GCC Industrial Exports and the Controversy Over Domestic Energy and Feedstock Pricing

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Domestic pricing of energy and feedstock in the oil and gas exporting countries has caused considerable controversy in international trade negotiations. The issue has been hotly debated in the context of WTO negotiations; it has delayed the accession of Saudi Arabia and is one reason still delaying the accession of Russia. It has however not been much of a problem with respect to the other GCC countries. In the context of the never ending negotiations for an FTA between the EU and the GCC, this remains a key stumbling block.

The countries of the Gulf Cooperation Council have leveraged their natural resources to integrate downstream in the value chain, investing in petrochemical and in other energy-intensive industries. The latter include cement, iron and steel, ceramics, glass and aluminium. Controversy is especially acute for petrochemicals and aluminium (which is specifically electricity intensive), less so for the other industries, for which the GCC countries remain net importers. For petrochemicals and aluminium, the GCC countries have become major exporters and current investment projects promise to further reinforce their position.

International competitors complain that the availability of feedstock and/or energy inputs for transformation industries at "subsidised" prices distort international competition. Domestic prices to industrial users are considered to be "subsidised" because they are below international prices; however this qualification is incorrect from the point of view of economic analysis. Prices may be considered to be subsidised if they are below cost, and some hidden or overt loss occurs that must be compensated somehow (the subsidy). But the international prices of oil, gas and petroleum products include a very significant component of rent, which originates out of the fact that production costs in the region are below the cost of the global marginal barrel of oil or cubic meter of gas. Hence, domestic prices can be lower than international prices and still not be subsidised, as long as costs are covered. In this case, the government simply forfeits a portion of the rent in domestic sales, but does not subsidise domestic producers.

In order to understand whether the GCC countries are or are not subsidising their domestic industry, it is then crucially important to discuss whether current prices are above or below cost. A first objective of this paper is to explain how defining the appropriate concept of cost is much more complicated than is normally perceived - and the relevant concept of cost may vary depending on circumstances. This is relevant not just from the point of view of international trade negotiations, but also from the point of view of the sustainability of the GCC development model. Indeed, if we were to find that GCC industry is competitive only because it is subsidised, we should

conclude that the regional development model is not sustainable.

A second objective is to explore the peculiar nature of competition in the petrochemical industry, where the key to competitiveness is in the ability to add large increments to production capacity and displace smaller, higher cost plants. In other words, the competition is for new capacity, and once that is "captured" the country acquires international competitiveness. Therefore, countries compete to attract foreign investment in new projects, and feedstock supply conditions (not just price) are a tool of this competition.

The paper is organised as follows: in a first section we contextualise the use of energy and feedstock prices as a subset of industrial policies that are common practice in all countries. The point is to show that the GCC countries do not engage in some especially distortionary practices. In a second section we discuss several concepts of cost and which is most appropriate depending on the circumstances. In a third section we discuss the relevance of alternative concepts of costs for each of the four key product categories that are used as feedstock or sources of energy for industrial transformation, namely: natural gas; crude oil; refined oil products; and electricity. In a fourth section, we discuss the nature of competition in the petrochemical industry and the role feedstock prices play. The fifth section concludes.

1. The issue

The use of incentives or disincentives as a tool of industrial policy is common practice in all economies, developed and developing. Governments influence relative prices through higher or lower taxation; through the provision of specific inputs, such as land or infrastructure services, frequently at less than "market" prices; and through access to privileged credit facilities, with terms that would not otherwise be available from any commercial institution.

In this context, it is hardly surprising that developing countries striving to industrialise and diversify their economies would resort to price signals as tools to promote their developmental objectives. The provision of facilities, such as industrial parks and transportation facilities, or favourable credit conditions for projects deemed to contribute to the development objectives, is standard practice. Any checklist of the "investment climate" of a country will include consideration of the availability of tax holidays, infrastructure and other forms of support on the part of the government to gauge the "attractiveness" of investing in the country concerned. Behind this approach there is the implicit or explicit assumption that in a globalised world economy, where goods and services move rather freely across borders, the decision to locate a project in one country or the other is one that the investor can make freely, and seek for the best conditions on offer. In other words, we live in a world where governments actively compete to attract investment and use a panoply of tools to achieve this goal.

