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# A Note on the Role of Monetary Policy When Natural Gas Supply Is Inelastic

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# A Note on the Role of Monetary Policy When Natural Gas Supply Is Inelastic

by

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## Abstract

This note argues that in a situation of an inelastic natural gas supply a restrictive monetary policy in the euro zone could reduce the energy bill and therefore has additional merits. A more hawkish monetary policy may be able to indirectly use monopsony power on the gas market. The welfare benefits of such a policy are diluted to the extent that some of the supply (approximately 10 percent) comes from within the euro zone, which may give rise to distributional concerns.

Keywords: energy crisis, monetary policy, natural gas

JEL classification: E52, Q31

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# 1 Introduction

The cost for natural gas is currently a major concern for EU countries. While the wholesale price has been more or less constant for years, starting in October 2021 prices have increased steeply. The resulting price increase is dramatic. The average price of a MWh of natural gas on the Dutch market was below €20 in 2020. In mid-September 2022, the average wholesale price of natural gas hovers around 200€/MWh. Figure 1 makes clear that much of the rally already began before the start of the Russian invasion of Ukraine in February 2022, but prices have increased markedly since then.

Figure 1: Wholesale Price of Natural Gas in Europe



Source: [www.tradingeconomics.com](http://www.tradingeconomics.com).

Note: Year labels are positioned at mid-year.

To highlight the effect of such a price increase on gas importing economies, note that at a price of €200/MWh the German 2021 gas consumption would amount to approximately 5.6% of German GDP. Although this situation in itself is worrisome, an additional effect of the stark increase in gas prices is that the price of power production also has exploded, thereby magnifying the impact of the current energy crisis.

Against this background, an economic consensus has evolved that the EU should reduce its gas demand not only by reacting to the increased price, but also by bringing about an additional demand shift to the left. Indeed, in early August 2022, the EU Council adopted a regulation on a “voluntary reduction“ of natural gas demand by 15% in member states beginning 1 August 2022 until 31 March 2023.

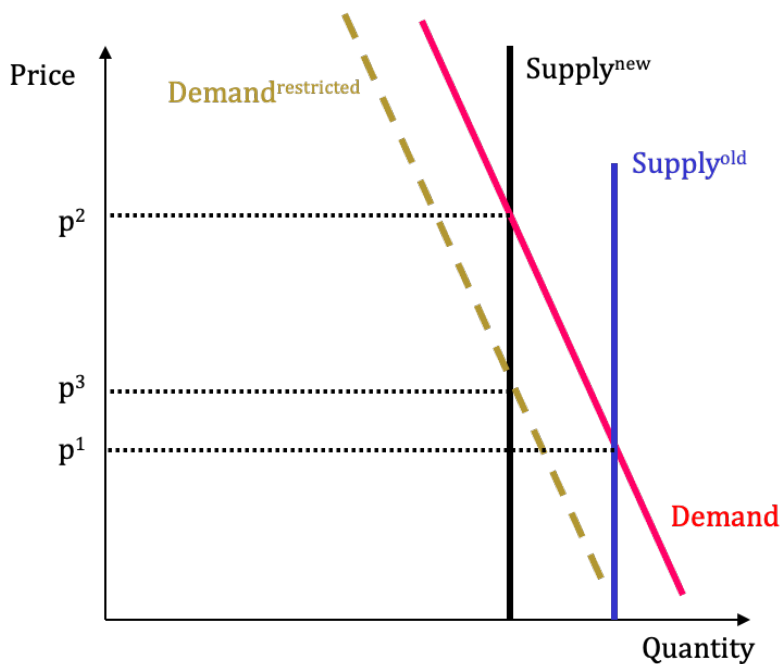
Such a restrained demand for natural gas is particularly critical given the current energy crisis in which Russia has abruptly cutoff its supply. Moreover, many of the remaining suppliers, such as Norway and the Netherlands, are already producing and delivering natural gas at full capacity. This situation has created a vertical and extremely price inelastic supply.

Figure 2 illustrates how in such a situation, a shift of demand leaves total gas supply constant and leads to a mere price effect. In the face of the withdrawal of Russian natural gas, aggregated supply to the EU shifts from Supply<sup>old</sup> to Supply<sup>new</sup> and increases the natural gas price from  $p^1$  to  $p^2$ . This price increase leads to a demand reduction on the red demand curve. A leftward shift of demand to the dotted line Demand<sup>restricted</sup> could lead to a price decrease to  $p^3$ . Additional imports of liquified natural gas (LNG) could shift supply to the right (not depicted) and could also help to reduce the price. It should be noted, however, that Germany, the EU’s largest natural gas consumer, at the time of writing, has no LNG terminal.<sup>1</sup>

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<sup>1</sup> Dezem and Shiryaevskaya (2022) report that German utilities tend to shy away from long-term LNG contracts that are preferred by LNG providers.

