Public Disclosure Authorize

Public Disclosure Authorized

Public Disclosure Authorized

Export Restraints on Russian Natural Gas and Raw Timber

What Are the Economic Impacts?

David G. Tarr

Abstract

Export restraints by the Russian Federation on natural gas and timber have been the source of major controversy between the European Union and the Russian Federation. The analysis of this paper suggests that the export restraints in natural gas very substantially benefit Russia. On the other hand, in raw timber the analysis suggests that a substantial reduction of Russian export taxes would increase Russian welfare.

The paper explains that Gazprom has failed to invest adequately, resulting in little development of new gas supplies. The result has been progressively increasing use by Gazprom of Central Asian gas supplies, at progressively higher prices for Russia. The increased prices of gas for Russian consumers have shown that it is crucial for Russia to allow new entrants and to introduce competition in the Russian domestic market. Without export restraints, however, competition among multiple gas suppliers from Russia would erode or eliminate the monopoly profits of the Russian Federation on gas exports. Thus, with a more competitive domestic market, the Russian government would be expected to grant exclusive exporting rights to a single entity (as it presently does with Gazprom) or impose export taxes. Thus, Europe should not expect to achieve cheaper Russian gas as a result of structural reforms within the Russian gas market. A more promising avenue for European energy diversification is new pipeline construction to open up new sources of supply independent of Russia (especially the Nabucco pipeline), and liquefied natural gas purchases.

Export Restraints on Russian Natural Gas and Raw Timber:
What Are the Economic Impacts?

David G. Tarr

Consultant and Former Lead Economist, World Bank

Export Restraints on Russian Natural Gas and Raw Timber: What are the Economic Impacts?

David G. Tarr

Export restraints by the Russian Federation on natural gas and timber have been the source of major controversy between the European Union and the Russian Federation. The European Union has raised both disputes as part of the WTO accession negotiations of the Russian Federation. The natural gas dispute was resolved as part of the bilateral agreement on Russian WTO Accession between the European Union and the Russian Federation. As of October 2009, however, the dispute on raw timber was still unresolved and remained one of the few issues blocking Russian WTO accession.

In the case of natural gas, the Russian Federation grants an export monopoly to Gazprom, allowing Gazprom to charge profit maximizing prices on its exports. The domestic price of natural gas, however, is regulated by the Russian Federation, resulting in dual pricing of natural gas, where export prices have far exceeded domestic prices in Russia. In the case of raw timber, as of April 1, 2008, the Russian Federation imposed export taxes on raw timber of about 25 percent, and planned to increase them to about 80 percent in 2009, but has so far delayed the implementation of the higher export taxes.

I argue in this paper that the Russian Federation possesses monopoly power on exporting of both natural gas and raw timber. This implies that from the perspective of the economic welfare of Russia as a whole, some export restraint by the Russian Federation is optimal in both natural gas and raw timber. My analysis of the economic impacts suggests that the export restraints in natural gas very substantially benefit Russia. On the other hand, in raw timber, the analysis suggests that Russia has an optimal export tax to exploit is monopoly power on exports of about 12 percent. I conclude that the contemplated raw timber export taxes of 80 percent vastly exceed the optimum level to exploit the monopoly power of Russia; export taxes above 12 are counterproductive to Russian welfare.

In Tarr and Thomson (2004), we argued that the Russian domestic market for natural gas would be better served if the Russian government were to introduce competition. Lack of development of new gas supplies by Gazprom, with resulting increased reliance

on central Asian gas supplies and increased prices of gas for Russian consumers, have shown that these structural reforms in Russia are even more important now.

As part of its energy strategy to diversify its energy sources, the European Union has also sought competition in the Russian natural gas market. Competition among multiple gas suppliers from Russia would erode or eliminate the monopoly profits of the Russian Federation on gas exports. Thus, the Russian government would be expected to grant exclusive exporting rights to a single entity (as it presently does with Gazprom) or impose export taxes. This, Europe should not expect to achieve cheaper Russian gas though competition within Russia. A more promising avenue for European energy diversification is new pipeline construction to open up new sources of supply independent of Russia (especially the Nabucco pipeline), and liquefied natural gas purchases.

A. Natural Gas

I. Introduction

Russia's Interest

During the accession negotiations to enter the World Trade Organization, the question arose whether Russia should charge the same price for the exports of its natural gas as it charges in its home market. This issue was highly controversial in Russia and was a major issue in the bilateral market access negotiations between the European Union and Russia. Peter Thomson and I analyzed this question (see Tarr and Thomson, 2004). We found that from Russia's perspective, there is a strong rationale for discriminatory pricing between gas sold domestically and exported gas. Our economic analysis suggests that pipelines allow Gazprom to segment the Russian market from the European (including Turkey) market, and that Russia has market power in the European market. It is in Russia's interest to exploit that monopoly power on export markets by charging a price above its long run marginal costs. Regarding Russia's domestic natural gas markets, the Russian market would be better served by competition. But while Gazprom retains a near monopoly, the analysis suggests that Russia should regulate domestic prices of natural gas so that gas producers recover the full long run marginal costs, but not more.

These conclusions imply higher export prices than domestic prices of natural gas. There have been a number of significant changes in the Russian gas market since Tarr and Thomson did this analysis. I discuss the most important changes below, but significant changes in the Russian domestic market have shown that the recommendation to increase competition within the Russian gas market is even more important today than it was earlier in this decade. Nonetheless, the basic principle that it is not in Russia's interest to unify natural gas prices has not changed.

World Efficiency

On the other hand, efficient pricing from the perspective of the world would call for unified pricing of gas. One pricing mechanism that could achieve this optimum of unified pricing is "two part tariff" pricing by Gazprom. Our estimates show, however, that two part tariff pricing would approximately double the profits of Gazprom on its European sales.

Europe's Interest

From Europe's perspective, rather than pressure Russia in WTO negotiations or in other fora, diversification of energy sources is the best way to achieve more competitive prices of energy. I discuss the most important of the several pipeline proposals under construction or discussion today and argue that construction of the Nabucco pipeline is crucial to diminish the monopoly power of Gazprom, and construction of the Trans-Caspian pipeline would also be quite helpful for Europe.[1]

Russia's Reserves and Exports.

Russia is endowed with very significant natural gas resources. Its proved reserves at the end of 2008 were 43.3 trillion cubic meters, which constitute 23.4 percent of the world's proven reserves.[2] Its 2008 production of 602 billion cubic meters (BCM) constituted 19.6 percent of world production. Its reserves to production ratio in 2008 of

---

[1] See Aslund (2008) for a similar view. Aslund also suggests liquefied natural gas projects for the European Union.

[2] See British Petroleum, *Statistical Review of World Petroleum*, various years. Russia's proved reserves are down from 47.6 trillion cubic meters and more than 30% of the world's proved reserves in 2001; production is up from 2001 production of 542 billion cubic meters.

72 years, is higher than any other significant producer except Saudi Arabia. Russia is also by far the world's largest exporter of natural gas. In 2008, Gazprom exported about 154 BCM to Europe (including Turkey).

