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Abstract

This article analyzes the shifts of power relation and influence between pharmaceutical industry (producers), pharmacies, and social health insurers (SHI) in Germany based on drug prices. Since the health care reform of 2004, these interest groups have negotiated fees and discounts among each other without any intervention from the government. These negotiations and resulting amendments to the original law express the shift of power of the involved groups, which can be explained with the Becker (1983) model. As a result, a trend becomes apparent, which shows a slight increase in political pressure on the part of SHI and a big decrease of political pressure on the part of pharmacies and producers. This reflects the cost control trend in combination with the empowerment incentives for SHI. The last years have shown increased competition between the interest groups, resulting in more balanced power relations. Nevertheless, the most powerful group is still the producer group and the influence of SHI is still very low.

Keywords: interest groups, political pressure, health care market, regulation

JEL codes: D78, I39, D72, I18

1 Introduction

Health care systems are subject to a high degree of public regulation. This creates strong incentives for interest groups to gain influence on the government. In the context of drug prices, pharmacies constitute a powerful interest group; two other powerful groups are the group of health insurers as well as the pharmaceutical industry because of its contribution to exports and employment. By way of contrast, patients have little influence on regulation because (fortunately) illness is the exception rather than the rule these days. The insured (including taxpayers in National Health Service-type systems) have little to say individually, but are collectively represented by health insurers and by politicians, as taxpayers. With so many players involved, health care reforms necessarily are the outcome of a quest for influence that reflects the relative power of interest groups. Evidently, an analysis of how the several interest groups influence reforms and their implementation is called for in order to predict the effects of public regulation on health care. However, in much of the health economics literature, this fact is neglected. This had often led to public regulation failing to have the intended effect.

The objective of this article is to provide such an analysis by applying the Becker (1983) model to the German health care system. This model depicts a passive government that is merely responsible for income redistribution using taxes and subsidies. Interest groups put pressure on the government to improve their financial situation. Thus, with political pressure it is possible to increase the subsequent political influence. There is no equivalence principle governing the exchange between the groups. [1] In the context of drug prices in Germany, the competing interest groups are the pharmaceutical industry which is interested in high ex-factory prices and low discount; the pharmacies who are interested in high pharmacy fees and low discount; and the social health insurers (SHI) who are interested in low net prices they have to pay for drugs. Since the reform of 2004, these groups have been negotiating the structure of fees and discounts among each other without any intervention by the government. This accords with the assumption of a passive government in the Becker (1983) model, making it a good choice for application. The negotiation results are laid down in an ordinance called *Arzneimittelpreisverordnung*[1]. The amendments of this ordinance reflect the shift of power and influence among the involved interest groups in the German health care market after 2004. The Becker

[1] This roughly translates into "Regulations for the price of medications".

model provides an explanation of these shifts. This article hypothesizes that a cost control trend in the German health care market in combination with the empowerment incentives for SHI led to more balanced power relations between the actors.

After an overview of the structure of drug prices since the reform of 2004 in the German health care market in Section 2, the Becker model is described in Section 3. Section 4 contains the adaption of this model to the German health care market, which is designed to predict the outcome of the reforms over the past years. In Section 5, the predictions are derived in two variants. First, a closed system with a constant budget is assumed following the theoretical work by Becker. Second, an open system with a budget that changes over the years is assumed. This is followed by a conclusion in Section 6.

2 The price of drugs and the German health care reform of 2004

In January 2004, the health care reform called *GKV-Modernisierungsgesetz*[2] came into force in Germany. There were two changes. First, SHI pays only for prescription drugs, while pharmacies are free to set the prices of over-the-counter-drugs. Second, the calculation of selling prices and net prices for prescription drugs is the result of negotiations over fees and discount negotiations between SHI, pharmacies and the pharmaceutical industry. Before 2004, the selling price of pharmacies contained a fixed percentage markup on the producer's ex-factory price. Table 1 illustrates the formation of the net price paid by SHI for prescription drugs after 2004.

Ex-factory price of producers	
+ wholesale surcharge	3%
+ fixed pharmacy fee	8.35€+0.16€
+ value added tax	19%[3]
= selling price at the pharmacy level	
- co-payment by insured persons	10%
- pharmacy discount	2€
- producer discount	7%
= net price paid by SHI neglecting possible discounts	

Table 1 Formation of drug prices paid by SHI after the 2004 reform [3]

For prescription drugs, the ex-factory price plus 3% wholesale surcharge, plus a fixed pharmacy fee of 8.10€, plus 19% value added tax results in the selling price at the pharmacy level. Since January 2013, the fixed pharmacy fee is 8.35€. Since August 2013, this has been increased by 0.16€ per prescription. The net price paid by SHI results from this selling price minus a co-payment by insured persons (10% per drug with a minimum of 5€ and a maximum of 10€), minus a pharmacy discount of 2€ per drug and minus a producer discount. As of January 2014, the producer discount increased from 6% to 7% per drug. [3]

Since 2004, negotiations have been involving two pairs of players: producers and SHI bargain over the producer discount, pharmacies and SHI bargain over the pharmacy discount and the fixed pharmacy

[2] This roughly translates into "SHI modernization law".
[3] The value added tax was raised from 16% to 19% on 1 January 2007.

fee. The amendments to the original law express the shift of power between these involved groups and will be described in Section 4 applying the Becker (1983) model, which is described next.

3 The Becker model: competition for influence

According to the Becker (1983) model, two interest groups compete for political influence while the government has no interests of its own such as vote maximization. The two interest groups compete about the redistribution of taxes and subsidies. Groups build up political pressure to higher their influence and to better their financial situation. Often, small groups are more productive because they can avoid free riding which lowers the net return of political pressure per group member. [1] A group that becomes more effective in producing political pressure can either reduce the tax it pays or increase the subsidy it receives. If one group increases pressure, subsequent its influence increases, enabling the group to improve its financial situation. Consequently, the influence of the other group decreases, although the group maybe increases the pressure level, causing its financial situation to deteriorate. Each group is assumed to anticipate a given pressure level of the other group when choosing its own level of pressure. [1]

4 Competition between interest groups in the health care market

When applied to the German health care market, taxes and subsidies in the Becker (1983) model become producer discount, pharmacy discount, and fixed pharmacy fee that determine the net price paid by SHI. The groups are defined as *pr* (producers, pharmaceutical industry), *ph* (pharmacies), and *s* (SHI).

4.1 Amount of total discount and fee

The objective of this section is to determine the total budget available to the three groups [for the following equations, see Becker (1983)]. The total SHI budget S_s for paying drugs is given by

$$S_s = n_s F(R_s) \tag{1}$$

with n_s the number of SHI members, the function *F*, which includes the deadweight loss, and the contribution paid by each member R_s. This function includes two kinds of deadweight loss, distribution cost and expenditure for lobbying such that

$$F(R_s) \leq R_s, F' \leq 1, F'' \leq 0. \tag{2}$$

By way of contrast, in the absence of deadweight loss, one would have

$$F(R_s) = R_s, F' = 1, F'' = 0. \tag{3}$$

The budgets available to producers and pharmacies for selling drugs are defined in an analogous way. For producers, it is given by

$$S_{pr} = n_{pr} G\left(R_{pr}\right), \tag{4}$$

with n_{pr} the number of producer members, the function *G*, which includes the deadweight loss, and the contribution received by each member R_{pr}. Due to deadweight loss, it is essential that

$$G\left(R_{pr}\right) \geq R_{pr}, G' \geq 1, G'' \geq 0. \tag{5}$$

In the absence of deadweight loss, one would have

$$G\left(R_{pr}\right) = R_{pr}, G' = 1, G'' = 0. \tag{6}$$

This is pictured in Figure 1, below. In quadrant I, the function G of producers is shown. In the absence of deadweight loss, the function equals the 45° line. In quadrant III, the function F is shown. In the absence of deadweight loss, the function equals the 45° line.

