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## Why Germany's "Gas Price Brake" Encourages Moral Hazard and Raises Gas Prices

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# Why Germany's "Gas Price Brake" Encourages Moral Hazard and Raises Gas Prices

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# Why Germany's "Gas Price Brake" Encourages Moral Hazard and Raises Gas Prices

## Abstract

To help German households and firms with exploding energy costs, the German government is about to implement a new transfer scheme called "gas price brake." A unique feature of this energy price relief measure is that both households and the industry receive a transfer that increases in one's actual gas price. In a formal model, we show that such a transfer scheme creates incentives for moral hazard of gas providers to raise gas prices. We also show that competition does not help to overcome this adverse effect of the gas price brake. An equivalent critique applies to the electricity price brake that is to be implemented at the same time as the gas price brake.

JEL-Codes: D040, L120, Q480, K330.

Keywords: energy prices, energy policy, consumer protection policy, gas price brake.

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# 1 Introduction

To help German households and firms with exploding energy costs, the German government is about to implement the biggest energy relief package ever with an overall budget of about 300 billion euros. The bulk of this budget—200 billion euro—is reserved for a “price brake” for gas and electricity.<sup>1</sup> In this paper, we focus on the “gas price brake” (*Gaspreisbremse*), which is of particular relevance as wholesale gas prices have dramatically increased in Germany after Russia invaded Ukraine.

The leitmotif behind the gas price brake is to lower gas bills and insure households against excessive gas prices without reducing marginal prices and, therefore, the incentives to save gas. Precisely, the *expert commission gas and heat* has proposed the following transfer scheme, which becomes effective by January 1<sup>st</sup>, 2023:<sup>2</sup>

$$\text{“transfer} = (\text{individual working price} - \text{guaranteed price}) \times \text{quota.}”$$

Here, the “individual working price” (*individueller Arbeitspreis*) is the household’s (current) contractual price per kWh, the “guaranteed price” is set to 12 euro cents per kWh, and the “quota” refers to 80% of the household’s average monthly consumption in 2022 as predicted by one’s monthly advance payment, which was determined at the beginning of the billing period.<sup>3</sup> Thus, the quota is based on the actual consumption of the household in 2021 when gas prices were relatively low.

The transfer scheme behind the gas price brake is distinguishably different from other trans-

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<sup>1</sup>See <https://www.bmwk.de/Redaktion/DE/Artikel/Energie/bundesregierung-spannt-abwehrschirm-auf.html>

<sup>2</sup>See <https://www.bmwk.de/Redaktion/DE/Artikel/Energie/strom-gaspreis-bremse.html> and <https://www.bmwk.de/Redaktion/DE/Downloads/Energie/entwurf-eines-gesetzes-zur-einfuehrung-von-preisbremsen-fur-leitungs-gebundenes-erdgas-und-warme-und-zur-anderung-weiterer-vorschriften.pdf>

<sup>3</sup>The Federal Ministry for Economic Affairs and Climate Action (*BMWK*) gives the example of a household with 15,000 kWh gas consumption in the previous billing period, and a working price of 22 euro cents, which gives a transfer of 1,200 euros for the entire billing period 2023. Households receive this sum, in parts, through lower advance payments and, in parts, through the year-end settlement. We do not differentiate between these two components. See [https://www.bmwk.de/Redaktion/DE/Downloads/F/faq-gaspreisbremse.pdf?\\_\\_blob=publicationFile&v=6](https://www.bmwk.de/Redaktion/DE/Downloads/F/faq-gaspreisbremse.pdf?__blob=publicationFile&v=6)

fer schemes which, for instance, specify a uniform fixed payment (like the *Energiepauschale*), a household-specific advance payment for one month (*Dezemberprämie*), or a textbook-like per unit-subsidy. Most importantly, it has the distinguishing feature that it is a lump-sum transfer that only varies in the household’s contractual gas price per kWh (also called “working price”; *Arbeitspreis*) valid for the billing period 2023. The transfer, therefore, does not impair consumers’ incentives to save gas as their “marginal” costs of gas consumption are not affected at all; i.e., saving one kWh of gas reduces their current gas bill according to their individual working price.<sup>4</sup>

While this policy measure takes care of consumers’ incentives to save gas, it creates moral hazard on the supplier side. This is due to the fact that the joint surplus of the provider and the consumer is *increasing* in the contractual gas price per kWh under the transfer scheme. We analyze the transfer scheme within a fairly standard model of supplier-consumer contracting; that is, depending on whether or not a transfer scheme is in place, the monopoly supplier offers a two-part tariff contract to consumers, who can accept or reject the offer and then decide about their gas consumption (see Tirole 1988). We show that if the transfer is in place, the supplier wants to raise the working price per kWh to increase the transfer from the government opportunistically. Importantly, competition does not help to overcome this induced moral hazard problem of the gas price brake: also perfectly competitive gas providers maximize the joint surplus of firms and consumers by increasing the gas price.