II. Optimal Export Prices

It is in Russia's interest to try to maximize its profits from exports of natural gas. Given the need to ship natural gas from Russia to Europe through a pipeline, Russia is able to "segment" the European market from the Russian market. Russia, in 2008, had a market share of approximately 28 percent of natural gas sales in Europe. In the year 2008, Europe including Turkey consumed about 547 billion cubic meters (BCM) of natural gas, while importing 154 BCM from Russia. This implies Russia has some market power in Europe.[3] The Russian government has given Gazprom exclusive right to use the pipelines for the export of natural gas to Europe.[4] In this situation, it is optimal for Gazprom to price above long run marginal cost to exploit this market power.

In more detail, given the significant role it plays in supplying the European market, Gazprom has market power.[5] The extent of the market power, however, is tempered by the existence of competing sources of gas. In addition, Gazprom wants to benefit from being perceived as a reliable supplier that can be trusted to continue to deliver gas (potentially in increasing quantities) at a fair price to European markets.[6] In the long run, Gazprom faces risks that new competitors will erode its market share and those risks are greater the higher its markup over marginal costs.[7] Volumes for the next

---

[3]   The largest importers of Russian natural gas are Germany (36 BCM), Italy, (25 BCM) and Turkey (24 BCM). The next largest importers are Poland, Hungary, France and the Czech Republic, all of whom imported about 7-9 BCM in 2008. The other principal suppliers of gas to the European market are Algeria (through a pipeline across the Mediterranean), Norway, the Netherlands and the UK. See British Petroleum (2009)

[4] Gazprom paid 685 billion rubles to the Russian government in taxes in 2008. At an average exchange rate of 25 rubles to the dollar for 2008, this was $27 billion. See http://eng.gazpromquestions.ru/?id=12#c337. Nemtsov and Milov (2008) argue, however, that due to gross inefficiency of Gazprom, Russia would be much better served with a state monopoly on exports, but competitive purchases by the state monopoly among competitive producers in Russia.

[5]   Based on data in the Europe market, in appendix 1 of Tarr and Thomson, we present our calculations of the Lerner index of market power. We find that it is significant in comparison with estimates of the Lerner index for other industries.

[6] In the two episodes of suspension of gas deliveries to Ukraine, Russia was forced to resume deliveries to Ukraine, despite lack of resolution of its dispute with Ukraine, in order to supply its European customers.

[7]   Since higher prices will accelerate the entry of new competitors, optimal dynamic pricing by Gazprom would result in a lower price to deter entry. If in the future, supplies from new competitors increase faster

several years are constrained by transportation facilities and long-term contracts. This limitation, of course, can be overcome and new entrants are likely to emerge. However, the longer-term constraint is the demand of export markets. Russia's proven reserves are sufficient to support a doubling, or even tripling, of its production capacity. In order to absorb this volume of gas, markets in Europe would have to increase dramatically.

The key point here is that Gazprom cannot sell significantly more natural gas in Europe without impacting the price of gas there. Russian domestic consumption in 2008 of 420 BCM, was 2.7 times Gazprom sales in Europe. To sell significantly more gas, Gazprom would have to accept a lower price, i.e., it faces a downward sloping demand curve. **This means that there is no "world price" of gas that Russia faces**. Rather, Gazprom must calculate an optimal price for its gas sales in Europe that reflects the tradeoff it faces between the additional revenue from additional sales of gas and the lost revenue from the reduction of price to sell additional gas. Gazprom's optimal price of gas in Europe will have to change over time as the demand for gas in Europe changes, but it is in Gazprom's interest to maximize its profits on exports.

In figure 1, I present the Tarr and Thomson model. Although the data have changed since we did this analysis, the principles still apply and I use the data of our original article to illustrate the argument. I indicate below some key changes and how this affects the results of the analysis.

We assume that Gazprom is optimizing the price and quantity that it sells in Europe—this was between $79 and $99 per thousand cubic meters (TCM) plus $27 transport costs in 2000 and 2001. (Prices were about $380 per TCM in 2008.)[8]. The analysis reveals that

_____

than demand from Europe, the markup by Gazprom would fall. Moreover, elasticities of demand are greater in the long run than in the short run, since, for example, inter-fuel substitution is possible in the long run. Greater elasticities imply less market power and lower the optimal markup over marginal costs. We presume, however, that Gazprom has optimized its markup based on long run calculations.

[8] Gazprom president Alexei Miller reported on March 14, 2008 that "the price [of Russian gas] in Europe now exceeds $370. We believe the average price in 2008 could be $378 and could even reach $400 per 1,000 cubic meters." Regarding demand in Russia, he noted that the rise of national industries, such as producers of cement, building materials, and fertilizers and gas refineries, is also pushing up Russian gas demands. Miller said. Gazprom plans to introduce market gas prices for Russian industrial consumers in 2011. See Johnson's Russia List, http://www.cdi.org/russia/johnson/2008-56-39.cfm.

In 2009, however, the price collapsed to an estimated $280 for 2009. Moreover, Gazprom in its zeal to control natural gas sales to Europe, entered into long term contracts with central Asian suppliers

if Russia were to sell its natural gas to Europe at only full long run marginal cost plus transportation costs, Russia would lose between \$5 billion and \$7.5 billion per year at 2001 values. On the other hand, consumers in Europe would gain even more (between \$7.5 billion and \$10 billion per year), as they would consume more gas at lower prices. If, instead, Russia were to raise its domestic prices to the prices it charges in Europe, Russian industry would incur very large adjustment costs as the gas cost increases would adversely impact on investment and unemployment in the short run. Absorbing the cost increases would induce Russian industry to switch to alternate fuels and produce less gas intensive products that, as we explain below, cannot be justified on the basis of Russia's comparative advantage.

III. Domestic Market Pricing in Russia

Gazprom had a virtual monopoly on domestic gas sales for many years after independence, but the price of gas sales in Russia is regulated by the Federal Tariff Service of the Russian Federation. Moreover, Gazprom controls the gas pipeline within Russia. Legally, "Third Party Access" to the pipelines is granted in Russian law to Russia's independent gas producers (who are both vertically integrated oil companies and specialized gas companies). In fact, independent gas producers frequently complain about their access.[9] Nonetheless, the share of the Russian market captured by independent gas producers in Russia has grown steadily since 2002, and reached an estimated 12-15 percent of the Russian market in 2008.[10] Moreover, independent gas producers control about 30 percent of the natural gas reserves.

Uzbekistan and Turkmenistan. Gazprom reportedly is paying \$340 per thousand cubic meters to Uzbekistan in 2009. But in 2009, due to a decline in world demand, Gazprom has been forced to close down its own wells that produce gas at much lower costs than it pays to central Asian suppliers. Gazprom has acknowledged losses on central Asian purchases in 2009, but argues they will be profitable contracts in the long term.. See "Falling Gas Prices Deny Russia a Lever of Power," *New York Times*, May 15, 2009. www.nytimes.com/2009/05/16/world/europe/16gazprom.html.

.

[9] See Baranov (2008) and "Deputy Prime Minister Instructs Gazprom to Ease Pipeline Access for Russian Gas Producers," *Global Insight*, July 7, 2008. www.globalinsight.com/SDA/SDADetail13190.htm.

[10] The largest independent seller of natural gas in Russia is the specialized gas company Novatek, followed by Rosneft. Other important independent sellers are Lukoil, Surgutneftegaz, TNK-BP and the Itera Group.

