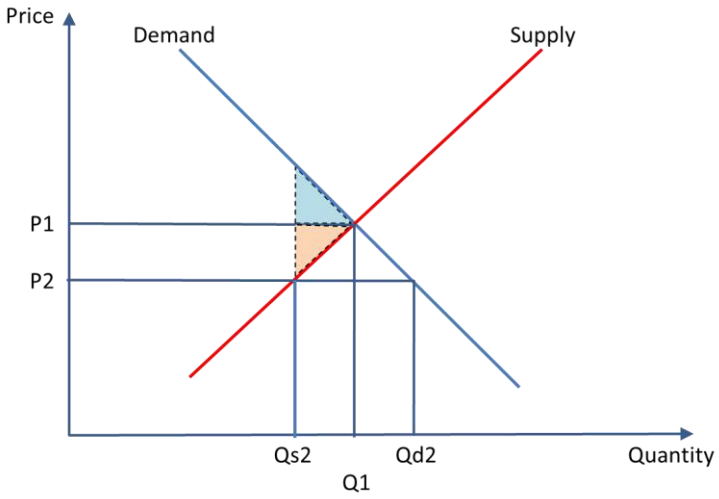
K4K food for thought:

Unforeseen consequences on electricity market from Iberian natural gas price cap

Who does not want cheaper energy? From a political perspective, this is a no brainer. As an economist, I want to highlight the ironies of pursuing counterproductive policies in the interest of social equality, which provides the impetus for the proposed interventions by the Spanish and Portuguese governments in what is a unified European electricity market. We can use Figure 1 below to explain what happens when one artificially caps prices (P2) below the equilibrium (P1) where demand and supply are matched (Q1), thereby generating two problems.

Figure 1: Impact of capping prices



Source: K4K.

From the supply side, lower producer prices reduce the incentive to supply (Qs2<Q1). In practice, this means generators with access to flexible supply may reduce their market offers if they believe the opportunity cost higher than the achievable market price. For example, flexible pondage Hydroelectric Power Plants ("HPPs") – those which can store water behind a dam and determine which hours in which to dispatch – already do this when prices are low, choosing instead to focus their available generation in hours when prices are highest. (Yes this also leads to higher margins but it also reduces the level of peak prices by idling more expensive thermal plants.) If government intervention imposes a temporary cap on market prices, hydro generators could sit on their existing reserves until those restrictions are lifted. And today this can

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be masked by a real excuse that hydropower reserves are at historically low levels. (In Spain, these stand more than 30% below the 2009/10-2020/21 average[1]).

Meanwhile, instead of reacting to the higher prices by reducing consumption, demand is kept higher than otherwise (Qd2>Q1). The result is excess demand (equal to Qd2-Qs2). One thing is people complaining about having to pay higher prices, quite another than people are left with less than what they were willing to pay at the prevailing capped price. How is that clever politics?

This price cap has a measureable social cost as illustrated by the shaded areas in the figure above. Economists refer to the sum of these areas as a deadweight (welfare) loss. Economists recognise social welfare as the sum of consumer and producer surpluses, i.e. the net benefit to consumers/producers from consuming/supplying at the prevailing equilibrium price. (Everyone understands the concept of profit when applied to a company's activities but something similar can be said of consumers: if I am willing to pay 100 for something I buy for 50, this translates to a consumer surplus of 50). This social welfare loss cannot be made up elsewhere. This is why sensible economists are unhappy with the use of price caps and prefer to use direct transfers or vouchers to vulnerable consumers to resolve social inequalities. Interfering in markets when there is no obvious market failure – asymmetric information, monopoly or monopsony power, imperfect information, etc – means you end up with a smaller pie with and less available for redistribution.

Note that the less elastic the demand – i.e. reduced sensitivity to changes in price – the greater the welfare loss since a steeper demand curve means the blue shaded area (consumer welfare loss) will be large than before. Politically speaking, inelastic demand is what turns electricity into an entitlement which the government feels a need to provide at a "reasonable" cost. (Even if a quick review of hourly supply and demand curves in the spot market shows that both demand and supply are price sensitive. See for example https://www.omie.es/es/market-results/daily/daily-market/aggragate-suply-curves?scope=daily&date=2022-04-10&hour=4.) This should call for simple solutions to make demand more price sensitive such as investing in energy efficiency measures and autogeneration. But these will not provide short-term relief defined by political timelines.

