DETERMINANTS OF VERTICAL INTEGRATION IN OIL INDUSTRY: CASE OF TRANSITION ECONOMIES

by

Volodymyr Marchak

A thesis submitted in partial fulfillment of
the requirements for the degree of

Master of Arts

EERC MA program in Economics

2003

Approved by Svitlana Budagovska, World Bank
Chairperson of Supervisory Committee

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Program Authorized
to Offer Degree _____

Date _____

EERC MA program in Economics

Abstract

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This study develops several testable hypotheses for vertical integration in oil industries and tests them, namely, demand variability, market imperfections and transaction cost approaches. Findings of empirical research supports Coase's preposition that firms decide to integrate vertically to substitute partly price mechanism of free markets due to large cost of such coordination through market operations. Empirical results show that oil companies decides to move in oil refinery sector in order to decrease uncertainty connected to oil prices and consequently profits fluctuations, and to diminish transaction costs of open market operations. In case of oil industry these transaction cost is partly associated with asset specificity problem i.e. location of each production stage. I found that firms with more distant refinery stage have higher level of vertical integration. I failed to prove empirically that monopolistic considerations induce firm to integrate vertically though these question require more detailed research.

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ACKNOWLEDGMENTS

I am thankful for my thesis advisor, Prof. Ronald Johnson for his support in work and multiple suggestions that helped me a lot during writing. Valuable comments of Prof. Tom Coupe, Jim Bugden and Robert Swidinsky are appreciated. I also owe many thanks for my friends for insightful and critical discussions, and my family for their patience.

GLOSSARY

Downstream firm – firm that produces final product

Horizontal integrated firm – a firm that combines with its rivals in the same market

Merger – a transaction in which the assets of one or more firms are combined in a new firm

Transaction costs – the cost associated with market transactions excluding price

Transfer prices – prices of good translated between units of firm

Upstream firm – firm that supplies inputs to production process

Vertical integrated firm – a firm that participates in more than one successive stage of the production or distribution of goods or services

Vertical restrictions – binding contractual limitations on price, distribution or quality, or behavior that one nonintegrated firm imposes upon another firm (seller or buyer)

Chapter 1

INTRODUCTION

With the development of transition countries and rapid pace of privatization processes new private conglomerates emerged. These conglomerates (or financial industrial groups) include a vast majority of enterprises often from different industries. The most widespread organizational form of a typical financial-industrial group is vertical integration i.e. when a firm consists of enterprises of the same supply chain. This form of industrial organization becomes popular especially in Ukraine and other CIS countries where almost all big corporations (in energy sector, metallurgy and car industry) are vertical integrated to some degree. Vertical integration in 'old' enterprises, which were built during industrialization period in Soviet Union, could be explained from historic point of view. Under the planned economy enterprises participated in successive stage of the production, almost in all cases were governed by the same industry ministry. This organizational structure was similar to vertical integration under one 'firm' (ministry in Soviet case). Privatization and the following corporate restructuring dissipated formal ties between enterprises. But now a significant part of large enterprises is again consolidated in new organizational forms – privately owned corporations that almost reproduce former ministries organizational structure and is mixture of horizontal and vertical integrated firms. A natural question arises: what causes re-integration process now under market economy rules?

The main objective of this paper is to show that although the level of corporate governance in transition economies is far below the level of the industrialized countries, incentives for vertical integration are in fact the same, and vertical integration in conglomerates could be explained with the help of the modern theory of industrial organization.

I decided to use oil industry as the example of vertical integration in transition countries for several reasons. The first argument is that the largest world oil companies have for a long time been vertically integrated, participating in most activities in the supply chain ranging from extraction and manufacturing to transportation and retailing. The major companies have owned refineries and retail sites (service stations) for decades supplying oil and gasoline to consumers. Historically, economic studies on vertical integration were generated by a rapid process of companies' assimilation in oil and metallurgical businesses during late XIX-early XX century in the USA and waves of acquisitions and mergers in world economy during past 20-30 years. Development path of newly created oil companies from New Independent States (NIS) and Central and Eastern Europe (CEE) region are almost the same as ones of world known companies like ExxonMobil (former Standard Oil), Royal Dutch Shell – vertical integration 'from oil drill to petrol station'.

