez de Cos & Moral-Benito, 2012). However, on the other hand doctors would compensate this low income per patient by treating more patients to offset the loss of income, so an income effect might be induce.

The results of Hernandez de Cos & Moral-Benito (2012) suggests that higher regulation is more efficient for health care outcomes. Grytten et al. (2008) find that the income effect is small. Greater price regulation reduces the number of unnecessary consults to the doctor and hence generate an increase in efficiency in the health care system. Ali Cengiz and Senel (2016) also find that this factor is related to a higher efficiency for health care.

H8: *Countries with a higher price level of prices billed by providers have a higher efficiency on their health care structure.*

This chapter outlined the theory used in the present study, which contributions by understanding the written theories. In the next chapter the research methodology will be explained.

Chapter 3 Methodology

In this chapter the methodology that will be used will be elaborated. It is tried to provide an association between various independent variables, the institutional factors, on the dependent variable, health outcome. The study of Wranik (2011) will be followed to find the effect of institutional characteristics on the dependent variable, health outcome, in relation to health expenditure of a country. This is done with a panel data set of OECD countries for four points in time and six measurements. The statistical program Stata is used to perform the analysis. This chapter will explain the statistical test, the dependent, independent, and control variables, and will show the descriptive statistics.

3.1 Stochastic frontier statistical test

An efficiency stochastic frontier framework is used in the analysis. This analysis is introduced by Aigner et al. (1977) and Meeusen and van den Broeck (1977). Economists are more often using and employing the frontier efficiency measurement techniques to evaluate the productivity of the performance of health care services since the last decades (Worthington, 2004). In modern economic theory the main core is based on the assumption of optimizing behavior (Kokkinou, 2010). However, firms or industries face different productivity levels rather than the optimal level. Therefore, it is important to make it able to analyze the degree to which a firm or industry fail to optimize the productive efficiency. One of the main analytical approaches to measure efficiency is the analysis of production frontiers. This frontier efficiency measurement techniques use a production possibility frontier to allocate a potentially efficient output combinations an organization is able to reach at a certain point in time. If the frontier falls beneath this frontier, so that the output combination of an organization does not lie on the possibility frontier, it can be said that the organization is inefficient. And inefficiency is tried to avoid, because that is foregone profit. This is technical inefficiency of production of firms (Battese & Coelli, 1995). The level of technical efficiency of a given firm (at which a country is looking for in the present study) is the factor by which the level of production is less than its frontier output (Battese, 1991).

In the area of stochastic frontier models the most important concern in the analyses is the estimation and analysis of the inefficiency, besides of the estimation of model parameters (Kokkinou, 2010). Relating inefficiency to a number of factors that might be the determinants is the important task in these models. Moreover, the measurement to which extent the

determinants are contributing to the appearance of inefficiency plays an important role. In the current study countries are seen as a firm to obtain the best technical efficiency outcome.

The stochastic frontier model is used in studies of costs, production, profit, revenue, and in models of goal attainment (Green, 2008). This model is looking for the maximum production or the lowest costs for an outcome, so its most efficient point. Researchers are using and developing frontier models to analyze health outcomes worldwide. If the production frontiers that represent the total economic efficiency can be determined, by using the best currently known production techniques, it is possible to evaluate the economic performance of an actual organization or industry. This can be done by comparing the actual behavior of the organization or industry with the idealized benchmark computed by the production frontier. Therefore the degree of efficiency can be exhibited (Worthington, 2004). The deviation of actual from the potential level is used to compute an inefficiency score by the stochastic frontier, given expenditures of a country (Ali Cengiz & Senel, 2016). Extensions to the stochastic model allow for incorporation of institutional and internal variables that might contribute to the efficiency of a firm or system. An alternative approach could be a data envelopment analysis. This is a non-parametric approach and it allows for specification of multiple outputs of a system. However, this approach is not preferable because it does not make a distinction between statistical noise and inefficiency (Hoolingsworth & Wildman, 2003; Bhat, 2005). So with that analysis it is not clear which part is technical inefficiency and when there is statistical noise in the model. With the stochastic production frontier model a production-function relationship is presumed between health inputs and health outputs, using a Cobb-Douglas framework. This relationship is specified with the translog model, including a series of control variables as a robustness check of the analysis. The model of Battese and Coelli (1995) is an inefficiency frontier estimation and will take the following form and can also be found in Wranik (2011):

$$y_{it}=\beta' x_{it}+\gamma' c_{it}+\delta' z_{it}+v_{it}-u_{it}$$

$$v_{it} \sim N[0.\sigma^2_v]$$

$$u_{it} \sim N^{+}[0.\sigma^2_u]$$

$$\lambda = \sigma_u/\sigma_v$$

$$\gamma = \sigma_u^2 / (\sigma_u^2 + \sigma_v^2)$$

where y_{it} is representing the log of the health outcome (HALE), x_{it} stands for the vector of the logs of the health system inputs. C_{it} is the vector of the control variables. Health care system policy institutions are of great importance in this analysis on the efficiency and production relationship. z_{it} is representing both dummy and continuous variables, so the influence of the institutional characteristics of a country on production and efficiency. v_{it} is the stochastic error term, which is statistical noise found in any relationship. And u_{it} is the indicator of greater technical inefficiency component, which is the shortfall of output from its maximum possible value given by the stochastic frontier (Jondrow et al., 1982). The error term is a one-side error since if inefficiency is occurring, than actual profit will be less than optimal profit (Kumbhakar et al., 2014). λ is the standard deviation of the model specification error. γ is the level of inefficiency of the stochastic frontier production model, and its outcome is always between 0 and 1. This model is a inefficiency estimation, so when the coefficient is positive and significant, the higher that variable is, the higher is the effect on inefficiency of the model.