In an extension, we show that when gas contracts are linear in the working price, the gas price brake could again create moral hazard on the supplier side both under monopoly and perfect competition. This is particularly likely if consumers’ overall utility increases in the working price because of the transfer scheme. Intuitively, households benefit from higher gas prices if this increase transfers by more than they increase the actual gas bill.

The draft legislation addresses potential misuse of the gas price brake by gas providers, stating that gas providers must not increase the price beyond “*an objectively justified*” amount; otherwise, the federal cartel office is empowered to intervene. But on the one hand, also experts question whether the federal cartel office has sufficient capacity to check price increases of up to

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<sup>4</sup>This only holds as long as the transfer does not exceed the overall gas bill; while this constraint is unlikely to be binding, we analyze its implications in the extensions of our model.

900 German gas providers.<sup>5</sup> And on the other hand, due to the second level of the *Emergency Plan Gas for the Federal Republic of Germany*<sup>6</sup>, as announced in June 2022, gas providers are even empowered to change contractual prices without much delay and any cap. Altogether, we think firms' discretion to raise prices beyond what is objectively justified is substantial, though not unlimited.

While we focussed throughout the paper on the gas price brake for households, the same gas price brake applies to small- and medium-sized firms and an equivalent price brake applies to the industry (with a different guaranteed price, a different quota, and additional requirements though). Moreover, an equivalent price brake also applies for electricity consumption of households, small- and medium sized firms, and the industry.

We contribute to the literature which deals with the energy crisis and the changing energy policies as a consequence of Russia's war against Ukraine (Bachmann et al. 2022, Grimm et al. 2022, and Kesternich et al. 2022) and more generally to works that evaluate energy savings policies (e.g., Reiss and White 2008 and Fraser 2022).

To the best of our knowledge, we are the first to investigate the German gas price brake theoretically. We are also unaware of any work investigating a transfer scheme similar to the proposed gas price brake. Price caps and lump-sum transfers analyzed in the literature do not share the novel and distinguishing feature of the gas price brake that the joint surplus of firms and consumers increases in the price (given the price is not below marginal cost). While we analyze the effects of the gas price brake, another approach would be to start with the principal's optimization problem and to derive optimal transfer schemes (see Laffont and Tirole 1993; Viscusi et al. 2018).

We contribute to the current policy debate on the gas price brake. Here, similar concerns have been raised most recently in the media by energy experts<sup>7</sup>. Beside those media articles,

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<sup>5</sup>See <https://www.handelsblatt.com/unternehmen/energie/stadtwerke-erhoehen-preise-strom-und-gas-zum-jahreswechsel-bis-zu-110-prozent-teurer-/28826220.html>

<sup>6</sup>See [https://www.bmwk.de/Redaktion/EN/Downloads/E/emergency-plan-gas-germany.pdf?\\_\\_blob=publicationFile&v=5](https://www.bmwk.de/Redaktion/EN/Downloads/E/emergency-plan-gas-germany.pdf?__blob=publicationFile&v=5)

<sup>7</sup>See <https://www.spiegel.de/wirtschaft/service/strom-und-gaspreise-wie-energieversorger-und-verbraucher-von-tariferhoehungen-profitieren-a-1fcf8e35-252b-4825-bac3-7401435dc0bd> or <https://www.handelsblatt.com/politik/deutschland/energiepreise-habeck-warnt-energieversorger->

we are only aware of one (informal) policy brief on the gas price brake (Atayev and Hillenbrand 2022) that points to the fact that this measure reduces consumers’ incentives to search for better deals, which mitigates price competition and could raise prices.

## 2 Model and Analysis

We examine a supplier-consumer relationship to study the effects of the transfer scheme that underlies the gas price brake. We start with analyzing the benchmark case, where no such transfer scheme exists. Here, we derive the market outcomes under monopoly and perfect competition when a contract is a two-part tariff consisting of a working price and a fixed fee. Then, we analyze the gas price brake; again under monopoly and perfect competition. In the next section, we discuss several extensions of our model; for instance, the case where gas providers can only set a working price (euro cents per kWh) and the case of gas price regulation.