The GCC countries of course are no exception, as industrialisation and diversification of the national economy is a key goal for all of them. Their competitive approach to attracting foreign direct investment has become considerably more sophisticated over time, with several GCC members climbing the ladder of international rankings of investment climate.

Pricing of energy inputs to industrial users should be viewed in this context. It is quite natural that a country possessing a potential competitive advantage in the form of availability of energy inputs should try and leverage this advantage to promote economic growth and diversification.

Administrative control of energy prices - oil products, natural gas and electricity - is common practice in numerous developing countries, both net importers and exporters. Generally this is done in the context of fighting inflation and preserving the purchasing power of poorer citizens with respect to basic necessities.

In the oil importing countries, such policies frequently lead to consumer prices that are below import prices and refining costs, hence the need for explicit subsidies to cover the losses of private or state-owned distributors and refiners. In these cases, export prohibitions also are imposed, that is products bought at cheaper domestic prices cannot be exported legally.

In the oil exporting countries, oil products are generally sold at prices that are well below the international price, leading to the accusation that domestic prices are "subsidised". However, it is not at all clear that this is the case. Prices would be "subsidised if they were below cost: but inter national prices include a very substantial component of rent above cost. There is no reason why the oil producing countries should forfeit the potential rent that they can receive from the international market; but it is less clear that the governments should exact the same rent from domestic consumers.

It should be noted that the issue arises exclusively because crude oil and products are relatively easy to export and are in fact largely exported - which leads to the differentiation of domestic from export prices. Were domestic energy inputs not available for export, the price advantage to domestic industry would appear to be quite natural - and we have examples of this in the low cost of electricity to Norwegian or Canadian aluminium smelters, thanks to the availability of hydro power. But if exports are technically feasible, the government is not expected to prohibit or limit the export of raw materials in order to encourage local transformation.

2. Prices and costs

In judging the appropriateness of GCC energy pricing policies attention should be given to whether prices cover costs. But what is the relevant concept of cost? The answer is complex and may vary depending on circumstances.

We may distinguish the following alternative definitions of cost:

- Average cost: this is the total cost of producing a specific product divided by the total volume produced. The total cost would include both investment and direct costs. It is the most straightforward concept of cost, and rarely the most relevant. It also suffers from ambiguities linked to the assessment of capital costs, and the allocation of costs in the case of joint products.
    - o Capital costs may be assessed at the historical or replacement level: the former is what has actually been paid; the latter is what would need to be paid if the investment were to be made today. As investment costs normally increase with time, replacement cost may be significantly higher than historical cost. The use of replacement cost may be more relevant for

sustainability, because it refers to the cost of recreating capacity today if it were lost. Because oil and gas are wasting assets, capacity is constantly eroded and investment is needed to maintain the same.

- o Joint products are the norm in the oil industry. Oil is produced in association with NGLs and almost invariably also gas - ethane and methane. So, what is the cost of producing oil, what is the cost of producing NGLs, what is the cost of producing gas? We may consider that the most important product, that on which production is scaled, is oil, and all the cost should be assessed to oil. In this case, NGLs and gas are viewed as by-products which cost essentially nothing, or at most the cost of the infrastructure which is needed to gather and distribute them to the final users. This view is reinforced when we consider that gas is flared in the atmosphere in many oil producing countries, and the GCC countries are the exception rather than the norm in having almost completely eliminated gas flaring and valorised the gas.