As in the analysis of Wranik (2011) this analysis will perform an extensions to the random effects model. The Battese Coeilli extension contains systemic variation in inefficiency (Battese & Coelli, 1995). This is preferred over the classic fixed effects model, and the classic random effects model since these models have the inability to isolate inefficiency from heterogeneity in a proper way and have specifications of the assumption of time-invariant inefficiency (Wranik, 2011). The model of Battese and Coelli (1995) makes it possible to incorporate explanatory variables of the efficiencies and allows for time variation in technical inefficiencies and its effects. This is a random effects model. In this model time-invariant variables may be included in the explanatory variables' vector, without causing the perfect multicollinearity problem, which is facing with the fixed effects model (Kumbhakar et al., 2014). The Battese and Coelli (1995) is different because of the distribution that is used.

3.2 Data

In this analysis 20 number of developed OECD countries is the data sample in four time periods. OECD countries are chosen because these countries are more homogenous in development terms and wealth, so that an efficient comparison across is possible and meaningful. Moreover, data collected for OECD countries are collected by the same criteria,

provided by the OECD itself (Afonso & Aubyn, 2004). All these countries have a well-developed health care system. OECD countries with a large population (>500,000) and are wealthy (GDP per capita >$24,000) are consist in the sample to make the sample size the most equivalent, which is also applied by Wranik (2011).

3.2.1 Dependent variable

The dependent variable in the present study is different from Wranik's (2011) work to represent health outcome. She used life expectancy, however she already argue that life expectancy is a crude measure of health outcome. In the current study healthy-adjusted life expectancy (HALE) will represent health outcome.

In the work of Wranik (2011) life expectancy is used, while other researches often uses (infant) mortality rate as the variable of health outcome (Albertus et al., 2001; Babazono & Hillman, 1994; Berger & Messer, 2002; Daponte et al., 1995; Grubaugh & Rexford, 1994). Another variable that is representing health care outcome is the healthy-adjusted life expectancy (HALE) (French & Miller, 2002; Self and Grabowski, 2003; Hernández de Cos & Moral-Benito, 2012). This variable represent the outcome of health care. This way of measuring health is something from the last decades. This variable represents information on vitality and the functional state of populations (Robine et al., 1999). Moreover it provides the quality of life of a population and it is an appropriate way for the epidemiological state of today. Furthermore the HALE variable offers the policy-relevance of health expectancy indicators. It accesses to see if an increased life expectancy is due to a reduction in morbidity or to an increase in disability (Robine et al., 1999). HALE is a comprehensive measurement of health (Self and Grabowski, 2003). This measurement of health makes it easier to compare divergent health of countries. HALE calculates the expected number of years in full health. This variable is preferred over disability-adjusted-life-years (DALY) because it does not distinguish the effect of every disease to the overall results, which means that the number of choice parameters is reduced for the calculation. So HALE is better comparable than DALY (Self and Grabowski, 2003). There are also other classifications of health expectancies, for example the difference between good or bad perceived health (Robine, et al., 1999). However, to conduct this information the answers are totally subjective. These life expectancy classifications are often generated by surveys in a country, therefore direct comparison of values is difficult because of specific characteristics of the national health surveys among countries. Moreover the estimation of disability weights for health states that are corresponding is another problem in self-reported health status survey (Mathers, et al., 2000).

Moreover, the answer of the question, would you say that your health is excellent, very good, good, fair, or poor?, is principally vague.

The HALE variable is something that is used since the last decades. Therefore, the available data is limited. One rapport of the World Health Organization (WHO) (Mathers, et al., 2000) is often used in cross-sectional analyses, since this provide the HALE in 1999. Therefore, the HALE are obtained from Kassebaum et al. (2016). This work provides the HALE coefficient four points in time (1990, 2000, 2005, and 2010). For 2005 there are also the distinction added between men and women and will be added to conduct the largest possible sample size. This variable will be control for, to see if it has a significant influence on the outcome. So, HALE is measured six points in time. The HALE variable is also available for 2015, but for this year the control variables are not yet available and without the control variables the analysis is not complete. To estimate HALE, Kassebaum et al. (2016) used the Sullivan method (Sullivan, 1971) by deducting duration of disability from life expectancy. It combines morbidity and mortality information and makes it a comparable variable for health studies.

To measure the efficiency of the institutions, health expenditure per capita and the square of health expenditure per capita is used. Health expenditure per capita, which is expressed in current prices (current PPPs), is included to represent a summary measurement of health system inputs, easily comparable among countries.

3.2.2 Independent variables

The independent variables are the health care system characteristics. These characteristics are identified by extensive literature review, where Wranik (2011) is the most important study. These variables are elaborated in the second chapter. Some of the studies used surveys held by health system experts. Respondents are asked to describe their health care system on selected features. If there was no clear right answer, they are asked to which system or characteristic their countries predominates. Even though these answers are also subjective, it is possible to control for the answers, since the real situation can be compared to the answers. Asking for the most predominated situation makes it easier to work in the analyses. For these variables dummy variables are made. This is done for the financial system (0=Beverage, 1=Bismarck), gatekeeper arrangements and cost sharing requirements (0=no, 1=yes), and GP (general practitioner) and specialist payment system (0=alternative, 1=FFS). It is known that the health care system is more complex than these dummy variables and will be part of the limitation section, however in this way it makes these variables workable in analyses.