### 2.1 Benchmark (without transfer scheme)

Suppose a monopolist supplier offers a two-part tariff contract with working price  $p$  (euro cents per kWh) and a fixed payment  $F$ , to consumers with overall utility

$$CS = \begin{cases} U(x) - px - F, & \text{if they accept the contract} \\ R, & \text{if they do not buy,} \end{cases} \quad (1)$$

where  $U(x)$  is the utility of consuming the quantity  $x \geq 0$  of gas, with  $U(0) = 0$ ,  $U' > 0$ , and  $U'' < 0$ . Moreover,  $R \geq 0$  is the value of the consumer’s outside option. Here  $R$  is the maximal utility the consumer can get when substituting to the best alternative. Assuming a monopoly position of a gas provider vis-à-vis consumers is not implausible because a substantial share of consumers do not even consider switching the provider as a viable alternative, so that their default provider de facto serves as a monopolist for this group (Hortacsu et al. 2017).<sup>8</sup> Moreover, a two-part tariff mirrors the fact that German gas contracts specify a “working price” (*Arbeitspreis*)  $p$  per kWh and a “fixed payment” (*Grundpreis*)  $F$  per period. When a lump-sum

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[vor-ungerechtfertigten-preiserhoehungen/28846934.html](https://www.ifo.de/DocDL/vor-ungerechtfertigten-preiserhoehungen/28846934.html)

<sup>8</sup>Also when a house owner decides on the gas contract for his tenants, the monopoly assumption is plausible as he might not internalize the positive effects of switching providers.



bonus is paid for a contract signature (which is particularly widespread in energy markets, see Dertwinkel-Kalt et al. 2019 and Feldhaus et al. 2022), the fixed transfer between the contracting parties' can also become negative.

The supplier's profit is  $\pi := (p - c)x + F$ , where  $c \geq 0$  is the marginal gas supply cost. We assume there is scope for Pareto-improving trade, and there is an upper bound on the consumer's maximum willingness to pay for the first unit of gas.

**Assumption (A1).**  $0 \leq c < U'|_{x \rightarrow 0} =: k < \infty$ , with  $k > c$  and there exists some  $x > 0$  so that  $U(x) - cx > R$ .

We analyze the following two-stage game. In the first stage, the supplier offers a two-part tariff; in the second stage, the consumer accepts or rejects the offer. If the consumer accepts, then he determines his gas consumption  $x$ . If the consumer rejects, he realizes the outside option value  $R$ .

If the household accepts the contract, then it solves  $\max_{x \geq 0} U(x) - px - F$ . The optimal gas consumption follows from the first-order condition

$$U'(x^*) - p \leq 0, \tag{2}$$

which holds as an equality if the solution is strictly positive,  $x^* > 0$ , in which case  $\frac{dx^*}{dp} = \frac{1}{U''} < 0$  (i.e., demand is downward sloping). If  $U'(x) < p$  for all  $x > 0$ , then  $x^* = 0$ .

Given consumer demand  $x^* > 0$ , we now impose a standard assumption on the joint surplus  $U(x^*) - cx^*$ .

**Assumption (A2).**  $U(x^*) - cx^*$  is strictly decreasing in  $p$  for all  $c < p < k$ .

The consumer accepts a contract offer if his participation constraint

$$U(x^*) - px^* - F \geq R \tag{3}$$

holds, where  $x^*$  follows from (2). If  $x^* = 0$ , then an acceptable contract satisfies  $F \leq 0$  and  $|F| \geq R$ ; i.e., a bonus payment is made from the supplier to the consumer.

In the first stage of the game, the supplier—anticipating consumer demand  $x^*$ —solves

$$\max_{F,p} (p - c)x^* + F \text{ s.t. } U(x^*) - px^* - F \geq R.$$

In equilibrium, the consumer's participation constraint must bind. Substituting the constraint into the supplier's profit function, the supplier solves  $\max_p U(x^*) - cx^* - R$ , which gives the

first-order condition  $U' - c = 0$ . By (A1) and (A2), there exists a unique profit maximizing two-part tariff contract, with  $p = c = U'(x^*)$  and  $F = U(x^*) - px^* - R > 0$ , with  $x^* > 0$ . Clearly, this solution maximizes social welfare, i.e., the joint surplus  $U(x) - cx$  of the supplier and the consumer.

If the government offers an unconditional fixed transfer  $T > 0$  to consumers (as happened in 2022 at the hand of the *Energiepauschale of 300 euros* and the *Dezemberprämie*, which is equal to one monthly advance payment), then this does not affect the optimal contract offer. In particular, this transfer is not part of the joint surplus of the supplier and the consumer net of the outside option so that the participation constraint (2) remains the same. Only the consumer's utility is increased from  $R$  to  $R + T$ .

With perfect competition, all firms make zero profits (due to constant marginal costs), so that  $F = 0$  and  $p = c$  holds. In this case, consumers would pocket all gains from trade,  $U(x^*) - cx^* > R$ , while the joint surplus remains maximal as before. We summarize these benchmark results as follows.