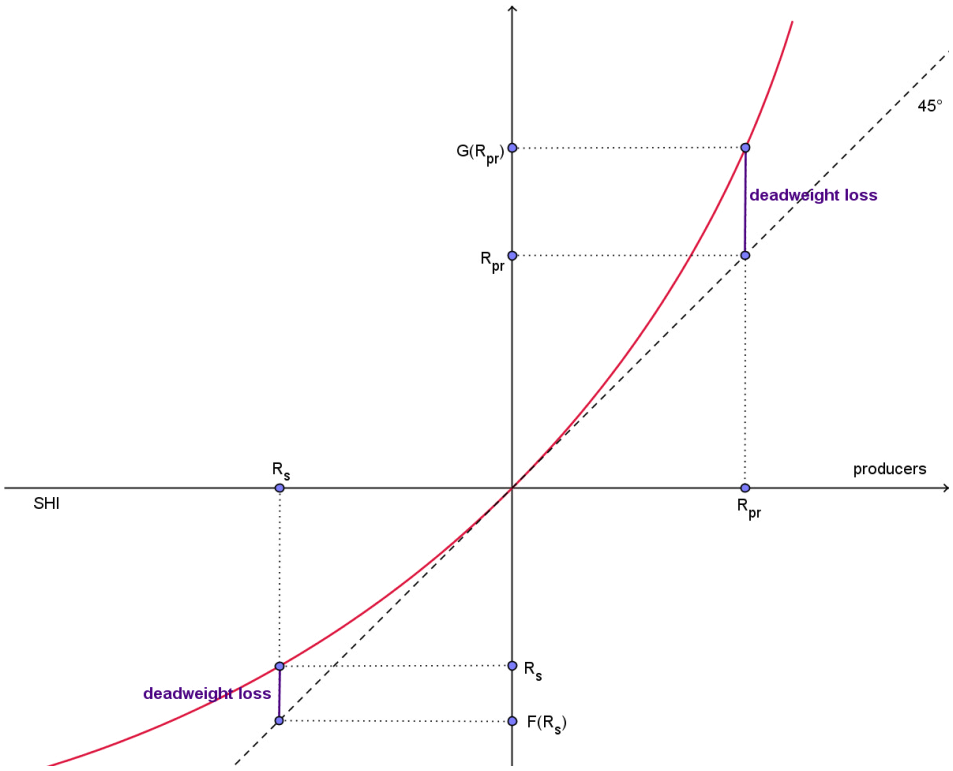

Figure 1 Redistribution of SHI and producers and the resulting deadweight loss

For pharmacies, the budget for selling drugs is given by

$$S_{ph} = n_{ph} G(R_{ph}), \tag{7}$$

with n_{ph} the number of pharmacy members, the function G, which includes the deadweight loss, and the contribution received by each member R_{ph}. Due to deadweight loss, it is essential that

$$G(R_{ph}) \geq R_{ph}, G' \geq 1, G'' \geq 0. \tag{8}$$

In the absence of deadweight loss, one would have

$$G(R_{ph}) = R_{ph}, G' = 1, G'' = 0. \tag{9}$$

The sum of budgets of pharmacies and producers equals the budget of SHI, reflecting the net price paid by SHI,

$$n_{pr} G(R_{pr}) + n_{ph} G(R_{ph}) = S_s. \tag{10}$$

4.2 Influence function of the interest groups

The influence function defined by Becker (1983) involves three elements; the amount of pressure exerted by each of the two groups (first two elements) and other variables (x) (third element, for example the relative size of the two groups). If a group can overcome the free rider problem, it will be able to increase its pressure on the government. If one group can raise thereupon the influence on the government, it lowers the influence on the other group. Influence has a direct effect of the financial situation so that the influence function equals the budget function. Aggregate influence must be zero. [1]

In a first step, SHI bargains with producers over the producer discount. In this case, the influence function involves the following elements; the amount of pressure exerted by SHI (p_s), the amount of pressure exerted by producers (p_{pr}), and other variables (x). The influence functions are thus given by

$$S_s = -I^s(p_s, p_{pr}, x), \tag{11}$$

and

$$S_{pr} = I^{pr}(p_s, p_{pr}, x), \tag{12}$$

respectively.

In another step, SHI bargains with pharmacies over the pharmacy discount and the fixed pharmacy fee. The corresponding influence functions are

$$S_s = -I^s(p_s, p_{ph}, x), \tag{13}$$

and

$$S_{ph} = I^{ph}(p_s, p_{ph}, x), \tag{14}$$

respectively.

The amount of budget provided and the amount of payments received equal the influence functions. Also, the aggregate influence must be zero

$$I^s + (I^{pr} + I^{ph}) = 0. \tag{15}$$

4.3 Reaction functions of producers, pharmacies, and SHI

This Section is devoted to the derivation of pairwise reaction functions. First, let a shock $d\alpha > 0$ impinge on the pressure equilibrium (p_s, p_{pr}), denoted by α. The direct effects of a change $d\alpha$ are s_α and pr_α, respectively [see Becker (1983)]. The variable a describes the resources spent per member to increase the own pressure and to lower the pressure of the other group, respectively; a is supposed to be fixed. The corresponding comparative statics equations can be written in matrix form,

$$\begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \begin{bmatrix} \frac{dp_s}{d\alpha} \\ \frac{dp_{pr}}{d\alpha} \end{bmatrix} - \begin{bmatrix} -s_\alpha \\ -pr_\alpha \end{bmatrix} = 0. \tag{16}$$

The first- and second-order conditions as well as the definitions of a_{11}, a_{12}, a_{21}, and a_{22} are given in the Mathematical Appendix.

With the help of Cramer's rule one obtains

$$\frac{dp_s}{d\alpha} = \frac{-1}{|H|} \begin{bmatrix} -s_\alpha & a_{12} \\ -pr_\alpha & a_{22} \end{bmatrix} \tag{17}$$

with

$$|H| = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}. \tag{18}$$

Integration and setting the integration constant $|H|$ to zero yields

$$p_s = -\frac{s(\alpha)}{a_{11}} - \frac{a_{12}}{a_{11}} p_{pr}. \tag{19}$$

The slope $-\frac{a_{12}}{a_{11}}$ is constant with a fixed a value and describes the marginal effect of competition and lobbying by SHI. With the same steps one obtain

$$p_{pr} = -\frac{pr(\alpha)}{a_{22}} - \frac{a_{21}}{a_{22}} p_s. \tag{20}$$

The slope $-\frac{a_{21}}{a_{22}}$ is constant with a fixed a value and describes the marginal effect of competition and lobbying by producers.

Both reaction curves have a positive slope [$a_{11} < 0$; $a_{22} > 0$; $a_{12} > 0$; $a_{21} < 0$; see Becker (1983) for a detailed analysis].

Next, SHI bargains with pharmacies. Again, a shock impinge on the pressure equilibrium (p_s, p_{ph}), denoted by α. The direct effects of a change $d\alpha$ are s_α and ph_α, respectively. The variable a describes the resources spent per member to increase the own pressure and to lower the pressure of the other group, respectively; a is supposed to be fixed. The corresponding comparative statics equations can be written in matrix form,

$$\begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \begin{bmatrix} \frac{dp_s}{d\alpha} \\ \frac{dp_{ph}}{d\alpha} \end{bmatrix} - \begin{bmatrix} -s_\alpha \\ -ph_\alpha \end{bmatrix} = 0. \tag{21}$$

The corresponding reaction curves are

$$p_s = -\frac{s(\alpha)}{a_{11}} - \frac{a_{12}}{a_{11}} p_{ph}\ , \tag{22}$$

$$p_{ph} = -\frac{ph(\alpha)}{a_{22}} - \frac{a_{21}}{a_{22}} p_s. \tag{23}$$

Now it is possible to pit SHI against both, producers and pharmacies. The comparative statics equations read

$$\begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \begin{bmatrix} \frac{dp_s}{d\alpha} \\ \frac{d(p_{ph}+p_{pr})}{d\alpha} \end{bmatrix} - \begin{bmatrix} -s_\alpha \\ -(ph_\alpha + pr_\alpha) \end{bmatrix} = 0. \tag{24}$$

They can be solved to obtain the reaction curves,

$$p_s = -\frac{s(\alpha)}{a_{11}} - \frac{a_{12}}{a_{11}} (p_{ph} + p_{pr}), \tag{25}$$

$$(p_{ph} + p_{pr}) = -\frac{(ph(\alpha)+pr(\alpha))}{a_{22}} - \frac{a_{21}}{a_{22}} p_s. \tag{26}$$

5 Deriving predictions regarding political pressure and influence

This Section is an attempt to apply the theoretical model to the German health care market. It is difficult to find indicators of influence to apply this theoretical work. Here, indicators for influence are defined with the help of the characteristic values “sales volume”, “economy measure”, “savings” and “expenditures”. The value “sales volume” contains the volume of sales for producers or pharmacies relating to drugs. The value "economy measure" expresses how much producers or pharmacies are affected by the austerity measures and regulations in recent years by the laws in the drug market. The value describes compulsory discounts. In contrast, the value “savings” expresses how much money the SHI was able to save because of austerity measures and regulations. The value “expenditures” characterizes the expenditures for drugs of the SHI. Now, the ratio of sales volume over economy measure is taken as an indicator for political influence by producers or pharmacies:

$$ratio\ producers = I^{pr} = f\left(\frac{sales\ volume}{economy\ measure}\right), \tag{27}$$

$$ratio\ pharmacies = I^{ph} = g\left(\frac{sales\ volume}{economy\ measure}\right). \tag{28}$$

If the ratio of sales volume over force of economy measure is large, the political influence is large, and vice versa. The ratio of savings over expenditures is taken as an indicator for political influence by SHI:

$$ratio\ SHI = I^{S} = h\left(\frac{savings}{expenditures}\right). \tag{29}$$

If the ratio of savings over expenditures is large, the political influence is large, and vice versa. These variables do not involve all aspects of political influence. The fact that “sales volume” and “economy measure” relate to the total drug market whereas “savings” and “expenditures” relate to the prescription drug market is a difficulty as well. In Table 2, the corresponding data taken from Statista are shown covering the years 2005 to 2013.[4] [20][21][22][23][24][25] Not all data are available for all years; they are complete for the years 2008, 2009, and 2010. In a closed system as assumed by Becker, aggregate influence is constant over time. Here, it is normalized to equal 10.