Figure 2. Natural Gas Market with Fixed Supply



Different ways to induce a shift in demand may be pursued. One suggestion has been to levy a tariff or a consumption tax on natural gas. In that case, the necessary size of the tax or tariff would equal the difference between  $p^3$  and  $p^2$  to reduce the pre-tariff price to the same extent as non-tariff-based demand restrictions. A tariff was advocated, for example, by Gros (2022) during a time when Russia was still delivering natural gas. Now that the Russian supply has been withdrawn, a tariff on gas from an EEA country such as Norway or from EU countries is no longer a viable option. An EU wide special excise tax on gas, in principle, is conceivable. However, the necessary unanimity for such an EU policy is not plausible; gas producing countries within the EU may have an interest to object such a move.

What other policies may lead to a demand shift to the left? This note argues that given the current energy crisis with unusually high inflation rates, a more hawkish or a more dovish monetary policy may affect aggregate GDP and thereby induce different levels of natural gas demand. In the special situation of a fixed gas supply, could it be that a more hawkish monetary policy increases a measure of EU welfare despite its contractionary effect on GDP? The analysis in this note suggests that a restrictive monetary policy could help reduce the natural gas price, because supply is inelastic. Considering foreign ownership of gas supply makes it

welfare increasing to have a somewhat more restrictive policy compared to a situation which ignores foreign supply.

## 2 A Stylized Model of the Euro Zone with Fixed Natural Gas Supply

Consider the following simple model. European output  $y$  is a function of natural gas input,  $R$ , and the policy rate  $r$ , say the headline ECB interest rate.<sup>2</sup> Input factors other than gas are considered fixed and left out of the picture.

$$y = y(R, r),$$

where  $y_r < 0, y_{rr} < 0$  is assumed. In the following  $R$  is considered as fixed based on the discussion pertaining to Figure 2: the amount of gas consumed is only determined by vertical supply and  $y = y(r)$ . The European social welfare function is written as

$$W = y(r) - \gamma I(r) - (1 - \varepsilon)p(y(r))R,$$

where general inflation  $I$  is a negative function of the interest rate  $r$  and enters the welfare function negatively as a social cost.<sup>3</sup> For simplicity, this general inflation rate is taken to be independent of the gas price that enters separately in the equations. Note that allowing the headline inflation rate to be dependent on the gas price would make the case for a restrictive monetary policy even more compelling.  $\gamma$  is a parameter that weighs the cost of inflation against total output. The natural gas price  $p$  is a positive function of  $y$ . The fraction  $(1 - \varepsilon)$  of fixed gas supply is sourced from outside the EU and the relevant fraction of the gas bill needs to be deducted from EU welfare. The optimal policy rate  $r$  is derived implicitly by the first order condition

$$\partial W / \partial r = y_r (1 - \overbrace{(1 - \varepsilon)p_y R}^B) - \gamma I_r = 0. \quad (1)$$

If all gas were sourced from within the EU,  $\varepsilon = 1$ , then the term  $B$  would equal zero and the optimal policy rate  $r$  would derive from a simple trade-off between inflation and output. The higher the sourcing of gas from outside the EU, the

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<sup>2</sup> The model abstracts from the fact that not all EU countries are members of the euro zone.

<sup>3</sup> Note that inserting deviations from target income and target inflation, as in the Taylor rule, would not alter the argument below and therefore has been omitted.

smaller the effective weight of the output loss in the optimality condition. The reason for this inverse relationship is that the output loss reduces the gas price, which tends to cushion the effect of an increased policy rate,  $r$ . The size of this cushioning depends on  $(1 - \varepsilon)p_y R$ . According to European Commission (2022), EU production of natural gas amounted to only about 10% of consumption in the first quarter of 2022. This suggests a rather low value of  $\varepsilon$  in the proximity of 0.1.