**Lemma 1 (Benchmark result).** *A two-part tariff contract implements the social welfare maximizing allocation  $x^*(p = c)$  both under monopoly and perfect competition. An unconditional fixed transfer  $T > 0$  from the government to the consumer only increases consumer surplus by  $T$ , and does not affect the market outcome under monopoly or perfect competition.*

## 2.2 The Gas Price Brake

Assume now that the government sets a transfer scheme  $T(p)$  before the supplier offers a new contract to consumers. Assume that  $T$  is linear in  $p$ , with  $\frac{\partial T(p)}{\partial p} > 0$  and  $\frac{\partial^2 T(p)}{\partial p^2} = 0$ . For instance, the gas price brake for households specifies the transfer scheme  $T(p) = \max\{(p - 0.12)0.8 \cdot \bar{x}, 0\}$ , which can be generalized as  $T(p) = \max\{(p - s)\alpha\bar{x}, 0\}$ , where  $p$  is the working price of gas the consumer has to pay under the currently prevailing contract,  $s > 0$  is the guaranteed per-unit price,  $\bar{x} > 0$  is the household's average monthly consumption in 2022 as predicted by one's monthly advance payment, which was determined at the beginning of the billing period, and  $\alpha \in (0, 1)$ . Independent of whether a household consumes more or less than the quota,  $\alpha\bar{x}$ , it

still gets the entire transfer  $T(p)$ .<sup>9</sup> By this, the household's opportunity cost of any unit of gas consumption is given by the current working price  $p$ .

The transfer scheme  $T(p)$  is therefore a lump-sum payment with the particular feature that it increases linearly in the price set by the supplier; i.e.,  $\frac{\partial T}{\partial p} = \alpha \bar{x} > 0$ . Moreover, we assume that  $s$  is smaller than the prevailing marginal cost of gas,  $s < c$ , so that  $T(p = c) > 0$ .

To analyze the incentive effects of  $T(p)$ , it is important to understand that the transfer becomes part of the joint surplus of the supplier and the consumer. Accordingly, the consumer's participation constraint is now given by

$$U(x) - px - F + T(p) \geq R.$$

If the consumer rejects the contract offer and reverts to his outside option, he cannot realize the transfer  $T(p)$ , which depends on the unit price,  $p$ , the supplier charges. Note next that the optimal consumption level as given by (2) is not affected under the gas price brake. Thus, we can turn directly to the supplier's maximization problem.

**Profit maximizing tariff.** Anticipating consumer demand  $x^*$ , the firm solves

$$\max_{F,p} \pi = F + (p - c)x^* \text{ s.t. } U(x^*) - px^* - F + T(p) \geq R.$$

Setting  $F = U(x^*) - px^* + T(p) - R$ , we get the reduced problem

$$\max_p U(x^*) + T(p) - R - cx^*. \quad (4)$$

This gives

$$\frac{\partial \pi}{\partial p} = (U' - c) \frac{dx^*}{dp} + \frac{\partial T}{\partial p} \text{ for } x^* > 0 \text{ or } \frac{\partial \pi}{\partial p} = \frac{\partial T}{\partial p} \text{ for } x^* = 0, \quad (5)$$

Without a transfer, the optimal price would be the joint surplus maximizing price  $p = c$  with  $x^* > 0$ . Introducing the transfer scheme creates an incentive to raise the price above  $c$ . For prices  $p > c$  the supplier's marginal profit is either monotonically increasing or non-monotone in  $p$  for  $x^* > 0$ . But even if there is an interval where it is decreasing, then by raising  $p$  above  $k$ , the supplier's marginal profit will increase indefinitely in  $p$ , because  $\frac{\partial T}{\partial p} > 0$  even for  $x^* = 0$ . Thus, formula (5) uncovers the fundamental drawback of the gas price brake. The joint surplus

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<sup>9</sup>This holds only if the household's annual gas bill  $px + F$  is larger than the transfer  $T(p)$ . Otherwise, the transfer is capped such that the household's gas bill is just zero. We examine this case below in Section 3.

of the supplier and the consumer can be indefinitely inflated by raising the per-unit price of gas. The transfer scheme, therefore, inevitably invites strategic pricing by the supplier to milk the transfer scheme  $T(p)$ .

**Proposition 1 (Unconstrained milking of the gas price brake).** *There always exists a contract with sufficiently large  $\hat{p}$ , where  $x^*(\hat{p}) = 0$ , such that the supplier's profit  $\pi$  is larger than the profit-maximizing contract where  $x^* > 0$ . The supplier then realizes  $\pi = T(\hat{p}) - R$ , and the consumer gets  $R$ .*

The unconstrained milking of the gas price brake represents an obvious misuse of the gas price brake, as forbidden in §27 of the draft legislation on the gas price brake, so assuming a price cap with  $x^* > 0$  is reasonable. Thus, in the following, we impose a maximum price per unit of gas,  $\bar{p}$ . Precisely, let  $c < \bar{p} < k$ , so that  $x^* > 0$ . The next proposition specifies the optimal contract and its properties depending on the constraint  $p \leq \bar{p}$ .