[4] The corresponding diagrams are given in the Data Appendix.

		2005	2006	2007	2008	2009	2010	2011	2012	2013
Producers										
volume of sales	*bn €*	32.400	35.000	37.600	38.300	37.300	37.500	39.200	41.400	42.600
economy measure	*bn €*	0.600	0.980	1.078	0.963	0.928	1.712	2.526	2.502	2.525
ratio producers		54.000	35.714	34.879	39.772	40.194	21.904	15.519	16.547	16.871
normalized ratio*					7.594	7.488	6.431			
Pharmacies										
volume of sales	*bn €*				24.400	25.300	24.600	25.400	25.600	26.700
economy measure	*bn €*			1.340	1.940	1.880	2.030	2.200		
ratio pharmacies					12.577	13.457	12.118	11.545		
normalized ratio*					2.402	2.507	3.558			
SHI										
expenditures	*bn €*	24.670	25.100	27.040	28.390	30.000	30.180	28.980	29.200	30.190
savings	*bn €*			0.100	0.620	0.850	1.100			
ratio SHI				0.004	0.022	0.028	0.036	0.015		
normalized ratio*					0.004	0.005	0.011			

**The ratios sum up to 10.*

Table 2 Volume of sales, economy measure, expenditures, savings, and the corresponding ratios [20][21][22][23][24][25]

5.1 Assumption of a closed system

The assumption of a closed system implies that the amount of money in the market is constant. Consequently, the amount of influence is constant. This assumption leads to the normalized indicator value of Table 2 and is depicted in Figure 2.

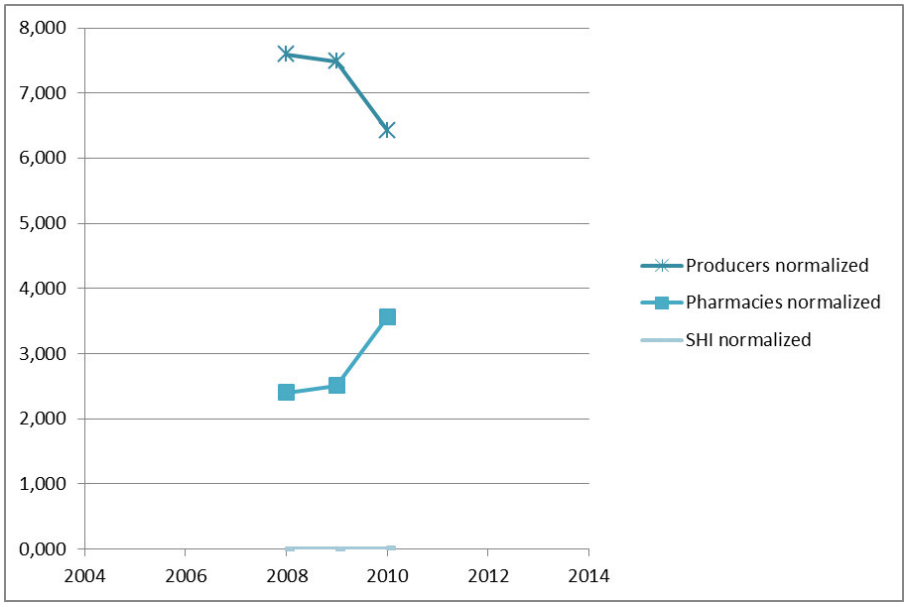

Figure 2 Sales volume/economy measure and savings/expenditures, normalized [20][21][22][23][24][25]

Between 2008 and 2010, the influence of SHI compared to the other two groups is small, with a slight increase from 0.004 to 0.011. The influence of producers is high but decreasing from 7.594 to 6.431.

The pharmacies are located in between with an increase from 2.402 to 3.558. These changes are now interpreted as displacements of the Nash equilibria caused by shifts in the reaction functions calculated in Section 4.3.

In Figure 3, the initial equilibrium e_0 describes the situation of SHI and producers in 2008. The corresponding reaction curves are pr_0 and s_0, respective political pressure of producers is high relative to SHI. As a consequence of the empowerment incentives in favor of SHI during the past few years[5], members of SHI have more individual responsibility and get more active. For example, it is possible to influence the risk structure of insured persons by paying bonuses or impose additional contributions. The SHI reaction curve is therefore shifted outwards to s_1. Ceteris paribus, the new equilibrium is located at e_1, which reflects the situation in 2009. In addition however, laws introduces during the past years lead to a decrease of strength of pharmaceutical producers; for example, the reforms of 2004. The producer reaction curve is shifted downwards, to pr_1. The resulting equilibrium is e_2, which reflects the situation of 2010. The change in the equilibrium characterizes the change in political influence. The political influence by producers decreases about 1.163, the one by SHI increases about 0.007.

[5] The reforms during the last years purpose more competition between social health insurers, for example the law *Gesetz zur Stärkung des Wettbewerbs in der gesetzlichen Krankenversicherung* in 2007. [8]

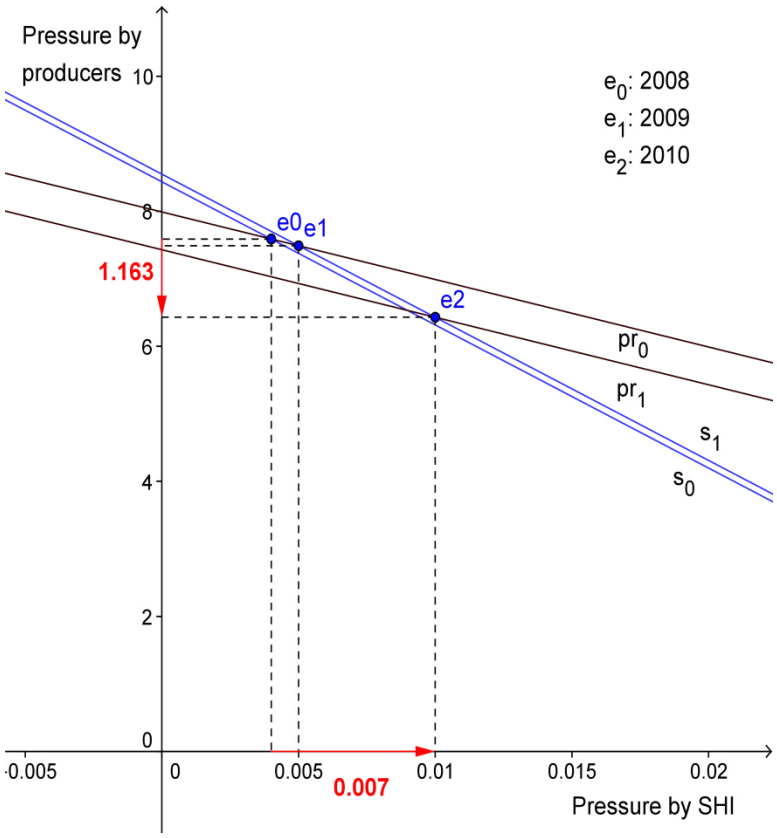

Figure 3 Discount bargaining between producers and SHI

In Figure 4, the initial equilibrium e_0 describes the situation of SHI and pharmacies in 2008. The corresponding reaction curves are ph_0 and s_0. The political pressure of pharmacies is high relative to SHI, but not as high as producers' pressure. In 2009, the reaction curve of SHI is shifted outwards, to s_1. In 2010, that of pharmacies is shifted inwards, to ph_1. The resulting equilibrium is e_2. By comparison with e_0, the influence by pharmacies increases about 1.156 and the one by SHI about 0.007.