Windfall profit tax

With the Royal Decree-Law ("RDL") 6/2022[2], which came into force on 31 March 2022, the Spanish government has introduced a tax on windfall profits applicable to projects that do not emit CO2. As an executive measure, an RDL must have an end date and this has been set to 30 June 2022. A €/MWh penalty on merchant sales will be indexed to 90% of the difference between the average daily gas price in the past month (as set in MIGBAS) and 20€/MWh(f). This will be adjusted for the thermal efficiency of Combined Cycle Gas Turbine ("CCGT") (55%) and the number of hours in which CCGT sets the price directly or indirectly (when others shadow price CCGT offers[3]).

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[1] See http://eportal.miteco.gob.es/BoleHWeb/bolehSRV.

[2] See https://www.boe.es/eli/es/rdl/2022/03/29/6/con.

[3] RDL 17/2021, Sec. I. Pág. 112397, states "En las horas en las que el precio marginal no haya sido marcado por una instalación de ciclo combinado… se asumirá que la oferta ha internalizado el precio del gas natural cuando existan ofertas de instalaciones de ciclo combinado en el entorno (±10 %) de dicho precio marginal". Note that RDL 17/2021 (https://www.boe.es/eli/es/rdl/2021/09/14/17/con) and RDL 23/2021 precede RDL 6/2022 2021

So if the gas price were 100€/MWh(f) and price-setting offers match CCGT marginal costs 100% of the time, then the penalty would be 131€/MWh (=90%*(100-20)/55%*100%).

Contracted energy sales executed before the introduction of RDL 6/2022 will be exempt as will any new sales contracted for more than 1 year and at a contract price less than 67€/MWh. A penalty equal to 90% of the difference between the contracted sales price and 67€/MWh will otherwise apply.

For PV and wind assets with given resource profiles and even baseloaded nuclear plants, the windfall tax is unlikely to have much bearing on their market behaviour. Nevertheless, as of today 23 April 2022, only baseload futures in OMIP for CY25 (65.88€/MWh) are trading below the 67€/MWh limit, so it is likely that this windfall profit tax will reduce liquidity in the short-term futures and increase the relative use of longer duration hedging instruments including PPAs.

Flexible HPPs may feel differently. The temporary nature of the RDL 6/2022 means that those assets with the ability to store water over long periods will have an incentive to withhold hydro capacity until the windfall profit tax is withdrawn (as legally it eventually must). And if hydro capacity is withdrawn, something we explore in the figures below, Spain will have to rely on greater participation of less efficient CCGT leading to higher prices than otherwise.

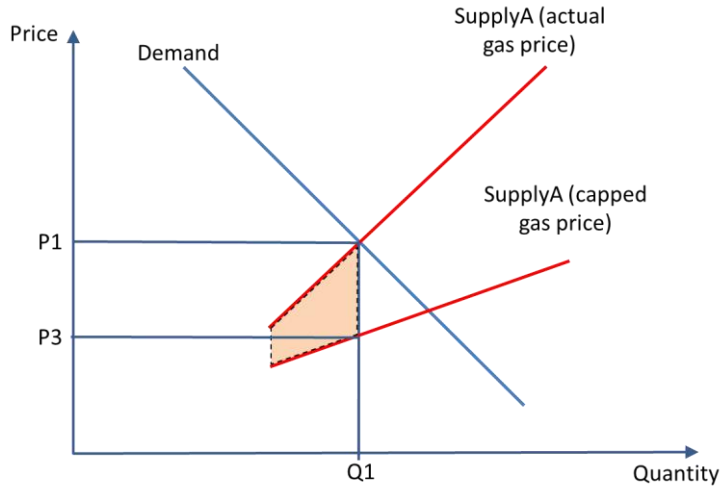
Dual auction to apply gas price cap in the spot electricity market

The Spanish government, in particular, is keen to also intervene directly in the European market clearing engine (known as Euphemia) since it relies only on the day-ahead spot price to set the electricity tariff for vulnerable consumers. No hedging, no forward contracted, no nothing. This provides the main rationale for the joint proposal to the European Commission for a dual-auction approach, the first which would work as today but a second where the price of gas would be capped at an artificially low level, reportedly initially as 30€/MWh(f).

