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Drug Prices, Rents, and Votes in the German Health Care Market: An Application of the Peltzman Model

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Abstract

Using the health care reform of 2004 as an experience, the reaction of consumers (insured persons) and producers (pharmaceutical industry) based on electoral behavior and relating to drug prices and co-payments imposed on drugs is analyzed. The changes in prices and medications after this reform make it to a natural choice. For the analysis, the interest group model by Peltzman (1976) is applied to the German health care market. The vote-maximizing government has to find the optimal combination of rent and price of regulation. As a result, the vote-maximizing outcome is determined by a price level which reflects the interests of consumers as well as the pharmaceutical industry. The analysis of the reaction of consumers related to the co-payment rules of 2004 leads to the hypothesis that the regulator, and finally the pharmaceutical industry, sets drug prices in a way that they are ranging from 5 to 50 Euro. Prices between 50 and 100 Euro are possible as well, reflecting a balance of power facing the pharmaceutical industry. Producers who had accepted the 1989 reference price had an incentive to increase their price while lowering their sales volume.

Keywords: German health care market, interest groups, political pressure, lobbyism

JEL codes: D72, D78, I39

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 as the regulator in health care. In most industrial countries, physicians constitute a powerful interest group; another one is defined by health insurers. Where the pharmaceutical industry importantly contributes to exports and employment, it cannot be neglected either. By way of contrast, patients have little influence on regulation because (fortunately) illness is the exception rather than the rule these days. The insured (the taxpayers, respectively in National Health Service-type systems) individually have little to say but are collectively represented by health insurers (politicians, respectively).

With so many players involved, health care reforms necessarily are the outcome of a quest for influence reflecting the relative power of interest groups. Evidently, for predicting the effects of public regulation in health care, an analysis of how the several interest groups influence its creation and implementation is called for. However, in much of the health economics literature, this fact is neglected, with the consequence that public regulation fails to have the intended effect. The objective of this article is to provide such an analysis by applying the Peltzman (1976) model to the German health care reform of 2004. This model depicts a vote-maximizing regulator, with votes contributed by producers (who benefit from a high regulated price) and consumers (who are hurt by a high price). [15] In the case of the 2004 reform, the two competing interest groups are the pharmaceutical industry (which is interested in high sales prices) and consumers (who are represented by the association of social health insurers, seeking low out-of-pocket prices). The 2004 reform is a telling example because it introduced a complicated co-payment schedule designed to protect certain groups of patients from high drug prices. The German experience is also of interest because a reference price system was introduced in 1989. A joint committee of physicians and health insurers established a price distribution of preparations, deemed to be of comparable efficacy. A reference price somewhat below the median was set. Prescriptions with a price at or below the benchmark were free of charge to socially insured patients, whereas those with a price above it entailed a co-payment equal to the excess. Since then, prices of the two categories of drugs have been diverging (see Figure 1 below). However, the 2004

reform had the puzzling consequence that preparations with prices below the reference level suddenly became more expensive, while those above the benchmark became significantly cheaper. The Peltzman model will be shown to provide an explanation of this unexpected phenomenon.

After an overview of the history of drug prices and the reform of 2004 in the German health care market in Section 2, the Peltzman model is described in Section 3. Section 4 contains the adaption of this model to the German health care market designed to predict the outcome of the 2004 reform. In Section 5 the deriving predictions are discussed, followed by a conclusion in Section 6.

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

Since 1980, the WIdO, the scientific institute of a German statutory health insurance, has been analyzing the German drug market. It created a price index for drugs covered by social health insurance (SHI). [20] The index reflects a basket of preparations, which is adapted annually. [22] It excludes medications paid by private insurance, used in hospitals, and bought without prescription. Until 2001, the data set is based on a sample, since then it includes all prescriptions. [21] Prices are measured at the pharmacy level.

