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Efficiency effects of cross-border medical demand

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Abstract:

There is a growing interest in cross-border medical care and its comparative advantages. In addition, medical care can be defined as a local assurance good. Little research is being carried out in this field. This paper discusses the individual considerations for medical treatment offered at home and abroad within a micro-economical framework. Specific assumptions as mistrust, monetary and non-monetary transaction-costs, a price and cost gradient, illness severity as well as a lump-sum insurance are discussed. We show that a demand abroad can be utility maximizing, however, only second best. There are inefficiencies in the dimensions of ex-post demand and income risk either on the side of gross-income or of costs. Furthermore, the foreign demand is restricted for low health stages driven by mistrust and restrictions in quality. Higher stages are more capable if fixed costs are low. To demand abroad the marginal treatment costs abroad must fall short of a threshold level. Finally, an out-of-pocket payment can reduce the moral hazard when treatment takes place abroad.

JEL-Classification: I19 , F1, D01, D80, R23

Keywords: Cross-border medical care, health tourism, efficiency, patient migration, trust

1 Introduction

This paper provides a contribution to the debate about cross-border medical care and patient migration. Little is happening in this field, although this subject has become more interesting recently in, both, practice and theory. Smith (2008) makes this subject into one of the most important the health economists will be faced with in the future. The political discussion about the benefits of cross-border care and a small number of scientific contributions have been delivered for almost a decade. However, the economic literature does not provide an acceptable framework for a detailed discussion with accurate results about the effectiveness of cross-border demand and its potential. Hence, this paper addresses the issue of how cross-border medical demand works and what the impact of specific determinants is in respect to the efficiency of demand.

The process of internationalization has advanced widely to almost all economic sectors. Since 1995, when the General Agreement on Trade in Services was signed by the WTO, also the health care sector came into focus as a potential globalizing service sector (Adlung and Carzaniga (2001), Chanda (2002)). However, measured on the total service trade and health care expenditures, the activities of patient migration in different OECD countries are low and without a cognizable trend (Waeger (2007)). Normally, the national governments deny their support and the portability of insurance coverage for tradable medical services (Mattoo and Rathindran (2006)). Even within supranational systems such as the European Union, an agreement has not taken place contrary to the general principle of free factor mobility and trade in goods and services. Patients and insurers are sceptical regarding the utility gain and the potential for cost-savings.[1]

However, world-wide, some dynamics have developed in the field of patient migration, also called health tourism. Countries like Thailand, Malaysia and India have developed into global destinations for medical care (Mattoo and Rathindran (2005)). From an economical perspective, the motivation for this demand is of importance and can be separated into a price and a quality gradient. The focus shall be on the price gradient, which should mainly be valid for patients from more highly developed countries. Busse et al. (2008) compare costs for specific treatments among a number of countries in the EU and show a strong variance among them caused by differences in wages and the technologies used.[2] Mattoo and Rathindran (2005) show price differences between the United States and countries of South East Asia up to a factor of ten for relatively standardised and tradable medical services of comparable quality.[3] They estimate a savings potential of 1.4 Billion $US if 10% of concerned patients were to demand relevant treatment abroad. Measured on the total expenditures of almost 2 trillion US$ (Smith et al. (2006)), this figure appears small. However, considering the degree of out-of-pocket payments in the United States

[1] Obermaier (2009) also identifies institutional and political barriers in medical trade between Austria and Hungary. He also estimates a potential for trade, which currently is a negligible phenomenon, however, with a possible potential for the future.

[2] Fujisawa and Lafortune (2008) analysed the wages of general practitioners and specialists in 14 OECD countries. Measured in purchasing power parities, there exists a wide range and variance, especially for specialists. The highest wages are paid in the US and The Netherlands, the lowest in Eastern Europe (Hungary and the Czech Republic) with a difference of almost 200T $US.

[3] For example, a skin lesion excision has an inpatient price in US of 6,240 $US. The average of the three lowest foreign prices is 812 $US, in which the travel cost are included.

and the chronic cost pressures in a number of other countries, price gradients could be useful instruments in the debate about options for making health systems more efficient.

Beside an existing quality and price gradient, the literature discusses transaction-costs as a further determinant for cross-border demand, which shall also be taken into account in this paper whereby these costs will be separated into monetary and non-monetary as well as variable and fixed costs.[4] Furthermore, this paper identifies the severity of illness as an additional determinant. Another central component is trust or better mistrust over the provided quality abroad. Healthcare provisions can be defined as a local assurance good derived from the basic characteristics of medical goods, from trust as a general determinant of economic transactions as well as the role of trust within trade relations. A change in the local place of medical provisions can generate a subjective mistrust about the foreign provider without any objective evidence.

The individual asks for a lump-sum insurance coverage that pays attention to a medical provision at home *or* abroad. Then, the objective of this paper is to show how cross-border demand changes the results of a pure home treatment solution in terms of the dimensions *ex-post demand* and *income-risk*. Afterwards, the medical demand abroad is analyzed for a utility-maximizing option.

Three cases can be constructed: First, provision at home; second, provision abroad with mistrust as a preference (intrinsic); and third, provision abroad with an influenceable mistrust (pragmatic). The results can be summarized as follows. In a case of intrinsic mistrust, the ex-post demand and income risk are not distorted compared to the solution at home as long as the maximum possible medical demand is not achieved abroad. If mistrust is extended beyond an intrinsic level (pragmatic) and transaction-costs as well as restricted quality are added, a demand bias is produced based on a lowering of demand and a subjective adjustment of quality. Furthermore, the non-compensatable transaction costs and a restricted quality abroad connected with a subjective adjustment of quality do not allow an equalization of net-incomes and utility, which induces an income-risk either on the side of gross-income or on the side of costs. In detail, mistrust generates an adjustment of marginal cost upwards in terms of higher average cost per effective quality unit whereby a differentiation between a perceived and a factual uncertainty must be attended to. The produced demand bias induces inefficiency costs of mistrust. The marginal treatment costs abroad must fall short of a threshold level to compensate for these effects and to achieve an improvement of expected utility. Based on a restricted quality and mistrust, diseases with a high degree of severity are unsuitable for a foreign provision despite increasing cost-saving potential. An extension of the available quality abroad above the level at home dampens this restriction. Higher levels of health are more

[4]There is a broad literature about hospital choice and its general determinants. Adams and Porell (1995) deliver a review article about a broad number of determinants. For a more detailed analysis of specific determinants see also McGuirk and Porell (1984), Garnick et al. (1989), Burns and Wholey (1989), Luft et al. (1990), Luft and Phibbs (1995). For the specific context of cross-border care within the EU see e.g. Calnan et al. (1997), Starmans et al. (1997), France (1997), Crivelli (1998), Crivelli and Zweifel (1998). The determinants shown in these papers are partially implemented or summarized in this paper. Not all determinants are included, especially the detailed assumptions about the physician.

suitable, however, fixed transaction-costs must receive attention.

Altogether, a second best solution at its best is possible abroad compared to a potential first best solution under purely intrinsic mistrust. Under pragmatic mistrust a third best solution is also possible when utility decreases below the level at home. In addition, a mixed insurance tariff is thinkable also in a case where no insurance is provided for foreign treatment whereby health stages are separated regarding severity and location of treatment which maximizes the expected utility.

At last, a fixed co-payment insurance is discussed where the insurance wants to restrict the foreign demand. An adjustment of the foreign co-payment allows a reduction in moral hazard and a implementation of cost savings which, however, must be shared with the patient. Transaction-costs must be compensated by an increasing savings potential. A full insurance at home reduces but not eliminates the incentive to demand abroad due to a reduced sensitivity over foreign costs. However, a gain of gross-income is impossible. If there is no insurance coverage, the critical level of marginal and fixed costs are of interest to fulfill the necessary condition of utility for the patient.

The results are a starting point for a discussion in health politics. The cost-advantage of the foreign country cannot be used in its total amount because of given inefficiencies. Furthermore, it must be asked in which amount the cross-border supply can remain unchanged when it is faced with inefficiency sources, which probably have a limited potential to be reduced below a prohibitive level. For example, Hirsch (1989) discussed the poor-tradability-hypothesis, which means a restriction of a trade based on transaction-costs and the necessity of a decentralized provision of e.g. the medical supply.

There are only a few contributions in the theoretical literature in the context of cross-border supply. Mattoo and Rathindran (2005) discuss the impact of an insurance for treatments abroad under consideration of an ex-post moral hazard but without paying attention to the specific characteristics of a demand abroad. Seninger (2000) analyzes theoretical and identifies empirical differences in spatial information and transaction costs between certain U.S. federal states as determinants for hospital choice. Crivelli (1998) discusses patient migration between cantons in Switzerland, and Crivelli and Zweifel (1998) do so in a principal-agent framework for the EU. However, the main focus is on physician behaviour and the procedure of approval caused by the insurance for treatment abroad.

As a theoretical basis, Zeckhauser (1970), Spence and Zeckhauser (1971) and Gaynor et al. (2001) deal with the insurance demand and the efficiency of the demand. Breyer et al. (1997) provide an excellent overview of the theory which is the foundation for the discussion of effectiveness of ex-post demand and insurance in this paper.