Gazprom, however, while not a monopoly in Russia's domestic market, is clearly a very dominant firm with considerable monopoly power. Until more effective competition is introduced into the Russian market, efficient regulation requires constraining the exercise of that monopoly power. Efficient regulation of monopolies calls for a price in the domestic market at levels that reflect the true alternate economic value of the commodity in question.[11] If there were a world price, the opportunity costs of selling gas domestically would be the world price and it would be optimal **for Russia** to charge a unique price on its domestic and export sales.[12] I have explained above, however, that there is not a world price of natural gas for Russia, and Gazprom must determine its export price independently of its domestic price. In Russia's domestic market, the opportunity costs then corresponds to the long run marginal costs of natural gas. In 2001, this implied that it was necessary for Russia to raise the domestic price of natural gas to achieve this economically efficient price; otherwise the capital stock will deteriorate and supplies will not be forthcoming over time. Many market economies, in fact, regulate the maximum price of monopolies such as gas and electricity distribution to achieve this pricing objective.[13] The analysis summarized in figure 1 suggests that in 2001, Russia should have allowed Gazprom to raise its domestic prices of natural gas from about $15 to $20 per TCM to the full long run marginal costs (about $35 to $40 per TCM). This would have resulted in benefits to Russia of about $1.24 billion dollars per year.

By 2007, natural gas prices in Russia had increased to between $64 and $72 per TCM.[14] Although I do not have an updated estimate of LRMC, it has surely increased considerably due to inflation and the substantial increase in steel and wage costs above

See "Gazprom is Not the Only Player in the Russian Fields," *Oil and Gas—Eurasia*. August 2008. http://www.oilandgaseurasia.com/articles/p/80/articles/684

[11] This discussion is based on the monopoly structure of the natural gas market in Russia. Of course, production of natural gas is not a natural monopoly and it would therefore be desirable to have additional producers. We discuss below that if alternate producers of natural gas were given access to the gas pipelines, there would be economic gains as well as environmental benefits. Nothing in the argument developed in this paper implies that the current structure of Russia's gas market is efficient.

[12] Given a domestic monopoly, unified pricing would call for a tax to prevent monopoly profits.

[13] See, Scherer (1980, chapter 18) and Carlton and Perloff (2000, chapter 20).

[14] Estimates based on Rosstat and Ministry of Economy data. According to Gazprom, in 2008, the average price excluding VAT and excise taxes was 1653 rubles per MCM, or about $66 per MCM at 25 rubles to the dollar. See http://old.gazprom.ru/documents/Background_09.06.09.pdf

the rate of inflation, coupled with the weaker dollar. It would appear, however, that with the substantial increase in the price of natural gas to producers in Russia, prices are much closer to LRMC in 2007 than when we conducted this analysis based on 2001 data. Moreover, with its decree #333 in May 2007, the Government of Russia announced plans to increase the price of natural gas to industrial users to international levels by 2011, less transportation costs and export taxes. In early 2008, prices on exports to Europe were about $378 per TCM. With transportation costs of about $35 per TCM and export taxes at 30 percent, to implement this plan today, prices in Russia would have to rise to about $225 per TCM. Russian government forecasts of domestic natural gas prices in 2011, however, are that prices would rise to about $120 per TCM. Thus, to implement this plan, Russian domestic market prices would have to rise dramatically more than what is planned. More importantly, such high domestic prices would be very inefficient. High prices would induce very significant reductions in Russian demand, to the point where the value to Russian consumers would be considerably greater than the long run marginal costs of production. This would imply substantial monopoly profits for Gazprom on domestic sales. Russia fought a bitter battle at the WTO and won the right to have dual pricing of natural gas. However, except for the 30 percent export tax difference and the transportation fees, Russian current plans call for it to unify natural gas prices for its industrial users.

IV. Restructuring of the Natural Gas Industry in Russia

Why is Russia planning to allow domestic prices of natural gas to rise to such high apparently inefficient levels? Two insiders, Nemtsov and Milov (2008), have argued that Gazprom is an inefficient company and that Russian consumers and taxpayers are being forced to pay for that inefficiency. As Russia's existing gas fields are being exhausted, a significant portion of the newer discoveries are available in more difficult places that require greater investment costs. But Nemtsov and Milov estimate that Gazprom's cumulative investments in its core business were only $27 billion from 2001 through 2007. Meanwhile it has failed to develop the key gas fields. For example, the gas deposits of the Yamal peninsula region, with an estimated $200 billion in investment costs, remain undeveloped. Gazprom's production has remained stagnant since 2003, and it has made up the gap between its supplies and demand by ever increasing purchases from central Asia. But these purchases are coming at increased costs. In 2008, the presidents of the gas companies of Kazakhstan, Turkmenistan and Uzbekistan announced that Gazprom would have to pay prices tied to European levels beginning in 2009.

The Russian domestic market would be best served if Russia were to fully introduce competition. Competition in Russian gas would be best accomplished by breaking up the production and distribution segments of Gazprom into separate independent companies, and effectively enforcing third party access to the pipelines. The pipelines could be operated as regulated monopolies. Licenses that Gazprom has failed to use to develop gas fields under the terms of the licenses could be provided to independent companies. This would result in significant additional production, and competition among the producers will hold down the costs of natural gas in Russia.

Competition in the Russian gas market would likely bring considerable additional production on-line. If the additional Russian producers were allowed to export natural gas, competition among Russian firms would erode Russian monopoly profits on European sales. That is, unconstrained access to export markets would result in unified pricing through structural reform of the Russian market. In the absence of the Gazprom monopoly, however, in order to extract the available monopoly profits on its exports of gas to Europe, it would be in Russia's interest to impose export taxes on Russian gas

exporters or to use a state trading monopoly as a marketing arm of Russian natural gas exports. Such a system would result in higher profits for Russia as a whole, since gas would then come from the most efficient Russian supplier.

V. Efficient Prices from the Perspective of the World

Given that Europeans lose more dollars than Russia gains from dual pricing, a natural question is whether there is a cooperative solution that makes both Europe and Russia better off. A cooperative solution would involve Russia selling gas to Europe at LRMC plus transportation costs and Russia receiving compensation in return. Such compensation could take the form of any aspect of the relationship between European countries and Russia, and need not be tied directly to gas prices. But for such an arrangement to be in Russia's interest, the compensation would have to be substantial, valued by Russia at not less than $5 to $ 7.5 billion per year. Alternatively, one can pose the question noncooperatively: can Gazprom develop a pricing strategy that would allow it to increase its profits? Monopolists often employ "two-part tariffs" as a method to extract the maximum profits. If European buyers were offered gas at a lower per unit usage price, but had to pay a fee to access the gas each year, this would be in effect, a two part tariff. For Gazprom, the optimal two part tariff requires pricing gas at LRMC plus transportation costs, and charging an access fee equal to the entire value of the gas to European consumers above LRMC plus transportation costs (the entire consumers' surplus). In principle, Gazprom's profits could increase by not only the $2.5 billion in inefficiency losses from prices exceeding marginal costs in Europe, but by an additional $4.8 billion due the additional value it can extract from consumers with high demand (the triangle DD'J in the figure). Gazprom's failure to maximize short run profits through optimum two-part tariffs, likely reflects its perceived risks of losing profits in the long run to substitutes. By identifying the stakes-- who gains and who loses— we hope that we will inform the debate on this important policy issue.