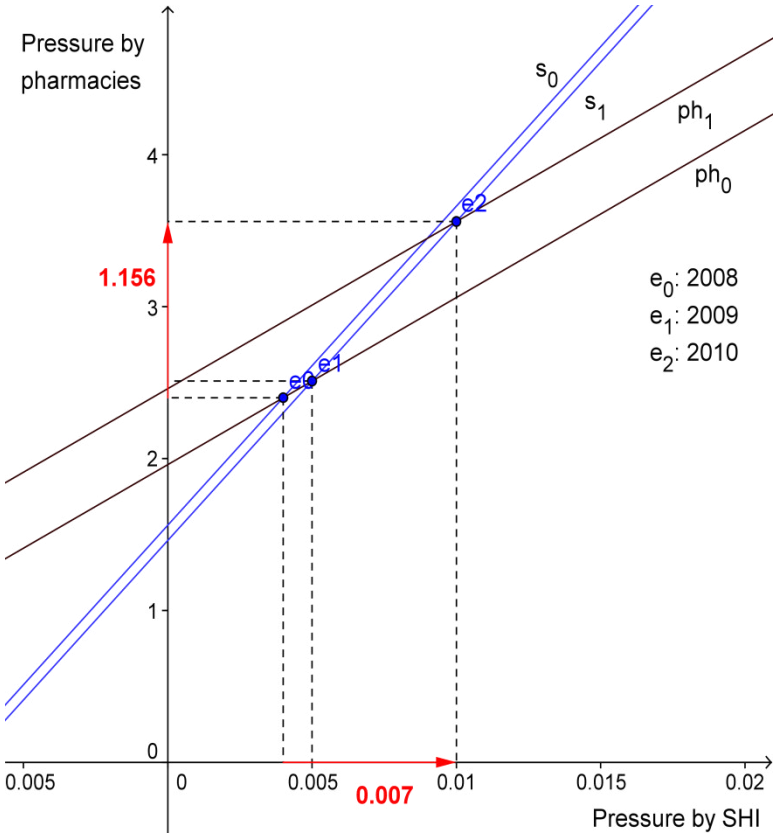

Figure 4 Fee and discount bargaining between pharmacies and SHI

In the aggregate producers and pharmacies can be seen as one group, receiving money for drugs. In Figure 5, the initial equilibrium e_0 describes the situation of SHI, producers and pharmacies in 2008. The political pressure of producers and pharmacies relative to that of SHI is high, mainly due to high pressure by producers. The equilibrium e_2 reflects the situation of 2010. By comparison with e_0, the influence by pharmacies and producers decreases about 0.007 and the one by SHI increases about 0.007. The aggregated influence must be zero. The difference between the reaction curves is very small in this case so that it is hard to see it. Because of this in Figure 5 only the equilibria are pictured.

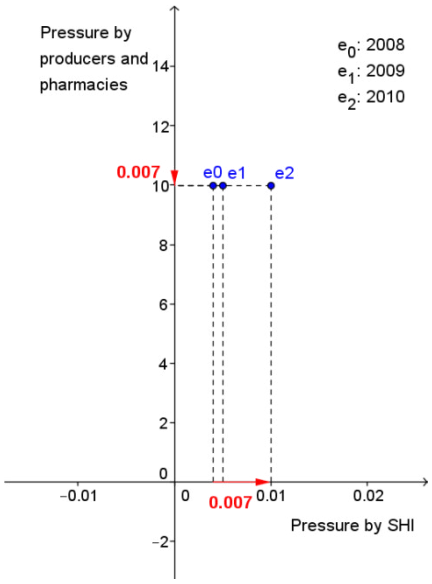

Figure 5 Aggregate fee and discount bargaining

5.2 Assumption of an open system

The assumption of an open system implies that the amount of money in the market is not constant. The total budget which is available for drugs in the market changes every year. Consequently, the amount of influence is variable and based on the corresponding changes without normalization (compare values in Table 2). The corresponding ratios taken from Table 2 are pictured in Figure 6.

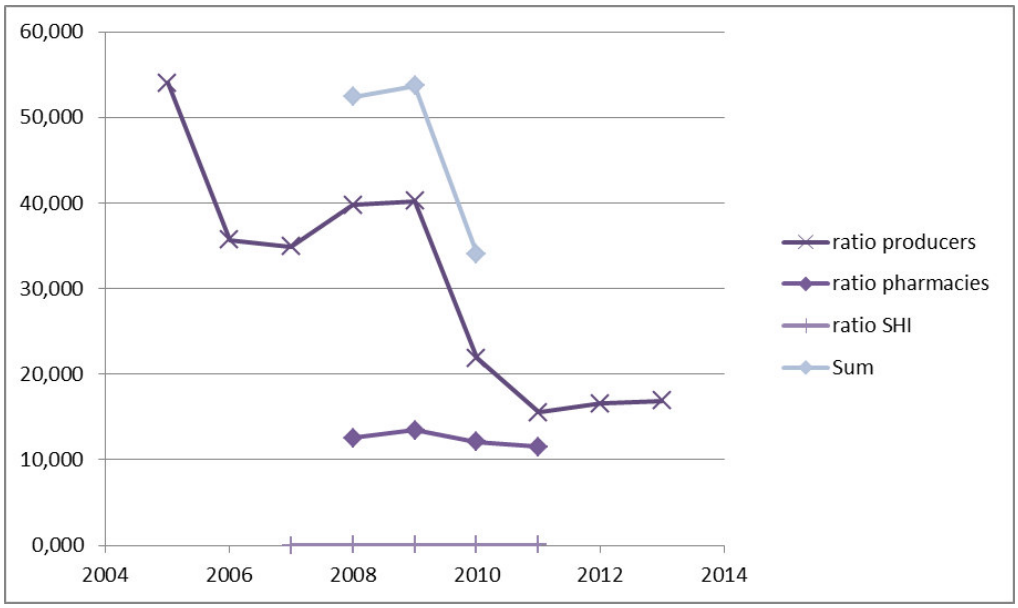

Figure 6 Sales volume/economy measure and savings/ expenditures [18][19][20][21][22][23]

The influence of SHI compared to the other two groups is again small, with a slight increase from 0.022 to 0.036. The influence of producers is high initially, but falls from 54 to 17 within six years. The pharmacies are located in between with a slight decrease from 12.577 to 11.545.[6] The total budget to generate influence decreases. More precisely, the sum of budget and therefore the sum of influence increases from 52.371 to 53.68 between 2008 and 2009; in 2010 the sum is 34.059. The changes documented in Figure 6 can now be interpreted as shifts in the reaction functions.

In Figure 7, the initial equilibrium e_0 describes the situation of SHI and producers in 2008. The corresponding reaction curves are pr_0 and s_0. The political pressure of producers is high relative to SHI. As a consequence of the empowerment incentives in favor of SHI during the past few years[7], the SHI reaction curve is shifted outwards to s_1. Ceteris paribus, the new equilibrium is located at e_1, which reflects the situation in 2009. In addition however, laws during the last years lead to a decrease of strength of pharmaceutical producers. The reaction curve is shifted downwards, to pr_1. The resulting equilibrium is e_2, which reflects the situation of 2010. The political influence by producers decreases about 17.867, the one by SHI increases about 0.015.

[6] Again, it should be noted that the indicator for influence of SHI refers only to the prescription market, while the indicators of producers and pharmacies describe the entire market.