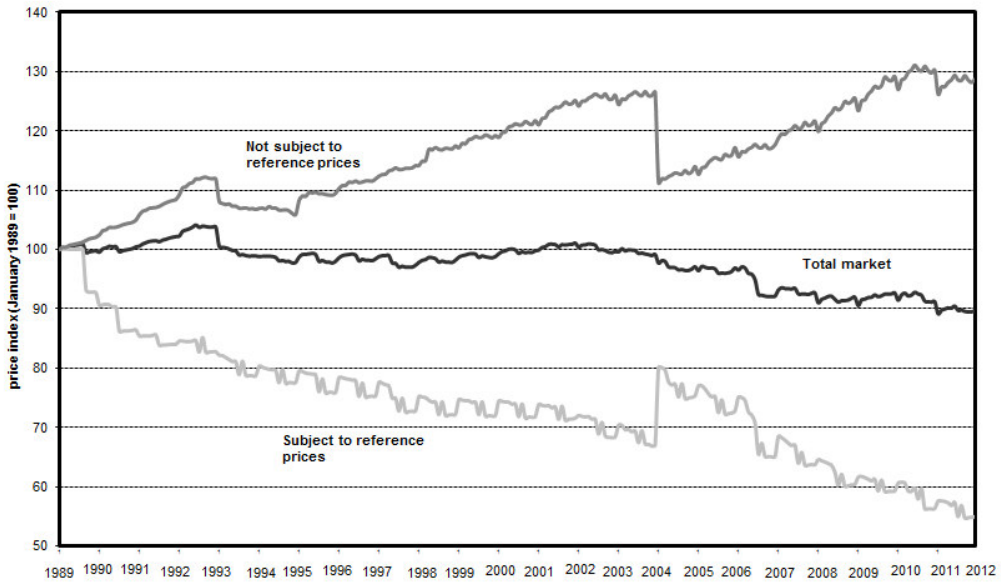

Figure 1 Price index related to different market segments from 1989 to 2012[1] [18]

In Figure 1, two features are noteworthy. First, with the introduction of reference prices in 1989, drugs that were rated similar to a generic became 20 percent cheaper within four years. Conversely, innovative pharmaceuticals, which are exempt from reference pricing, exhibit an upward drift in price, which however does not prevent the overall price index from slowly falling. Second, there are two spikes in 2004. Preparations not subject to reference prices are dropped by more than 10 percent on average, while those subject to price regulation shot up by almost 12 percent.

In January 2004, the health care reform called *GKV-Modernisierungsgesetz* came into force. It makes patients to pay 10% of the pharmacy selling price for drugs with a minimum of 5€ and a maximum of

[1] Beginning 1991, the data include former communist East Germany.

10€[2]. Based on these co-payment rules, four cases can be distinguished. If the price of the drug is less than 5€, consumers have to pay themselves. If the price lies between 5€ and 50€, they have to pay the minimum of 5€. Between 50€ and 100€, they have to pay 10%, while above 100€, the maximum of 10€ co-payment is reached.

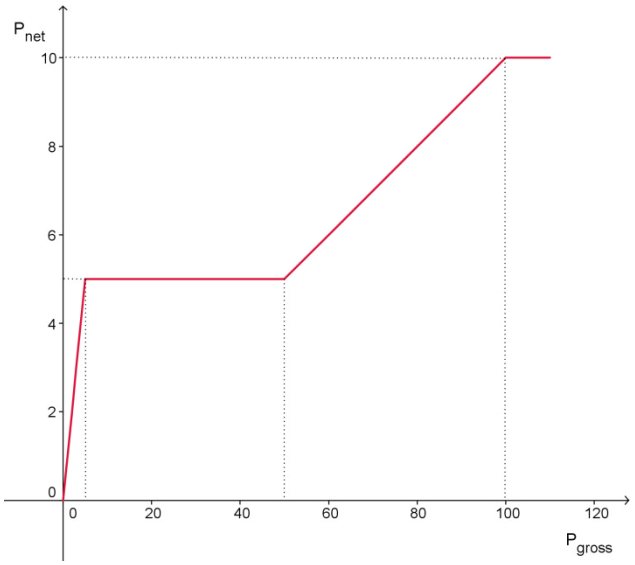

Figure 2 Relationship between gross and net price of drugs (in Euro)

Figure 2 illustrates the relationship between the gross price (i.e. the sales price at the pharmacy) and the net price (i.e. the amount paid out-of-pocket). In the following Table some price examples are illustrated.