Population insurance coverage and public share of total health expenditure is obtained from the OECD statistic Database. Data for the prices billed by providers is very limited. The only data available is a scale made by Hernandez de Cos and Moral-Benito (2012) and runs from a scale from one to seven. This means that a low score on this scale is attributed to countries with low price regulation on drug prices and prices billed by suppliers, physicians, and hospitals.

3.2.3 Control variables

Besides the institutional arrangements, also production functions and life-style factors are added to the analysis as control variables to complete the analysis. As the current study is following Wranik (2011), it is chosen to not have all the same control variables to make a distinction and see the influence of other variables on health outcome. Moreover, since the current study is using HALE as the dependent variable control variables as an alternative explanation for the morbidity of the dependent variable. Therefore, these variables must be controlled for since this applies to influence the HALE outcome, which is not necessary in the study of Wranik (2011) since she is using life expectancy. The production function control variables are: population age structure, income per capita, employment rate, and average years of total schooling. Education and GDP per capita are added as control variables, because these variables have a significant influence in the study of Leu (1986) on the study of efficiency in the health care sector. It is interesting to see if these factors still are of relevance in the health care sector. Education is represented by average years of total schooling (15+), and also added since there is an association between higher educational attainment and better health status in a country (Kawachi et al., 2010). The age structure of the population is included since the aging population is an important factor in the increasing health care expenditures. This variable is the percentage of the population of a country over 65. Employment rate (share of population working) and income per capita, which is expressed in current prices, current PPPs, are added to represent the current state of the economy of a country. Self and Grabowski (2003) advocate that economic well-being is a dominant factor in health care determination and that a higher income result in better health (Kawachi et al., 2010). These variables about the economy are added to isolate the effects of health spending on the state of the economy. It is expected that these variables have a positive influence on the inefficiency of the model and to complete the model. So when the economy is doing better, by which income per capita, employment rate, and education are relatively high, HALE will also be

higher. It is likely that these variables have a high correlation, but they are still added separately to make it possible to distinct the variables and its influence.

Three life-style/environmental factors are also added, which are: alcohol consumption, food consumption, and gas-emission per capita. Several studies (Crémieux et al., 2005; French & Miller, 2002) found a significant influence of life-style factors on health outcome. Wranik (2011) is suggesting to use other factors of influence in the analysis like environmental and life-style factors, since these factors are of influence on a healthy life. Moreover, the morbidity can be expressed by these factors. As Nixon and Ulmann (2006) explain in their study, there is relatively less written about these influences. Tobacco consumption is also considered, but the data is too incomplete to find enough data points. Alcohol consumption is expressed in liters per capita 15+ annual and food consumption in kilocalories per capita, daily. Also gas-emissions per capita is added, which is also of influence on a healthy life. It is expected that these factor have an influence on a healthy life-expectancy, and are therefore included in the model. Without these factors a complete picture of a healthy life is hard to provide. It is expected that a higher alcohol consumption, a higher food consumption, and gas-emissions have a negative effect on the efficiency to reach the highest level of HALE. All data of the control variables are found on the statistical database of the OECD, except for average years of schooling, which is obtained from the World Bank online database.

For the robustness checks another distribution will be used. With the original distribution a truncated-normal distribution from the Batesse and Coelli (1995) model is used. As a robustness check the half-normal/normal distribution and an exponential distribution is used. This is suggested by one of the introducers of the stochastic frontier analysis (Aigner, 1977) and by Green (2008) to see if the outcome is robust, even when there is another distribution used. It is commonly assumed that a model is robust with a different distribution, which checked with this robustness check.

3.3 Descriptive statistics

Table 1 shows the health care characteristics of the various countries taken in the analysis.

Table 1

Health care system characteristics per country

Country	HALE	System	Gatekeeper	Cost Sharing	GP payment method	Specialist payment method	Population covered %	Public share of total health expenditure %	Prices billed by provider
Australia	70.3	Beveridge	Yes	Yes	FFS	Alternative	100.00	67.38	2.6
Austria	69.6	Bismarck	Yes	Yes	Alternative	FFS	98.55	75.51	4
Belgium	69.1	Bismarck	No	Yes	FFS	FFS	98.72	76.66	3.6
Canada	70.0	Beveridge	Yes	No	FFS	FFS	100.00	70.70	4.3
Denmark	68.8	Beveridge	Yes	No	Alternative	Alternative	100.00	83.76	3.7
Finland	69.0	Bismarck	Yes	Yes	Alternative	Alternative	100.00	75.49	5
France	70.4	Bismarck	No	Yes	FFS	FFS	99.84	78.32	3.5
Germany	69.4	Bismarck	No	Yes	FFS	Alternative	98.00	80.36	3.1
Greece	70.0	Beveridge	No	Yes	Alternative	Alternative	64.75	61.4	2
Ireland	69.8	Beveridge	Yes	Yes	FFS	Alternative	100.00	74.58	3.5
Italy	70.8	Beveridge	Yes	Yes	Alternative	Alternative	100.00	76.82	5.2
Japan	72.9	Bismarck	No	Yes	FFS	Alternative	100.00	82.02	5
Netherlands	69.7	Bismarck	Yes	Yes	Alternative	FFS	92.05	75.49	5

New Zealand	69.6	Beveridge	Yes	Yes	FFS	Alternative	100.00	79.91	3.8
Norway	70.0	Beveridge	Yes	Yes	Alternative	Alternative	100.00	83.79	5
Portugal	68.7	Beveridge	Yes	Yes	FFS	Alternative	100.00	68.57	5.8
Spain	70.9	Beveridge	Yes	No	Alternative	Alternative	98.50	72.22	5.2
Sweden	70.8	Beveridge	No	Yes	Alternative	Alternative	100.00	82.61	5.2
Switzerland	70.9	Bismarck	No	Yes	FFS	FFS	99.92	61.54	4.5
UK	69.6	Beveridge	Yes	No	Alternative	Alternative	100.00	80.73	4.2

Table 2 shows the descriptive statistics of the dependent, independent, and control variables.