[7] The reforms during the last years purpose more competition between social health insurers, for example the law *Gesetz zur Stärkung des Wettbewerbs in der gesetzlichen Krankenversicherung* in 2007. [8]

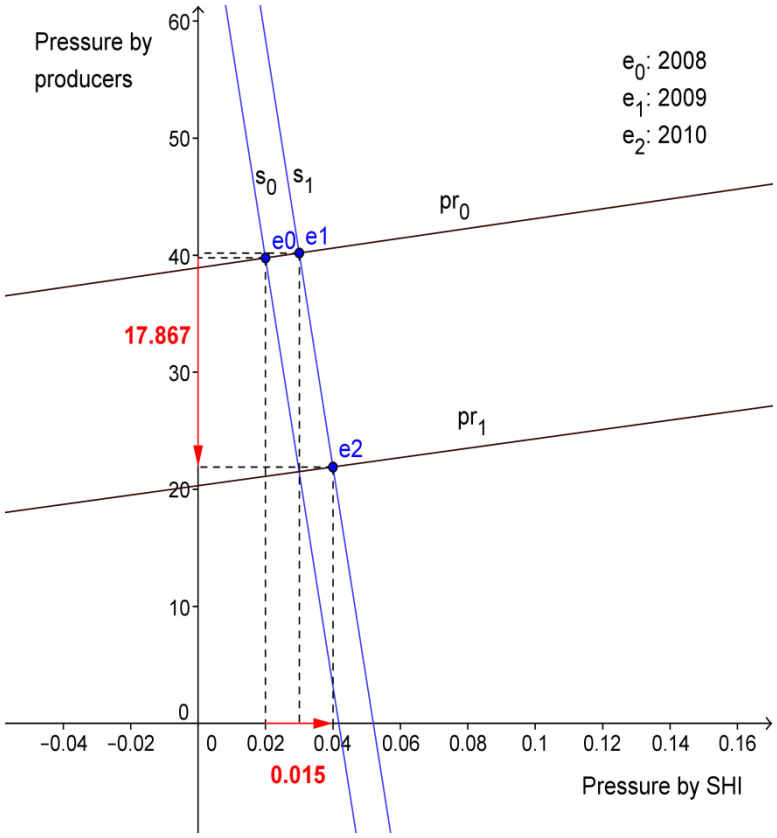

Figure 7 Discount bargaining between producers and SHI

In Figure 8, the initial equilibrium e_0 describes the situation of SHI and pharmacies in 2008. The corresponding reaction curves are ph_0 and s_0. In consequence of the empowerment incentives for SHI, the reaction curve is shifted outwards to s_1, while that of pharmacies is shifted inwards to ph_1. The resulting equilibrium is e_2, which reflects the situation of 2010. The political influence by pharmacies decreases about 0.459, the one by SHI increases about 0.015.

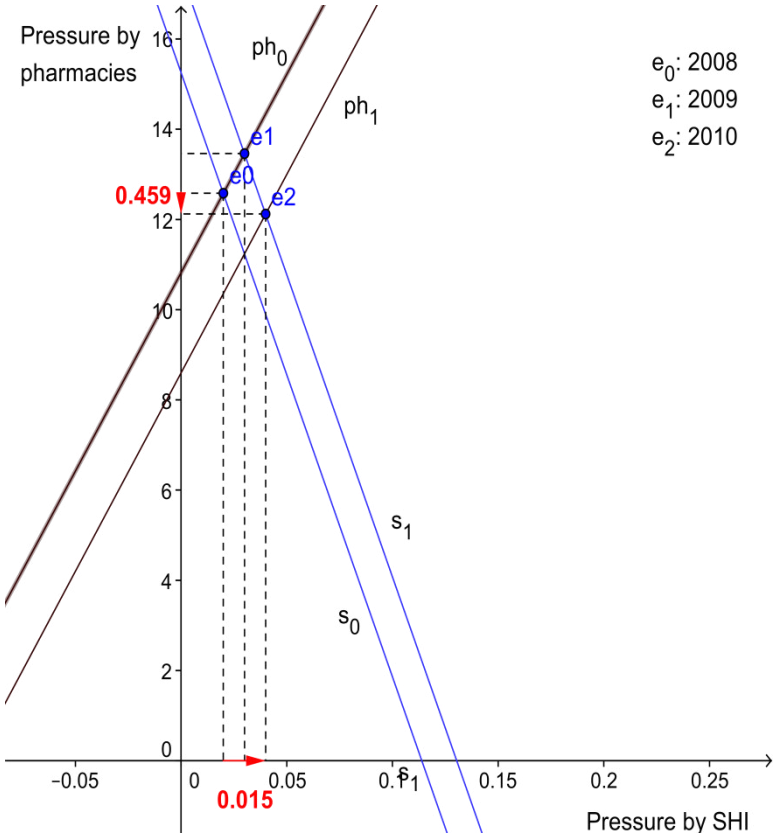

Figure 8 Bargaining over fees between pharmacies and SHI

In the aggregate producers and pharmacies can be seen as one group, receiving money for drugs. In Figure 9, the initial equilibrium e_0 describes the situation of SHI, producers and pharmacies in 2008. The corresponding reaction curves are $(ph + pr)_0$ and s_0. The political pressure of producers and pharmacies relative to that of SHI is high, mainly due to high pressure by producers. As a consequence of the empowerment incentives for SHI, the reaction curve is shifted upwards, to s_1. The reaction curve of producers and pharmacies is shifted downwards, to $(ph + pr)_1$. The resulting equilibrium is e_2, which reflects the situation of 2010. The political influence by producers and pharmacies decreases about 18.326, the one by SHI increases about 0.015. In consequence of cost control laws the scope of pressure incentives of producers and pharmacies is limited more and more. But the incentives to higher the influence by SHI are not strong enough to compensate this limitations.

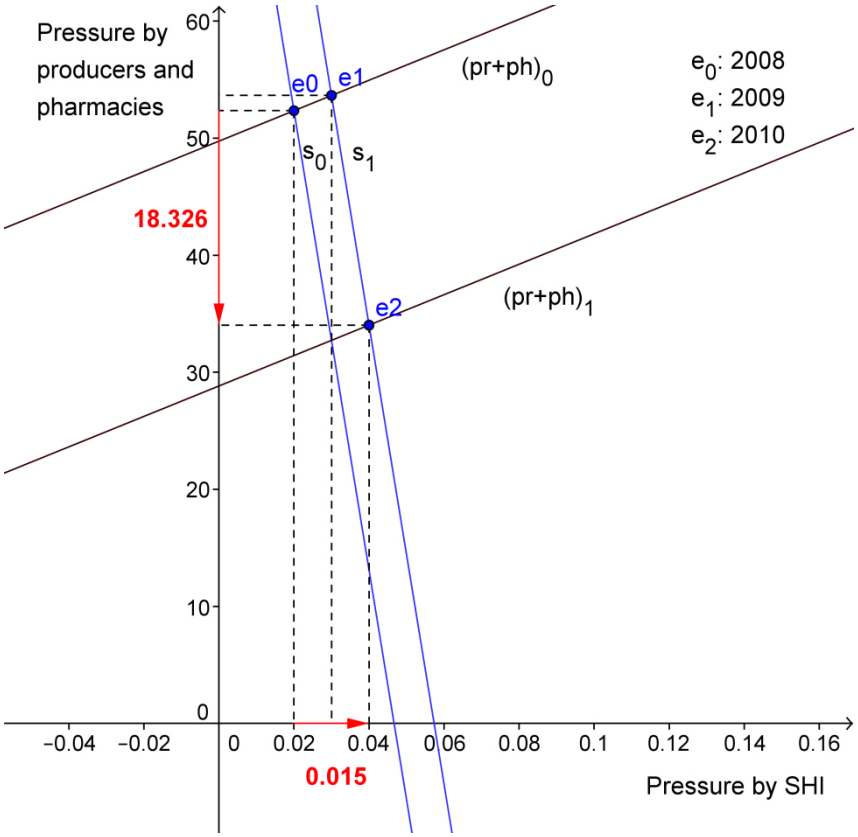

Figure 9 Aggregate fee and discount bargaining

6 Conclusion

Since the reform 2004 in Germany, the pharmacy fees and producer discounts granted to SHI have been negotiated by pharmacies, pharmaceutical producers, and SHI without intervention by the government. The amendments reflect shifts of power between these interest groups that are analyzed using the Becker (1983) model. Becker's assumption of a passive government fits well because of the absence of governance intervention. Reaction curves are derived for two different cases. The first is a closed system as in Becker (1983), with a fixed amount of total health care budget. The normalized influence of producers and pharmacies decreases slightly, whereas that of SHI increases slightly between 2008 and 2010. In the second case the total budget and hence the total influence can change over the years. Indeed, pharmaceutical expenditures increased from Euro 24.67 bn in 2005 to 30.18 bn in 2010 but fell to 29.2 bn by 2012, with a final increase to 30.19 bn in 2013. In real terms, this is an increase of 22% between 2005 and 2013. With the assumption of a changing budget, political

influence by SHI increases slightly as before, but that of producers falls by 70 percent between 2004 and 2013. This reflects the cost control trend in combination with the empowerment incentives for SHI. It proves possible to interpret these changes as displacements of the Nash equilibria caused by shifts in the reaction functions of the three players. The high level of producers influence compared to the other interest groups is noteworthy. In conclusion, the past few years saw a movement towards a more balanced distribution of power. Nevertheless, the most powerful group continues to be the producers, while the influence of SHI is still very low.