VI. Energy Diversification for Europe

Diversification of Russian Supplies

The European Union has been pressing Russia to introduce competition into the Russian natural gas market and to allow all producers access to the pipelines both within Russia (presently in Russian law) and for exports. Moreover, some press reports have indicated that Russia agreed to limit its export taxes as part of its bilateral agreement on WTO accession with the EU. If additional Russian producers were allowed to compete and export natural gas, as explained above, in order to extract the available monopoly profits on its exports of gas to Europe, it would be in Russia's interest to impose export taxes on Russian gas exporters or to use a state trading monopoly as a marketing arm of Russian natural gas exports. A more promising avenue for European energy diversification is new pipeline construction to open up new sources of supply independent of Russia, and liquefied natural gas purchases.[15]

Several new pipelines are proposed or under construction between Russia, central Asia and Europe. The most important are: Nord Stream, South Stream, Nabucco and the Trans-Caspian pipelines. Since the former two traverse Russia, they do not offer energy diversification for Europe; Russia already supplies central Asian gas to Europe through its pipelines based on contracts with central Asian suppliers. The latter two offer real diversification of natural gas supplies.

Nord Stream. Russia and Germany agreed to construct the "Nord Stream" project through the Baltic Sea to Germany at an estimated cost of construction of $15 billion. EU officials forecast a beginning to the construction in 2010.[16] The alternate project is a second pipeline adjacent to the existing Yamal-Europe route at a cost of about $2.5 billion. The considerably higher transportation tariffs of the Nord Stream project will allow the gas to by-pass Belarus and Poland, which is seen as an advantage from Russia's perspective. But it must traverse either the Finnish or Estonian seabed and then the

---

[15] For example, Qatargas and Polish gas monopoly PGNiG signed an agreement in which PGNiG will import the equivalent of 1.5 BCM annually of liquefied natural gas from 2014 to 2034. Poland's consumption in 2008 was 13.9 BCM. PGNiG will construct a regasification terminal in time for the deliveries.

[16] See "Nord Stream Gas Pipeline on right track," Euractiv.com, March 11, 2009. http://www.euractiv.com/en/energy/official-nord-stream-gas-pipeline-right-track/article-180127. Smith (2008) estimates that the costs would have been only $2.8 billion for an alternate pipeline—an enlargement of the Yamal pipeline that runs through Poland.

Swedish seabed before reaching Germany, so other intermediary countries remain involved in the transportation route.

South Stream. On May 15, 2009, the gas companies of Russia, Italy, Bulgaria, Serbia and Greece signed an agreement on construction of the South Stream pipeline with a capacity of about 30 BCM per year. The pipeline would travel from Russia through the Black Sea and through Bulgaria. Although the exact route is not finally determined, the Southwestern portion should travel through Greece and the Ionian Sea to Italy, while the Northwestern portion would travel through Serbia and Hungary to Austria. The estimated cost of construction of the pipeline is about $20 billion.

From Russia's perspective, the idea is to by-pass Ukraine and Turkey, but the existing pipeline through Ukraine transports 130 BCM, so Ukraine will retain its dominant position. Moreover, maritime rights with either Urkaine or Turkey will have to be agreed, thereby negating a least part of the key advantage of this project.

Nabucco. The Nabucco pipeline is a planned natural gas pipeline from Erzurum, Turkey through Bulgaria, Romania, Hungary to a major natural gas hub at Baumgarten an der March, Austria. It is a partnership of five companies, with one company from each of the five countries through which the pipeline runs. Construction is expected to begin in 2010 and be completed in 2014. It is a significant part of the European strategy for diversification of energy sources. The initial source of natural gas for the pipeline would be gas from Azerbaijan through existing pipelines that link Azerbaijan gas to Turkey. There are estimates, however, that Azeri gas supplies are inadequate to justify construction of the pipeline, so additional supplies are sought. Turkmenistan is expected to feed the pipeline also, either through pipelines in Iran or through the proposed complicated Trans-Caspian pipeline across the Caspian Sea. If the Trans-Caspian pipeline were constructed, Kazakhstan could also become a supplier to the pipeline. Egypt and Iraq could supply the pipeline through the Arab Gas Pipeline. Finally, Iran could also supply the pipeline, but this is opposed politically by the European Union and the United States.[17]

---

[17] For further details on th Nabucco pipeline see the Wikipedia article at http://en.wikipedia.org/wiki/Nabucco_Pipeline.

Trans-Caspian Pipeline. The proposed Trans-Caspian gas pipeline would run under the Caspian Sea from Türkmenbaşy in Turkmenistan to the Sangachal Terminal in Baku Azerbaijan. From Baku it would connect with the existing South Caucusus pipeline through Tbilisi to Erzurum in Turkey, where in turn it would be connected to the Nabucco pipeline, thus taking natural gas from Turkmenistan to Central Europe. According to some proposals it would also include a connection from the Tengiz field in Kazakhstan to Türkmenbaşy. Thus, the Trans-Caspian pipeline would link Turkmen and possibly Kazakh gas with central Europe through a route independent of both Russia and Iran. The estimated construction cost is $5 billion.

In 2008, a German and Austrian company set up a joint venture named the Caspian Energy Company, to carry out exploration for a gas pipeline across the Caspian Sea that would feed into the Nabucco pipeline. Based on exploration outcomes the company plans to build and operate a gas transport system across the Caspian Sea .Both Russia and Iran, however, oppose the Trans-Caspian pipeline project and have objected on environmental grounds. Both nations maintain that any pipeline built under the Caspian Sea would require the approval of all five countries that border the Sea.

B. Timber

The Russian Government has taken several policy actions in its efforts to diversify its economy. One of these actions has been the imposition of export taxes on raw timber. The export taxes were progressively raised over a period of years, reaching the maximum of 25 percent or 15 euros per cubic meter as of April 1, 2008, and they were planned to increase further in January 2009 to the maximum of 80 percent or 50 euros per cubic meter.[18] To date, however, the Russian Government has postponed implementation of the 80 percent export tax. The hope of the Russian government is that the export taxes will lower timber prices to the wood processing sector within Russia and thereby expand this sector and value-added within Russia. It is a well-known result in the

---

[18] In 2005, Russia introduced a 6.5 percent export tax on logs. As of July 1, 2007, export taxes were raised to the maximum of 20 percent or 10 euros per cubic meter. As of April 1, 2008. export taxes were raised to the maximum of 25 percent or 15 euros per cubic meter.

international trade literature, however, that absent monopoly power on exports, the expansion of value-added through export taxes is socially undesirable. i.e., it will typically reduce economic welfare.[19]

It is likely; however, that Russia possesses some monopoly power on the exports of timber. Russia possesses the largest share of world forest reserves (22%),[20] and Russian timber plays a significant role on world markets for some products. For example, about 40% of world conifer is produced in Russia.[21] For markets geographically close to Russia, such as Finland and Sweden, Russia's role is even more important. Finland imports about 25 percent of its timber and about 80 percent of its imports are of Russsian of Russian origin. Russia's share of the combined Finnish-Swedish timber market is about 11.4 percent. [22]

Given some monopoly power on world export markets for Russia, there is a positive export tax that would increase Russian economic welfare. But the planned Russian government's export tax of 80 percent may considerably exceed the optimal export tax, so it is necessary to analyze the problem more carefully to estimate the optimal export tax.