Table 2

Descriptive statistics

	1990	2000	2005	2010
Health production function				
HALE				
Mean	67.06	68.79	69.86	70.82
SD	1.15	1.08	1.72	0.97
Minimum	64.83	67.05	66.36	69.46
Maximum	70.37	72.07	75.43	73.62
Health expenditure per capita ($US PPP)				
Mean	1252.95	2140.85	2904.65	3820.55
SD	361.61	513.78	580.03	835.84
Range	649	1413	2124	2687
	2026	3332	4149	5686
Alcohol consumption per capita				
Mean	11.03	10.37	10.46	9.68
SD	2.73	2.43	2.08	1.68
Minimum	5.00	5.70	6.40	6.60
Maximum	16.00	14.20	13.40	12.30
Food consumption per capita				
Mean	3312.45	3400.75	3394.65	3385.80
SD	223.95	256.63	224.64	248.06
Minimum	2949.00	2900.00	2828.00	2692.00
Maximum	3746.00	3803.00	3734.00	3777.00
Gas emission per capita				
Mean	42.92	36.84	34.21	27.61
SD	22.05	21.56	21.82	21.64
Minimum	15.95	14.86	12.48	9.84
Maximum	103.00	99.21	108.40	104.44
Employment (share of population working)				
Mean	55.97	57.32	58.10	57.11
SD	8.87	7.37	9.12	6.69
Minimum	43.30	43.4	34.20	44.20
Maximum	73.00	70.9	72.50	69.30
Education (years of schooling)				
Mean	9.19	10.08	10.66	11.11
SD	1.46	1.11	1.19	1.25
Minimum	6.00	7.40	7.00	7.40
Maximum	11.60	11.80	12.00	13.00
GDP per capita ($US PPP)				
Mean	17528.96	27263.97	33256.81	39324.48
SD	2732.62	4693.34	5640.27	7480.42
Minimum	11748.30	188824.20	22739.70	27361.00
Maximum	21967.00	36927.70	47775.40	57998.80
Institutional arrangements – time varying				
Public share of total health expenditures				
Mean	74.31	74.07	75.17	77.27
SD	9.08	7.48	6.53	6.32
Minimum	51.00	55.40	59.90	64.10
Maximum	84.30	85.50	83.70	87.00

Percentage population covered				
Mean	97.20	99.69	99.66	99.55
SD	8.79	0.65	0.69	1.20
Minimum	61.40	97.60	97.90	94.75
Maximum	100.00	100.00	100.00	100.00
Institutional arrangements – time invariant				
Financial system type	Beverage: 13	Bismarck: 7		
Primary physician payment	FFS: 10	Alternative: 10		
Specialist payment	FFS: 6	Alternative: 14		
Cost sharing requirements	Yes: 16	No: 4		
Gatekeeping requirements	Yes: 13	No:7		

Chapter 4 Results

In this chapter the results of the analyses are represented. The main analysis will be shown and elaborated first, thereafter the robustness checks will be presented.

4.1 Checking for multicollinearity

First, the variables must be checked for multicollinearity to see if the variables do not measure the same in a different way. A correlation matrix is made for all variables. The results are shown in the following table.

Table 3

Correlation matrix variables

	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*
1. Financial system	-														
2. Gate keeping arrangements	-.48	-													
3. Cost sharing	.20	-.35	-												
4. GP payment method	.21	-.30	.29	-											
5. Specialist payment method	.57	-.20	-.09	.22	-										
6. Share of population covered	-.19	.13	.23	.11	-.19	-									
7. Public share of expenditures	-.06	.29	-.06	-.19	-.28	.08	-								
8. Prices billed by providers	.00	.29	-.10	-.26	-.04	-.03	.24	-							
9. Alcohol consumption	.22	.01	-.10	.29	.15	-.07	-.13	-.29	-						
10. Food consumption	.02	.02	.10	-.03	.37	.01	-.20	-.22	.42	-					
11. Gas emission per capita	-.38	.39	-.17	.16	-.04	.02	-.19	-.34	-.12	-.17	-				
12. Income per capita	.15	.01	.07	-.04	.22	.16	.13	.04	-.25	.10	-.10	-			
13. Health expenditure per capita	.26	-.10	.09	.06	.34	.14	.05	-.03	-.14	.19	-.18	.93	-		
14. Employment	-.10	.18	-.04	-.03	-.06	.11	.18	.22	-.36	-.40	.18	.30	.22	-	
15. Education	-.02	-.10	-.07	.13	.03	.07	.25	-.25	-.43	-.30	.14	.62	.54	.38	-

The correlation matrix shows that the financial system have a high correlation with gate keeping arrangements (-0.48) and specialist payment system (0.57), therefore financial system will be deleted from the analyses to prevent multicollinearity. Since the financial system variable has a high correlation with two other independent variable this variable will be dropped. Moreover, this variable has some doubtful characteristics, since it is hard to interpret a financial system in only two categories. Besides, changing a whole financial system in a country is harder to reach, since it originates from history and culture. Though, it would have been valuable information. As O'Brien (2016) mentions the variable with high correlation and are not of most interest to the research and do not reach a significant level in the analysis, which is checked for, is the variable to be dropped. There is also a high correlation between income per capita and the health expenditure per capita and income per capita and schooling, but these are production function variables to measure efficiency and variables which has been turned out to have a significant influence in previous studies, and will be included in the analyses.