- Marginal cost: this is the cost of producing one additional barrel of oil or cubic metre of gas. If the oil field has been developed and capacity to produce an incremental barrel already exists, then the marginal cost will include only the direct cost and no capital cost at all. Such marginal cost is bound to be very small. However, if existing capacity is fully utilised and a new field has to be developed or additional investment made in an existing field to increase production, the marginal cost may be very high. For gas, the marginal cost will depend not only on whether capacity exists or has to be created, but also on the utilisation that is made of the gas: if a proportion of the gas produced in association with oil is reinjected in the field to maintain pressure, the marginal cost of the additional cubic metre may be negative, because it would be a cubic metre not reinjected, and reinjection has a direct cost of its own. There would be an opportunity cost - in terms of lost pressure or having to inject more water or adopt other recovery methods - but that is a different cost concept.
- Opportunity cost: this is the revenue lost by selling the oil or gas at a price lower than the maximum which the market would bear. As such, opportunity cost is not at all linked to the cost of production, but rather depends on market circumstances. If the market is "saturated" and the alternative to selling the barrel at a lower price would be to keep it in the ground (which means that this barrel would only be produced much later, when the country's production is in decline and cannot be maintained at the desired level) then the opportunity cost is very close to zero.

3. Assessing the cost of energy and feedstock

How therefore are we going to assess the cost of production of oil or gas in the GCC countries? The matter is certainly not straightforward, and conflicting conclusions are possible depending on circumstances.

3.1. Natural gas

Let us first consider natural gas. Natural gas is produced in association with oil or in fields containing gas only (with a component of NGLs or condensate diluted in the gas). Associated gas used to be considered as worthless by the companies, and it has

acquired value only thanks to the investment which has gone into separating, treating, collecting and redistributing the gas. These costs must obviously be allocated to the gas stream, but otherwise associated gas may legitimately be considered as a free by-product.

That said, we have situations in which the associated gas or dry gas produced in association with NGLs is not sufficient to meet demand, and additional capacity must be developed which may be considerably more expensive. An example in point is Abu Dhabi, which has been one of the earlier exporters of gas in liquefied form (LNG) to the Far East, but today is unable to cover domestic consumption and has launched the development of expensive tight and sour gas deposits. In this case, the correct cost concept would be marginal cost, i.e. the cost of producing more expensive gas from new deposits.

Opportunity cost is not immediately relevant for gas except if the country has an export facility for either pipeline gas or LNG. In this case, and assuming that the country is refusing to serve its potential foreign customers in full and yet has capacity to do so, the cost of using a cubic metre of gas domestically would be the difference between international and domestic prices. However this case is extremely rare for gas, because if capacity to export exists and customers are ready to buy more, they will be served.

3.2. Crude oil

The situation for oil is altogether different. In most GCC countries capacity for producing oil is not fully utilised. Some of this capacity is deliberately kept unutilised to be available in case of a crisis erupts: this should not be considered to be available. But normally capacity in excess of that strategic cushion is available, and the opportunity cost of selling the cost domestically rather than keeping it in the ground may be very low or even negative (that is the domestic price may be higher than the future international price discounted to today). Then the marginal cost concept becomes relevant, and this again is very low because only direct costs are to be included.

However, when domestic demand expands and turns into a significant share of total production - which it has by now in most if not all cases - then it becomes clear that satisfying domestic demand requires the creation of capacity well in excess of what would be needed to serve the export market only. In this case, average cost becomes relevant, and we shall consider either the historical cost of investment or the replacement cost depending on whether our emphasis is recovering actual costs with a profit but no more, or on ensuring sustainability, i.e. the ability to recreate capacity as it becomes progressively eroded. Both concepts of average cost are significantly higher than marginal cost, because investment is the main cost component in this industry.

That said we should keep in mind that in the GCC average cost for newly developed fields is normally estimated to be below 5 dollars per barrel, while the international price is well above 60 dollars. This means that the full cost domestic price may very well be many times below the international price, considering that (by definition) exports are constrained and the full international price cannot be had (otherwise the correct cost concept would be opportunity cost).