P_{gross}	1	3	5	7	10	60	80	110	500
P_{net}	1	3	5	5	5	6	8	10	10

Table 1 Gross and net prices for drugs after the reform of 2004 (in Euro)

The function of gross and net prices is of crucial importance for the application of the Peltzman (1976) model to the reform of 2004.

[2] Annual co-payment amount is capped of 2% of gross income (1% in case of a chronic illness). This amount includes all co-payments, not only for drugs, but also for hospitals and other medical expenses.

3 The Peltzman model: Vote maximization of politicians

According to the model by Peltzman (1976), government seeks to maximize votes by regulating the price of a product. A high price serves to boost rent for producers, who contribute to votes (also through campaign contributions). However, it hurts consumer, who may sanction the government at the polls. Peltzman extended the analysis by Stigler (1971), who focused exclusively on the producer group interest. [15] The more recent model by Becker (1983) is less suitable in the present context because he acts on the assumption of a passive government, which only redistributes funds. [1] In the present context, the producers are the pharmaceutical industry and the consumers (potential) patients. Although ineffective as a lobby group, they have political influence through elections.

In the Peltzman model the relative power of interest groups shapes the regulator's utility function. He questioned by occurring regulation how it will modify the unregulated price structure and how it will change the division of the gains over time. In doing so, the maximum price is the monopoly price P_m and the minimum price the competitive price P_C. Let V denote the number of votes gained by a politician reflecting the impact of regulation on the utility of producers and consumers. [4] With U_P the utility of producers and U_C the utility of consumers, one has

$$V = V(U_P, U_C),\ \frac{\partial V}{\partial U_P} > 0,\ \frac{\partial V}{\partial U_C} > 0 \tag{1}$$

These utilities are equated to producer and consumer surplus [4], respectively:

$$U_P = \alpha(p) \tag{2}$$

$$U_C = \theta - \alpha(p) - \beta(p) \tag{3}$$

Producer surplus α is maximal if the politician permits the producer to set the monopoly price P_m (see Figure 3). As to consumers, their surplus is given by their willingness to pay in excess of marginal cost MC minus α minus the deadweight loss β caused by a price that exceeds MC (MR symbolizes marginal revenue). [4]

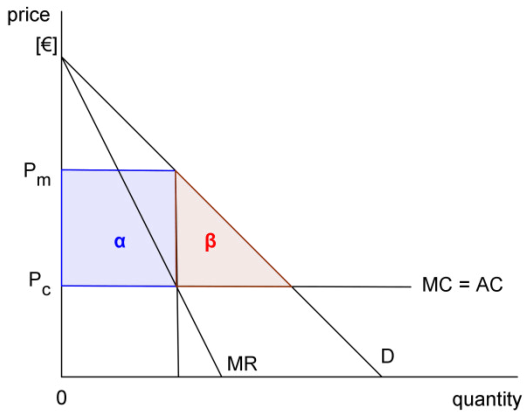

Figure 3 Producer surplus and deadweight loss

The objective is to derive the regulator's utility maximum in order to determine the regulated price (lying between P_m and $P_C = MC$). For $\frac{dV}{dp}$, note first that dV is given by

$$dV = \frac{\partial V}{\partial U_p} dU_p + \frac{\partial V}{\partial U_c} dU_c \, . \tag{4}$$

From equation (2), one has

$$dU_p = \frac{\partial \alpha}{\partial p} dp. \tag{5}$$

From equation (3), it follows

$$dU_c = -\frac{\partial \alpha}{\partial p} dp - \frac{\partial \beta}{\partial p} dp. \tag{6}$$