4.2 Stochastic frontier analysis

The first result is the outcome of the stochastic frontier analysis of Battese and Coelli (1995) with seven independent variables, without the financial system dummy. Since gender in the dependent variable can play a crucial role for the independent variables, this is also added as a dummy variable. In this model also the control variables are included, since the analysis is not complete without these effects and the results show only partial the reality because the control variables do also influence the dependent variable. For the variables with numbers, the numbers are transformed to ln numbers, which must be done in this model, just like the dependent variable. The dummy variables will stay with 0 or 1, since it is not possible to take the ln from 0. The outcome of this model is shown in table 4.

Table 4

Determinants of efficiency

Variable	*Coefficient*	*Standard error*	*p-value*
Production function			
Constant	5.168	0.392	0.000
Health expenditure per capita	0.138	0.077	0.075
Health expenditure per capita squared	-0.007	0.005	0.187
Alcohol consumption	-0.020	0.009	0.036
Food consumption	-0.154	0.237	0.000
Gas emission per capita	-0.005	0.004	0.204
Income per capita	0.007	0.005	0.142
Population age structure	-0.001	0.001	0.682
Employment	-0.118	0.010	0.000
Education	0.028	0.017	0.110
Sex	-0.002	0.002	0.319
Institutional arrangements			
Gate keeping arrangements	0.001	0.004	0.786
Cost sharing arrangements	0.004	0.004	0.252
GP payment method	0.003	0.003	0.409
Specialist payment method	-0.004	0.004	0.245
Share of population covered	0.048	0.025	0.054
Public share of expenditures	-0.041	0.015	0.006
Prices billed by providers	0.016	0.009	0.070
Model parameters			
Usigma	-3.913	26.486	0.883
Vsigma	-9.083	0.262	0.000
sigma_u	0.141	1.872	0.940
sigma_v	0.011	0.001	0.000
λ	13.262	1.872	0.000

The model reaches a significant level. This inefficiency effects model has a truncated-normal distribution. This is a normal distribution of which the probability of a normally distributed random variable whose values are either bounded below or above the normal distribution.

This distribution will choose a range to limit the distribution to an upper, lower or double truncated-normal distribution, so it is asymmetric. The empirical rule that is used for this distribution is that 99.7% of data does tend to fall within the boundary. The 0.03% that falls outside the boundary, might be more than ten standard deviations away from the mean. Therefore, the truncated-normal distribution makes it possible to deal with the data in a reasonable way. The truncated-normal model has heterogeneity in the mean, which allows for great flexibility in the tools.

Table 4 shows which factors have a significant inefficiency term in the model. The coefficients are part of the inefficiency frontier estimation. It determines the factors responsible for inefficiency and therefore efficiency. This model makes an inefficiency outcome, so a measurement of inefficiency. When a coefficient is positive (and significant), it indicates that the higher that independent variable, the more inefficient this variable is for the output, however this is an association. For the independent variables this is the case for the percentage of the population that is covered by insurance and the regulation of prices billed by providers. This is against the hypothesis of regulation of prices billed by providers. So if the regulation is lower, the health care system is more efficient. However, this coefficient is 0.02, so the effect is not that big. This is the substitution effect, which triggers a lower volume of health service as treating patients is not lucrative enough (André et al., 2010). Regarding the potential income effect, the effect is small and unnecessary treatments are not necessary to provide. Moreover, the government is able to avoid monopolistic power to the suppliers, since the government has more influence on the price regulation.

The percentage of the population that is covered, does also have a significant influence, however this does not reach the 5% significance level, only the 10% level. The coefficient is 0.048. This means that a higher level of coverage of the population makes the health care structure less efficient. The result is against the expectations. This can be explained by a decrease of technical efficiency when systems increase input consumption generating increasing cost, when the share of the population covered by insurance increases. This increase is not accompanied by an increase of HALE in the short run (Cozad & Wichmann, 2012). This decreases efficiency in the system.

A negative coefficient estimation means that the higher that value of the independent variable, the less inefficient that variable will be. This is the case for the public share of the health care expenditures. For the share paid by the public there is an indication that there is a small positive effect on the efficiency of the structure. So a higher level of the public share is more

efficient for the health care structure. This is in line with the expectations. A higher percentage of the public share improves efficiency in a country, since governments have the ability to redistribute among citizens (Or, 2000).

The variables that obtained a dummy variable for the group type (men, women, total) and the age population structure of a country are included as control variables, but do not reach the significant level, so these variables do not influence the model. It does not have a significant influence on the outcome if the measurement of the dependent variable is a men, women, or the total of the population, nor the age structure of the population.

This model provides the specification of the inefficiency component for the inefficient variance function (Usigma). It is the one-side error term representing technical inefficiency of the model. This is the shortfall of output from its maximal possible value given by the stochastic frontier. This outcome has a high p-value, so this number is not significant in this model. Vsigma is the specification of the idiosyncratic component, which is the error variance function and reaches a significant level. In the truncated-normal distribution model, this has a two-sided distribution. This is the error term representing the usual statistical noise found in any relationship. λ provides the estimation of the standard deviation of the inefficiency component. Lambda is the estimation of the standard deviation of the inefficiency component to the standard deviation of the idiosyncratic component. It is the parameter of the inefficiency component of the model (Green, 2008). If lambda equals 0, a simple OLS regression can be performed, than every country will operate on its maximum production frontier. The larger lambda, the greater the technical inefficiency in the data. With this level of lambda, it can be said that the countries do not operate on its maximum production frontier. Lambda reaches a statistically significant level, so there is evidence of technical inefficiency in the output. The lower the level of lambda, the larger are the noise components. It is allowed to use the stochastic frontier approach instead of a OLS regression, since the lambda is higher than zero.