**Proposition 2 (Constrained milking of the gas price brake).** *If the supplier solves (4) under the constraint  $p \leq \bar{p}$ , then two solutions are possible.*

*i) Interior solution. If  $(U' - c) \frac{dx^*}{dp} + \frac{\partial T}{\partial p} < 0$  at  $p = \bar{p}$ , then the optimal per-unit price,  $p$ , follows from  $(U' - c) \frac{dx^*}{dp} + \frac{\partial T}{\partial p} = 0$ , in which case  $c < p < \bar{p}$  holds.<sup>10</sup>*

*ii) Corner solution. If  $(U' - c) \frac{dx^*}{dp} + \frac{\partial T}{\partial p} > 0$  at  $p = \bar{p}$ , then the optimal per-unit price is  $p = \bar{p}$ . In both cases the supplier realizes  $\pi = (p - c)x^* + T(p) + U(x^*) - R$  and the consumer gets  $R$ . Moreover,  $T(p = c) < T(p)$  and  $x^*(p) < x^*(p = c)$ .*

Proposition 2 shows that the introduction of the transfer scheme raises the price above the level without the scheme (i.e., marginal costs). Thus, it raises the equilibrium price and the transfer that would prevail if the gas price would not react to the introduction of the gas price brake.

**Perfect Competition.** The market outcome as given by the working price  $p$  and the gas consumption  $x^*$  (as identified in Proposition 2) stays valid under perfect competition. Note first that a consumer, who faces more than one acceptable contract offer, chooses the contract that yields the highest utility  $U(x^*) - px^* - F + T(p)$ . In a competitive equilibrium, firms offer two-part tariff contracts, which maximize the joint surplus as in a monopoly, while they make zero

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<sup>10</sup>Uniqueness follows from (A2). Note that  $\frac{\partial \pi}{\partial p} = \frac{\partial T}{\partial p} > 0$  at  $p = c$ , from which  $p > c$  follows.

profits (due to constant returns to scale). Consequentially, the fixed payment becomes negative with  $F = -(p - c)x^*$ . Thus, the consumer now fully pockets the transfer  $T(p)$ , gets on top the induced supplier's profit margin  $(p - c)x^*$ , and keeps his utility  $U(x^*)$ .

**Corollary 1.** *Assume  $p \leq \bar{p}$  and a transfer scheme  $T(p)$ . Under perfect competition, gas consumption  $x^*$  and the per-unit price  $p$  are the same as under monopoly, while the suppliers realize  $\pi = 0$  and consumers get  $CS = U(x^*) + (p - c)x^* + T(p) > R$ .*

### 3 Extensions

In the following we discuss three extensions of our model: i) a linear gas price, ii) regulated gas prices, and iii) capped transfers.

#### 3.1 Linear Gas Price

So far, we assumed that the supplier could set a two-part tariff contract. With two “prices” at hand, the supplier can maximize the joint surplus with the working price  $p$  and share it efficiently with the fixed payment  $F$ . Energy market regulations could constrain gas providers’ ability to set the fixed payment.<sup>11</sup> How do our results change when the supplier can only set the working price  $p$ ?

Assume a monopoly supplier and the same two-stage pricing game as above, with the only difference that the supplier can only set a working price  $p$ . Consumer utility is given by (1), with  $F = 0$ . If a consumer accepts the offer, his demand follows again from (2).

For a given transfer scheme  $T(p)$ , the participation constraint of the consumer is now given by

$$U(x) - px + T(p) \geq R, \tag{6}$$

where the left-hand side is the overall utility from accepting a contract with working price  $p < k$ . The supplier, anticipating  $x^*$ , solves

$$\max_p (p - c)x^*$$

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<sup>11</sup>The draft legislation on the gas price brake states in §4 (1) that the fixed payment (*Grundpreis*) can only be changed if there is a cost-based justification. Otherwise, any “agreement about the fixed payment is void”.

subject to the participation constraint (6) evaluated at  $x^*$ . Notably, in the linear pricing case, the profit is always zero for  $x^* = 0$ , which is different to the two-part tariff case, where a transfer scheme  $T(p)$  can be exploited to make an outcome with  $x^* = 0$  profitable (see Proposition 1).

The analysis of the effects of a transfer scheme depends on the contracting outcome in the absence of it. Here we have to distinguish two cases depending on whether or not the participation constraint

$$U(x) - px \geq R \quad (7)$$

is binding at  $x^*$ .

**Case I (Participation constraint not binding).** The standard monopoly solution,  $p^I$ , follows from the first-order condition

$$\frac{\partial \pi}{\partial p} = x^* + (p - c) \frac{dx^*}{dp} = 0. \quad (8)$$

By assumption (A2) this is unique and interior. The supplier can implement the standard monopoly solution in the absence of a transfer scheme  $T(p)$ , if the associated overall consumer utility,  $U(x^*) - px^*$ , is higher than  $R$ ; i.e., the participation constraint (7) does not bind at the monopoly price  $p^I$ . In this case, the transfer scheme is irrelevant to the contracting outcome and the consumer will pocket the benefits of an introduction of a transfer  $T(p^I)$ . If the supplier can realize the monopoly solution  $p^I$  in the absence of the transfer scheme, then its introduction does not change the market outcome, because the monopolist cannot exploit it. This result, however, must change if the participation constraint binds, so that the monopoly solution according to (8) is not feasible.