The paper is structured as follows: In the second chapter, the basic structure and assumptions of the model are described. Afterwards, in chapters three to five, the demands at home and abroad according to efficiency impacts as well as the condition for a utility improvement abroad are discussed. Chapter six presents a short discussion of the ex-post medical demand in a framework of a co-payment insurance. Chapter seven presents a short discussion of the results and the conclusion.

2 The model

The individual is faced with an uncertain event of a tradable illness, which means an illness without acute perilous character. It can be treated in two hospitals: 1. at home *(h)* or 2. abroad *(f)*.

2.1 Quality, Cost and Utility

The treatment quality can be characterized as follows. The individual has a health status H_s with $0 \leq H_s \leq \bar{H}$, with $\bar{H}$ as maximal health. Each H_s occurs with a probability π_s. $\bar{H}_s$ can be defined as a status after medical treatment was undertaken:

$$\bar{H}_s = H_s + q_s \tag{1}$$

For simplification, the health status has the form of an investment good whereby Y_{si} is the gross-income:

$$Y_{si} = Y_{si}(H_s + q_{si}) \quad \text{with} \quad i = h, f \; ; \; Y_i' > 0 \; ; \; Y_i'' < 0 \tag{2}$$

q_s represents the demanded quality with a maximum amount of $\bar{q}_s$ to achieve the maximum $\bar{H}$. Hence, every health status has another range of treatment quality, which is demandable and depends on the severity of the illness. E. g. for an ordinary influenza, a lower range of medical instruments exists compared to a difficult cardiac-surgery.[5] It can be explained by an operation. There exist different techniques such as the usual gash with a scalpel, keyhole surgery or high frequency surgery. Every method results in a specific success, which differs in its level of quality for the patient, e. g. in the duration of aftercare, infections, or a large cicatrice, which generates psychological problems.

To simplify, the maximum level of medical quality for the most difficult condition $H_s = 0$ is $\bar{H} = \bar{q}$. Both countries can be differentiated by this quality level. The home country can provide this maximum level $\bar{q_h} = \bar{H}$, therefore, any illness can be returned to $\bar{H}$. However, the foreign country can only provide a maximum quality level of $q_f^{max} = \theta \bar{q_h}$ with $0 < \theta \leq 1$. Therefore, health levels exist with $H_s < \bar{q} - q_f^{max}$ which cannot be returned to $\bar{H}$, completely. By this difference is meant that especially the most modern technologies are unavailable or there is a lack of experience with them. Hence, the foreign medical provisions are less developed than those in the home country.[6]

The basic cost function for providing quality is linear in quality:

$$c_h(q) = q \tag{3}$$

$$c_f(q) = \gamma c_h = \gamma q \tag{4}$$

The price offered by a hospital in both countries is equal to the cost. The foreign country has a cost advantage with $\gamma \leq 1$. The individual can insure the treatment costs with a

[5] It is not possible to offer a quality level higher than $\bar{q}_s$ for a specific health status H_s because of its inefficacy. Hence, smaller levels of $\bar{q}_s$ are not a subset of higher $\bar{q}_s$'s.

[6] This assumption will be relaxed in a later part of this paper.

lump sum refund. The insurance objective is the maximization of the patient's expected utility. Under an assumption of a fair premium, R_i can be written as:

$$R_i = \sum_{s=1}^{S} \pi_s A_{si} \tag{5}$$

R_i is the insurance rate and A_{si} the reimbursement. Finally, the individual's benefits are achieved only by her net-income y_{si} in a given status with C_{si} as the total costs.

$$y_{si} = Y_{si}(H_s + q_{si}) - R_i - C_{si} + A_{si} \quad \text{with} \quad U(y_{si})' > 0 \,;\, U(y_{si})'' < 0 \tag{6}$$

2.2 Information, trust and trade in medical services

Information

The health status H_s is observable in the context of a lump-sum insurance. The patient is fully informed about the treatment quality offered by a hospital at home and abroad. Therefore, the ex-post quality demand takes place under certainty and the individual receives the quality which is demanded. Therefore, a strategic behaviour of the supply side or any kind of an exogenous shock by the choice of quality are excluded in the model. The exclusion of risk also means that the providers at home and abroad behave as perfect agents to maximize patient utility.

However, there is one important difference to the home country. The individual mistrusts the provided quality abroad. Due to the importance of trust, for the further discussion we want to motivate this point based on its extraordinary but particular importance in the general economic discussion.

Trust in economic relations

There is a growing literature discussing trust and its determinants and impact on economical transactions. Arrow (1972) already described trust as an essential element of the economic's operativeness. Coleman (1990) defined trust as a principal's voluntary transfer of resources to an agent in expectation of a specific payback whereby a formal contract does not exist. Trust also plays a critical role in the intensively discussed field of social capital. This form of capital is seen as a main determinant for the performance of institutions and therefore the economical prosperity on a micro- and macro-level based on overcoming imperfect information within an informal environment of communities (Fukuyama (1995), La Porta et al. (1997)).

But how can trust be described in more detail from an economical perspective? Typically, trust is connected to a risk about the agent's behaviour. However, as could be shown in different experiments, trust can be separated from the common known risk of a lottery. It is primarily connected to an interpersonal relationship to another human being and represents an additional risk beside a natural risk according to a lottery.[7]

[7] E. g. Bohnet and Zeckhauser (2004) show that a principal reduces his investment activities when a game changes from a pure lottery with a natural risk to a principal agent relationship with an identical expected revenue. Thus, the authors infer another risk, namely trust, which is purely connected to an interpersonal relationship to the agent's behaviour as a human actor and exists beside the preference for risk aversion. In addition, Eckel and Wilson (2004) cannot affirm a straight connection between a natural

Experiments based on game theoretical theories as prisoners dilemma, reciprocity and repeated games give us an insight into the important drivers of trust. In particular, experience gained in history within a specific relationship and the possibility to develop reputation as an agent is described as essential institutional environments to develop the trusting behaviour of the principal and the trustworthiness of the agent (Glaeser et al. (2000), Bohnet and Huck (2004)).[8] Other determinants are religious (La Porta et al. (1997)) and cultural similarities (Greif (1993), Fukuyama (1995), Rauch (1999), Glaeser et al. (2000)), historical ties (Greif (1993), Rauch (1999)) as well as associated persons (Buchan and Croson (2004)). Furthermore, network structures within organizations or specific coalitions with a specific cultural background can be of importance (Greif (1993), La Porta et al. (1997), Rauch (1999), Rauch and Trindade (2002)). These institutional arrangements can reduce mistrust and extend investment activities (see also Knack and Keefer (1997)).

Trust and medical care

Medical services are generally accepted as reputation or assurance goods as Pauly (1988) already described. This is based on specific characteristics of medical demand, in particular the information asymmetry between the expert physician and the laymen patient, the exceptional circumstances in which the medical demand of a sick individual takes place and the small-sized sample of demand (Arrow (1963)). Gaining experience is necessary within an interpersonal patient-physician relationship (PPR) to generate trust.

A more specific definition of trust within a PPR is an interpersonal relationship in which a potential vulnerability of a sick individual is not exploited by the physician given the asymmetric relationship (Hall et al. (2001), Abelson et al. (2008)). This is also based on an ethical dimension (Maynard and Bloor (2003)). Goudge and Gilson (2005) give an overview about the important characteristics of this specific form of trust. The patient's belief in trust is more focussed on the motivation and the intention the physician acts on. Hence, trust depends on the aggregated characteristics of the provider connected to his integrity. As concrete dimensions, the technical competence, ability to communicate, fidelity, confidentiality, and the anxiety of well-being are stated. Thus, trust in medical care has a higher degree of emotionality compared to other goods and services (Mechanic (1998), Hall et al. (2001), Goudge and Gilson (2005)).[9]

The former discussion of trust in general and, more specifically, in health care results in a definition of a trusty PPR based on experience with a specific medical provider and the reputation this provider could assemble. Furthermore, the relation is not purely based on a risk produced by potentially opportunistic behaviour by the physician as an agent but on more fundamental and emotional trust than an interpersonal tie, which also holds

risk and trust due to an experiment in which participants change their strategies within a repeated game despite an unchanged basical attitude to risk.

[8]Bohnet and Huck (2004) identify a strong impact of experiences when the relationship between agent and principal has a form of a partnership and not only of an anonymous reputation system.

[9]Hall et al. (2001) differ between an intrinsic and an instrumental form of trust. The former is applied to the PPR and its inherent characteristics, the substantial sense of a trustworthy and sensitive interpersonal relation. The latter is more pragmatic and is related to a concrete PPR connected to a specific medical demand. It is also related to the patient's compliance to abide with a physician and maybe to recommend him to other individuals within a health care system.

up beside a concrete case of illness and generated medical demand (Hall et al. (2001)).