Appendix

Mathematical Appendix

Based on equation (16), in this Mathematical Appendix the definitions of a_{11}, a_{12}, a_{21}, and a_{22} are calculated with the first- and second-order conditions. This is done for the bargaining between SHI and producers. With the same steps of calculation one obtains the equations for the bargaining between SHI and pharmacies, and for the aggregated situation. The parameters are described in Section 4. First, the value a_{11} is calculated with the help of the first- and second-order conditions. With equation (16), the following equations by Becker (1983)

$$n_{pr}G(R_{pr}) = I^{pr}(p_s, p_{pr}, x) \tag{A.1}$$

$$p = p(m,n),\ m = a \cdot n \tag{A.2}$$

and the resulting function R_{pr}

$$R_{pr} = \frac{I^{pr}(p_s, p_{pr}, x)}{n_{pr}G'} = \frac{I^{pr}(p_s(a_s n_s, n_s), p_{pr}(a_{pr} n_{pr}, n_{pr}), x)}{n_{pr}G'}. \tag{A.3}$$

it is possible to define the first-order condition:

$$\frac{dR_{pr}}{da_{pr}} = \frac{1}{n_{pr}G'} \frac{\partial I^{pr}}{\partial p_{pr}} \frac{\partial p_{pr}}{\partial m_{pr}} \frac{\partial p_{pr}}{\partial m_{pr}} \frac{\partial m_{pr}}{\partial a_{pr}}. \tag{A.4}$$

With $\frac{\partial m_{pr}}{\partial a_{pr}} = n_{pr}$, $\frac{\partial I^{pr}}{\partial p_{pr}} = I^{pr}_{pr}$ and $\frac{\partial p_{pr}}{\partial m_{pr}} = p^{pr}_{m}$ one obtains

$$\frac{dR_{pr}}{da_{pr}} = \frac{I^{pr}_{pr} p^{pr}_{m}}{G'} = 1. \tag{A.5}$$

This equals 1 because

$$Z_{pr} = Z_0^{pr} + R_{pr} - a_{pr}, \tag{A.6}$$

$$R_{pr} = a_{pr} + Z_{pr} - Z_0^{pr}, \tag{A.7}$$

$$\frac{dR_{pr}}{da_{pr}} = 1. \tag{A.8}$$

Z_0^{pr} is the income of producer members before the government redistribution and Z_{pr} the income of producer members after the government redistribution.

Consequently, the second-order condition is

$$\frac{d^2R_{pr}}{da_{pr}^2} = \frac{d\left(\frac{I_{pr}^{pr}p_m^{pr}}{G'}\right)}{da_{pr}} \tag{A.9}$$

with

$$\frac{d\left(I_{pr}^{pr}p_m^{pr}\right)}{da_{pr}} = \frac{\partial I_{pr}^{pr}}{\partial a_{pr}}p_m^{pr} + \frac{\partial p_m^{pr}}{\partial a_{pr}}I_{pr}^{pr} = \frac{\partial I_{pr}^{pr}}{\partial p_{pr}}\frac{\partial p_{pr}}{\partial m_{pr}}\frac{\partial m_{pr}}{\partial a_{pr}}p_m^{pr} + \frac{\partial p_m^{pr}}{\partial m_{pr}}\frac{\partial m_{pr}}{\partial a_{pr}}I_{pr}^{pr}. \tag{A.10}$$

With $\frac{\partial m_{pr}}{\partial a_{pr}} = n_{pr}$, $\frac{\partial p_{pr}}{\partial m_{pr}} = p_m^{pr}$, $\frac{\partial I_{pr}^{pr}}{\partial p_{pr}} = I_{prpr}^{pr}$, and $\frac{\partial p_m^{pr}}{\partial m_{pr}} = p_{mm}^{pr}$ one obtains

$$\frac{d\left(I_{pr}^{pr}p_m^{pr}\right)}{da_{pr}} = I_{prpr}^{pr}\left(p_m^{pr}\right)^2 n_{pr} + p_{mm}^{pr}n_{pr}I_{pr}^{pr}, \tag{A.11}$$

which results with the help of the quotient rule in

$$\frac{d^2R_{pr}}{da_{pr}^2} = \frac{\left(I_{prpr}^{pr}\left(p_m^{pr}\right)^2 n_{pr} + p_{mm}^{pr}n_{pr}I_{pr}^{pr}\right)G'}{(G')^2} - \frac{I_{pr}^{pr}p_m^{pr}G''}{(G')^2} = \frac{\left(I_{prpr}^{pr}\left(p_m^{pr}\right)^2 n_{pr} + p_{mm}^{pr}n_{pr}I_{pr}^{pr}\right)}{G'} - \frac{I_{pr}^{pr}p_m^{pr}G''}{(G')^2}. \tag{A.12}$$

Finally, the second-order conditions differentiated with respect to any $\propto$ derivates the value a_{11}:

$$a_{11} = \frac{\frac{d^2R_{pr}}{da_{pr}^2}}{\frac{dp_{pr}}{da_{pr}}}. \tag{A.13}$$

With $\frac{dp_{pr}}{da_{pr}} = \frac{\partial p_{pr}}{\partial m_{pr}}\frac{\partial m_{pr}}{\partial a_{pr}} = p_m^{pr}n_{pr}$ one obtains the notation used by Becker (1983)

$$a_{11} = \frac{\left(I_{prpr}^{pr}\left(p_m^{pr}\right)^2 n_{pr} + p_{mm}^{pr}n_{pr}I_{pr}^{pr}\right)}{G'p_m^{pr}n_{pr}} - \frac{I_{pr}^{pr}p_m^{pr}G''}{(G')^2p_m^{pr}n_{pr}} = \frac{I_{prpr}^{pr}p_m^{pr} + \left(p_{mm}^{pr}I_{pr}^{pr}\right)/p_m^{pr}}{G'} - \frac{I_{pr}^{pr}G''}{(G')^2n_{pr}}. \tag{A.14}$$

With the same steps of calculation one obtains the value a_{22}. With the following equation by Becker (1983)

$$n_s F(R_s) = -I^s(p_s, p_{pr}, x) \tag{A.15}$$

and the resulting function R_s

$$R_s = -\frac{I^s(p_s,p_{pr},x)}{n_s F'} = -\frac{I^s(p_s(a_s n_s,n_s),p_{pr}(a_{pr} n_{pr},n_{pr}),x)}{n_s F'} \tag{A.16}$$

it is possible to define the first-order condition:

$$\frac{dR_s}{da_s} = -\frac{1}{n_s F'}\frac{\partial I^s}{\partial p_s}\frac{\partial p_s}{\partial m_s}\frac{\partial p_s}{\partial m_s}\frac{\partial m_s}{\partial a_s}. \tag{A.17}$$

With $\frac{\partial m_s}{\partial a_s} = n_s$, $\frac{\partial I^s}{\partial p_s} = I_s^s$, and $\frac{\partial p_s}{\partial m_s} = p_m^s$ one obtains

$$\frac{dR_s}{da_s} = -\frac{I_s^s p_m^s}{F'} = -1. \tag{A.18}$$

This equals 1 because

$$Z_s = Z_0^s - R_s - a_s, \tag{A.19}$$

$$R_s = -a_s + Z_s - Z_0^s, \tag{A.20}$$

$$\frac{dR_s}{da_s} = -1. \tag{A.21}$$

Z_0^s is the income of SHI members before the government redistribution and Z_s the income of SHI members after the government redistribution.