**Case II (Participation constraint binding).** Alternatively, assume the participation constraint (7) is violated at the monopoly price  $p^I$ . Then, the monopolist sets the maximal price,  $p^{II}$ , such that the participation constraint (7) binds given that consumer demand is  $x^*$ ; i.e.,  $U(x^*) - p^{II}x^* = R$ . The introduction of a transfer scheme  $T(p)$  then directly relaxes the consumer's participation constraint because  $U(x^*) - p^{II}x^* + T(p^{II}) > R$ . Thus, with the introduction of  $T(p)$ , the price charged in the constrained solution  $p^{II}$  can be increased to a level  $p \leq p^I$ , where  $p$  solves

$$U(x^*) - px^* + T(p) = R \text{ for } x^* > 0. \quad (9)$$

The introduction of the transfer scheme not only comes as a lump-sum payment, which relaxes

the consumer's participation constraint. It also depends on the working price due to  $\frac{\partial T}{\partial p} > 0$ . So, how does overall consumer utility depend on  $p$ ? The effect of a marginal price increase on consumer's overall utility,  $U(x^*) - px^* + T(p)$ , is given by

$$\frac{\partial CS}{\partial p} = -x^*(p) + \frac{\partial T}{\partial p} \text{ for } x^* > 0, \quad (10)$$

where we used (2). Note also that  $\frac{\partial^2 CS}{\partial p^2} = -\frac{dx^*}{dp} > 0$ , so that  $CS$  is strictly convex in  $p$ . Thus, we get

$$\frac{\partial CS}{\partial p} \underset{<}{\geq} 0 \Leftrightarrow \frac{\partial T}{\partial p} \underset{<}{\geq} x^*(p) \Leftrightarrow \alpha\bar{x} \underset{<}{\geq} x^*(p) \text{ for } x^* > 0. \quad (11)$$

Clearly, overall consumer utility can never increase in  $p$  without a transfer scheme. However, if there is a transfer scheme,  $T(p)$ , and a price  $0 < \tilde{p} < k$ , such that  $\left. \frac{\partial CS}{\partial p} \right|_{p=\tilde{p}} = 0$  (according to (10)), then overall utility is increasing in  $p$  for all  $p > \tilde{p}$  until the reservation price  $k$  is reached. For this to happen, the marginal loss of gross utility,  $-x^*(p)$ , must be smaller than the marginal increase of the transfer  $\frac{\partial T}{\partial p} = \alpha\bar{x}$ . This is the more likely, the larger the current working price  $p$  (because then  $x^*$  is relatively small) and the larger the quota  $\alpha\bar{x}$ . As  $\bar{x}$  is based on the low gas prices that prevailed before the gas prices exploded, while  $x^*$  is the allegedly much lower demand at the current high gas prices, the condition for consumer utility increasing in price (11) is likely to hold.

Thus, if consumers' overall utility is increasing according to (10) at the constrained solution,  $p^{II}$ , the supplier will raise the price up to the unconstrained monopoly price  $p^I$ . In this case,  $-x^*(p^{II}) + \frac{\partial T}{\partial p} > 0$  or  $\alpha\bar{x} > x^*(p^{II})$  holds. We can summarize these results as follows.

**Proposition 3.** *Assume the monopoly supplier can only set the working price  $p$ . If the supplier can realize the standard monopoly solution  $p^I$  (according to (8)) without violating the consumer's participation constraint (7), then the introduction of a transfer scheme  $T(p)$  has no effect on the gas market outcome and only increases consumers' overall utility by  $T(p^I)$ . If the supplier's price-setting is effectively constrained by the consumer's participation constraint (according to (9)), then the introduction of a transfer scheme  $T(p)$  has the following effects:*

- i) It always relaxes the consumer's participation constraint and therefore induces a price increase.*
- ii) If overall consumer surplus increases in  $p$  after the introduction of the transfer scheme, then the unconstrained monopoly solution is realized. For this to happen, it is sufficient that  $-x^*(p^{II}) + \frac{\partial T}{\partial p} > 0$  or, equivalently,  $\alpha\bar{x} > x^*(p^{II})$ , holds.*

**Perfect Competition.** As in the previous section, we here assume some maximally feasible price  $c < \bar{p} < k$ . Under perfect competition,  $p = c$  must hold in the absence of a transfer scheme  $T(p)$ . If this equilibrium does not change with introducing such a transfer scheme, then consumers can pocket the entire transfer  $T(p = c)$ , which will be strictly positive for  $c > s$ . If, however, the transfer scheme implies that overall consumer utility is increasing in the working price at  $p = c$ , then  $p = \bar{p}$  is the unique equilibrium. If, alternatively, overall consumer utility increases only at higher prices  $p > c$  then whether the equilibrium outcome is  $p = c$  or  $p = \bar{p}$  depends on the exact shape of  $U(x)$ . Finally, if overall consumer utility is never increasing in  $p$ , then  $p = c$  is the unique equilibrium outcome.