Inserting (5) and (6) into (4), one obtains

$$dV = \frac{\partial V}{\partial U_p} \frac{\partial \alpha}{\partial p} dp + \frac{\partial V}{\partial U_c} \left(-\frac{\partial \alpha}{\partial p} dp - \frac{\partial \beta}{\partial p} dp \right). \tag{7}$$

Collecting terms in dp and dividing through yields

$$\frac{dV}{dp} = \frac{\partial V}{\partial U_p} \frac{\partial \alpha}{\partial p} - \frac{\partial V}{\partial U_c} \frac{\partial \alpha}{\partial p} - \frac{\partial V}{\partial U_c} \frac{\partial \beta}{\partial p} = \left(\frac{\partial V}{\partial U_p} - \frac{\partial V}{\partial U_c} \right) \frac{\partial \alpha}{\partial p} - \frac{\partial V}{\partial U_c} \frac{\partial \beta}{\partial p}. \tag{8}$$

The sign of this expression is indeterminate in general. While its second term is negative, its first term is negative only if $\frac{\partial V}{\partial U_c} > \frac{\partial V}{\partial U_p}$, i.e. if consumers have more political power (at the margin) than

producers. In most representative democracies, this is an unlikely situation, expect when a high regulated price causes public uproar. Expression (8) has a positive sign if $\frac{\partial V}{\partial U_c} = 0$, or more generally, if $\frac{\partial V}{\partial U_p} > \frac{\partial V}{\partial U_c} > 0$ combined with $\frac{\partial \alpha}{\partial p} \gg \frac{\partial \beta}{\partial p}$. Producers' influence has to be comparatively strong, and their profits strongly depend on the sales price of their product.

Setting (8) to zero defines an indifference curve. The change in producers rent is defined as $dRent \coloneqq \frac{\partial \alpha}{\partial p} dp$ and the change in the price paid by consumers $dPrice \coloneqq dp$. Then, (7) can be written

$$dV = \frac{\partial V}{\partial U_p} dRent + \frac{\partial V}{\partial U_c}\left(-dRent - \frac{\partial \beta}{\partial p} dPrice\right) = 0, \tag{9}$$

which can be solved for the slope in (Price, Rent)-space,

$$\frac{dRent}{dPrice} = \frac{\frac{\partial \beta}{\partial p}\frac{\partial V}{\partial U_c}}{\frac{\partial V}{\partial U_p} - \frac{\partial V}{\partial U_c}} \quad . \tag{10}$$

The slope of this indifference curve is indeterminate as well. It is positive if $\frac{\partial V}{\partial U_p} > \frac{\partial V}{\partial U_c}$, zero if $\frac{\partial V}{\partial U_c} = 0$, and negative if $\frac{\partial V}{\partial U_p} < \frac{\partial V}{\partial U_c}$.

The vote-maximizing price p is implicitly given by

$$\frac{\partial V}{\partial U_p} \cdot \frac{\partial \alpha}{\partial p} = \frac{\partial V}{\partial U_c}\left(\frac{\partial \alpha}{\partial p} + \frac{\partial \beta}{\partial p}\right). \tag{11}$$

The left-hand side of (11) describes the gain of votes coming from producers in response to a marginal increase of the regulated price ($\frac{\partial \alpha}{\partial p} > 0$). The right-hand side indicates the number of votes lost, which depends on the extra producer surplus $\frac{\partial \alpha}{\partial p}$ (which is to the detriment of consumers) as well as the extra deadweight loss $\frac{\partial \beta}{\partial p}$ (which also potential consumers). Thus, the regulator will set a price P* in a way that the marginal gain in producers' support for more monopoly rent increment balances the loss in consumers votes.