3.3. Refined oil products

A further complication relates to the fact that crude oil is normally not used as such, but as refined products. The refining process is one in which multiple joint products are produced, and attribution of cost to each one of them, including the cost of the oil feedstock, is essentially arbitrary. Some of the products have an active international market and are in stable demand, some have a market but have very variable seasonal demand (for example LPG - i.e. propane and butane) and some finally do not really have much of an international market. Refineries may have yields whose composition in terms of products slate depends on the configuration of the refinery and the quality of crude oil that is fed to the plant.

The GCC countries produce crude oils of different qualities, the lighter ones being in greater demand than the heavier ones. Heavy crude oils have proven difficult to sell at times, and this is prompting the GCC countries to invest in refineries that are specially designed for turning heavy oil into valuable products. Depending on the configuration of the refinery, it will yield more gasoline, kerosene and diesel, which are used as transportation fuels and have a significant international market; or naphtha, which is used as petrochemical feedstock and has much less of an international market.

What the above means is that one cannot easily allocate cost to each joint product of a refining and petrochemical process, and indeed not even of a gas project. The strategy that each producer adopts to maximise the value of the natural resource may be complex and involves investment decisions that cannot easily be changed at a later date. Allocating costs requires knowledge of which is the main motivation of each project, and for each joint product a decision is needed on whether to sell internationally or use domestically (which would also involve a sale, if the user is a third party - in which case the user is a captive customer).

3.4. Electricity

So far we have discussed the price of hydrocarbons: what about electricity prices? Power generation in the Gulf is based exclusively on hydrocarbon fuels: either gas, or crude oil, or fuel oil. A limited amount of diesel is also used in remote areas.

The cost of producing power is determined by the investment costs and by the cost of fuel. Investment costs are lowest for a simple gas turbine power plant and are highest for a large thermal power plant which can burn crude or fuel oil. The cost is also influenced by the degree of utilisation of the plant - because electricity demand varies during the day and seasonally (seasonal variations are especially significant in the Gulf). The cost of the kw needed to satisfy peak demand a few days of the year is certainly very high, because the investment to acquire the necessary capacity must be recouped with minimal utilisation.

The matter is further complicated because of the growing number of integrated desalination and power production plants. In this case, electricity and desalinated water are joint products, and the question arises of how much of the cost should be imputed to each. In the GCC countries all prices for water and electricity are administered, and neither electricity nor water companies are able to fully recover their costs, but depend on continuing subsidies.

3.5. Some conclusions on energy/feedstock costs

With all the necessary caveats, we can note the following points concerning the situation of the GCC countries:

a) oil production capacity exceeds the desired level of exports almost at all times: the alternative to using the marginal barrel domestically is keeping it in the ground

b) domestic consumption has grown considerably and is now a significant proportion of total production, therefore it is no longer appropriate to consider the marginal cost only; rather, an average cost concept, which includes investment, may be more appropriate; if sustainability is the main concern, then replacement cost for investment must be considered.

c) heavy oil production has been difficult to sell at times, and the rationale for developing refineries to convert heavy oil into oil and/or petrochemical products is strong; how then cost is allocated to each joint product is largely a subjective matter

d) natural gas (methane and ethane) was in the past almost exclusively produced in association with oil, but this is no longer the case. In Qatar, where the largest volumes of non associated gas are produced, NGLs play a fundamental role in the economics of upstream projects undertaken by International Oil Companies (IOCs)

e) outside of Qatar, available gas production is insufficient to meet potential demand. Projects have been sanctioned or may be required to bring supply in line with demand but the gas cost for these increments (marginal gas volumes) would be considerably higher than the price at which gas is currently sold to large users. The current price may be sufficient to cover the cost of old supplies, but at this price demand exceeds supply and additional supply cannot be brought to the market. Hence, an increase in the sale price to major users is required to balance the market.

f) power generation is based on either gas, heavy crude oil, or residual fuel oil from domestic refineries. As current gas production is not sufficient to meet demand, burning gas in a power plant has an opportunity cost which is equal to the cost of developing additional gas supplies, or to the netback value of the petrochemical or other products that may be derived from it - whichever is smaller. The opportunity cost of burning heavy crude oil is the netback value of the barrel when refined in a domestic refinery. For residual fuel oil, the alternative would be to revamp refineries and reduce the share of fuel oil in the products slate, to the benefit of more valuable, lighter products. Such investment is now largely taking place, and less residual fuel oil might be available in the future. The bottom line is that *all fuels used for power generation have some opportunity cost* as dictated by alternative domestic uses - not export markets necessarily - and it is quite possible that such opportunity cost exceeds the price at which fuels are sold to power plants.