To give an idea about the partial derivative  $p_y$ , consider the gas market that clears if the exogenous supply,  $\bar{R}$ , equals demand:

$$R(y(R, r), p) = \bar{R}$$

Total differentiation yields

$$\frac{dp}{dy} = -\frac{R_y}{R_p}$$

It is beyond this note to determine precisely the term  $R_y$ , the marginal increase in gas demand when GDP increases by one unit. In terms of Figure 1, this amounts to a horizontal shift of the demand curve. A rough approximation for  $R_y$  derives from the average,  $R/y$ . The possible value of  $R/y$  may be illustrated with eurozone data. In 2021,  $R$  amounted to some 3.5bn MWh in the eurozone<sup>4</sup> and  $y$  was €12,300 bn.<sup>5</sup> Accordingly, we have  $\frac{R}{y} = 0.00028$  MWh/€.  $R_p$  may be approximated by noting that current developments may indicate that in Germany an increase of €200 per MWh seems to reduce demand roughly by some 15% or, scaled to the eurozone 0.525 bn. MWh.<sup>6</sup> Hence,  $R_p \approx -\frac{0.525 \text{ bn.MWh}}{\text{€200}} = -2,625,000 \text{ MWh/€}$ . Using these numbers, we arrive at  $\frac{dp}{dy} \approx 1.07E(-10)$ . Plugging this in for  $p_y$ , we receive  $p_y R \approx 0.37$ . In other words, the policy weight on GDP is diminished by an estimated 37 percent if the EU ownership of natural gas supply equals zero. With 10% EU production ( $\varepsilon$ ), the

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<sup>4</sup> Source: BP Statistical Review of World Energy 2022, 71st edition, p. 31. BP reports no gas consumption for Cyprus and Malta. Cubic meters were transformed into kWh by a factor of 10.55.

<sup>5</sup> Source: Eurostat data browser, <https://ec.europa.eu/eurostat/databrowser>.

<sup>6</sup> Shiryayevskaya (2022), based on Citigroup calculations, reports a European reduction for August 2022 that is 12% below 2021. In the very short term, by April 2022, Ruhnau et al. (2022) report a German reduction in gas demand and arrive at a 6% percent decrease for consumers (who experience a delayed price effect) and an 11% reduction for industrial demand; the industrial reductions, it should be noted, already started in August 2021.



weight reduction is still around 33 percent. This implies that the relative policy weight on inflation increases and thus monetary policy should act more restrictively.

### 3 Discussion

It is often argued that the supply side nature of the current inflationary push makes it difficult for monetary policy to effectively reduce inflation. This note contests this view. The currently inelastic gas supply in connection with an income dependent gas demand requires a qualification.<sup>7</sup> To the extent that a restrictive monetary policy indeed reduces EU output and income, a more hawkish monetary policy not only reduces general inflation via a lower price trend for domestically produced goods, but also has the merit of lowering natural gas prices. The central bank has a collective, although indirect, instrument to leverage monopsony power in that market. This argument, to the best of the author's knowledge, seems new to the current economic policy discussion on the EU energy crisis. While, in general, it may be doubted whether the use of monopsony power is within the ECB's mandate, the lowering of the natural gas price is certainly a helpful instrument to contain euro zone inflation and, moreover, should help fulfill the ECB mandate.

The argument for a more hawkish monetary policy comes with caveats, however. First, as some of the natural gas supply comes from within the EU, there are redistribution effects that are ignored in the above analysis. For example, a country like Germany, that has deliberately abstained from fracking and the production of natural gas in the recent past would benefit, whereas the Netherlands may be negatively affected due to its role as a natural gas producer. Second, the effects of monetary policy may be slow and thus the transmission lag on EU GDP may mean that some of the effects only begin to phase in when the inelastic supply of natural gas is already beginning to ease. Third, because not all

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<sup>7</sup> A further effect, of course, should come via the euro exchange rate. A more restrictive monetary policy should appreciate the euro and reduce the energy bill as calculated in euros.

EU countries belong to the euro zone, the use of EU monopsony power may not be fully exploited.

## 4 References

Dezem, Vanessa and Anna Shiryayevskaya (2022), Energy crisis pushes Germany to lock in LNG for decades, Bloomberg, 9 September 2022, [www.Bloomberg.com](http://www.Bloomberg.com) (last accessed: 28 September 2022).

European Commission (2022), Quarterly report on European gas markets, Market Observatory for Energy DG Energy, Volume 15, issue 1.

Gros, Daniel (2022), Optimal tariff versus optimal sanction: The case of European gas imports from Russia, CEPS Policy Insights, No 2022, 12 March 2022.

Ruhnau, Oliver, Stiewe, Clemens, Muessel, Jarusch and Hirth, Lion (2022), Gas demand in times of crisis. The response of German households and industry to the 2021/22 energy crisis, ZBW – Leibniz Information Centre for Economics, Kiel, Hamburg.

Shiryayevskaya, Anna (2022), Gaspreis fällt weiter: Schwache Nachfrage, höhere Lagerbestände, 1 September 2022, <https://de.finance.yahoo.com> (last accessed: 28 September 2022).

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