4 Applying the Peltzman model to the reform of 2004

When applying the Peltzman model to the 2004 reform, 'price' becomes the price of a pharmaceutical. The assumption of constant MC is realistic, as is the monopoly assumption for patented drugs. Therefore, maximum rent can be achieved at P_m, the monopoly price. This is the price the producer would achieve absent regulation. At the competitive price P_C, MC=AC; there, the profit is zero.

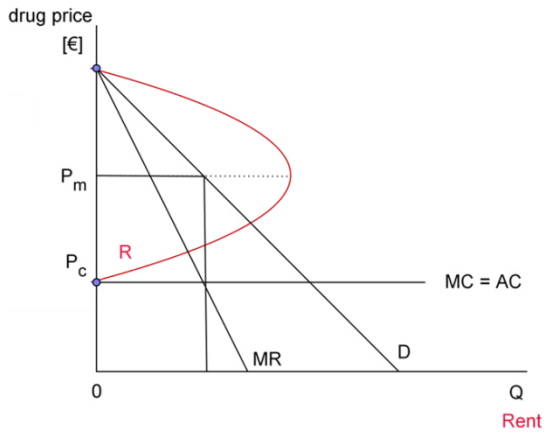

Figure 4 Producer's rent as a function of drug price

The rent function of a producer therefore has the parabolic shown in Figure 4. The next step is to add the regulator's indifference curve to the picture. This is done in Figure 5. Its quadrant I repeats Figure 3. In quadrant II, drug price is projected on the x axis. The rent function derived in Figure 4 appears again in quadrant III. It is now juxtaposed with the isovote curves V_1 and V_2 indicating regulators indifference. Convexity of the indifferent curve is assumed for simplicity. As drawn, these indifference curves reflect the assumption that when it comes to drug prices, German consumers (also represented by the association of SHI) have more political clout than the pharmaceutical companies, resulting in a negative slope in (price, rent)-space [see equation (10) again].

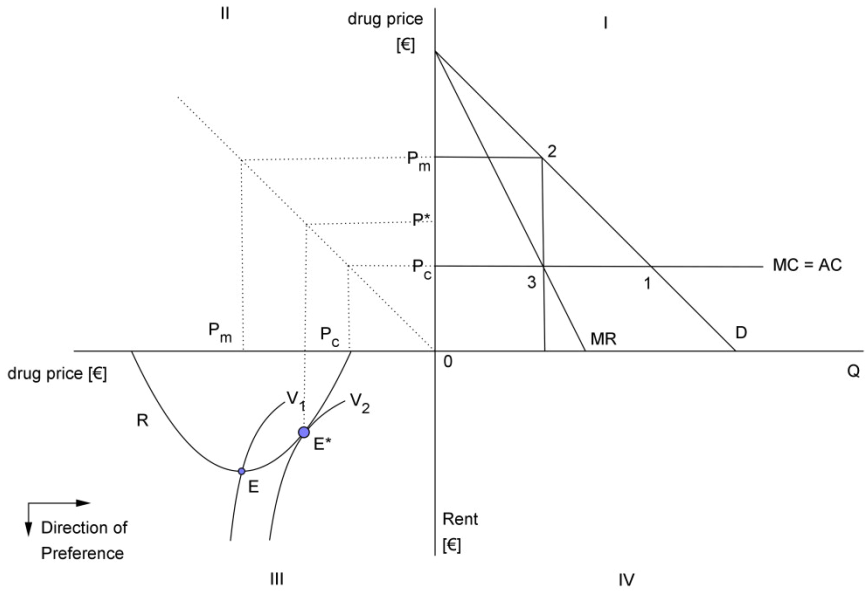

Figure 5 Regulation to vote-maximize [4]

Under this assumption, one prediction follows immediately from Figure 5. The regulator will never permit the producers to set their monopoly price. This would correspond to point E in quadrant III, which is suboptimal. The optimum solution is indicated by point E*, leading to a drug price P* below the monopoly price P_m.