The analysis of optimal export pricing for Russia on timber exports differs in a crucial way from the gas pricing problem discussed above. In the case of gas pricing, Gazprom has a monopoly on export sales of Russian gas. In the case of timber, there is competition among timber exporters from Russia. If Russia as a whole possesses monopoly power on its timber exports, competition among timber exporters will prevent the firms from exploiting that monopoly power. An export tax by the Russian government could be used to extract the monopoly rents for Russia as a whole.

In general, the Russian government would want the export price to be at a level where the marginal revenue from additional timber sales to the country equals marginal costs. We can use the mathematics of the gas pricing analysis, where the Russian government is playing the role of Gazprom on exports. Abstracting from transportation costs, it is optimal for the Russian government to have its firms charge a price where

---

[19] See Takacs (2008) for an excellent elaboration of how export taxes reduce economics welfare.
[20] See www.forest.ru.
[21] "Russian Newspaper (Rossiiskaya Gazeta)",#4317, 03.16.2007. Internet page: "Российская газета" - Федеральный выпуск №4317 от 16 марта 2007 г.
[22] Khramov et al.(2008, p4).

price exceeds marginal costs, and the markup of price above marginal costs depends on the perceived elasticity of demand for Russian exports of timber.

$$p(q_E) = [\varepsilon /(1+\varepsilon^P)]\ c$$

Where $p(q_E)$ is the price of exports, q_E is the quantity of exports, $\varepsilon^P =$ the perceived elasticity of demand by the Russian government on its exports of timber (assumed to be less than negative one) and $c =$ marginal costs of producing timber.

Competition among exporters will induce exporters to set prices equal to marginal costs. If the Russian government imposes and export tax of t, it will increase marginal costs to $c(1+t)$. Then exporters will charge the optimal price to extract monopoly profits if t is set such that:

$$\varepsilon /(1+\varepsilon^P) = (1+t^*)$$

Then the optimal export tax t* is:

$$t^* = \frac{\varepsilon^p}{1+\varepsilon^p} - 1 = \frac{-1}{1+\varepsilon^p}$$

For competing Cournot oligopolists, the perceived elasticity of demand is equal to the market demand in the relevant market divided by the oligopolist's share of the market.

$$1/\varepsilon^p = \frac{s}{\varepsilon_E}$$

Khramov et al. (2008) estimate the market elasticity of demand for timber in Finland and Sweden at -1.16. With a market share of about 12 percent, the perceived elasticity of demand for Russia is -9.7, and the optimal export tax t* is 11.5 percent. If the market elasticity of demand for timber in Finland were -2, then the optimal export tax would fall to 6.4 percent. In summary, the 80 percent export taxes imposed by the

Russian government in 2009 on raw timber appear to be between 7 and 14 times higher than the optimal level. Even the export tax of 25 percent (in effect at the time of this writing) is more than twice the optimum level.

References

Al-Sahlawi, Mohammed A. (1989), "The Demand for Natural Gas: A Survey of Price and Income Elasticities," Energy Journal, 10 (1), January, 77-90.

Aslund, Anders (2009), "Gazprom's New Weakness offers Opportunity, *Moscow Times,* May 27. http://www.themoscowtimes.com/article/1028/42/377459.htm

Aslund, Anders (2008), "Russia's Energy and the European Union's Perspectives on Gazprom," Speech before the European People's Party, European Parliament, May 15. http://www.iie.com/publications/papers/aslund0508.pdf

Baranov, Viktor (2008), Rising Gas Exports, Demand for New Supply Guarantees Future of Russia's Independent Gas Producers on the Russian Gas Market, *Oil and Gas Eurasia*, April. http://www.oilandgaseurasia.com/articles/p/70/article/581/

Beierlin, J., J. Dunn and J. McConnor, Jr. (1981), "The Demand for Electricity and Natural Gas in the Northeastern United States," *Review of Economics and Statistics*, 64, 403-408.

Blagov, Sergei (2009). "Alternate Gas Suppliers Face Overproduction in Russia," *European Dialogue*, September. http://eurodialogue.org/node/679.

British Petroleum (2000; 2001, 2009), Statistical Review of World Petroleum, 2000, 2001, 2009. Available at:www.bp.com/centres/energy/

Bresnahan, Timothy (1989), « Studies of Industries with Market Power, » in Richard Sshmalansee and Robert Willig (eds.), *The Handbook of Industrial Organization*, Amsterdam: North-Holland.

Cala, Andres (2009), Eurasia Geopolitics: Iran Making Inroads On Caspian Gas, *Global Research*, February26. http://www.globalresearch.ca/index.php?context=va&aid=12468

Carlton, Denis and Jeffrey Perloff (2000), *Modern Industrial Organization*, 3rd edition, Harper Collins.

Chaudhary. Mohammad Ali et al. (1999), "Industrial Sector Input Demand Responsiveness and Policy Interventions," *Pakistan Development Review*, 38 (4), Winter, 1083-1099.

Estrada, Javier and Ole Fugleberg (1989), "Price Elasticities of Natural Gas Demand in France and West Germany," *Energy Journal*, 10 (3), 77-90.

Gaskins, Darius (1971), "Dynamic Limit Pricing: Optimal Pricing under Threat of Entry," *Journal of Economic Theory* 3, September, 306-322.

Heinrich, Andreas and Julia Kusznir (2005), "Independent Gas Producers in Russia," KICES Working Paper, September. Available at: http://www.kices.org/downloads/KICES_WP_02.pdf

Hsing, Yu (1992), Interstate Differences in Price and Income Elasticities: The Case of Natural Gas, *Review of Regional Studies, 22 (3),* Winter: 251-59

Inside US Trade, April 26, 2002.

Joskow, P. and M. Baughman (1976), The Future of the U.S. Nuclear Energy Industry," *Bell Journal of Economics*, 7 (Spring), 3-32.

Khramov, Vadim, Larisa Korableva and Anna Kovaleva (2008), "Export Taxes on Russian Timber Case of Finland and Sweden," New Economic School International Trade Policy term project paper, Moscow, May 5, mimeo.

Liu, Ben-Chieh (1983), "Natural Gas Price Elasticities: Variations by Region and by Sector in the USA," *Energy Economics 10* (3), 195-201.

Nemtsov, Boris and Vladimir Milov (2008), Putin and Gazprom
http://www.docstoc.com/docs/1603180/Nemtsov-White-Paper-Part-II----Gazprom

Oi, Walter (1971), "A Disneyland Dilemma: Two-Part Tariffs for a Mickey Mouse Monopoly" *Quarterly Journal of Economics, 85* (1), February: 77-96

Phlips, Louis (1981), *The Economics of Price Discrimination*, Cambridge: Cambridge University Press.

Ramirez, Juan C. and Juan Rosellon (2002), "Pricing Natural Gas Distribution in Mexico," Energy Economics, 24(3), May: 231-248.

Scherer, F.M. (1980), *Industrial Market Structure and Economic Performance*, Chicago: Rand McNally

Sherman, Roger and MichaelVisscher (1982), "Rate-of-Return Regulation and Two-Part Tariffs," *Quarterly Journal of Economics*, 97(1), February: 27-42.