4. Feedstock prices and the competition for capacity in the petrochemical industry

To understand the impact of feedstock prices on petrochemical industry growth we need to introduce certain key elements of the economics of the industry.

Firstly, the industry is characterised by a sequence of stages or successive transformations: initial feedstock, which may originate from the field or from a refinery, is transformed into basic or commodity petrochemicals, and these are then transformed into more complex, lower volume and higher value added products. Three or four successive transformations are possible before a final product is reached which is used in manufacturing industry.

Generally speaking, the cost of feedstock will be especially relevant for the initial transformation: once an intermediate product is produced, the competitiveness of successive stages depends on whether the intermediate product is used within an integrated complex, so that only the value of final products that are sold matters; or is sold to an independent buyer for further transformation. In the latter case, the advantage of a cheaper feedstock may be entirely appropriated by the initial transformation.

Secondly, the incidence of the cost of feedstock also very much depends on the specific process - it may be important for lower value added, open technology processes; and have more limited importance in other processes.

The pricing of feedstock has played an important role at the early stages of the industry, when emphasis was on the primary transformations based on simple feedstock - methane and ethane. But as the industry has matured and added successive transformations or begun using more complex molecules as feedstock, the influence of pricing is greatly reduced, and other factors have become more important.

In fact, to fully understand the dynamics of competition in the petrochemical industry it is necessary to factor in the consideration of investment costs and of the investment cycle. Investment costs are a very important component of total costs in the industry. The competitiveness of a plant very much depends on minimizing the investment cost and maximising capacity utilisation.

Investment cost is primarily a function of plant size: the bigger the plant the lower the unit cost of the product. This is a common characteristics of all processes requiring vessels and/or pipes, as the cost of the vessel is a function of its surface, hence of the square of the radius; while the capacity is a function of its volume, hence of the cube of the radius. Consequently, newer plants tend to always be bigger than all preceding ones, the limit being the physical ability to build bigger plants and the size of the market. Capacity then cannot be increased gradually: it increases in discrete increments, through the addition of new plants that are normally as big, if not bigger, than the largest previously existing plants.

As a consequence, the industry tends to experience investment cycles, which are accompanied by very wide product prices swings. As demand increases monotonously with GDP (and more rapidly than GDP), given any initial capacity it is expected that within a certain time demand will exceed capacity and prices will increase. The industry then experiences a period of attractive profits, which stimulate investment. Whichever company/country is first to announce and implement capacity additions may succeed to discourage competitors from doing the same - but competitors are

tempted to "call the bluff", and it always happens that too many projects are launched all at once.

As capacity additions are large and discrete, the implementation of a round of new projects normally results in excess capacity and tumbling prices. In the subsequent low prices period, high cost producers may be pushed out of the market, until equilibrium is restored. The industry almost never finds itself in equilibrium: it most commonly oscillates between excess capacity and excess demand, and at each round less efficient producers are eliminated and more efficient plants are added.

The competitive game in the petrochemical industry - at least in basic commodity chemicals, whose technology is available to all for a fee - is therefore conducted primarily through aggressive addition of more efficient capacity. From the point of view of countries striving to diversify their economies, this means that it pays to attract investors to undertake large scale projects relatively early in the cycle. Once those projects are implemented, they are likely to be more efficient than older projects, and survive the next slump in prices.