5 Deriving predictions regarding the reform of 2004

Predictions are derived by assuming that gross drug prices have no influence on the popularity of the government, only net prices. In Figure 6, demand as a function of net price is mapped into demand as a function of gross price (which determines rent). Demand as a function of net price is shown in quadrant III.

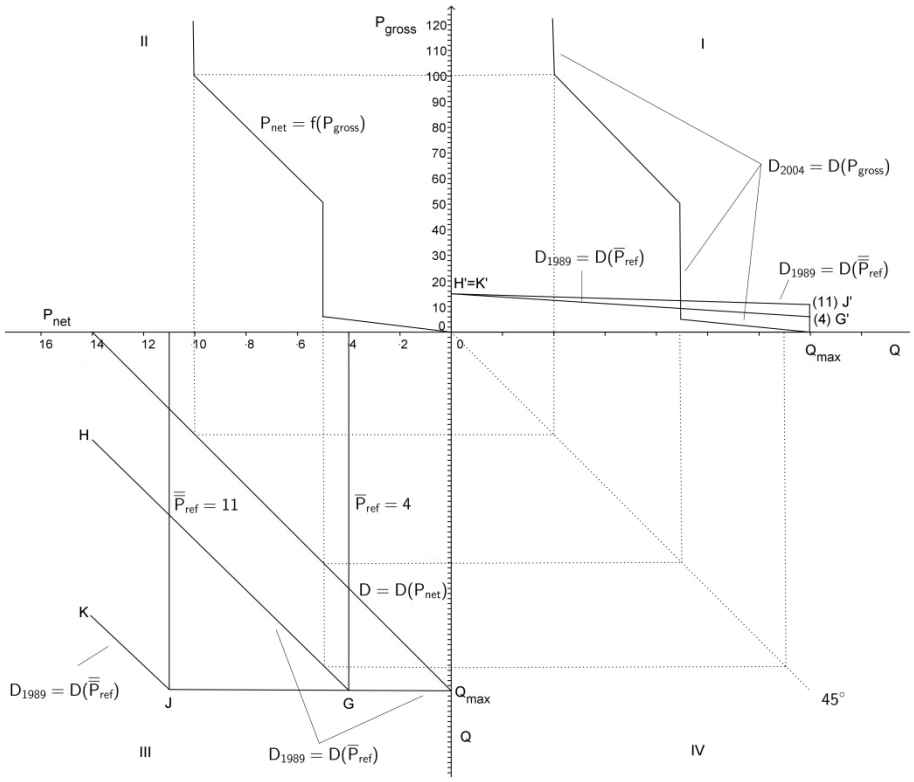

Figure 6 Demand as a function of the gross price before and after the 2004 reform

The first step is to introduce two reference prices $\bar{P}_{ref}$ (low) and $\bar{\bar{P}}_{ref}$ (high). For prices below the reference price, the quantity demanded equals the satiation level Q_{max} by assumption [see Zweifel and Crivelli (1996) for an analysis of reference pricing in the context of a duopoly model]. Above the reference price, consumers have to pay the excess out-of-pocket. Given the low reference price $\bar{P}_{ref}$, their demand function therefore becomes $Q_{max}GH$. Given the high reference price $\bar{\bar{P}}_{ref}$ it shifts out the $Q_{max}JK$. Using the 45° line in quadrant IV, these two functions become $Q_{max}G'H'$ and $Q_{max}J'K'$ respectively, relating quantities demanded to the sales prices received by the pharmaceutical producers.

Next, the same mapping is performed using the co-payment rules introduced with the 2004 reform (Figure 2 reappears as quadrant II). For simplicity, demand as a function of net price is assumed to be the same. Mapping it into quadrant I, one obtains quantity demanded as a function of gross prices. This function inherits the co-payment schedule of quadrant II (note however the change in scale from P_{net} to P_{gross}). One thing is salient: Compared to the 1989 function in quadrant I, the 2004 function entails a boost of effective demand for all producers of small values of drugs.