Health outcome is significantly affected by health expenditures (at the 10% level). Some control variables do also have a significant influence. This is the case for alcohol consumption, food consumption, health care expenditure per capita, and percentage of population employed. Alcohol consumption, food consumption, and percentage of population that is employed have a negative coefficient. This means that the higher these variables, the lower the inefficiency to obtain the highest possible health outcome. For alcohol consumption and food consumption this is against economic and health theories, but this influence is rather

small, since the coefficients are close to zero. A potential explanation is that people who have a high alcohol and food consumption do not live that long compared to people with a lower alcohol and food consumption. Education has a positive coefficient, this means that the high this variable, the higher the inefficiency of this variable on the health outcome HALE. This is as well against the literature, but again the coefficient are right around zero, so the effect are very small. The outcomes of these control variables asked for some further investigation, since the efficiency on HALE has the opposite influence than explained in the literature, this is more discussed in the recommendations sector of the last chapter.

The results are totally different than Wranik's (2011) results. In her work the payment system of FFS to general practitioner and specialists are significant to efficiency. Moreover, cost sharing requirements and an increase in the share of population that is covered increased the efficiency of health. The variable of the share of population that is covered does have the opposite direction to reach a higher level of efficiency. A possible explanation is the absence of the US in the current study and many other countries researched in the present study have a general coverage for all citizens. An explanation would be the fact that the production function variables are almost all of difference, this can influence the model and outcomes enormously, especially because the current study does not have that many observations, which makes it more influential by adding more variables.

4.3 Robustness checks

For the robustness check another model within the stochastic frontier analyses will be performed. This is more often done to check if the results are robust. Testing with another distribution model is recommended by for example Aigner et al. (1977), Coelli (1995), and Green (2008). The main test is performed as in Wranik (2011) and has a truncated-normal distribution. The test that is most often performed with stochastic frontier analyses has the normal or half-normal distribution for the symmetric disturbance. It is most useful for the formulation of efficiency. This has a one-side error term for the technical inefficiency measurements, because it is not possible to outreach the maximum production frontier. The systematic error term has a two-sided error term, therefore normal or half-normal distribution. This stochastic frontier analysis will be the first robustness check. The second is the distribution with an exponential distribution. These tests have other distributional assumptions. In this test the technical efficiency error term is assumed to follow the one-parameter exponential distribution, the rest is identical to the half-normal case (Jondrow et al.,

1981). Using different kind of models with different assumptions in the distribution provide the appealing of robustness and the potential for a consistent estimator of the inefficiency in the models (Green, 2008). The results are shown in table 5.

Table 5

Robustness checks with normal/half normal and exponential distribution

Variable	*Normal/half normal distribution*	*Exponential distribution*
Production Function		
Constant	5.173 (0.391)***	5.168 (0.392)***
Health expenditure per capita	0.143 (0.775)*	0.138 (0.077)*
Health expenditure per capita squared	-0.007 (0.005)	-0.007 (0.005)
Alcohol consumption	-0.020 (0.009)**	-0.020 (0.009)**
Food consumption	-0.157 (0.025)***	-0.154 (0.024)***
Gas emission per capita	-0.005 (0.004)	-0.005 (0.004)
Income per capita	0.007 (0.005)	0.007 (0.005)
Population age structure	-0.001 (0.001)	-0.001 (0.001)
Employment	-0.121 (0.012)***	-0.118 (0.010)***
Education	0.026 (0.018)	0.028 (0.017)
Sex	-0.001 (0.002)	-0.001 (0.002)
Institutional arrangements		
Gate keeping arrangements	0.001 (0.005)	0.001 (0.005)
Cost sharing	0.004 (0.004)	0.004 (0.004)
GP payment method	0.003 (0.003)	0.003 (0.003)
Specialist payment method	-0.004 (0.004)	-0.004 (0.004)
Share of population covered	0.051 (0.024)**	0.049 (0.025)*
Public share of expenditures	-0.038 (0.016)**	-0.041 (0.149)***
Prices billed by providers	0.016 (0.009)*	0.016 (0.009)*
Model parameters		
sigma_u	0.014 (0.014)	0.006 (0.003)
sigma_v	0.009 (0.003)	0.011 (0.001)
λ	1.597 (0.010)	0.543 (0.004)

*Note: * significant at the 10% level of significance, ** significant at the 5% level of significance, *** significant at the 1% level of significance*

In the two robustness checks the coefficients and significance are the same for the independent variables, which were significant in the original analysis. The coefficients are provided with the standard error between brackets. The number of stars indicates the level of significance. The Lambda among the models are the biggest difference, as well the technical and idiosyncratic error term. In the robustness checks models, these inefficiency term is not signed with a significance factor. Just like in other studies (Green, 2008) the truncated-normal and exponential distribution the coefficients do have a striking agreement. Not only on the sign and significance of the coefficients, but also on the value of it. The estimated inefficiencies coefficients and error terms seem quite robust to the model specification. The lambda in these models are lower than in the original analysis. In the half-normal/normal distribution the technical inefficiency component (sigma_u) is just as in the original analysis greater than the noise component (sigma_v). In the exponential distribution the technical inefficiency is lower than the standard error term, which makes the lambda smaller than the other two models. So with the another distribution the technical inefficiency in the model is lower. This can be explained because the distributions lowers the technical and idiosyncratic error terms, therefore the lambda is always smaller than the truncated model (Green, 2008). However, it seems that the inefficiency estimates, and therefore the efficiency, and the significant coefficients derived from the application of the stochastic frontier analysis are fairly robust to the different distributional assumptions to use.