Another reason for choice of oil industry is that this industry is the one of the most rapidly growing in the last ten years since the collapse of the Soviet Union and the beginning of transition from planned to market economy, and plays a significant role in economies of some states like Russia, Ukraine, Poland or Hungary. For example, in all of these countries the largest companies work in oil sector – 'Lukoil' in Russia (#2 in Russia), 'Naftogaz Ukrainy' in Ukraine, MOL in Hungary, 'SNP Petrom' (Romania) and 'PKN Orlen' in Poland. Obviously, these economies are highly vulnerable to oil and refinery sectors' performance and,

consequently, to oil prices changes. Moreover, privately owned oil companies are more transparent in part of production and financial data that allows particular analysis of incentives for vertical integration.

The paper is organized in the following way: after the introduction previous empirical and theoretical studies on vertical integration are reviewed; subsequent section 'Empirical Testing' stipulates the way hypothesis about incentives for vertical integration will be tested and presents oil industry review in transition countries where some industry peculiarities are described. In section "Results and Discussions" empirical results and practical implication of this paper are presented.

Chapter 2

THEORY DESCRIPTION AND LITERATURE REVIEW

Broadly viewed, vertical integration is the merger of two or more firms operating at different stages of a productions process. A more formal definition, one proposed by Perry (1989), is the following:

'A firm can be described as vertically integrated if it encompasses two single-output production processes in which either (1) the entire output of the "upstream" process is employed as a part or all of the quantity of one intermediate input into the "downstream" process, or (2) the entire quantity of one intermediate input into the "downstream" is obtained from part or all of the output of the "upstream" process'.

All inputs save one could be purchased by a downstream entity from upstream firms or entities, and assembled with some value added. That product could then be sold to another downstream entity or firm. Conceivably, production at Adam Smith's (1937) pin factory could have been subdivided into numerous separate transactions between entities or firms. In a more familiar setting, consider that many firms have their own accounting and finance departments though almost all these services could be obtained from specialized firms. Understanding why firms are vertically integrated has been the subject of much debate and has given rise to an extensive literature on the subject.

The main explanation for vertical integration from the point of view of firm managers is usually higher profits that integrated firm could obtain in short or long run periods. But not all firms move in boundaries production or distribution

stages are profitable and some of them decrease efficiency. For example, managers may desire to control larger firms because they enjoy power, and they may pursue expansionary policy, especially in transition economies where property rights are weak and assets are easy to be stripped by interest groups.

It also should be noted that vertical integration is not only a form of a strategical behavior when a firm tries to control supplies or sales chains. Often a firm that relies on small number of sellers and buyers writes complex contracts that restrict outside options for its contractors. Vertical restriction is the approximate form of vertical integration though firms under these arrangements are nominally independent and not connected by property rights.

According to Perry (1989), there are three groups of incentives for vertical integration: (1) technological economies, (2) transaction economies, and (3) market imperfections. Theses groups include different explanations for the firms' decisions to vertically integrate: assuring a steady supply of a key input, increasing market power, eliminating market power of other firm, rising rival's cost etc. In following subsections each group of incentives will be reviewed in details.

Technological economies.

Vertical integration may enhance efficient use of primary resources in particular technological processes, and a firm needs less intermediate goods substituting them for primary goods. For example, Perry (1989) presented an example when 'integrating primary metallurgy production with final metal product manufacturing on one production site decreases energy costs since there is no need to reheat steel for final product formation'. However, there is no practical interest in explaining vertical integration with the help of technological factors because it is applicable only for very specific production processes.