Now the stage is set for transforming Figure 6 into Figure 7 depicting the specifics of the German market for pharmaceuticals. Quadrant I shows the relationship between gross price P_{gross} and quantity demanded Q of 1989 and 2004. These functions are complemented by the pertinent marginal revenue function $[MR(\bar{P}_{ref}), MR(\bar{\bar{P}}_{ref})$ for 1989, MR_{2004} for 2004, respectively] as well as three marginal cost levels $MC < \overline{MC} < \overline{\overline{MC}}$ for determining Cournot points.

The profit margin multiplied by the monopoly quantity Q_m (point N in Figure 7) exceeds the margin implied by the reference price $\bar{P}_{ref} = 4$ multiplied by Q_{max}; therefore, this company would have rejected the reference price. However, it would have accepted the reference price $\bar{\bar{P}}_{ref} = 11$ because when multiplied by Q_{max}, it entails a higher producer surplus than that implied by point N.

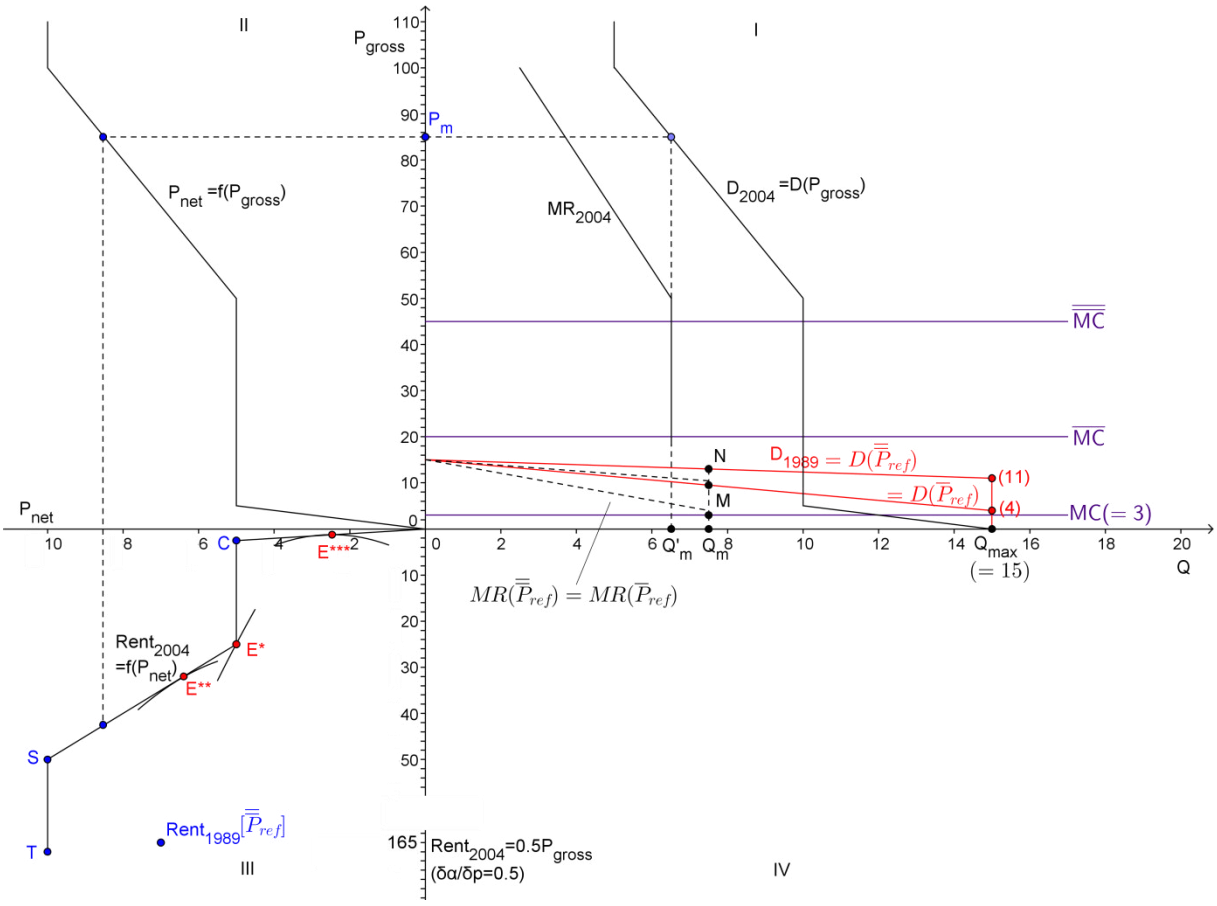

Figure 7 Rents before and after the 2004 reform and change of optima

In quadrant III, the point $Rent_{1989}$ indicate the rent obtained by accepting the higher reference price $\bar{\bar{P}}_{ref}$. After the 2004 reform, there is a rent function that needs to be constructed in quadrant III. One

point on it is given by the monopoly price P_m, which is determined by the intersection of the MR_{2004} curve with a MC schedule. However, there is ambiguity because e.g. both $\overline{MC}$ and $\overline{\overline{MC}}$ lead to the same value of P_m. Therefore, producer surplus (rent) cannot be determined unambiguously. The assumption is that the rent corresponding to P_m is 50 percent of the price (42.5). On this assumption, $P_{gross} = 50$ in quadrant II maps into a rent of 25 and $P_{gross} = 5$, into one of 2.5. This gives the function $OCEST$.

Complementing the graph with the regulator's indifference curve, one sees that E* is an accumulation point. A whole set of curves, reflecting different power structures leads to the prediction that the net price will be at 5 Euros, which however will go along with gross prices ranging from 5 to 50 Euros. This is possible thanks to the co-payment schedule as shown in Table 1. However, the actual price will be 50 Euros on the 50 percent assumption because Rent=25. Moreover, on optimum at E** entailing a higher net price and a gross price between 50 and 100 Euros is possible as well, reflecting a balance of power