Chapter 5 Discussion and Conclusion

In this chapter the study will be discussed and a conclusion will be made. The present study had the aim to find institutional factors for the efficiency of the health care sector. Since there is a growing urgency to optimize the health care sector, because of the growing costs, aging population, and more expensive techniques in the health care sector. More information is needed about the efficiency of the triangle in the health care sector (access, quality, and cost). The empirical research is scare about the efficiency of health care systems. Not much is known about the channels of which institutional factors operate and how they affect the input mix and productivity within the health care sector. The health care sector has to deal with various market failures, which makes this sector different than other markets. Data of 20 OECD countries are used in this research. The effect of institutions in relation to the health outcome (HALE) and health expenditure is the key point of the current study. This study finds that the share of the population that is covered by insurance and prices billed by providers do have a positive influence on inefficiency for the health outcome. The share of public health expenditure has a negative influence on inefficiency, so a positive influence on efficiency. It can be said that these institutional factors have an association with higher health outcome.

Very often the institutions of a health care system are complementary to each other. To prevent the market failure of moral hazard, a government has more options to use or combine. For example in the Netherlands there is a single-payer financial system, with competition among insurers, the acceptation obligation of insurers, and price regulation of the suppliers of medical services. Or for example by price regulation, governments are setting maximum prices to prevent monopolistic positions. Governments are trying to prevent the market failures by setting and using various institutional factors. Combining these factors can prevent market failures. Countries often choose different methods to overcome these problems (Hernandez de Cos & Moral-Benito, 2012; Ali Cengez & Senel, 2016).

5.1 Discussion

The variables percentage of the population that is covered by insurance, share of public health expenditures, and the regulation of the prices billed by providers have a significant influence on the efficiency on the health outcome. All independent variables are institutional variables of a health care sector in a country. These institutional factors are chosen because the government of a country has influence on these factors and are therefore able to optimize the health care sector in the most efficient way and to limit the market failures in the health care

sector. With a more efficient health care sector the healthy-adjusted life expectancy is able to grow, which is a favorable outcome for a country and its citizens. It turns out that the percentage of the population that is covered by insurance has a positive influence on inefficiency. So therefore a negative influence on efficiency. This is due to the growing costs by more people using health care and the deserted influence on HALE. However, for the society as a whole, a higher coverage is unintentionally because of the inefficient outcome, but for individuals being covered can be of great value. This institutional variable is a potential counteract for moral hazard and adverse selection, problems occurring in the health care market, which are trying to prevent by the government.

The second significant variable which has influence on efficiency is the share of public health expenditure. This is a percentage of the amount paid for health expenditure by the public institution. This has a small negative coefficient, so a negative effect on the inefficiency. The higher the share of the public share, the more efficient a country is to obtain a higher healthy life-expectancy. An explanation is that the government can redistribute the costs for the health care among all citizens. So the more wealthy people in a country can pay for the less unfortunates. It makes the health care sector more efficient when the government pays a higher amount. Moreover, adverse selection will be reduced in the health care sector, since all citizens are paying for it and not by itself via the premiums paid to an insurer. The regulation of the price level billed by providers has a positive influence on the inefficiency. Physician are triggered to have a lower volume of health service, since treating patients is not lucrative enough. However, it turns out that this is positive on the efficiency, so the treatments have a higher value. This variable makes it able to beat monopolistic positions of the suppliers of medical services, one of a potential market failure in the health care sector.

For the variables gatekeeping arrangements, cost sharing requirements, general practitioner payment method, and specialist payment method there is no evidence found of a significant influence on the efficiency. So regarding this study the outcome and influence is uncertain. For the distinction between the financial system (Bismarck or Beverage financial system) it is not possible to make a conclusion, since this variable was deleted because of multicollinearity.

The model together with the robustness checks show that these effects have a significant effect on technical efficiency. The inefficiency in stochastic frontier analysis is divided in two components, namely the technical inefficiency and the idiosyncratic error term, which is always part of a statistical test. The idiosyncratic error term is inevitable, while for the

technical inefficiency a company, in this case a country, which has some *abnormal economic* parts, can improve the maximum production frontier by other inputs via institutional influences and decisions. The indicator for the level of inefficiency (lambda) is relatively high in the original model, this means that there is a lot of technical inefficiency in the model, which indicates potential improvements for the health care market, which can be made by the government to make it more efficient and reduce the market failures in the health care sector. However, the variables which do reach a significant level should be taken into consideration during potential reforms by policy-makers, at which they need to overthink the fact that many institutional variables are complementary to each other.