Because of $-I^s = I^{pr}$ one obtains

$$\frac{dR_s}{da_s} = \frac{I_s^{pr} p_m^s}{F'} = -1. \tag{A.22}$$

Consequently, the second-order condition is

$$\frac{d^2 R_s}{da_s^2} = \frac{d\left(\frac{I_s^{pr} p_m^s}{F'}\right)}{da_s} \tag{A.23}$$

with

$$\frac{d(I_s^{pr} p_m^s)}{da_s} = \frac{\partial I_s^{pr}}{\partial a_s} p_m^s + \frac{\partial p_m^s}{\partial a_s} I_s^{pr} = \frac{\partial I_s^{pr}}{\partial p_{pr}} \frac{\partial p_s}{\partial m_s} \frac{\partial m_s}{\partial a_s} p_m^s + \frac{\partial p_m^s}{\partial m_s} \frac{\partial m_s}{\partial a_s} I_s^{pr}. \quad \text{(A.24)}$$

With $\frac{\partial m_s}{\partial a_s} = n_s$, $\frac{\partial p_s}{\partial m_s} = p_m^s$, $\frac{\partial I_s^{pr}}{\partial p_s} = I_{ss}^{pr}$, and $\frac{\partial p_m^s}{\partial m_s} = p_{mm}^s$ one obtains

$$\frac{d(I_s^{pr} p_m^s)}{da_s} = I_{ss}^{pr} (p_m^s)^2 n_s + p_{mm}^s n_s I_s^{pr} \quad \text{(A.25)}$$

which results with the help of the quotient rule in

$$\frac{d^2 R_s}{da_s^2} = \frac{(I_{ss}^{pr} (p_m^s)^2 n_s + p_{mm}^s n_s I_s^{pr}) F\prime}{(F')^2} - \frac{I_s^{pr} p_m^s F''}{(F')^2} = \frac{(I_{ss}^{pr} (p_m^s)^2 n_s + p_{mm}^s n_s I_s^{pr})}{F\prime} - \frac{I_s^{pr} p_m^s F''}{(F')^2}. \quad \text{(A.26)}$$

Because of $I_s^{pr} = -I_s^s$ one obtains

$$\frac{d^2 R_s}{da_s^2} = \frac{(I_{ss}^{pr} (p_m^s)^2 n_s + p_{mm}^s n_s I_s^{pr})}{F\prime} + \frac{I_s^s p_m^s F''}{(F')^2}. \quad \text{(A.27)}$$

Finally, the second-order conditions differentiated with respect to any $\propto$ derivates the value a_{22}:

$$a_{22} = \frac{\frac{d^2 R_s}{da_s^2}}{\frac{dp_s}{da_s}}. \quad \text{(A.28)}$$

With $\frac{dp_s}{da_s} = \frac{\partial p_s}{\partial m_s} \frac{\partial m_s}{\partial a_s} = p_m^s n_s$ one obtains the notation used by Becker (1983)

$$a_{22} = \frac{I_{ss}^{pr} p_m^s + (p_{mm}^s I_s^{pr})/p_m^s}{F\prime} + \frac{I_s^s F''}{(F')^2 n_s}. \quad \text{(A.29)}$$

The values a_{12} and a_{21} can be calculated with the help of the cross-derivative. Three equations by Becker (1983) are helpful for these next steps:

$$\frac{G'}{F'} = -\frac{I_{pr}^{pr} p_m^{pr}}{I_s^{pr} p_m^s} \rightarrow 1 = -\frac{I_s^{pr} p_m^s G'}{I_{pr}^{pr} p_m^{pr} F'} \quad \text{(A.30)}$$

$$R_{pr} = \frac{I^{pr}}{n_{pr} G\prime} \rightarrow \frac{dR_{pr}}{da_{pr}} = \frac{I_{pr}^{pr} p_m^{pr}}{G\prime} \quad \text{(A.31)}$$

$$R_s = -\frac{I^s}{n_s F\prime} \rightarrow \frac{dR_s}{da_s} = \frac{I_s^{pr} p_m^s}{F\prime} \quad \text{(A.32)}$$

The value a_{12} is defined as

$$a_{12} = \frac{\frac{d\left(\frac{dR_{pr}}{da_{pr}}\right)}{da_s}}{\left(-p_m^s n_{pr} \frac{G'}{F'}\right)}. \tag{A.33}$$

Becker (1983) uses the notation

$$a_{12} = \frac{I_{prs}^{pr} p_m^{pr}}{G'} + \frac{I_{pr}^{pr} p_m^{pr} G'' F'}{(G')^3 p_m^s n_{pr}}, \tag{A.34}$$

which can be calculated with

$$\frac{d\left(\frac{dR_{pr}}{da_{pr}}\right)}{da_s} = \frac{I_{prs}^{pr} p_m^s p_m^{pr} n_s G' - I_{pr}^{pr} p_m^{pr} G''}{(G')^2} = \frac{I_{prs}^{pr} p_m^s p_m^{pr} n_s}{G'} - \frac{I_{pr}^{pr} p_m^{pr} G''}{(G')^2}, \tag{A.35}$$

which results in

$$a_{12} = \frac{I_{prs}^{pr} p_m^s p_m^{pr} n_s F'}{-G' p_m^s n_{pr} G'} - \frac{I_{pr}^{pr} p_m^{pr} G'' F'}{-(G')^2 p_m^s n_{pr} G'} = \frac{I_{prs}^{pr} p_m^{pr} n_s F'}{-(G')^2 n_{pr}} + \frac{I_{pr}^{pr} p_m^{pr} G'' F'}{(G')^3 p_m^s n_{pr}}, \tag{A.36}$$

with

$$F' = -\frac{G' I_s^{pr} p_m^s}{I_{pr}^{pr} p_m^{pr}}, \tag{A.37}$$

which results in

$$a_{12} = \frac{I_{prs}^{pr} p_m^{pr} n_s G' I_s^{pr} p_m^s}{(G')^2 n_{pr} I_{pr}^{pr} p_m^{pr}} + \frac{I_{pr}^{pr} p_m^{pr} G'' F'}{(G')^3 p_m^s n_{pr}} = \frac{I_{prs}^{pr} n_s I_s^{pr} p_m^s}{G' n_{pr} I_{pr}^{pr}} + \frac{I_{pr}^{pr} p_m^{pr} G'' F'}{(G')^3 p_m^s n_{pr}}, \tag{A.38}$$

and with

$$I_s^{pr} p_m^s n_s = I_{pr}^{pr} p_m^{pr} n_{pr}, \tag{A.39}$$

$$p_m^{pr} = \frac{I_s^{pr} p_m^s n_s}{I_{pr}^{pr} n_{pr}}, \tag{A.40}$$

which finally results in the Becker notation (A.34).

The value a_{21} is defined as

$$a_{21} = \frac{\frac{d\left(\frac{dR_S}{da_S}\right)}{da_{pr}}}{\left(-p_m^{pr} n_s \frac{F\prime}{G\prime}\right)} \quad . \tag{A.41}$$

Similar to the value a_{21}, Becker (1983) uses the notation

$$a_{21} = \frac{I_{spr}^{pr} p_m^s}{F\prime} - \frac{I_s^s p_m^s F'' G'}{(F')^3 p_m^{pr} n_s}, \tag{A.42}$$

which can be calculated with

$$\frac{d\left(\frac{dR_S}{da_S}\right)}{da_{pr}} = \frac{I_{spr}^{pr} p_m^{pr} p_m^s n_{pr}}{F\prime} - \frac{I_s^{pr} p_m^s F\prime\prime}{(F')^2}, \tag{A.43}$$

which results in

$$a_{21} = \frac{I_{spr}^{pr} p_m^{pr} p_m^s n_{pr} G'}{-F' p_m^{pr} n_s F'} + \frac{I_s^{pr} p_m^s F'' G'}{(F')^2 p_m^{pr} n_s F'} = \frac{I_{spr}^{pr} p_m^s n_{pr} G'}{-(F')^2 n_s} - \frac{I_s^s p_m^s F'' G'}{(F')^3 p_m^{pr} n_s}, \tag{A.44}$$

with

$$G' = -\frac{F\prime I_{pr}^{pr} p_m^{pr}}{I_s^{pr} p_m^s}, \tag{A.45}$$

which results in

$$a_{21} = \frac{I_{spr}^{pr} n_{pr} I_{pr}^{pr} p_m^{pr}}{F\prime n_s I_s^{pr}} - \frac{I_s^s p_m^s F'' G'}{(F')^3 p_m^{pr} n_s}, \tag{A.46}$$

and with

$$p_m^s = \frac{I_{pr}^{pr} p_m^{pr} n_{pr}}{I_s^{pr} n_s}, \tag{A.47}$$

which finally results in the Becker notation (A.42).

Data Appendix

In this paper, indicators for influence are defined with the help of the characteristic values “sales volume”, “economy measure”, “savings” and “expenditures” (compare Table 2). These data are taken from the following Figures taken from Statista.

The ratio of sales volume over economy measure is taken as an indicator for political influence by producers or pharmacies. The following Figures show the volume of sales and economy measures of producers and the corresponding data of pharmacies.