Transactional economies

Transaction cost approach is one of the most important and influential in explaining factors that lead to vertical integration. Transaction cost contrary to the production cost refers to value of exchange. Coase (1937) firstly mentioned transaction cost as the cost of revealing prices on the market. Author claimed that internal cost of exchange and cost of using markets defines optimal size of the firm in terms of number of production processes that the firm accomplishes. He took exception from prevailed belief that firm expansion outside production boundaries has monopoly origins and it was main break through in studies of vertical and horizontal merging. Later Coase (1960) described transaction cost as cost of market transaction that include cost of conducting negotiations, drawing up contracts and inspections of terms of contracts. When administrative cost of rearranging of legal rights for means of production is lower than cost of market transaction, than market transactions are substituted with administrative decisions within the firm. 'Transaction cost' in broader definition also includes not only direct costs of signing and monitoring of contracts but also risk associated with market transactions and transaction specific investments.

Williamson (1975, 1979), one of the proponents of transaction cost approach, provided framework for investigating incentives for vertical integration, later supported by Klein, Crawford, and Alchian (1978). According to their studies, the crucial determinant of vertical integration is the low possibility of outside options in bilateral relationships. If a firm can't find sufficient large number of suppliers or buyers in a particular production stages, possibility of vertical integration introduction increases possibility to avoid hold-up. A small number of suppliers or buyers is the result of asset specificity i.e. when production assets can hardly be used in other production process. For instance, asset specificity may mean specific physical capital when investments have lower outside payoff (oil refinery,

pipelines or oil terminal), specific human capital (high qualified labor force), site specificity when a firm saves on transportation/inventory cost (oil refinery near oil terminal) or capital in form of special rights, intellectual property or human specificity (quota for oil transportation or export, patents etc.).

Opportunistic behavior arising from asset specificity problem could be prevented not only by vertical integration but also by establishing long-run contracts. When bargaining is not possible or maintaining legal arrangements is prohibitively expensive, firms decide to internalize exchange in order to decrease cost of exchange and, obviously, to increase degree of vertical integration in the industry. Naturally, the choice between contractual relations and vertical integration depends on degree of asset specificity and contractual enforcement in particular country. For example, Joskow (1985) showed that in case of coal-burning electric utilities industry in USA only 15 % coal supply was delivered by vertical integrated coal mines, 70% of total coal demand – due to long-term contract (1-50 years) and 15% was bought on spot market.

Market imperfections.

Monopolistic behavior is the next incentive for producer to extend in boundary industries. There are two possible motives: a firm may vertically integrate to create or increase market power, and a firm that faces another firm's market power may integrate vertically to eliminate this power. There are two possible sources of monopolistic profit for vertically integrated firm. Firstly, upstream monopolist could integrate forward into the competitive downstream stage of production process, outperform its competitors and increase its monopolistic rent on this market. Backward integration (when downstream producer merge with monopoly supplier) leads to the identical results. Vertical integration also allows price discrimination for monopoly supplier. Model of monopolist forward integration proves that under reasonable assumptions (constant return to scale,

constant marginal cost for inputs production) upstream monopolist has no incentive to integrate vertically into downstream industry if firms face fixed-proportion production function. In both cases (vertical integration or not), a monopolist gains identical profits and could control prices for final consumers. If we assume that cost of vertical integration is nonzero, than monopolist decreases its profit when it integrates with downstream buyer. Situation changes if firms in downstream industry have variable-proportions production function. To be short, if downstream could substitute between inputs, monopolist loses control over buyers from downstream industry. Then, if upstream producer integrates forward, it monopolizes downstream industry and re-establishes control over it.

There are several theoretical works investigating market imperfection as incentive for vertical integration. Stigler (1951) pioneered formal investigation of vertical integration and used a theorem of Adam Smith that "division of labor is limited by the extent of the market" to state arguments for integration. The author divided production process of the final goods into series of distinct operations with different cost functions. Some of individual cost functions have increasing form, some falling, and some U-shaped.

Stigler (1951) explains how firm chooses quantity of input that is produced by firm itself and share that is obtained from market. A firm produce only amount of good on decreasing part of AC curve for this operation; rest of required product could be obtained from independent producer. This producer will specialize in certain manufacturing stage if magnitude of overall industry expansion will be sufficient to permit this firm to specialize in production of abandoned product. Therefore, each firm focuses only on those stages where it could exploit decreasing part of cost function and cost functions determine degree of vertical integration. For example, if a market is small, a firm could not specialize in particular good since fixed cost are prohibitively large and,

consequently, exploit economy of scale. Therefore, firm has no choice and should produce inputs for its production processes i.e. to be vertically integrated.