facing the pharmaceutical industry. Finally, an optimum at E***, implying a net price below 5 Euros, comes about only in the event of a balance of power extremely tilted towards the producers. But then, E*** would almost certainly be dominated by E* and E**. Note also that optima between points C and E as well as S and T are excluded. The regulator's indifference curves would have to run vertical, which happens only if the two interest groups have exactly the same amount of influence at the margin [$\frac{\partial V}{\partial U_p} = \frac{\partial V}{\partial U_c}$ in equation (10)].

The following prediction can be derived from Figure 7. Concerning the transition from the 1989 regime to the 2004 reform: Producers who had accepted the reference price had an incentive to increase their gross price while lowering their sales volume (from Q_{max} to Q'_m in Figure 7).

6 Conclusion

With the introduction of the 2004 health care reform in Germany the co-payment schedule and thereby the drug prices changed. Looking into the developing of drug prices in Germany, noteworthy are the spikes in 2004. Preparations not subject to reference prices are dropped by more than 10 percent on average, while those subject to price regulation shot up by almost 12 percent.

Based on the Peltzman (1976) model, the influence of the government, the pharmaceutical industry (producers) and the insured persons (consumers) can be analyzed relating to reform creation. By regulating the price of pharmaceuticals, the government seeks to maximize votes. The optimum solution leads to a drug price below the monopoly price. For the optimum solution, the variation of votes on the part of pharmaceutical industry has to equal the variation of votes on the part of consumers.

Reflecting different power structures leads to drug prices ranging from 5 to 50 Euros, associated with a co-payment of 5 Euros. Prices between 50 and 100 Euros are possible as well, reflecting a balance of power facing the pharmaceutical industry. These prices are associated with a co-payment of 10% of the selling price. Concerning the transition from 1989 reference price regime to the 2004 reform one can say that producers who had accepted the reference price had an incentive to increase their price while lowering their sales volume. In a further step, an empirical analysis of drug prices in Germany can proof these predictions.

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