Trust, trade and medical demand

In a very recent paper, Guiso et al. (2009) discuss the impact of trust on trade. They find that according to trading partners, trust depends on the specific bilateral country's relationships. Furthermore, the highest trust can be found according to one's fellow countrymen. These findings are based on stereotypes generated by cultural characteristics, available information through the media, one's common history, and religious similarities. The more similar countries are the higher trust is pronounced in terms of trade relations. They also find an increasing role of trust for highly differentiated goods.[10] The characteristics of trust connected to a medical demand outside the local place of residence precede the definition of medical provision as a local assurance good. Experience with a specific provider and also reputation of a specific provider is usually gained locally. Mostly, individuals are used to ask for care locally within a small group of providers as general practitioners, specialists, and hospitals. Thiede (2005) uses the term of overlapping life worlds (derived from Habermas's communication theory), which means that an increasing degree of congruency of different life worlds increases information in their trustworthiness. Hence, the habit of using a specific health care system makes it a part of the individual's life world, which is a broader definition of a trusty relationship. In this definition not only an interpersonal PPR but also the health care system itself plays a role for trust. Then, trust is also influenced by a general attitude according to the health care system in which the patient asks for care.[11] Finally, for trade in medical services trust plays an outstanding role. Due to the character of a local assurance good, trust decreases in a case in which a potential medical demand is directed towards a provider abroad or the familiar life world of the patient.[12]

Trust is implemented as τ with $\tau < 1$ with:

$$\bar{H}_{si} = H_s + \tau_i q_{si} \tag{7}$$

This function describes τ as a subjective perceived productivity downgrade below the actual level abroad. $\tau_h = 1$ which means there is no downgrade at home. An important assumption is that τ does not represent a probability of a failed medical quality due to an actual opportunistic behaviour of the foreign provider. Instead, it stands for a general and subjective downgrade of the capacity the foreign provider can deliver despite the fact that the patient actually might know something about an objective certainty of

[10] Therewith they also approve of Rauch (1999) who postulates specific searching costs for highly differentiated goods, which make an informal and trusty network structure necessary. Greif (1993) discusses historical trade networks in the Mediterranean area which were based on informal relations and therefore trust. Economic losses are also identified based on a reduced trade outside these networks.

[11] There exists some literature about trust in medical institutions which is quite different to the trust in a PPR and describes a bi-directional impact of trust between interpersonal and institutional relations (Mechanic (1998), Hall et al. (2002), Rowe (2006), Schee et al. (2007), Abelson et al. (2008)).

[12] Seninger (2000) makes the choice of hospitals between U.S. federal states dependent on the spatial availability of information which differs between the state of origin and the target state. Finally, this could be translated into differences in information about the general system or differences in trust.

quality.[13] This is related to the described fact that the PPR is more emotional and not only related to a specific demand but to a familiar relationship which cannot be provided by a foreign physician at the beginning. The assumption of the physician as a perfect agent gives trust an emotional dimension, which is based less on calculations of risk.[14] Hence, τ just bundles the considerations made above in a very simple approach, and a factual uncertainty about the success of a treatment is excluded.[15]

Furthermore, trust shall be separated into: a) intrinsic trust $\bar{\tau}$ and b) pragmatic trust $\tau < \bar{\tau}$. Both differ in their rationality. The intrinsic mistrust $1 - \bar{\tau}$ can actually be hardly changed externally and cannot bet totally eliminated. This parameter represents a more natural mistrust and is a preference-inherent variable.[16] As described above, medical goods and services are often allegorized as very sensitive goods when the habitual environment of medical provision changes, which is particulary the case in foreign treatment.

However, the pragmatic mistrust $1 - \tau > 1 - \bar{\tau}$ can be changed by external measures more effectively and is basically connected to general characteristics of the foreign health care system which generates a specific attitude regarding the system.[17] Schee et al. (2007) delineate this kind of trust partially as a public attitude produced by different kinds of experience and public exposure in the media.[18] Therefore, it can depend on the country itself, its characteristics connected to a different image of quality.[19] In addition, networks such as cross-border cooperations of health care providers and political agreements can communicate a higher degree of trust in the foreign system. Not least, one's own experience, gained from foreign medical provisions can influence mistrust derived from a specific PPR abroad. Altogether, the pragmetic mistrust can be interpreted as

[13] To generate demand information must be available which is not free. These costs are not implemented in τ but in provider related transaction-costs presented below.

[14] Hall et al. (2001) draw the picture that an individual could prefer a less skilled physician compared to a highly skilled one as long as the former is more committed to the well-being of the individual.

[15] Guiso et al. (2009) use a similar approach to implement mistrust in a decision about a foreign direct investment. However, beside a subjective mistrust about the trustworthiness of the foreign partner they also assume an objective probability of misinvestment. A decreasing trust level reduces the opportunity for investment and generates first-order losses.

[16] Fehr (2008) gives the example of a statement that 'someone cannot be careful enough' which rather represents a general preference than a specific behaviour.

[17] In general, a specific attitude also exists in terms of higher developed systems (e. g. in U.S. mistrust rises due to managed care, cost pressure, and restricted freedom of choice (Mechanic (1998))). This image must not be better compared to a foreign system urgently. However, the general attitude according to a trustier health care at home is assumed.

[18] As Fehr (2008) described, preferences are mostly exogenously fixed long-term. This means that preferences shape trust similar to the defined intrinsic trust. Guiso et al. (2009) also say that trust can take the form of a preference, e. g. the long term relations between French and British citizens and a kind of congenital mistrust. But it is also endogenous in the sense that belief influences trust. This is more compatible with an influenceable pragmatic trust.

[19] E. g. a higher maximum quality abroad could be connected to higher trust in this system ($\tau'(\theta) > 0$). The affinity of countries is also relevant. E. g., regions like the western border of Germany to The Netherlands, Belgium and Luxembourg are similar in different aspects of their language, traditions, historical development, cultural, and religious similarities etc. which also influence the subjective assessment of medical provision. Individuals could also associate low prices with a lower level of quality ($\tau'(\gamma) > 0$). This point is quite eligible. Due to γ determines the level of demand, a functional dependence between mistrust and γ would have an important influence on a treatment choice abroad. However, this shall not be implemented into the discussion.

non-rational because it is less preference-inherent and therefore problematic for efficiency (similar to the problem Guiso et al. (2009) described).[20] Due to the paper only wants to focus on demand behaviour, measures to increase trust are negligible.

3 Provision at home as a benchmark

At first, the benchmark is analyzed for a medical provision at home. This is presented only briefly due to its status of common knowledge. There are two important dimensions to be analyzed: optimal quality demand and optimal insurance coverage. The following utility- and expected utility function can be specified for the home country:

$$U_{sh}(y_{sh}) = U_{sh}[Y_{sh}(H_s + q_{sh}) - R_h - q_{sh} + A_{sh}] \tag{8}$$

$$EU_h(y_h) = \sum_{s=1}^{S} \pi_s U_h(y_{sh}) \tag{9}$$

The following condition is maximized to obtain the optimal quality demand and refund A_{sh} with (5) as constraint:

$$L_h = \sum_{s=1}^{S} \pi_s U_{sh}(y_{sh}) + \lambda(R_h - \sum_{s=1}^{S} \pi_s A_{sh}) \tag{10}$$

$$\frac{\partial L_h}{\partial q_{sh}} = \pi_s U'_{sh}(y^*_{sh})(Y'_{sh} - 1) = 0 \tag{11}$$

$$\frac{\partial L_h}{\partial A_{sh}} = \pi_s U'_{sh}(y^*_{sh}) - \lambda^* \pi_s = 0 \tag{12}$$

$$\frac{\partial L_h}{\partial R_h} = -\sum_{s=1}^{S} \pi_s U'_{sh}(y^*_{sh}) + \lambda^* = 0 \tag{13}$$

$$\frac{\partial L_h}{\partial \lambda} = R^* - \sum_{s=1}^{S} \pi_s A^*_{sh} = 0 \tag{14}$$

Therefore, the condition for the optimal demand is (FOC (11)):

$$Y'_{sh} = 1 \tag{15}$$

Condition (15) says that the marginal product of medical demand must be equal to the marginal costs of treatment (except for $\bar{H}$). Then, the same income Y_h in every health status is produced with an optimal demand q^*_{sh}, which delivers $\bar{H}^*_s \ \forall H_s$.

The marginal utility is equal in every health status after treatment (FOC (12)) which is fulfilled in a case in which the costs for q^*_{sh} are covered completely.

Thus, the standard conclusion for a lump-sum insurance is a demand along the marginal costs linked with identical incomes in every health status based on full coverage and, therefore, full elimination of the ex-post income risk.

[20] Of course, intrinsic and pragmatic mistrust are not irrespective of each other. An increase in pragmatic trust regarding a specific country could influence the intrinsic trust positively. Hence, measures to reduce the pragmatic mistrust also influence intrinsic mistrust which, however, cannot be eliminated totally. However, this interdependence shall not be discussed.

4 Provision abroad

Let us now discuss the case of foreign treatment with the integration of the assumptions explained above. Similar to (8) and (9), the patient's utility function and the expected utility for a treatment abroad are:

$$U_{sf}(y_{sf}) = U_{sf}\left[Y_{sf}(H_s + \tau q_f) - R_f - \gamma q_{sf} + A_{sf} - t(q_{sf})\right] \tag{16}$$

$$EU_f(y_f) = \sum_{s=1}^{S} \pi_s U_{sf}(y_{sf}) \tag{17}$$

Due to an adjusted quality q_{sf}, the Y_{sf} and y_{sf} are also adjusted. The cost-function is represented by (4). Under $t(q_{sf})$, the different kinds of transaction-costs are summarized:

$$t = T + m_s(q_{sf}) + n_s(q_{sf}) \tag{18}$$

T are lump-sum when $q^*_{sf} > 0$, e. g. travel costs with $T > 0$. m describes monetary and n non-monetary costs with $m'_s(q_{sf}), n'_s(q_{sf}) > 0$, $m_s(0) = n_s(0) = 0$, $m_s^{max}(\bar{q}_{sf}); n_s^{max}(\bar{q}_{sf})$. A lower health level H_s makes a greater effort m necessary e. g. through higher organizational effort, the management of interfaces between ex-ante and ex-post provision, and higher effort in locating a specific provider.[21] n as physical or mental pain is strictly connected to a specific kind of illness and increases in its severity.[22] [23]

The insurance can reimburse the monetary transaction-costs T and m included in A_{sf} with $R_f = \sum_{s=1}^{S} \pi_s A_{sf}$.