Smith, Keith (2008), "Russian Energy Policy and its Challenge to Western Policy Makers," Center for Strategic and International Studies," March. Available at:
http://csis.org/files/media/csis/pubs/080407_helsinki.pdf

Tarr, David and Peter Thomson (2004), "The Merits of Dual Pricing of Russian Natural Gas," *The World Economy*, Vol. 27, Issue 8. August, 1173-1194.

Taylor, L.D. (1977), "The Demand for Energy: A Survey of Price and Income Elasticities," in E.D. Nordhaus (ed.) , *International Studies of the Demand for Energy*, Amsterdam: North Holland.

APPENDIX A

Derivation of the Optimal Pricing of Russian Natural Gas in Europe and in Russia by Gazprom

Model

We assume that the market for Russian natural gas is segmented between Russia and Europe. We assume Gazprom acts as a monopoly in Russia but faces rival oligopolistic competitors in the Europe market.

Define the following notation:

P = Price in Russia
Q = Quantity in Russia
p = price in Europe
q_E = total quantity in Europe
q_i = quantity supplied in Europe by supplier i
q_R = quantity supplied in Europe by Russia
c = costs of producing natural gas in Russia (assumed constant)
t =   transport costs of natural gas from Russia to Europe (assumed constant)

Then profits for Gazprom are:

$$(1) \quad \pi = P(Q)Q - cQ + p(q_E)q_R - (c+t)q_R$$

Assume that Gazprom and its rivals in the Europe market compete as noncooperative Cournot oligopolists. (A cooperative equilibrium would imply a markup over marginal costs that is higher than derived below with a noncooperative equilibrium.) Then the optimum prices and quantities in the two markets for Gazprom are obtained by solving (2) and (3):

$$(2) \quad \frac{\partial \pi}{\partial Q} = P'(Q)Q + P(Q) - c = 0$$

$$(3) \quad \frac{\partial \pi}{\partial q_R} = p'(q_E)\frac{\partial q_E}{\partial q_R}q_R + p(q_E) - (c+t) = 0$$

Since under the Cournot assumption $\frac{\partial q_E}{\partial q_R} = o \; \forall \, i \neq R$, we have that $\frac{\partial q_E}{\partial q_R} = 1$. Then (2) and (3) may be written as:

$$(4) \quad P(Q) - c = -\frac{dP}{dQ}Q$$

$$(5) \quad p(q_E) - (c+t) = -\frac{dp}{dq_E}q_R$$

Multiply the right hand side of (4) by *P/P* and divide both sides by *P* to obtain:

$$(6) \quad \frac{P(Q)-c}{p(Q)} = \frac{-1}{\varepsilon_R}$$

where ε_R = market elasticity of demand in Russia.

Equation (6) states that the optimal percentage markup over marginal costs that Gazprom desires is equal to the inverse of the market demand elasticity in Russia. This is the well-known Lerner market power measure.

For the Europe market, multiply the right hand side of (5) by pq_E / pq_E and divide both sides by p, then

$$(7) \quad \frac{p(q_E)-(c+t)}{p(q_E)} = \frac{dp}{dq_E}\frac{q_E}{p}\frac{q_R}{q_E} = \frac{-s}{\varepsilon_E}$$

where $\varepsilon_E = \dfrac{dq_E}{dp}\dfrac{p}{q_E}$ = market elasticity of demand in Europe and $s = \dfrac{q_R}{q_E}$ = the market share of Gazprom in Europe.

Define the perceived elasticity of demand by Gazprom in the Europe market as ε^P. Then:

$$1/\varepsilon^P = \frac{\partial p}{\partial q_R}\frac{q_R}{p} = \frac{dp}{dq_E}\frac{\partial q_E}{\partial q_R}\frac{q_R}{p} = \frac{dp}{dq_E}\frac{q_E}{p}\frac{q_R}{q_E} = \frac{s}{\varepsilon_E}$$

Thus, the right hand side of (7) is the absolute value of the inverse of the perceived elasticity of demand by Gazprom in the Europe market. Analogous to the monopoly condition in Russia, the optimum markup of price over marginal costs for Gazprom in Europe is equal to the inverse of its perceived elasticity of demand, where marginal costs includes transportation costs.

It is evident from equation (7) that the optimal markup of Gazprom in the European market increases with the market share s and decreases as the absolute value of market elasticity of demand increases. The optimal price also increases as marginal costs c, or transportation costs t increase.

The optimal price quantity combination is depicted in Figure 1. The Russian market is depicted to the right of the origin. The Europe market is to the left of the origin, where the quantity increases further to the left. In Europe, perceived marginal revenue equals marginal production plus transportation costs at point E, where Gazprom sells 126 billion cubic meters of natural gas. At this quantity, the market clears at point D, where price equaled $106 per thousand cubic meters (TCM) in 2000.

Lerner Index of Market Power

Using data available in the text, or figure 1, we calculate the Lerner index of market power in Europe; that is, we estimate equation (7); note that a perfectly competitive market would yield a value of zero for equation (7).

. Using LRMC, the Lerner index equals 0.37 based on prices in 2000 or 0.47 based on prices in 2001. With short run marginal costs (about $20 per TCM) the Lerner index would rise to 0.56 or 0.63, depending on the year. So the Lerner index for Gazprom in Europe ranges from 0.37 to 0.63, depending on the year or the measure of marginal costs.

Bresnahan (1989, table 17.1) has surveyed the estimates in the literature of the Lerner index of market power in many industries. Bresnahan notes that the literature has focused on (U.S.) industries with high concentration ratios, that is, industries where we expect to find significant market power. There are several industries in which the Lerner index is higher than the value for Gazprom in Europe (e.g., tabacco, 0.65; aluminum between the two world wars, 0.59; banks before deregulation, 0.21-0.88). But most of the studies of market power in industries had estimates of market power lower than our measure for Gazprom in Europe (e.g., coffee roasting, 0.025-0.05; rubber, 0.05; textiles, 0.07; electrical machinery, 0.2; railroads, 0.4; retail gasoline, 0.1; automobiles, 0.1-0.34; banks after deregulation, 0.16-0.4). Thus, despite the fact that the sample of industries selected for study are those where the authors expected to find significant market power, our estimate for Gazprom is among those the estimates with a large amount of market power.

Appendix B
Implied Welfare and (Relative) Quantity Effects
of Changes in Russian Natural Gas Prices

Welfare and Relative Quantity Effects of Natural Gas Pricing in Russia

"**Relative" Decline in Natural Gas Consumption in Russia**. A crucial determinant of the demand for natural gas in Russia over time is the aggregate income of Russia. As the economy grows, Russia can be expected to increase its demand for natural gas in accordance with its income elasticity of demand for natural gas. The demand for natural gas is also responsive to price. In the analysis below, we focus on the price effects and estimate the impact of increases in the price of natural gas, and hold other variables like the income of Russia constant. In other words, the analysis employs the standard comparative static "*ceterus paribus*" assumption of economic analysis to evaluate the impact of a policy change. It is not a forecast of the change in demand for natural gas. One would expect that even with the price increases implied below, with enough time, the growth in Russian GDP will dominate the price impacts and the quantity demanded of natural gas will increase over time. With that understanding, we estimate the impact on the change quantity demanded and welfare as a result of price changes in Russia induced by pricing policies. To simplify the discussion, we refer to quantities and prices as of 2001, and measure changes in quantity demanded relative to the quantity demand in 2001, but actual quantities in the future will differ due to growth in demand and other factors.