5.2 Limitations of the research

The present study has several important limitations. The current study tries to work further on the work of Wranik (2011) and have therefore some of the same limitations. One important limitation is the limited data of the dependent variable and therefore the number of observations in this study. Since a healthy-adjusted life expectancy is only be used since the last decades, this data is limited and not every year is available to use for statistical studies. This is the reason that there are gaps between the time periods and not every year is accounted and that for one year males and females are added to reach to highest possible number of observations, which can be of influence on the outcome. This is also observable by the level of the coefficients. The coefficients are almost all around zero, so there is an effect, but only a small one. With more observations, it is more robust to say the effects find in this study. However, there is also a crudeness of indicator as the health care measurement. For this study the healthy-adjusted life expectancy is used and this variable has some disadvantages. This is for example the availability. Another important disadvantage is the moral question about who measures and defines disability or *full health*.

Another limitation is the simplicity of the dummy variables of the dependent variables. Many variables in many countries are more complex in reality. Using a binary classification for more complex levels of characteristics of a country is to make the variable workable. This can be one of the reasons of the contrary outcomes of the same variables by various authors, because many variables are too complex to measure it unambiguously. Many countries have a mixture of for example the financial system, or more specific rules for the payment system for general practitioners and specialists. In actual fact, practice the complexities of health care characteristics by categorical variables is a shortcoming for all studies in system-level cross-

country comparisons. Besides, cross-country comparisons are complicated by inconsistencies of the variable interpretation within the country.

What also have to be kept in mind is the conjuncture of the economy. There are several economic control variables in this study, and while there is an increasing trend in the healthy-adjusted life expectancy, it cannot be said that the influence of economic variables do exist because of this, or because of the state of the economy. Moreover, it is possible that there are some trends from the variables. This is for example likely for HALE, but also for some control variables like the life-style factors.

Despite the fact that this model is stimulated from another paper, there need some consideration of the fact that a country is not that simple as a firm. Therefore this study can be organized in health economics, with suggested that it is more complex than a firm. This is done to make this kind of topic workable. But with all the different intentions of the stakeholders in the health care sector must be kept in mind.

In spite of the significance of the variable of the regulation of prices billed by providers, there is a need for some caution of this variable. This variable is taken from another paper and has a scale and is only available for one year, but it is not said that this variable is time-invariant. Since this variable has a significant outcome, it is recommended to do more research on this influence on the efficiency of health care outcome. More recommendations are provided in the next part.

5.3 Recommendations for further research

Even though the setup of this study is well through thought there are some recommendations for further research to obtain more important information for policymakers to make the health care sector as efficient as possible. The indicator of technical efficiency in the model shows that there are potential improvements to optimize the health care market in a country. So this research has proven there are possibilities to make the health care sector more efficient, now it is recommended to have further research in this area. A first recommendation is to use another dependent variable representing health outcome. Or to stay close to this study, to find or create more data points of HALE for OECD countries to expand the knowledge and data for this relatively new measurement of health outcome of a country. Having more data points for HALE makes it also easier for other relative studies to use morbidity and mortality knowledge. Moreover, it makes the model more robust if the data sample is greater.

A next recommendation will be the inclusion of more or other institutional, economical, and life-style factors. This can be for institutional variables for example decentralization of decision making, corruption, or politics rights. For economic variables the options can be female labor force participation rate, Gini-coefficient, and proportion of white-collar worker in total work force. And for life-style factors smoking, fat or sugar consumption, obesity number or daily intake of animal products can be included. But also more health care variables can be added, just like in-patient beds per 1000 population, number of physicians per 1000 population, or specific chronic diseases . All these variables are already used in other health care studies and the combinations are infinite. Finding the most important for efficiency can be of great value in the health care sector. Since many control variables reaches the level significance and are against the health theories, it is recommended to do more research to the influence of these variables on health outcomes. Further research is necessary to learn the real influence of these variables. It is also an options to use lagged (control) variables to explain efficiency in the health care sector. This is already done by Leu (1986), however in the current study it is not advisable because there are various time gaps between the panel data, and it is not that obvious how long the lagged period should be to receive the most preferable outcomes.

Despite the limitations, this study offers some guidance for policymakers and political instruments they can introduce to make the health care sector the most efficient and healthy as possible.

Chapter 6 References

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Chapter 7 Appendixes

7.1 Appendix 1. HALE values

Table 6

HALE 6 data points, 20 OECD countries

Country	HALE 1990	HALE 2000	HALE 2005	HALE 2005 female	HALE 2005 male	HALE 2010
Australia	67.11	69.24	70.43	71.88	68.94	71.16
Austria	66.39	68.4	69.51	71.19	67.65	70.38
Belgium	66.6	6.93	69.08	70.88	67.18	69.91
Canada	67.67	69.02	69.88	71.39	68.29	70.82
Denmark	65.92	67.53	68.52	69.73	67.24	69.46
Finland	65.80	67.97	68.79	71.05	66.44	69.69
France	67.64	69.25	70.39	72.66	68.01	71.22
Germany	66.06	68.27	69.36	70.86	67.72	70.15
Greece	67.76	69.07	69.91	71.62	68.22	70.68
Ireland	66.83	68.08	69.64	70.80	68.43	70.78
Italy	67.51	69.57	70.93	72.34	69.36	71.72
Japan	70.37	72.07	72.92	75.43	70.32	73.62
Netherlands	67.38	68.22	69.44	70.43	68.31	70.51
New Zealand	66.20	68.39	69.48	70.59	68.32	70.32
Norway	67.02	68.50	69.79	70.96	68.50	70.58
Portugal	64.83	67.05	68.50	70.60	66.36	69.78
Spain	67.56	69.51	70.55	72.81	68.29	71.91
Sweden	68.41	69.93	70.64	71.97	69.24	71.51
Switzerland	67.50	69.51	70.77	72.15	69.23	71.74
UK	66.65	68.30	69.29	70.63	67.86	70.39