The further calculation is similar to (10) with the following necessary conditions:

$$\frac{\partial L_f}{\partial q_{sf}} = \pi_s U'_{sf}(\tilde{y}^*_{sf})\left(\tau Y'_{sf} - \gamma - m' - n'\right) = 0 \tag{19}$$

$$\frac{\partial L_f}{\partial A_{sf}} = \pi_s U'_{sf}(\tilde{y}^*_{sf}) - \lambda^*_f \pi_s = 0 \tag{20}$$

[21] As an empirical example, the position m arises through an added organizational effort the insurance has to make in the case when a patient demands home-based out-of network treatment (Obermaier (2009)).

[22] m and n are explicitly separated from the impact of trust. Both kinds of costs are specifically connected to a specific provider (m) and to an illness (n). Someone could argue that mistrust could also be a part of non-monetary transaction-costs. Maybe this could be an alternative description. However, the transformation of the production function is more plausible as will be seen below.

[23] An interpretation of tradable illnesses can be the following. Constant marginal costs are assumed independent of illness severity. However, illnesses exist with an acute character e. g. an acute myocardial infarct. Such a condition makes immediate treatment necessary for survival. Any attempt to demand treatment abroad produces transaction-costs against infinity. Hence, rising marginal costs of m and especially n make more sense. In contrast, for less severe conditions like a simple common cold, immediate treatment is also necessary due to a general indisposition. A severe condition such as cancer or a bypass operation could allow more time for planning or are connected with an indisposition as a usual circumstance for the patient. Then, decreasing marginal transaction-costs for severe conditions makes more sense. In this paper, acute illnesses are excluded as not tradable. To keep the analysis simple, there is no differentiation between different levels of disease. Every illness level makes an identical contribution to the marginal costs, which means that there are no disease-immanent attributes. In other words, only illnesses that produce further costs *outside* the illness itself (m and n) are tradable. Trading itself does not worsen the illness. Acute illnesses such as a myocardial infarct are excluded from the discussion.

$$\frac{\partial L_f}{\partial R_f} = -\sum_{s=1}^{S} \pi_s U'_{sf}(y^*_{sf}) + \lambda^* = 0 \tag{21}$$

$$\frac{\partial L_f}{\partial \lambda} = R^* - \sum_{s=1}^{S} \pi_s A^*_{sf} = 0 \tag{22}$$

From (19) follows:

$$\tau Y'_{sf} = \gamma + m' + n' \tag{23}$$

Again, the marginal revenue must be equal to the sum of the marginal costs consisting of treatment costs and of monetary and non-monetary transaction-costs. To simplify, let us assume a case in which $\gamma = 1$ and $t = 0$ generalized later. Then, the marginal revenue must rise for $\tau < 1$ to be equal to 1. The slope of the foreign production function is smaller in every point of q than at home because each unit of demanded quality produces a lower perceived extension of income than at home. Hence, the demand abroad is reduced with: $q^*_{sh} > q^*_{sf}\ \forall s$. Furthermore, q^*_{sf} determines $c_f(q^*_{sf})$ as costs, which the patient and the insurance pay for, respectively. However, based on mistrust, the quality implemented as an input for income is only given with τq^*_{sf}.

Let us denote the former case F_τ. In a case $\bar{F}_\tau$ in which mistrust is implemented as a pure preference parameter (or maximum trust) and transaction costs shall accrue, the first order condition (19) is simplified and delivers:

$$\bar{\tau} Y'_{sf} = \gamma \tag{24}$$

$\bar{F}_\tau$ can be described as the benchmark abroad. However, (24) also describes a reduced demand compared to home for $\gamma = 1$.

As in the case at home, the income Y^*_{sf} is equal for all H_s. Condition (20) postulates a constant marginal revenue and a income for all H_s. A_{sf} can cover all monetary costs arising from a treatment with $A^*_{sf} = \gamma q^*_{sf} + T + m_s$. However, there are transaction-costs n_s which cannot be compensated by the insurance. Hence, it must be proved whether full insurance is optimal whereas (25) shows the Kuhn-Tucker condition for it:

$$\frac{\partial L_f}{\partial A_{sf}} = \begin{cases} \leq 0 \ \ if & A^*_s = 0 \\ = 0 \ \ if & 0 < A^*_s < m_s + T + \gamma q_s \\ \geq 0 \ \ if & A^*_s = m_s + T + \gamma q_s \end{cases} \tag{25}$$

Furthermore, we assume that it is optimal for the individual to insure the treatment costs abroad. In a case in which full insurance is optimal $A^*_s = m_s + T + \gamma q_s$ takes place. Then, (25) and (20) deliver:

$$U'_{sf}(Y_{sf} - R - n_s) \geq \sum_{s=1}^{S} \pi_s U'_{sf}(Y_{sf} - R - n_s) \tag{26}$$

The right-hand side is the expected marginal utility over all s, and the left-hand side the marginal utility for a specific s. Hence, (26) cannot be fulfilled for all s. The corner solution for full insurance of monetary costs cannot be optimal in a case in which

$n'(q^*_{sf}) > 0$. This result is based on a non-insureability of n which results in an impossible equation of marginal utilities. Only in a case in which $n'(q^*_{sf}) = 0$, (26) can be fulfilled. As a solution either an over-insurance or a deductible are offered in theory to fulfill (26). However, due to the non-monetary character of n and the difficulty to observe such costs an implementation of an over-insurance or deductible is assumed as excluded.[24] At this point it must also be highlighted that Y_{sf} is not necessarily equal for all s as claimed in (23). This is based on an adjustment of the demanded quality upwards based on $\tau < 1$. The adjustment must increase when the health stage decreases but is limited in the maximum possible demand q_f^{max}. Hence, in a case in which this upper bound is achieved Y_f is not longer equal for all health stages in anticipation. This point is discussed below in more detail. At this point, is important that an insureability of differences in gross-income is also excluded. As a result we have full insurance of monetary costs to reduce the gap between the net-incomes as much as possible but a remaining uncertainty.

In case $\bar{F}_\tau$ with $t = 0$ a complete cost coverage with constant ex-post costs still remain.

Impacts of a foreign treatment option

What are the impacts of treatment abroad in detail? There are different sources of inefficiency which shall be discussed for both F_τ and $\bar{F}_\tau$.

Mistrust

First, in the case of F_τ mistrust produces a bias in the form of a reduced demand and net-income below the level under full trust. However, not $1 - \tau$ but $\bar{\tau} - \tau$ is responsible for an inefficiency. For $\bar{\tau} = \tau$ and $t = 0$ (case $\bar{F}_\tau$) mistrust only represents a specific preference by the individual. Then, the demand itself (24) is efficient. But as long as $\bar{\tau} - \tau > 0$ it is defined as not preference-inherent but endogenous. An increase in efficiency abroad can be possible through adequate measures.

Furthermore, under mistrust the perceived income $Y_f(\bar{H})$ for $\theta = 1$ is not achievable for F_τ and $\bar{F}_\tau$. For a given illness indeed $\bar{q}_{sf}$ is possible to be provided abroad. Even if this quality is demanded, the ex-ante adjusted quality is lower and therefore the adjusted income as well ($Y_{sf}(H_s + \tau\bar{q}_{sf}) < Y_{sh}(H_s + \bar{q}_{sh})$ for $\bar{q}_{sf} = \bar{q}_{sh}$) (also valid for $\bar{\tau}$). Then, the condition of equal ex-post health stages $\forall s$ is not longer fulfilled from an ex-ante point of view. Although the individual would receive what s/he demands abroad ex-post in a case in which $\bar{q}_{sf}$ is demanded, the subjective adjustment of quality produces a perceived uncertainty which reduces the ex-ante utility. On the other side, a factual inequality of gross-incomes arises for all demand levels below $\bar{q}_{sf}$ also based on the adjustment of the real demand. However, this inequality is not in the mind of the patient. In addition, based on the adjusted quality a decreasing health status reduces the ex-ante income due to a decreasing lower bound H_s in $Y_{sf}(H_s + \tau\bar{q}_{sf})$. In general, the lower the H_s the higher the quality demand must be measured relative to a higher H_s due to a relative share of τ on q^*_{sf} and a constant marginal return $Y'_{sf}(H^*)\forall s$ to be achieved in the optimum. This

[24] For a detailed analysis of these elements in general see Breyer et al. (1997), ch. 6. They also discuss administration costs which the insurance can shift to the insurant. However, in this paper transaction-costs would also arise without insurance and are an inherent part of a foreign provision. Hence, it remains optimal for the individual to cover these with a maximum amount.

is intuitively clear due to which the degree of severity of N illness must have an impact on the necessary demand because of a compensation for mistrust, which is more effective for severe illnesses.[25] Altogether, in the case F_τ another inefficiency in demand arises beside a reduced demand which is a risk in gross-income and therefore, net-income. An equation of marginal utility is impossible in this case. This kind of risk is also relevant to $\bar{F}_\tau$. However, as already mentioned, a demand $\bar{q}_{sf}$ is basically efficient because it exactly matches the demand which is calculated by the first order condition and is supplied ex-post independently of an subjective adjustment downwards.