Price Elasticity of Demand for Natural Gas. The amount of the decline in Russian consumption of natural gas following a price decrease depends on the elasticity of demand. There have been estimates of the price and income elasticities of demand for natural gas by various authors, including Joskow and Baughman (1976) for 48 U.S. States, Beierlin, Dunn and McConnor (1981) for nine U.S. states, Estrada and Fugleberg (1989) for France and West Germany, Hsing (1992) for the states in the United States, Liu (1983) for regions and sectors of the United States, and Chaudry (1999) for Pakistan.

These estimates and others have been surveyed by Al-Sahlawi (1989) and earlier by Taylor (1977). Regarding the price elasticities of demand, the studies typically find that short run price elasticities are inelastic but the long run elasticities are elastic. From the survey of Al-Sahlawi (1989, tables 1 and 2), the various studies of short run price elasticities of demand range from –0.07 to –0.63, with a modal estimate of about –0.25. Long run price elasticities of demand range from –0.56 to –4.6, with a modal estimate of about –2.3.

In the analysis below, we shall assume a value for the price elasticity of demand in Russia of –0.5. This is in between a short and long run price elasticity. The larger the elasticity estimate, the larger the welfare effects from a price increase. From a long run perspective, a value of –0.5 for the price estimate, clearly underestimates the welfare loss from price unification.

Increase in the Price in Russia to LRMC. If the price of natural gas were increased to the LRMC (that is, from $20 to $40 per TCM), consumption of natural gas would be more efficiently allocated and would decline compared to the current level of 375 BCM.

 If we assume a market elasticity of –0.5, consumption would decline to 251 BCM. This would generate a welfare gain to the economy of $1.24 billion per year.

Details of the calculations are as follows:

The elasticity of demand in Russia is $\varepsilon_R = \dfrac{\Delta Q}{\Delta P}\dfrac{P}{Q}$. Rearranging yields: $\Delta Q = \varepsilon_R \dfrac{\Delta P}{P} * Q$

$\Delta P = \$20/TCM$; $P = \$30/TCM$ (at the midpoint); $Q = 375\,BCM$.

$\therefore \Delta Q = \varepsilon_R \left(\dfrac{2}{3}\right) * (375\,BCM)$

If $\varepsilon_R = -0.5$, then $\Delta Q = -124\,BCM$.

 The welfare gain is equal to the value of the triangle AA′B in figure 1. This is $0.5 * \Delta Q \cdot \Delta P = 0.5 * (-124\,BCM) * (\$20/TCM) = \$1.24$ billion.

Increase in the Price in Russia to Export Parity Levels. If on the other hand, the price in Russia were increased to export parity levels, the price in Russia would have to increase to between $(106 – 27)= $79 per TCM and $(126 – 27) = $99 per TCM (data are from Tarr and Thomson (2004, table 1). Given that the present price is less than $20 per TCM, this means that the price would have to at least a quadruple and the price increase would be at least $59 per TCM. At unchanged quantities, the increase in the cost of natural gas in Russia would be:

 $59 per TCM * 375 BCM = $22.1 billion

The quantity demanded at these higher prices would depend on the elasticity of demand for natural gas in Russia. To estimate the implied decrease in natural gas consumption in Russia, suppose that the price increase is "only" $59 per TCM. Then the change in quantity would be as follows:

The elasticity of demand in Russia is $\varepsilon_R = \dfrac{\Delta Q}{\Delta P}\dfrac{P}{Q}$. Rearranging yields: $\Delta Q = \varepsilon_R \dfrac{\Delta P}{P} * Q$

$\Delta P = \$59/TCM$; $P = \$39.5/TCM$ (at the midpoint); $Q = 375\ BCM$.

$\therefore \Delta Q = \varepsilon_R * 1.5 * (375\ BCM)$

If $\varepsilon_R = -0.5$, then $\Delta Q = -280\ BCM$.

Then the new quantity demanded in Russia would be 95 BCM. That is, Russian quantity demanded would fall to roughly 25% of the original quantity demanded.

For constant elasticity demand curves with elasticities greater than 0.65 in absolute value, we estimate that this price increase would induce a fall in the quantity demanded to zero. Thus demand must be rather inelastic in order for any significant natural gas market to remain in Russia following a price increase of this magnitude. Most likely, the elasticity is sufficiently small for key buyers that there would be some demand even at high prices, but this shows that the contraction in demand and shrinkage in production would be very large for Russia. The implication is that there would be very large adjustment costs for Russia from this policy. These adjustments would be inefficient since they are not based on comparative advantage.

Welfare Economics for Russia in the Europe Market

If Gazprom lowers the export price in the Europe market to LRMC plus transport costs, the new equilibrium is at point F in figure 1. At point F, Russia will earn zero rents, since price equals costs at this price-quantity combination. At the higher prices in Europe, however, Gazprom earns rents equal to the rectangle DD'E'E. Thus, the loss to Gazprom is the value of this rectangle. (It can be equivalently measured by the triangle EFG.) Note that the estimated loss to Gazprom from moving to marginal cost pricing in the Europe market is independent of the elasticity of demand. The losses are simply the rents Gazprom earns on its prior sales in Europe. Depending on prices in year 2000 or 2001, the price reduction is $39 per TCM or $59 per TCM. Then the value of the losses to Gazprom are between $5 billion and $7.5 billion per year. (126 BCM * $39/TCM = $5 billion) or (126 BCM * $59/TCM = $7.5 billion).

Welfare Economics for Europe in the Europe Market

If Gazprom lowers the export price in the Europe market to LRMC plus transport costs, the new equilibrium is at point F. European consumers would receive the benefit of paying $5 to $7.5 billion less per year less on their present purchases (the rectangle DD'E'E). In addition, at the lower natural gas prices, European consumers can expand consumption of Russian gas until price exceeds the lower marginal cost. Thus, they would also receive the benefit of the resource allocation gain equal to the triangle DEF. The Europeans obtain a rent transfer from Russia plus a triangle of resource allocation benefits.

The value of the triangle DEF depends on the perceived elasticity of demand of Gazprom. Since it is natural to assume that Gazprom optimizes on its sales in Europe, it follows that it charges a price where the perceived elasticity of demand exceeds unity in absolute value. (Otherwise marginal revenue is negative, i.e., it is operating in the portion of the demand curve to the left of point H, and it can increase profits by reducing sales.) We assume the elasticity is –1.5 in this calculation and we take a price decline of $50 per TCM, an average of the implied price decline in 2000 and 2001. Recall that the perceived elasticity of demand is the market elasticity of demand times the share of Gazprom in the European market, i.e., in absolute value the perceived elasticity is larger than the market elasticity of demand by a multiple of about (10/3). We calculate the value of the triangle as follows:

The perceived elasticity of demand is:

$$\varepsilon^P = \frac{\Delta q_E}{\Delta p_R} \frac{p_R}{q_E}.$$

The quantity change, implied by a $50 price reduction is:

$$\Delta q_E = \varepsilon^P \frac{\Delta p_R}{p_R} \cdot q_E$$

$$= -1.5 * \frac{-\$50}{\$92} \cdot 126 \, \text{BCM} = 103 \, \text{BCM}$$

where $92/*TCM* is the price midpoint.