Consumers always get the maximal overall consumer utility while firms could make strictly positive profits in the high-price outcome  $p = \bar{p}$ . Interestingly, the equilibrium gas price can be higher under perfect competition than under monopoly whenever  $\bar{p} > p^I$ . The high-price outcome is not unlikely because in winter 2022/23 per-unit procurement costs of gas are rather high, while the quota specified in the transfer scheme is based on the relatively high gas consumption in 2021, where gas prices were low. Formally, the negative gross utility effect of a price increase at currently high gas prices,  $-x^*$ , could be relatively low when compared with the positive marginal transfer effect,  $\frac{\partial T}{\partial p} = \alpha \bar{x}$ , which is based on the large gas consumption in 2021 when gas prices were low.

### 3.2 Regulated Gas Prices

Let us now study the scenario in which the government regulates the working price suppliers can charge. A standard approach is a cost-based price regulation, for instance, a regulation that fixes a supplier's price at  $p^R := c + \varepsilon$ , with  $\varepsilon > 0$ . Suppliers' marginal gas supply costs differ as they adopt different strategies to procure gas. As an example, suppose two types of suppliers with high and low marginal costs,  $c_H$  and  $c_L$ , respectively. Thus, with a cost-based price regulation in place, high-price suppliers charge  $p_H^R = c_H + \varepsilon$ , and low-price suppliers charge  $p_L^R = c_L + \varepsilon$ , with  $p_L^R < p_H^R$ . Assuming  $p_H^R < k$ , consumer demand is strictly positive for both prices; i.e.,  $x_H^* := x^*(p_H^R) > 0$  and  $x_L^* := x^*(p_L^R) > 0$ , while  $x_L^* > x_H^*$  because  $p_L^R < p_H^R$ .

Without a transfer scheme  $T(p)$ , consumers would prefer the low-price contract, and high-price suppliers could only survive with locked-in consumers. However, with a transfer scheme



$T(p)$  in place, high-price suppliers could survive in the market even if all consumers can easily switch suppliers.

Given the regulated working prices, consumers choose the contract with the higher overall utility. In particular, consumers prefer the high-price contract over the low-price contract when

$$U(x_H^*) - p_H^R x_H^* + T(p_H^R) > U(x_L^*) - p_L^R x_L^* + T(p_L^R), \quad (12)$$

which holds if  $-x_L^* \leq \alpha \bar{x}$  according to (11). The interpretation is straightforward: Suppose a consumer selects the low-price contract and thus consumes  $x_L^*$ . At this point a marginal price increase reduces consumer utility by  $-x_L^*$  but increases the transfer payment by  $\alpha \bar{x}$ . If the latter effect outweighs the former, the consumer must be better off by choosing the high-price contract as any price above  $p_L^*$  reduces  $x^*$  while the transfer increases linearly in price.

Alternatively, we could also assume that suppliers can choose between the two different costs of gas supply. Then, we also get that some suppliers choose to have high costs to offer the high-price contract, which is demanded by those consumers who prefer to get the high-cost contract according to (12).

Overall, the transfer scheme can impact on the market outcome even if the government imposes a cost-based price regulation. In this case, consumers could have incentives to sign the high-price contract as this ensures a higher transfer, while the drawback of a high-price contract is the lower, the lower one's equilibrium gas consumption.

### 3.3 Capped Transfers

The draft legislation specifies several upper limits for the transfer scheme depending on the type of customer. For households, the transfer cannot be larger than the total gas bill at the end of the year (see § 3 (4) of the draft legislation on the gas price brake). In other words, the consumer cannot pay less than zero for his gas contract.

Formally, given a two-part tariff contract and gas consumption  $x$ , the transfer  $T(p)$  is capped if

$$px + F < T(p) \quad (13)$$

holds. The capped transfer  $\tilde{T}(p)$  then fulfills  $\tilde{T}(p) = px + F$ , and the consumer pays zero as long as (13) holds. If the fixed fee is not constrained by regulation, then the supplier will always increase it such that (13) binds.

If this is not possible, because of a cost-based regulation of the fixed fee, then one could still argue that practically the condition for a capped transfer (13) is unlikely to hold, because for it to hold a consumer must reduce its gas consumption drastically. In this case our previous analysis is untouched.