Restricted quality $\theta < 1$
Second, connected to the first point and through the assumption of a maximum quality abroad $q_f^{max} = \theta \bar{q}_h$, a restricted demand intensifies the inequality of gross- and net-incomes across low health stages which is valid for both, F_τ and $\bar{F}_\tau$. Furthermore, for $\theta < 1$ and a maximum demand $\bar{q}_{sf}^* < q_{sh}^*$ in the optimum the objective (not only the perceived) achievable quality is inefficient compared to the home country.

Monetary transaction costs
Third, variable transaction-costs reduce the ex-post demand below the level at home and $\bar{F}_\tau$. Lump-sum costs T increase R_f and it reduce the net-income. Especially for high levels of H_s and therefore low levels of q_{sf}^*, T is proportionately high measured on the total costs of $c_f(q_{sf}^*) + m_s + n_s + T$. If there were a utility gain based on saving variable treatment costs, T could compensate this advantage. Only at a lower level H_s, the proportion of T is reduced in the total costs and the total cost-saving. In other words, for a common cold, the flight ticket compensates the total savings due to a comparably low potential for savings, however, for cardiac surgery, the ticket has the same price but loses in importance.

Non-monetary transaction costs
Fourth, the non-monetary transaction-costs have to be covered by the patient alone. The characteristic of equal net-incomes for every health status is not fulfilled. Thus, costs connected to psychological discomfort as a specific characteristic of medical treatment is an important factor for inefficiency through a reduced demand and an induced risk which decreases the expected utility.

Again, this is not valid for $\bar{F}_\tau$ due to $t = 0$. Hence, in this case, no income risk exists on the side of costs due to the possibility of the full coverage of the marginal treatment costs. However, as described above, the differences between a perceived and a factual risk must receive attention.

Finally, the issue of effective costs arises, which can be separated into two sub-issues. First, how do costs behave within the foreign country, and, second, how does that work between both countries?

For the first question, the costs under $\bar{F}_\tau$ are $c_{sf}^{\bar{F}_\tau}(q_{sf}^{\bar{F}_\tau *}) = \gamma q_{sf}^{\bar{F}_\tau *}$ for H_s and $E[c_f^{\bar{F}_\tau}(q_f^{\bar{F}_\tau *})] =$

[25] A simplified comparison can be made with a demand for a four-star-hotel abroad whereas the consumer demands a five-star-hotel to be on the safe side. In the case of very low trust a six- or seven-star-hotel is necessary but not available. Then, the perceived quality is reduced.

$\gamma \sum_{s=1}^{S} \pi_s q_{sf}^{\bar{F}_\tau *}$ as expected costs, whereas $q_{sf}^{\bar{F}_\tau *}$ is calculated by condition (24) with marginal costs of γ and the mistrust parameter $\bar{\tau}$. Then, the costs for the case F_τ with mistrust only ($\tau < \bar{\tau}$) and $t = 0$ are $c_{sf}(q_{sf}^{F_\tau *}) = \gamma q_{sf}^{F_\tau *}$ and $E[c_f(q_f^{F_\tau *})] = \gamma \sum_{s=1}^{S} \pi_s q_{sf}^{F_\tau *}$ with (23) as the necessary condition for $q_{sf}^{F_\tau *}$. Then assume $H_f^{\bar{F}_\tau *} < \bar{H}$. Because of mistrust τ it is not possible in general for a given γ that the demand will rise above the efficient level with $q_{sf}^{F_\tau *} < q_{sf}^{\bar{F}_\tau *}$ $\forall H_s$ and $E(c_f^{\bar{F}_\tau}) > E(c_f^{F_\tau *})$. However, the average costs per effective quality unit are higher, even without transaction-costs: $\gamma q_{sf}^{\bar{F}_\tau *}(\gamma, \bar{\tau}) / (q_{sf}^{\bar{F}_\tau *}(\gamma, \bar{\tau})\bar{\tau}) < \gamma q_{sf}^{F_\tau *}(\gamma, \tau) / (q_{sf}^{F_\tau *}(\gamma, \tau)\tau)$. This means, that the marginal costs abroad are adjusted upwards above the real variable costs per quality unit based on the mistrust bias in demand. This adjustment takes place in the case $\bar{F}_\tau$ and F_τ, but only $\bar{\tau} - \tau$ is the source of the adjustment which represents an inefficiency. The point here is, that the individual pays for demand $q_{sf}^{F_\tau *}$, anticipates however, only a lower amount of quality. That is the reason for the adjustment of quality demand downwards in consequence of higher effective marginal costs. Finally, the inefficiency must then be sought in transaction costs ϵ^* calculated as: $U(y_{sf}^{\bar{F}_\tau}(q_{sf}^{\bar{F}_\tau *}, c_{sf}^{\bar{F}_\tau *})) - U(\tilde{y}_{sf}(q_{sf}^{F_\tau *}, c_{sf}^{F_\tau *})) = \epsilon_{sf}^*$ which is the bias between the net-income under „efficient mistrust“ and „inefficient mistrust“ abroad. This kind of transaction-costs can also be defined as costs used in the framework of institutional economics whereby a lack of information cause a reduction in individual activities. In other words, this effect is sufficient for a second best solution abroad compared to a solution with $\bar{\tau} = \tau$.

The second question discusses the cost relation between the two countries. Again, the average costs of an effective quality unit shall be discussed. At home, they are $AC_h = 1$ and abroad, $AC_f = (MC_f q_{sf}^*(MC_f, \tau) + T) / (q_{sf}^*(MC_f, \tau)\tau)$. For $MC_f < 1$ the relation between AC_h and AC_f depends on the bias of the quality and therefore specifically on the relation between MC_f and τ.[26] In principle, the same conclusion as before can be drawn. A bias between both countries causes higher average costs based on an adjustment of marginal costs upwards, which produces further costs of mistrust. Finally, a compensation of a price-advantage $\gamma < 1$ takes place.[27] Furthermore, the fixed transaction costs T increase the average costs and can reduce the net-income below the net-income at home.

A first result can be derived according to the efficiency of a foreign demand. Despite a demand along marginal costs in F_τ, the demand is biased and reduced compared to a solution at home. Furthermore, the income risk cannot be totally eliminated. Compared to $\bar{F}_\tau$ as a benchmark abroad the solution under F_τ can only be second best in its best compared to $\bar{F}_\tau$ where τ is in its maximum and transaction-costs are zero.

So far, the dimensions of ex-post demand and income risk have been focused on. Final conclusions about an improvement of expected utility abroad were not drawn. However, the previous findings are important for exactly this discussion in the next chapter.

[26] For $MC_f = \tau$ and $T = 0$ identical average costs with identical net incomes are produced.

[27] In this context, Rauch (1999) postulates a decreasing success of matching when the degree of differentiation of a traded good increases. A trusty environment would be necessary to compensate this. This can also be translated into an adjustment of marginal costs based on a lack in trust, especially, when the health stage decreases and the portfolio of treatments expands.

5 The choice between home and foreign treatment

In this chapter, an improvement of the expected utility through the choice of the foreign option is analyzed with (9) < (17):

$$\sum_{s=1}^{S} \pi_s U_{sh} \left[Y_{sh} - R_h - q_{sh} + A_{sh} \right] < \sum_{s=1}^{S} \pi_s U_{sf} \left[Y_{sf} - R_f - \gamma q_{sf} + A_{sf} - t(q_{sf}) \right] \qquad (27)$$

At first, a possible improvement of ex-post utility must be investigated, given a specific health stage without a possibility of insurance coverage. Hence, the net-incomes have to be compared with $y_{sh} < y_{sf}$ as a condition for a choice of the foreign option.

The demand abroad is given with $\tau Y'_{sf} = \gamma + m' + n'$. As can be seen, $Y'_{sh} = Y'_{sf} = 1$ is valid for $\tau - m' - n' = \gamma$. Hence, an increasing demand abroad compared to a treatment at home is necessary for $\bar{\tau} q^*_{sf} = q^*_{sh}$ (due to $H_s + \tau q^*_{sf}$) for which the marginal costs abroad must decrease to $\tau - m' - n' = \gamma^*$. Then the same ex-post health status is achievable in both countries and equal gross-incomes at home and abroad must follow. In addition, due to $\tau q^*_{sf} = q^*_{sh}$ and $\tau - m' - n' = \gamma^*$, the variabel costs must also be equal with $c_h(q_{sh}) = q^*_{sh} = \gamma^* q^*_{sf} = c_f(q_{sf})$ and then also the net-income with $y_{sh} = y_{sf}$.[28] The former discussion is also valid for $\bar{F}_{\tau s}$ with $\bar{\tau} = \gamma^*$ as indifference condition.

q^*_{sf} increases above the indifference level for every health stage (or the perceived level $\bar{\tau} q^*_{sf} = q^*_{sh}$) as long $\gamma/(\tau - m' - n') < 1$ (for $\bar{F_{\tau s}}$: $\gamma/\bar{\tau} < 1$) and the maximum $\bar{H}$ is still not achieved. In addition, an extension of demand for high health stages, for which no demand occurs at home, becomes possible. However, in a case in which $\bar{H}$ is already achieved at home with $\bar{q}^*_{sh}$ as demand, the situation changes. Let us assume $\bar{q}^*_{sh}$ is exactly the optimal demand for marginal costs of 1 at home. The perceived gross-income abroad must be below the gross-income at home with a maximum of $Y_{sf}(H_s + \tau \bar{q}_{sf})$ (for $\bar{F_{\tau s}}$: $Y_{sf}(H_s + \bar{\tau} \bar{q}_{sf})$). An increase of q^*_{sf} above $\bar{q}^*_{sh}$ is not possible anymore for all s with a perceived quality $\bar{q}^*_{sf}$. To achieve a higher net-income abroad, the level of γ must be sufficiently low to compensate the difference of gross-incomes.