Figure 2 below illustrates the impact of reducing the cost of generation by capping the natural gas price to expensive thermal plants. The shift downwards in the supply curve reflects the reduction in the cost of generation of CCGT applied in the second auction. This results in a drop in price (from P1 to P3), the main stated aim of the policy. However, someone must make up the difference to pay the CCGTs their actual gas cost, illustrated by the shaded area. One of the current proposals has non-emitting generators covering this cost as a gas cross-subsidy penalty. Another option might be to socialise these costs by having all consumers share this cost. (Note that in the latter case, savings to consumers would still be significant since the shaded area is smaller than the initial price discount equal to area Q1*(P1-P3).)

(https://www.boe.es/eli/es/rdl/2021/10/26/23) but nevertheless define some of the parameters of the current version of the windfall profit tax.

Figure 2: Static assessment of capping gas prices



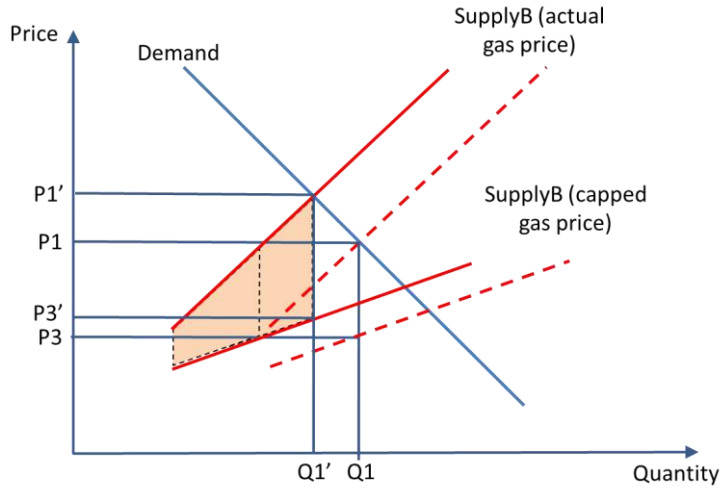
Note: Chart not to scale since we are zooming into the area where prices are set. Supply curves shown focus on thermal assets affected by the gas price adjustment. Supply from projects unaffected by the gas price adjustment will sit to the left of the area of focus.

Source: K4K.

From a static perspective, there appears to be no social welfare loss since this appears as a straightforward transfer from producers to consumers. But this assertion is incorrect. As under the windfall profit tax, PV, wind, and nuclear plants may have limited incentive and/or flexibility to adjust to lower market prices and this gas cross-subsidy penalty. But the gas price cap would add insult to injury to flexible HPPs (and more so if non-emitting generators had to pay the gas price difference to CCGTs). The availability of flexible non-emitting plants will drop which will force more CCGTs to be dispatched instead increasing gas use. Figure 3 below shows this by shifting the supply curve to the left. Prices in the first auction would now be higher (from P3 to P3') and demand lower (from Q1 to Q1'). Moreover, payments to CCGT for their actual gas use would rise as shown in the additional strip added to an expanded shaded area.

Note that the above assessment does not assume the CCGTs will adjust their price offers upwards, something that might happen with a larger thermal gap, less price-disciplining effect from flexible non-emitting plants and the concentrated nature of CCGT ownership in Spain where five gencos own 80% of the mainland CCGT capacity. (Another reason CCGT may inflate their offers is to ensure sufficient gap between their offers and those shadow pricing their marginal costs to reduce the proportion of hours in which CCGT indirectly sets prices and thus reducing the burden on merchant sales from the windfall profit tax. Offers >10% below CCGT marginal costs will be assumed to not be shadow pricing CCGTs.)