One of the implications of Smith's theorem is that vertical disintegration prevails in 'growing' industries and vertical integration in old or 'declining' industries in terms of industries' life cycle. Since young industries are often innovative and require new technology and products, they produce their own specialized equipment and input resources. Later, after expansion, when market size increases enough, it becomes profitable to other firms to supply equipment and resources for industry, to sell final products etc.; and sufficient part of internal production functions are translated to other firms. Finally, when the industry begins to decline, firms again are forced to integrate different stages of production process since independent firm is not capable to carry on functions due to decline in the industry. This pattern in Stigler (1951) was illustrated with help of the example of cotton textile machinery industry. This industry began as a part of textile industry: Each mill had its machinery shop to build and repair. Subsequently locomotives, direct selling, machine tools, designing of cotton mills were abandoned. Later, during a decline of cotton industry in 1920s, the machinery industry began to produce new products: paper machinery, machinery for other fabrics, or completely novel things like refrigerators.

Some works referring to the market imperfections as determinants for vertical integration rose from information asymmetry problem. For instance, Carlton (1979) in his work revealed price uncertainty for input goods as the incentive for firms to integrate vertically. According to his findings, a high price fluctuation on the market is one of the forms of uncertainty and, therefore, creates negative effects for firms operating on the market. Hence, firms usually decide to internalize negative externalities of high price fluctuations of inputs through integration of different production stages in its internal structure. Although price

variations are often mentioned in historical studies of vertical integration as an incentive, Carlton was the first who explained it using the model of firms operating on the market under uncertainty where both input and output firms (stage 2 and 1 firms according to Carlton) face random demand.

One of the most valuable consequences of Carlton model of vertical integration is the influence of concentration on market for inputs on decision of output firm to integrate backward. When a firm constitutes only small part of the demand for an input, there is a disincentive for the firm to integrate, because it would lose the possibility to share risk with other firms in case of insufficient demand. For example, when car producer buys tire plant and, the overall demand for cars falls drastically, car producer suffers losses from both lower car production and falling tire manufacturing. On the contrary, incentives may increase when other firms have high variability in demand. In this case, mechanism of risk sharing through common market is not so attractive for a particular firm.

Although, as we can see from the chapter above, there is no lack of theories explaining vertical integration, businessmen decision to expand in upstream or downstream industry remains still unclear in many cases. Williamson (1971) expresses it as following:

> 'The study of vertical integration has presented difficulties at both the theoretical and policy levels of analysis. That vertical integration has never enjoyed a secure place in value theory is attributable to the fact that, under conventional assumptions, it is anomaly'.

Empirical evidence.

Most of existing empirical studies test mainly transaction cost (asset specificity) and market power approaches. A traditional empirical model on determinants of vertical integration uses the mode of organization as a dependent variable and a

number of independent variable that reflect different approaches mentioned above. The principal question that all studies try to answer is what kind of relationship prevails in a particular case and to what extent it could explain degree of vertical integration.

Most cited and to some extent traditional work include Levy (1985) and Lieberman (1991) where transaction cost theory and demand variability model developed by Carlton (1979) were tested.

Levy (1985) used U.S. Census-Link panel data set for the years 1963, 1967 and 1972 for 69 firms representing 37 different industries to run a two-way random effect regression model in order to test transaction cost hypotheses. Vertical integration (VI) was measured by the ratio of value added to sales. Levy uses several explanatory variables: such as four-firm concentration ratio, proximity of goods transported between stages, measures of anticipated and unanticipated changes in demand etc. This study found evidence in favor of the transaction costs motives where vertical integration is positively related to small numbers of bargaining and supply reliability problem; and negatively related to managerial diseconomies.

McDonald (1985) examined vertical integration using data of the 1977 drawn from the Annual Survey of Manufactures panel representing 18 out of 20 two-digit manufacturing groups. Two measures of vertical integration were used. The first, Total Vertical Integration (TVI) is the share of total shipments that are directed to enterprises owned by a seller. Manufacturing Vertical Integration (MVI) is similar to TVI to some extent but restricted to shipments for only manufacturing establishments connected to sellers. This study reveals that extent of vertical integration is positively connected to the degree of capital intensity, seller and buyer concentration.