In the case of $\gamma/(\tau - m' - n') > 1$ (for $\bar{F_{\tau s}}$: $\gamma/\bar{\tau} > 1$) and $H^*_h < \bar{H}$, as the cost-advantage is too low or the mistrust too high, q^*_{sf} decreases below the indifference level based on an adjustment of marginal-costs upwards above the level at home.

At this point a link to the average costs makes sense. $AC_{sf} = (MC_f q^*_{sf}(MC_f, \tau) + T)/(q^*_{sf}(MC_f, \tau)\tau) < 1 = AC_{sh}$ is necessary for an increasing utility abroad given a specific health status. Furthermore, we know that $\gamma q^{\bar{F}_\tau *}_{sf}(\gamma, \bar{\tau})/(q^{\bar{F}_\tau *}_{sf}(\gamma, \bar{\tau})\bar{\tau}) < \gamma q^{F_\tau}_{sf} * (\gamma, \tau)/(q^{F_\tau}_{sf} * (\gamma, \tau)\tau)$. Hence, we can also derive a conclusion about a ranking of preferable options of treatment location. For $\gamma/\bar{\tau} < 1$ the option abroad with $\bar{\tau}$ is utility maximizing and finally first best. But where does $F_{\tau s}$ have to be? From the relation of average costs it could be derived that F_τ can only be second best in its best compared to $\bar{F}_{\tau s}$ with $F_{hs} < F_{\tau s} < \bar{F}_{\tau s}$ when $AC_h > AC_f(\tau)$. Then the foreign option is utility maximizing and the solution at home is third best. However, a third best solution is also possible abroad in a case in which the constellation of marginal costs and mistrust as well as

[28] In principle this result is also valid for a quadratic cost-function, whereby the necessary γ must decrease below $\tau - m' - n' = \gamma^*$ for an indifference.

transaction-costs as before are not fulfilled either with $F_{\tau s} < F_{hs} < \bar{F}_{\tau s}$ or $F_{\tau s} < \bar{F}_{\tau s} < F_{hs}$.

After the discussion of the general condition for a utility improvement ex-post, we need to switch back to condition (27). Now we will discuss the ex-ante case with $A^*_{sh} = q^*_{sh}$ and $A^*_{sf} = T + m(q^*_{sf}) + \gamma q^*_{sf}$ to check for a possible improvement of the expected utility. (27) can then be transposed to:

$$\sum_{s=1}^{S} \pi_s A^*_{sf} + n(q^*_{sf}) - \sum_{s=1}^{S} \pi_s A^*_{sh} < Y_{sf}(H_s + \tau q^*_{sf}) - Y_{sh}(H_s + q^*_{sh}) \tag{28}$$

Condition (28) can be interpreted as an economic border, whose shift depends on the constellation of the parameters. For this, we must know how an increasing γ changes the expected utility:

$$\frac{\partial EU_f}{\partial \gamma} = \sum_{s=1}^{S} \pi_s U'(y_{sf}) \left[\left(\tau \frac{\partial Y_{sf}}{\partial q_{sf}} - n' \right) \frac{\partial q_{sf}}{\partial \gamma} - (\gamma + m') \sum_{s=1}^{S} \pi_s \frac{\partial q_{sf}}{\partial \gamma} - \sum_{s=1}^{S} \pi_s q_{sf} \right] < 0 \tag{29}$$

The term on the left in the brackets is strictly negative for an optimal demand when all the elements of the marginal costs are positive (see condition (23)). A rising γ reduces the income Y_{sf} and decreases the non-monetary transaction-costs due to reduced demand. The middle term describes the reduction of the insurance rate based on the demand effect. The contribution for $U_{sf}(y_{sf})$ is positive in terms of marginal treatment costs and monetary transaction-costs. The first two terms are in sum negative due to uncertainty. The term on the right has a negative impact on the expected utility and represents the price effect. Hence, an increasing γ reduces the expected net-income and the expected utility abroad.

We already know that for a possible choice of a foreign country $\gamma/(\tau - m' - n') < 1$ is necessary. In addition, let us assume $\theta = 1$ and $\tau < \bar{\tau}$. R_f is positive and T shall be zero. Furthermore, the optimal demand at home shall be $Y_h(H^*) < Y(\bar{H})$. Due to $MC_h = 1$, R_h is also positive. To know whether condition (28) is satisfied for all H_s one must distinguish between the different levels of health. The described assumptions can be summarized as follows:

$$(MC_f > 0 \wedge T = 0) \supset (R_{f1} > 0),\ \tau < \bar{\tau},\ \theta = 1,\ Y^*_h(H^*) < Y(\bar{H}),\ R_h > 0 \tag{30}$$

(i) $H^{high}_s \supset [Y^{high*}_{sf}(H_s + \tau q_{sf}) \geq Y^*_{sh}(H^*)] \ \rightarrow \ (y^{high}_{sf1} > y^{high}_{sh})$

(ii) $H^{mid}_s \supset [Y^{mid*}_{sf}(H_s + \tau q^-_{sf}) < Y^*_{sh}(H^*)] \ \rightarrow \ (y^{mid}_{sf1} > y^{mid}_{sh})$

(iii) $H^{low}_s \supset [Y^{low*}_{sf}(H_s + \tau q^-_{sf}) < Y^{mid*}_{sf}] \ \rightarrow \ (y^{low}_{sf1} < y^{low}_{sh})$

As can be seen, the fulfillment of (27) depends on the health level and its risk. If the emphasis on risk lies on high levels H^{high}_s, the foreign option would be preferable

given MC_f.[29] However, the following has to be taken into consideration. Compared to a solution at home, full insurance coverage abroad is not possible as shown in (26) based on non-monetary costs $n(q_{sf})$. Hence, due to uncertainty abroad, there is no ex-ante indifference but a strict preference for the home option for $\gamma/(\tau - m' - n') = 1$. Therefore, $\gamma/(\tau - m' - n') < 1$ is necessary but not sufficiently. γ must be sufficiently low to compensate this element of uncertainty abroad.

In a case in which the emphasis is on middle health stages H_s^{mid}, a situation is imaginable in which the perceived income can only achieve a level below $Y_{sf}(q_{sf}^*)$ due to mistrust and the connected adjustment of demand. However, (28) can still be fulfilled despite $Y_{sh}(H^*) > Y_{sf}(H^*)$.[30] This depends on the marginal costs at home and on the strength of income, adjustment abroad through mistrust and quality restriction. For a sufficiently low γ the gross-income deficit abroad could then be compensated by a cost-advantage. Furthermore, γ must also be sufficiently low to compensate an arising risk on the side of gross-income due to a maximum demand $\bar{q}_{sf} \forall H_s^{mid}$ and a connected decrease in the perceived gross-income for decreasing health stages. Altogether, also for H_s^{mid} an improvement of the expected utility could arise.

For an emphasis of risk on H_s^{low} the income abroad is too low for satisfying (28). Despite an extreme case of $\gamma = 0$ the gross-income deficit could be too high for being compensated by a costs advantage.[31]

The higher the illness severity the higher the value of income risk based on the income risk on the gross-income side as well as on the cost side or n, respectively. In conclusion γ must decrease a fortiori when the risk for suboptimal health stages increases. This may be a bit confusing as someone can think that lower health stages improve the situation due to higher potential savings measured on the product of marginal costs differences and the number of demanded units. If someone thinks about a common cold or a bypass operation the latter would save more costs in terms of the total number of demanded units of quality and T becomes less important. Hence, low health stages generate a specific advantage in terms of these costs.[32] However, mistrust and non-monetary costs worsen this advantage due to a remaining risk. Therefore, individuals with a relatively high probability of suffering a severe illness and a low probability of remaining healthy

[29] To prove that H_s^{high} is not a null set under specific conditions we firstly know that $(Y'_{sh} = \tau Y'_{sf}) \supset ((q_{sh}^* > q_{sf}^*) \wedge (Y_{sh}^* > Y_{sf}^*))$ is valid. For $q_{sh}^* > q_{sf}^*$ and $Y_{sh}^* > Y_{sf}^*$, $\tau < \gamma^* < 1$ exists. Then $0 < \tau = \gamma^{**} < \gamma^* < 1$ must exist, with $Y'_{sh} = Y'_{sf}$ when $Y_{sh}^* = Y_{sf}^{**}$ shall be fulfilled, whereby $q_{sf}^{**} > q_{sh}^*$ due to adjustment of demand in $Y_{sf}(H_s + \tau q_{sf})$ based on τ. However, this can only be fulfilled as long as $Y_{sf}^{**} < Y_{sh}(\bar{H})$ and $q_{sf}^{**} < \bar{q_{sf}}$. Then γ must decrease below τ ($\gamma = 0$ in case 1) for H_s^{high} with $\bar{q_{sf}}$ as a set with a positive number of elements. For a decreasing H_s, represented as H_s^{mid}, also $\bar{q}_{sf}(\gamma = 0)$ is demanded. However, in this case H_s decreases as a lower bound in $Y_f(H_s + \tau q_{sf})$ whereby the necessary demand q_{sf}^{**} is not achievable due to $q_{sf}^{**} > \bar{q}_{sf}$ (despite $\theta = 1$). Then Y_{sf} decreases below the level Y_{sh}^*.