The competition is therefore centred on locational decisions: if a major company with good marketing decides to set up a production unit in my country, and the plant is completed at low cost and managed efficiently, my country has acquired a competitive advantage.

Locational decisions are influenced by feedstock prices, but there is much more to it. Specifically, the availability of attractive credit conditions for the implementation of large industrial investment projects is a major consideration; as is the availability of infrastructure and transportation facilities, notably close to the sea; and the ease of the investment approval process, especially with respect to environmental impact.

The industrial clusters that have been developed by the GCC countries are especially attractive for the petrochemical industry thanks to potential synergies between different plants located in the same cluster. The output of one project is frequently a feedstock for another project. A joint product which may be available in small volumes from one project may be also available from others, so that in the aggregate enough of it is available to sustain further transformation. Common support services can be developed which contribute to efficiency and the lowering of costs.

In summary, the provision of cheap feedstock has played an important role in attracting foreign investment at the early stages of the industry, but it was not the only element. The creation of strong local partners (SABIC first and foremost) willing to substantially contribute to the equity, the provision of favourable long term credit, the availability of infrastructure and transportation facilities, geographical location and access to the high seas: a host of factors contributed to the initial locational decisions of the early investors. Thereafter, the industry has tended to grow on itself following an internal dynamics in which feedstock prices play a rapidly diminishing role and other factors become increasingly important.

5. Concluding remarks

All national governments engage in various practices of "price distortion" to support their industry and attract foreign direct investment. In this context, it is logical that GCC member countries should leverage their advantage in the availability of hydro-

carbons to pursue industrialisation and economic diversification.

It is relatively easy to enunciate the principle that in any case the price should be sufficient to cover costs, otherwise inefficient, unsustainable industries are encouraged. However, the relevant concept of cost needs to be clarified, and, as we attempted to demonstrate, which of the multiple definitions of costs is relevant depends on circumstances. The latter change over time; therefore, price levels that might have been rational and defensible in the past cease to be so if circumstances change and a different cost concept becomes relevant.

This paper has argued that domestic pricing policies for associated natural gas and for petrochemical feedstock from refinery (naphtha) are well above the relevant concept of cost, therefore cannot be said to be subsidized. However, we also noted that current natural gas prices do not justify the exploitation of some new non-associated gas deposits (e.g. in Abu Dhabi and Saudi Arabia) and consequently supply of natural gas has been constrained. Eventually, domestic prices will need to be increased if supplies are to match industrial demand.

Cheap feedstock prices have played a significant role in the early stages of the petrochemical industry's development, but are today probably much less important. To conclude that the petrochemical industry in the GCC is not viable because it is based on cheap feedstock would be grotesque.

The paper also argued that competition in the petrochemical industry takes place at the level of attracting new capacity, because new plants are always more competitive than old plants. In this "competition for capacity" feedstock costs are but one of numerous important considerations. Notwithstanding the violent oscillations in the price of oil and the global crisis, new large scale petrochemical projects have been launched in the region in 2009. All major petrochemical companies are investing in the GCC in joint venture with local players, and the region is rapidly consolidating its specialization in the production of intermediate petrochemicals.

However when it comes to electricity, the wisdom of offering low tariffs when power is generated from burning hydrocarbons that have a much higher opportunity cost is debatable. Selling electricity cheap to manufacturing industries, such as ceramics and glass, may be justified on the basis that the benefit in terms of value added by far exceeds the opportunity cost.

But the case of industries that fundamentally rely on large inputs of electricity - notable among which is the aluminium industry - is altogether different. The GCC countries face such levels of electricity consumption already today - and rapidly increasing - that they will need to diversify from simple use of fossil fuels, and invest massively in new generation capacity, including nuclear. The opportunity cost of burning natural gas and crude oil in power plants has certainly become significant, and additions to power generation capacity are expensive and not entirely paid by current tariffs. It is not excluded that nuclear energy may be produced at competitive cost, justifying the regional specialization in aluminium smelting, but it is clear that the GCC countries face some critical decisions in this respect.

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