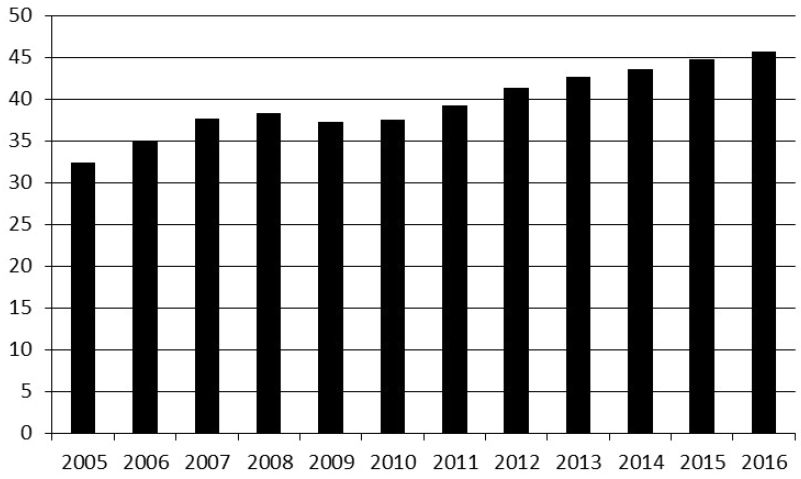

Figure A.1 Volume of sales of producers in bil. € [20]

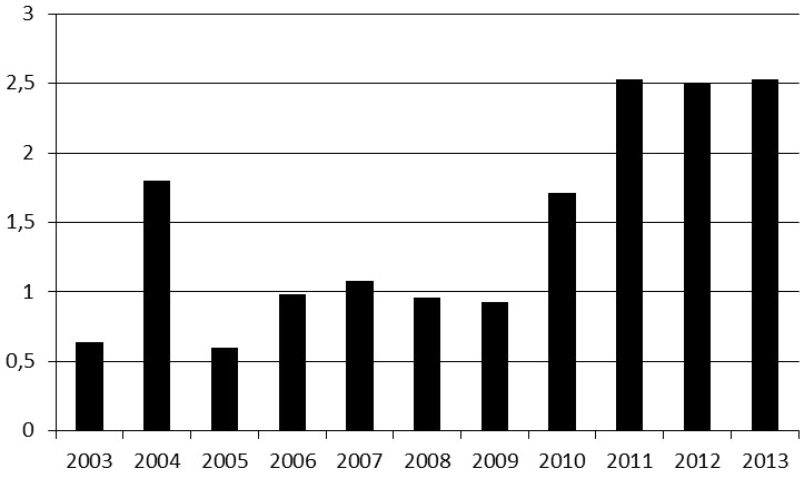

Figure A.2 Economy measures of producers in bil. € [21]

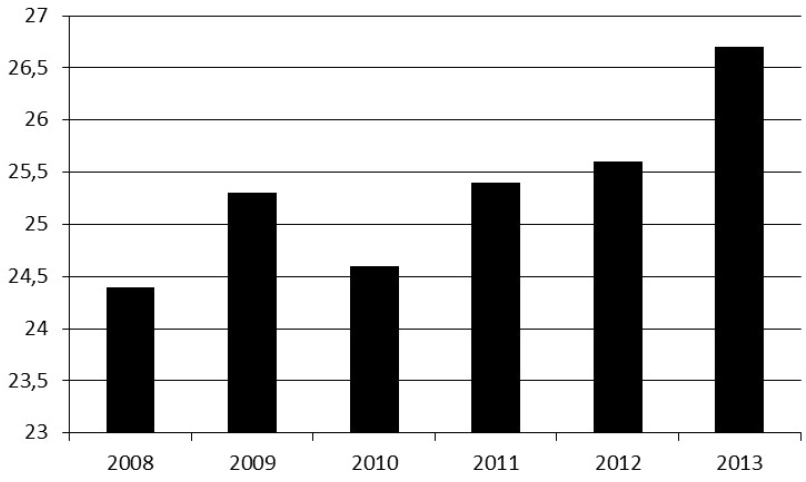

Figure A.3 Volume of sales of pharmacies in bil. € [22]

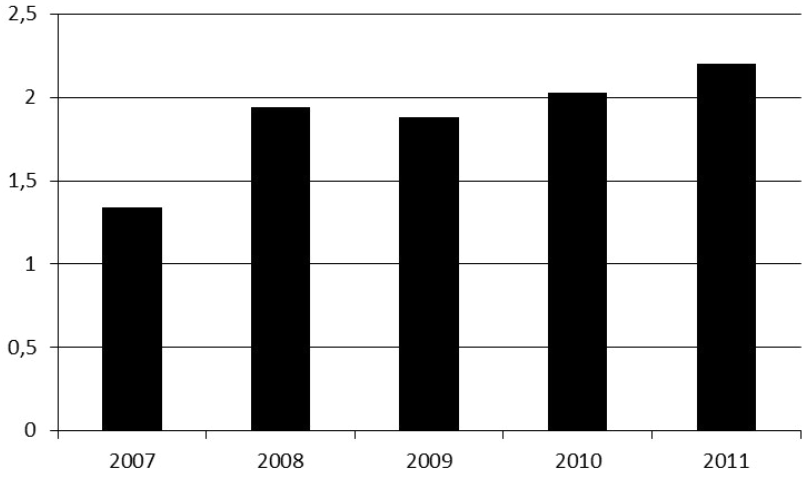

Figure A.4 Economy measures of pharmacies in bil. € [23]

The ratio of savings over expenditures is taken as an indicator for political influence by SHI. The following Figures show the expenditures and the savings of SHI.

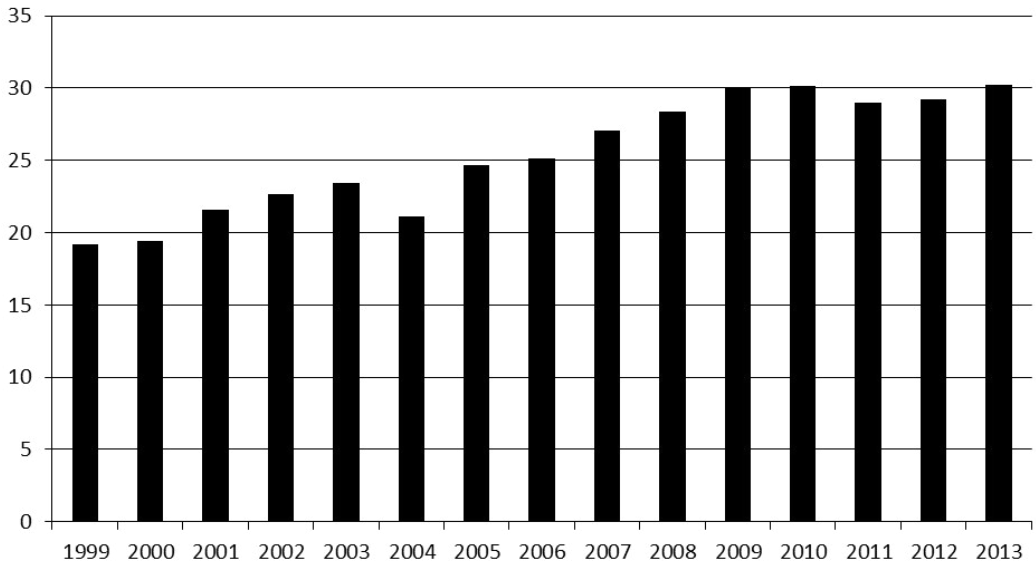

Figure A.5 Expenditures of SHI in bil. € [24]

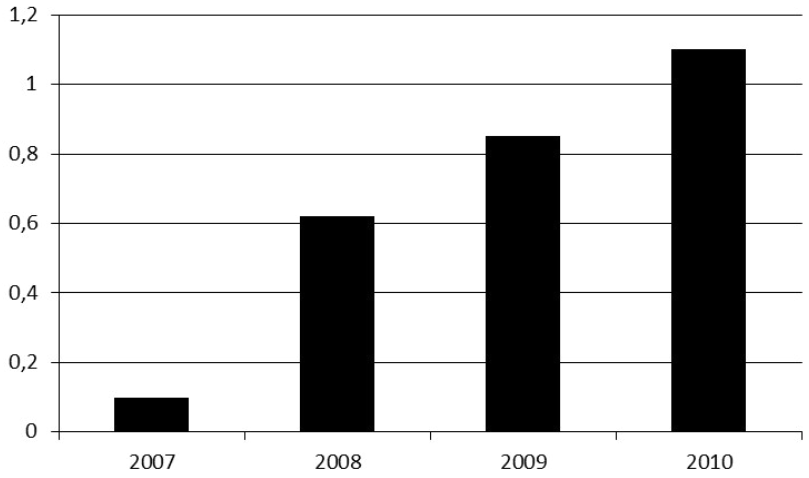

Figure A.6 Savings of SHI in bil. € [25]

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