[30] If a quality difference was a source of utility reduction beside the reduction of income a utility improvement in such a constellation would not necessarily take place.

[31] Hall et al. (2001) postulate trust as an essential element for severe illnesses which is derived from a larger degree of vulnerability. In addition, patients are more willing to enter a paternalistic relation due to a high degree of powerlessness. This is quite compatible with my results. The patient makes an ex-ante decision whereby the existing mistrust in terms of a treatment abroad has a higher impact for severe illnesses. This induces a decision in aid of the provider at home, who is more trustworthy.

[32] For a concave structure of variable transaction-costs, a relative advantage (per unit) for low health stages would be produced whereby a convex structure would generate the opposite.

would prefer a treatment solution at home and vice versa. This means also that a possible compensation for immaterial damage would be an incentive to demand abroad which is, however, difficult to quantify and therefore excluded in the model.

Connected to this point, as was already seen when the average costs were discussed, T implemented in R_f has the highest weight for high health stages and decreases in its relative value for lower stages. Therefore, higher health stages degrade due to fixed costs and low stages due to mistrust.

Altogether, an improvement of the total expected utility over all three health stages is possible when $\gamma/(\tau - m' - n') < 1$ complies with the necessary compensation of transaction-costs, deficits in gross-income, mistrust and income-risk. Then, for a fulfillment of (27), F_τ a second best solution would be between first best $\bar{F}_\tau$ and third best of F_h.

$\theta < 1$ worsens the foreign option at every stage due to a lower achievable income, especially for lower health stages. However, a reduced income $Y_h^*(H^*)$ improves the situation of a treatment option abroad for all H_s. For $Y_h^*(\bar{H})$, all stages have a lower gross-income abroad whereby the basic result remains unchanged with an intensified situation for the foreign country. Finally, a decreasing parameter τ shifts the borders among the three separate health levels. This means that the set of income relations for low health stages increases and decreases for high stages, which worsens the total result of the foreign option.

So far, a strict division into a tariff at home *or* abroad was assumed. Based on the previous results, a mixed insurance tariff can be conceivable. High health stages should only be treated abroad when fixed costs are low whereas low stages are treated at home. As was shown, the degree of such a distribution of treatment locations depends on the level of marginal costs abroad. Hence, the stages in the middle are more predestined for treatment abroad despite a reduced ex-post health stage. Such a mix maximizes the expected utility. In this context, the subject of selective contracts shall be discussed briefly. This is specifically relevant for a provider contracting forced by the insurance. If the expected utility of the insurant is in the focus of the insurer, the insurer must orient himself toward contracting with specific countries that have sufficient cost advantages and a positive influence on the trust the individual would have to muster up.

Another remark is the following. It is thinkable that an insurance contract is not provided for a foreign provision. Then, the individual has to choose between a full provision at home with a total elimination of risk or a mixed contract whereby particular treatments (e. g. low health stages) are insured at home and others are treated abroad without insurance. The latter option must generate a higher expected utility for choosing such a mix. In principle, the same sufficient condition as above must be fulfilled. The individual substitute treatments at home through medical services abroad for which a necessary cost-advantage exists that is sufficient for a compensation of transaction-costs, income risk, and losses in gross-income. Here, this risk is not only produced by non-monetary transaction-costs and differences in gross-income as above but also by monetary as well as medical treatment costs, which are also different at every health stage.

Furthermore, let us relax the assumptions of $\gamma \leq 1$ and $\theta \leq 1$. In principle, four cases can be differentiated, whereby the first one was discussed above with the given as-

sumptions. A second case is $\gamma > 0$ and $\theta \leq 1$. This means that quality abroad is still restricted, but the marginal treatment costs can be higher than at home. This case is easy to solve due to $\gamma < 1$ remains necessary for a utility improvement. The third case is $\gamma \leq 1$ and $\theta > 0$. Here, a cost and quality advantage exists abroad which implies $\bar{q}_h$ not as the maximum for $H_s = 0$. Then, a situation is possible in which γ is low enough to generate a perceived quality and gross-income above the level at home. This constellation improves the total position of the foreign country.[33] The fourth case is the most general one with $\gamma > 0$ and $\theta > 0$. For $\gamma > 1$, $\theta > 1$ has no effect in terms of an improvement of a foreign treatment due to a demand in the optimum, which is below the demand at home.[34] Therefore, only case three with $\gamma \leq 1$ and $\theta > 0$ improves the foreign option due to the weakening of restrictions in demand discussed above.

Finally, differing to the definition of medical goods as local assurance goods, $\tau_f > 1$ could mean an over-assessment of the foreign quality whereby the objective productivity abroad and θ shall be one. Then, based on $\gamma/(\tau - m' - n') = 1$, MC_f can be higher than MC_h to achieve a perceived indifference. Contrary to $\tau_f < 1$ the optimal demand is too high. Furthermore, lower health stages have an advantage. The lower H_s the more the demand is adjusted downwards relative to higher H_s due to $q_{sf}\tau_f$. Compared to $\tau_f < 1$ a perceived uncertainty in gross-income can never arise due to the fact that an upper quality bound does not come into effect. However, due to an adjustment of quality upwards, $\bar{q}_{sf}$ (or higher quality levels, in general) would not be demanded in a case in which $\bar{H}_f^*$ is the optimal ex-post health. Then, the perceived uncertainty in the case $\tau_f < 1$ changes into a factual uncertainty due to the adjusted demand downwards, which is also valid for all otherH_{sf}^*. However, ex-ante this inequality the individual does not have in mind.

6 Fixed insurance tariff and ex-post choice

Co-payment insurance

In this chapter, the ex-post demand shall be discussed, in which the insurance tariff is already fixed. The patient only has an insurance contract for treatments at home because the foreign option was not available when the contract was signed. Furthermore, the contract is not reimbursed by a lump-sum, but the patient has to make a co-payment α_h. Then, a further source of inefficiency exists, namely an ex-post moral hazard.[35] The question is whether there is a utility improvement possible if a foreign treatment is possible at once ex-post given a specific health status H_s:

$$[Y_{sh}(H_s + q_h) - R_h - \alpha_h q_{sh}] < [Y_{sf}(H_s + \tau q_{sf}) - R_h - \alpha_h \gamma q_{sf} - t(q_{sf})]$$

or

$$[Y_{sf} - Y_{sh}] > [\alpha_h(\gamma q_{sf} - q_{sh}) + t(q_{sf})] \tag{31}$$

[33] It could be discussed whether pragmatic mistrust according to a foreign country with a higher quality than at home is a feasible assumption.

[34] However, $\gamma > 1$ may be possible, when $\bar{H}$ is achieved with $MC_h = 1$.

[35] For a basic discussion of the moral hazard and treatment abroad see Mattoo/Rathindran (2005).

The co-payment rate is given through the insurance rate at home and shall also be valid for a possible demand abroad. Then, the difference of gross-incomes as in (31) on the left hand side must be higher than the difference of costs paid abroad and at home. The optimal demand abroad is given similar to (23) with:

$$\frac{\partial U_f(\tilde{y}_{sf})}{\partial q_{sf}} = 0 \quad \rightarrow \quad \tau Y'_{sf} = \alpha_f \gamma + \beta m' + n' \tag{32}$$

β is a co-payment for monetary transaction-costs (also for T). Only γ can be changed perhaps through the choice of a country where treatment can be demanded. The derivative of (31) under attention of a given demand at home and condition (32) delivers:

$$\tau \frac{\partial Y_{sf}}{\partial q_{sf}} \frac{\partial q_{sf}}{\partial \gamma} > \left[\alpha_h \gamma \frac{\partial q_{sf}}{\partial \gamma} + \alpha_h q_{sf} + \beta m' \frac{\partial q_{sf}}{\partial \gamma} + n' \frac{\partial q_{sf}}{\partial \gamma} \right] \text{ or } 0 > \alpha_h q_{sf} \tag{33}$$

Condition (33) means that for a rising γ the change of the gross-income is higher than the change of costs in a marginal consideration. For a decreasing γ the net-income abroad increases compared to the net-income at home ($\alpha_h q_{sf} < 0$). Under consideration of quality constraints abroad, variable transaction-costs, and the mistrust bias, a country with a sufficiently low γ can (not necessary) produce a preference for a treatment abroad in a marginal consideration. The fixed transaction-costs must be attended to as well, which becomes less important when the demand and therefore the total costs increase.