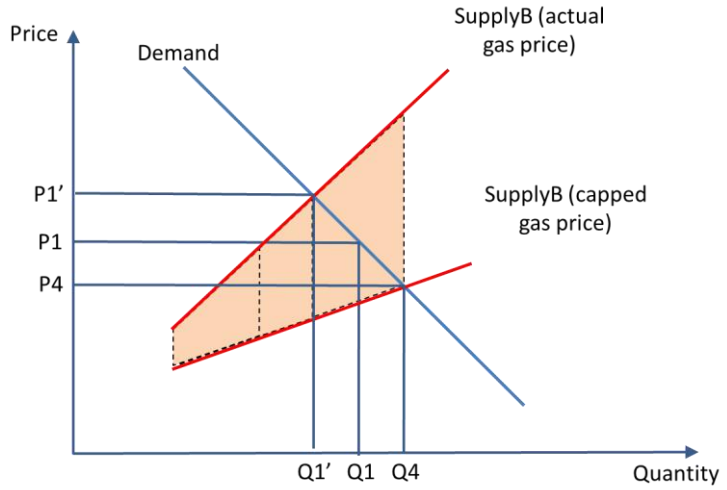
Figure 3: Supply-side reaction to capping gas prices



Source: K4K.

Figure 3 above is incomplete since it does not factor in the reaction from consumers to lower purchase costs. Figure 4 below combines the supply and demand side impacts of the policy. With the effective supply curve being the lower one, demand will be higher than otherwise (from Q1 to Q4) and prices lower but not as low as initially envisaged (from P1 to P4, where P4>P3 or P3'). Since this additional demand must be met by CCGTs, this increases further the payments needed to accommodate the difference between actual and capped gas usage costs. As illustrated in Figure 4 below, these transfers may grow to several times their original estimate. At some point, this burden will affect other non-emitting generators, not just flexible HPPs thus leading into a vicious cycle of lower non-emitting supply, extra reliance on CCGTs, and additional gas make-up payments. And last but not least, the achieved reduction in consumer costs (P1*Q1-P4*Q4) may look much smaller next to the make-up gas surcharge required to compensate the CCGTs if consumers have to bear this cost. A solution would be to limit supply to Q1'. But this would translate to the type of rationing that we described at the beginning of this note in Figure 1.

Figure 4: Supply and demand-side reaction to capping gas prices



Source: K4K.

Moreover, if market participants know that the marginal unit in the market is a gas-fired CCGT, they will reinterpret the new rules to enable them to maximise value through loopholes. Those loopholes may include the intra-day or the ancillary services markets. In the case of the intra-day market, you could imagine a CCGT being scheduled in the day-ahead market but deciding to "buy back" that energy in the intra-day market from flexible HPPs. As things stand, the CCGT will be paying gas at full cost so will be happy to buy back power at a discount to full cost (thus capturing a margin without ever getting dispatched). In this manner, the capacity withholding tactic of flexible non-emitting plants discussed above will be somewhat reversed since they will be able to sell power at a something a lot closer to their real opportunity cost. But what if the government intervenes to cap prices in the intra-day market as well? Owners of flexible capacity could shift their attention to the ancillary services which would be a lot harder to police. It remains unclear whether these type of reactions have been factored into the government's assessment.

Given the potential implications of the proposal to cap gas prices in the spot market in Iberia, it is surprising that no quantitative assessment has been published. No theoretical assessment based on economic rationale has been proffered either. This note provides a framework to help understand the unintended consequences of this policy. The conclusion is that the simplistic view taken by the Spanish government about the obvious success of this policy does not reflect the most likely outcomes. When one interferes in markets and changes the rules, market participants adapt to the new rules leading to unintended consequences which in this case will undermine the stated aims of the initiative. And all this because the Spanish government wants to hide the fact that it was negligent in not hedging its obligation to vulnerable consumers using readily-available solutions, the most basic of rules that all electricity retailers must adhere to if they don't want to go bankrupt.

Mr. Kim Keats

Madrid, 23 April 2022.