Lieberman (1991) tested the incentive for vertical integration that arises jointly from transaction costs and demand variability. Study for a sample of 34 chemical products in the U.S. found that firms' integration decision is influenced by the transaction costs related factors such as the asset specificity, input market's variability and the proportion of cost accounted for an input. The likelihood of integration increased with asset specificity, measured as the sunk investment cost of a plant. The empirical finding supports mainly Carlton (1979) but some cautions should be made. Carlton (1979) in his theoretical model did not make difference between vertical integration and long run contracts, and there were no prediction which alternative is more feasible in case of U.S. petrochemical industry.

Industry specific empirical studies include Monteverde and Teece (1982) (automobile industry), Masten (1984) (aerospace firm), Stuckey (1983) (aluminum industry) and Joskow (1985) (coal-burning electric utilities).

Monteverde and Teece (1982) investigated the vertical integration decision in U.S. automobile industry. The study exploited a general transaction costs proposition that the greater is the engineering effort associated with the development of an car component, the higher is the appropriable quasi rent that in turn translates into greater likelihood of vertical integration in the production of that component. They acquired a list of 133 automotive components from two major U.S. car manufacturers along with measures of each individual component's extent of vertical integration in production and engineering development cost rating. Subsequent probit regression showed that the likelihood of backward vertical integration was significantly influenced by the amount of development effort required for a component.

Masten (1984) obtained results similar to Montaverde and Teece (1982) but with reference to aerospace industry and found that asset specificity plays crucial role

in a firm's decision to produce spare parts itself or obtain it through market procurements. Design and site specificity was used to measure asset specificity. Design specificity was measured by three possible options: special part (only one firm exclusively could use this part), somewhat specialized part that could be used in aerospace industry and standard part that is used in other industries. Masten found that if product is more complex in production, the more likely it was that a firm would produce this item internally. Site specificity is not a significant factor in aerospace industry.

Stuckey (1983) claimed that in case of aluminum industry vertical integration between bauxite mines and alumina refineries is a consequence of physical asset specificity and site specificity considerations. But integration in the next stage of production process (between smelting and fabrication) is more likely to be 'a consequence of the desire of aluminum firms to engage in downstream price discrimination than a consequence of transaction costs considerations'.

Site specificity argument

sharing. Therefore, with presence of FSC any external shock for the one firm will be automatically translated to the other through profit sharing mechanism. Profit interdependence leads to correlation between residuals of stock returns of two firms (stock returns after clearing of industry and market specific effects) and this correlation is supposed to be higher than correlation between stock returns of two other firms in similar industries. Firms decide to integrate when benefits of integration rises or costs of long run contracts (due to cheating for instance) have risen significantly. In case of increasing value of vertical integration, firms will cooperate more closely, and correlation will arise. Mounting cost of maintaining and establishing long-run contracts, on the other hand, implies decreasing correlation over time between two firms due to weakened link between them.

Empirical part is based on three cases. In the first two cases firms initially cooperated through markets using long-run contracts and later decided to merge. In the third case downstream firm gained control over upstream firm prior to FSC, then downstream firm relinquished control despite continued dealing. In all cases it was showed that correlation between stock returns could be used as indirect evidence of the presence of FSC and timing of vertical integration/divestiture.

Oil industry always was in the center of discussion about vertical integration. Recent empirical work on VI in oil industry focuses mainly on consequences for retail sector and policy implications. For example, Cook (1997) investigated vertical integration in brewing and petrol industries in UK during 1964-1988 considering three stages: production, wholesale distribution and retail. Vertical relationships were established in these industries in the form of ownership or exclusive dealing contracts. With the respect to petrol industry he finds that vertical integration in oil industry was on upward trend - share of sales through 'managed' sites increased from 25% in 1964 to 53,1% in 1988; sales proportion

for owned petrol premises was equal in 1964 to 0, rising to 32,3% in 1988. Transaction costs seemed to be more important in determining vertical collusion in UK petrol industry. According to Cook (1997) 'the increase in integration in petrol is counter to the fall in power (market), but consistent with the increase in transaction costs.'