Similar to the solution within the former chapter, γ must not increase about a maximum level. The optimal demand at home is calculated by $Y'_h = \alpha_h$. Similar to the case above, Y'_f must be equal to α_h. From (32) follows for the maximum of γ: $\gamma^{max} = \tau - (\beta m' + n')/\alpha_h$ which generates an indifference in gross-incomes. Due to the fixed insurance rate only the variable co-payments are relevant, which shall be equal at home and abroad. Hence, the net-incomes are equal as well. Therefore, γ must decrease below γ^{max} whereas the marginal effect in (33) shows an increase in utility.

Condition (31) is written for the patient. But what is the condition for the insurance to send the patient abroad? The objective of the insurance could be the following:

$$q_{sf} = \frac{q_{sh}}{\tau} \tag{34}$$

The effective quality abroad shall be equal to the demanded quality at home which is the benchmark health level ex-post for the insurance. Then, $\gamma^{max} = (\alpha_h \tau)/\alpha_f$ $(t = 0)$ is necessary to fulfill this condition, whereas with α_f a separation of co-payments between both countries is installed. Then the marginal costs abroad $\gamma(\alpha_f)$ must be low enough to achieve $q_{sh}\tau$. Hence, a situation can occur in which $\gamma < \gamma^{max}$, so that $\alpha_f > \alpha_h$ whereby (34) still remains. Beside the still relevant mistrust bias, the degree of ex-post moral hazard abroad could be reduced compared to the home country and the costs advantage can also be achieved. However, the amount of costs savings must be shared with the patient to fulfill (31), which must be carried out as a lump-sum reimbursement.

If transaction-costs are included, γ must decrease to $\gamma^{max} = (\alpha_h \tau - \beta m' - n')/\alpha_f$. The co-payment β for $m(q_{sf}) + T$ can be orientated toward a level at which (31) can be fulfilled. However, to fulfill (34) and to carry out an advantage in total costs, $\gamma < \gamma^{max}$ is

necessary to compensate $(1-\beta)(m(q_{sf})+T)$ and to produce further cost savings which can be shared with the patient. Non-monetary costs n must not be too high because this amount cannot be covered except only indirectly through covering m and T. In principle, the reduction of the moral hazard is also possible in this case.

Full insurance coverage
The full coverage of treatment costs at home, e. g. in a context of a social security system, in which the duty exists to pay a defined premium, is a borderline case. Then, condition (31) cannot be fulfilled. $\alpha_h = 0$ and therefore the right-hand side of the inequation can be at minimum zero or positive for $t > 0$. The left-hand side however is negative due to an achieved maximum of demand at home. This can also be seen in $\gamma^{max} = (\alpha_h\tau - m' - n')/\alpha_f$ which cannot be fulfilled independently on the level of α_f and γ. Therefore, the patient actually has no incentive to choose the foreign country, which is also valid for $\alpha_f = 0$. A full coverage reduces the sensitivity over a costs advantage abroad. Then, only a higher quality abroad could induce foreign demand.

However, the insurance is interested in a foreign treatment as long as, $\gamma < 1$ and a fulfilled condition (34). Similar to the case before, a lump-sum reimbursement is possible to induce demand and to achieve the cost advantage. However, despite condition (31) could then be fulfilled, the patient urgently lose in terms of the health stage after treatment and gross-income.

No insurance coverage
Here, we can separate into a case in which $\alpha_f = \beta = 1$ and $\alpha_f = \alpha_h = \beta = 1$. For the first γ must achieve the level $\gamma^{max} = \alpha_h\tau - (m' + n')$ for a fulfillment of (31). In the latter $\gamma^{max} = \tau - (m' + n')$ must be fulfilled as in the discussion in the previous chapter. Furthermore, for both cases the fixed costs T must be considered in the calculation.

7 Discussion and Conclusion

The paper provides a contribution to the debate about cross-border medical care and its advantageousness. The analysis shows that a treatment abroad can be utility-maximizing, however, only second best in its best compared to a solution with mistrust as a preference. An insurance tariff with mixed locations is thereby utility-maximizing. The demand option abroad is connected with a biased and reduced demand as well as an income risk on the cost and gross-income side. Mistrust plays a significant role. It generates an upward adjustment of marginal costs whereby costs of mistrust can be caluculated. A necessary condition can be derived for utility improvement. The marginal treatment costs abroad must fall short of a threshold level to compensate transaction-costs, income losses, and induced income risk. There is also a relative advantage for higher health stages, however, alleviated through fixed transaction-costs. Low stages are less capable to generate foreign demand despite higher cost savings potential due to an increasing impact of mistrust and a restricted quality.

Furthermore, higher quality and lower costs abroad lead to a migration along a qual-

ity gradient. Furthermore, in a case in which the foreign quality is overrated, inefficient demand takes place as well, however, without a perceived uncertainty in gross-incomes.

At last, co-payment is discussed with an insurance objective of a cross-border equalization of demand. A reduction of the moral hazard through an adjusted co-payment is possible. Then, cost savings can be realized which, however, must be shared with the patient. Transaction-costs must be compensated by an increasing saving potential. A full insurance at home reduces but does not eliminate the incentive of demand abroad due to a reduced sensitivity over foreign costs whereby a gain of gross-income is, however, impossible. If there is no insurance coverage at home and abroad, the critical levels of marginal and fixed costs are of interest to induce demand abroad.

What are the consequences for a health policy to achieve a foreign cost advantage? Mistrust over the quality abroad plays a vital role. An important issue must be targeted for its empirical relevance and influenceable determinants. If mistrust is a pure preference, an immediate efficiency problem would not exist but the potential of cross-border medical care would be restricted nonetheless due to a general reduction in demand. If mistrust is based on a general lack of information, the question follows how these deficits can be reduced. Greif (1993), Rauch (1999, 2002), Guiso et al. (2009) discuss cross-border networks and the affinity of trading partners as important instruments for improving the efficiency of trust in trade relations. Hospital networks and transferred standards to hospitals abroad could enlarge the familiar care of a health care system at home to a foreign country. For example, U.S. hospitals such as Harvard or John-Hopkins arrange network contracts with hospitals abroad. Schroth and Khawaja (2007) discuss the necessity of validating quality in the form of accreditation as it is done e. g. by the Joint Commission International who set quality standards in the U.S. but also has accredited a number of foreign medical providers. As derived from Rauch (1999), a higher degree of standardisation through a certification of specific treatments could reduce the importance of trust. Furthermore, the literature identifies reputation and experience as central determinants of trust. Hence, if the implementation of a foreign treatment option shall come into real focus, a process over a specific period of familiarization between patients and providers is necessary, whose success will depend on the numerous further characteristics of the target country and the individuals involved. The instrument of a separate insurance tariff connected to a free choice of preferable providers at home and abroad could stimulate the use of a foreign provider despite existing sources of inefficiency. Last but not least, the effort connected with an improvement of trust in a foreign system must be investigated to give a final answer about the efficiency of such measures.

A restricted maximum quality is motivated by the existence of the differently developed health care systems in the world. Hence, a network of developed countries could also be necessary, e.g. within systems as EU, NAFTA or others due to their integrated character and the instruments used in bilateral agreements (Calnan et al. (1997), France (1997), Starmans et al. (1997)). Such cross-border agreements support the integration of markets and reduce the inefficiencies discussed above, especially in regions with neighbourly relations.

The integration of transaction-costs m and n is typical for trade, also or even more in

medical services. Can these costs be reduced below a prohibitive level through a better integration of international health care markets? The organization, travelling and interfaces between the different stages of treatment at home and abroad are important sources for such costs. Attention has to be paid to non-monetary transaction-costs, which are specific for the demand for medical services abroad. These costs are closely connected to the specific character of a treatment. They are also a parameter for mobility, especially connected to different kinds of illnesses whereby not all of them are eligible for international trade. Mostly, these costs are responsible for a restricted trade in health care due to a prohibitive level. A payment of compensation for immaterial damages could be an instrument for an inducement of demand.

Of course the discussion is incomplete. A number of questions are still open such as the integration of the supply side with a specific form of competition and cross-border hospital choice. Furthermore, a competitive advantage in the case of the integration of foreign suppliers through specific contracts with a foreign supplier is of specific interest. Another important point in this context is the matching process of patients, hospitals and insurance under the discussed inefficiencies. Furthermore, it was assumed that a cost advantage can compensate quality deficits. However, the assumption of a lexicographical configuration of preferences is imaginable whereby the foreign quality must at least be identical with the quality at home. Furthermore, the legal resources abroad are also an important element. As Cortez (2009) shows, U.S. patients are often not able to appraise the legal risks abroad but also at home. Furthermore, it is often a show of strength to become compensated when malpractice take place abroad and at home. These things could have an important influence as a specific risk. Another important point is the insurance itself for which a foreign option is currently not given in most cases. The reason is also based on a kind of trust and the unobservability of the foreign quality.

The potential to carry out a comparative advantage abroad is bounded as long as the assumptions made play a significant role. As a result, cross-border care is mainly possible - if at all - between countries with a high degree of proximity. The discussed assumptions have a relatively obvious impact. However, to underline these is an important point in the context of an internationalization process of health care. Today, this process is in its infancy. Hence it is important to discuss the general possibilities and trade limitations in health services. Firstly, it is important to begin a theoretical discussion not only due to the unavailability of data but also for the creation of a general analytical framework with a connection to health and international economics.

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