Then the value of the triangle DEF is:

$$0.5 * (103 \, BCM) * \$50 / TCM = \$2.6 \, \text{billion}.$$

The gain to consumers in Europe is the sum of the rectangle DD'E'E plus the triangle DEF. This value is between $7.5 billion an $10 billion per year.

Net Welfare Change in the Europe Market

Since Europe gains the rectangle DD'E'E plus the triangle DEF, while Russia loses the rectangle DD'E'E, there is a net welfare gain equal to the triangle DEF associated with uniform pricing. This is a familiar triangle of distortion costs from monopoly pricing. Thus, Europe gains $2.5 billion per year more than Russia loses.

Full Potential Value of Consumers surplus in European Market

The full potential value of consumers surplus to Gazprom (potentially extractable through a two part tariff) includes the rectangle DD'EE' (between $5 and $7.5 billion) plus the triangle DEF ($2.6 billion) plus the triangle DD'J. To calculate the value of the triangle above DD'J, we must estimate the price at which the demand curve intersects the vertical

axis. In the triangle DD'J, the quantity change is equal to the negative of the initial equilibrium quantity of 126 BCM. Thus,

$$-\Delta q_E = q_E = 126 \, \text{BCM}$$

The initial price is $116 TCM, if we take the midpoint of the prices in 2000 and 2001. The change in price implied by the quantity change to zero, with a liner demand curve with perceived elasticity –1.5 is therefore:

$$\Delta p_R = \frac{p_R}{\varepsilon^P} \frac{\Delta q_E}{q_E} \cdot = -\frac{p_R}{\varepsilon^P} = *\frac{\$116}{1.5} \cdot = \$77 \, \text{TCM}$$

Then the value of the triangle DD'J is:

$$0.5 * (126 \, BCM) * \$77 / TCM = \$4.8 \, \text{billion}.$$

Consequently, the optimal two part tariff from Gazprom would extract between $12.2 and 14.7 billion [=(5-7.5) + 2.6 + 4.8] billion (DD'EE'+ DEF + DD'J). This is approximately double the rents that Gazprom extracts on their sales from the single price based on usage.

Figure 1: Optimal Pricing of Russian Natural Gas in Europe and in Russia
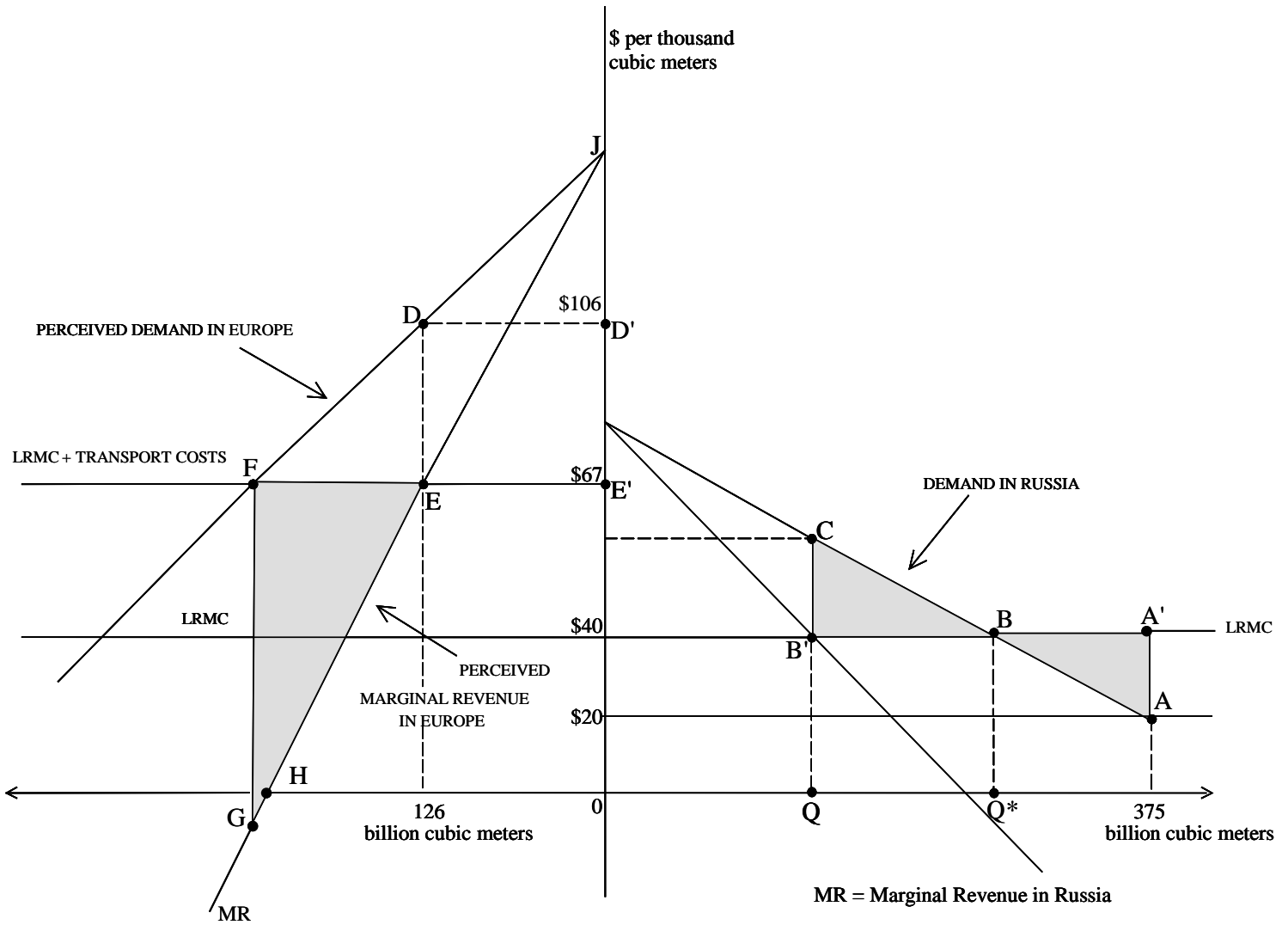
Optimum in Europe Market. We assume Gazprom maximizes profits on the quantity of natural gas sales in Europe. This occurs at point E, where perceived marginal revenue equals marginal production plus transportation costs. At this quantity (126 billion cubic meters), the market clearing price is at point D ($106 per thousand cubic meters). For quantities greater than at point E, marginal revenue is less than marginal production plus transportation costs. Thus, expansion of sales to the point F, where the price ($67) equals marginal production plus transportation costs, will result in losses on Russia's exports (relative to point D) equal to the value of the shaded triangle (EFG) (which is equal to the rectangle DD'E'E). For quantities greater than point H, additional sales will reduce the revenues received, and additional costs are also incurred.

Russia Market Gazprom faces a controlled price at $20 per thousand cubic meters, leading to quantity demanded (and sold) of 375 billion cubic meters of sales in Russia. The social optimum for Russia is at point B where long run marginal cost equals price at $40. An increase in the price in Russia from $20 to $40 results in an increase in welfare in Russia equal to the triangle AA'B. Gazprom would maximize profits where marginal revenue equals marginal costs, leading to point C. Since the value to Russia exceeds the marginal costs of production for quantities less than at Q*, there is a triangle of losses equal to BB'C for an increase in the price resulting in a movement from B to C.