However, there might be consumer types for which the condition (13) could hold, because they find it particularly easy to save large amounts of gas. Ironically, if those consumers select a contract where (13) holds, then their expenses for gas are zero independently of gas consumed (as long as (13) binds). But then there is no incentive anymore to save gas up to the quantity  $x_0$  for which the transfer is just equal to the overall gas bill. The value of  $x_0$  follows from

$$px_0 + F = T(p) = (p - s)\alpha\bar{x},$$

which gives

$$x_0 = \frac{(p - s)\alpha\bar{x} - F}{p}.$$

Note that  $\frac{\partial x_0}{\partial p} = \frac{s\alpha\bar{x} + F}{p^2} > 0$ , so that  $x_0$  increases in the working price, while  $\lim_{p \rightarrow \infty} x_0 = \alpha\bar{x}$ . Given that the condition for a capped transfer (13) holds, a household's total gas expenses are zero for all  $x < x_0$ , where the upper bound  $x_0$  increases in the working price and approaches in the limit 80% of the household's gas consumption in the past (for  $\alpha = 0.8$ ). Intuitively, if it is optimal for a consumer to consume only a small amount of gas, then a very high working price means that the guaranteed working price  $s$  becomes negligible and the entire gas consumption is paid via the transfer scheme up to almost 80% of the household's former gas consumption.

Take the example mentioned above from the Federal Ministry for Economic Affairs and Climate Action (see Footnote 3) with the current working price charged by the default gas provider in Duisburg (see Footnote 10) of 32 euro cents<sup>12</sup>—which is one of the highest prices currently charged in Germany—, then the maximum transfer is  $(0.32 - 0.12)0.8 \cdot 15,000 = 2,400$  euro, which gives  $x_0 = 2,400/0.32 = 7,500$  kWh. That is, the household pays nothing for gas as long as its consumption is not larger than 50% of its last year's consumption. Notably, the gas price brake foils incentives to save gas for those consumer types, which would have saved a lot of gas if the transfer scheme had not been capped. Consumers with such strong savings could help

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<sup>12</sup>See [https://www.verbraucherzentrale.nrw/sites/default/files/2022-09/grundversorgungstarife-strom-und-gas\\_nrw\\_011022.pdf](https://www.verbraucherzentrale.nrw/sites/default/files/2022-09/grundversorgungstarife-strom-und-gas_nrw_011022.pdf)

to achieve the national goal of overall savings of 20%, as many people have no or insufficient financial motivation to save gas (in particular, when consumers are price inelastic, e.g., because the social welfare office pays the gas bill). Presumably, the relevance of these considerations may be negligible, because only extraordinary savings in combination with the most expensive gas tariffs makes the legal upper bound of the transfer binding.

## 4 Conclusion

We have formally delineated novel incentives for moral hazard that arise from the energy price brakes. As consumers' and providers' joint surplus increases in the contractual electricity and gas prices, both parties can have incentives to sign contracts with particularly high prices. More competition between providers cannot prevent this effect but only shifts the rents from providers to consumers.

Interestingly, German media have focused on the question how “consumers can react against energy price increases,”<sup>13</sup> which neglects that consumers can benefit from price increases and therefore may actively *seek* contracts with higher prices. It is exactly this feature of the price brakes, which can also make outright price-regulation ineffective. That is, even if providers must only charge cost-based prices, consumers could still prefer to choose high-price contracts because of the benefits of the transfer scheme.

That massive gas and electricity price increases coincide with the start of the gas price brake, namely Jan 1, 2023, might suggest that firms respond to the incentive we have delineated in this paper. Right after the announcement of the price brakes, more than 200 default gas providers (*Gasgrundversorger*) announced to increase prices on this day; among them are the default providers in some of the biggest German cities. Also electricity providers have raised their prices, for instance, by 77% in Cologne and 110% in Leipzig and Munich, up to more than 40, 50, or even 60 euro cents per kWh, respectively; such price increases appear to be “excessive” also according to expert opinions.<sup>14</sup>

A positive side effect of the price brakes is that it could reduce gas consumption considerably.

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<sup>13</sup>See <https://www.deutschlandfunk.de/gaspreisdeckel-bedeutung-100.html> and others

<sup>14</sup>See <https://www.handelsblatt.com/unternehmen/energie/stadtwerke-erhoehen-preise-strom-und-gas-zum-jahreswechsel-bis-zu-110-prozent-teurer-/28826220.html>.

When moral hazard on the supplier's side raises gas prices, the households' incentives to save gas increase likewise. While our analysis suggests that the price brakes might become more expensive than estimated, it is unlikely to produce fewer savings than intended.

One way to reduce the costs of the price brakes could be the implementation of another much-discussed instrument, namely the excess profit tax for energy providers. The excess profit tax could lower the costs of the gas price brake by extracting excessive provider profits arising from moral hazard. This only holds in the absence of competition, as with intense competition, consumers are the beneficiaries of providers' moral hazard. Alternatively, regular lump-sum payments such as the *Energiepauschale* could relieve households while circumventing the pitfalls of the price brake and maintaining strong incentives to save electricity and gas.

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