There are several works that focus on influence of vertical integration on firm's production and profitability. Gabel (1979) examined structure-performance relationship of the US petroleum refining industry during 1924-1971. Paper stated a dynamic simultaneous equation model of industrial structure and performance with a number of exogenous and endogenous variables including a measure of the balance between refining and production. This study showed positive relation between refinery capacity utilization and vertical integration index. Contrary, Bhuyan (2002) focused on food industry and used traditional one-equation cross-section regression for investigation of vertical integration impact on profitability. Results were quite opposite to Gabel (1979) and there was a strong negative relationship between degree of vertical mergers and profitability.

A number of empirical works on vertical integration in petroleum sector was devoted to the question of competition policy and justification (or rejection) of state regulation in this sector. For instance, Blass and Carlton (2001) investigated determinants of organizational structure and cost of law restriction of vertical integration on retail petroleum market. According to this paper, the number of outlets running by oil companies in US increased significantly since 1970s while the number of independent dealers diminished steadily. There are two possible explanations: predatory pricing behavior and cost cutting incentive. Predatory pricing behavior means that vertically integrated oil firms running petrol outlets sell petrol below cost and, finally, drive out independent competitors and create entry barriers for potential rivals. Therefore, the state often regulates this sector

imposing restrictions on vertical integration on retail basis. Blass and Carlton (2001) use data for about half of US retail sales for 1984-1987 to show that "retail gasoline operations are motivated by efficiency considerations". Anderson and Johnson (1999) in their study present empirical evidences on influence of legislation that prohibits sales below cost (SBC) on retail gasoline prices. SBC law implies that seller violates antitrust law when sell goods or services under the cost or its proxies. Large vertical integrated oil firms could establish prices far below costs and, therefore, to drive out present and potential competitors. The main difficulty is to define 'cost' since difference between actual price and cost of producing and selling serves as a crucial evidence of predatory pricing. In case of vertical integrated oil companies, cost of petrol on retail outlet could be lower because of higher production efficiency as a result of vertical integration. Empirical investigation of 42 metropolitan areas in US showed that enacting of SBC laws increases retail prices. One of the paper's conclusions states 'gasoline-specific SBC laws may have protected a few establishments from going out of business; they have done so at the expense of consumers'.

Though vertical integration becomes a widespread form of firms' organization in transition economies there is evidently lack of papers on incentive and description of vertical integration of new created corporations in Central and Eastern Europe and CIS countries. Gow and Swinnen (1998) presented one of the first studies on vertical integration in transition countries on example of Eastern Europe sugar industry. Vertical restrictions in form of long-term contract helped to avoid holdup problem when contract payments from food-processors for farmers were delayed.

Though there is numerous research of vertical integration, several blank places remains in this area. First, unfortunately, economists didn't provide complete theory of vertical integration that could incorporate transaction cost in

neoclassical microeconomic theory. As Coase (1992) noted in informal way '…incorporating transaction costs into standard economic theory…would be very difficult, and economists who, like most scientists … are extremely conservative in their methods, have not been inclined to attempt it.' Therefore, each case of vertical integration needs a specific approach to explain it, and theoretical models often fail to explain vertical integration. This fact explains why industry specific studies become so popular. Nevertheless, deficit for empirical justifications of existing theoretical background for vertical integration still has to be compensated.

Section 3

EMPIRICAL INVESTIGATION

Section 3.1 Industry Review[1]

In our industry analysis, contrary to econometrical part where all data is aggregated, we should distinguish between Central and Eastern Europe (CEE) countries and Russia. The reason is that the development path of Russian companies differs to large extent from the one of companies from Ukraine, Hungary or Poland mainly due to substantial difference in oil production/reserves and property types (Russian corporations are mostly privately owned while privatization process in oil sector in CEE countries is still in process).

Russian Oil Industry.

The Russian oil industry has undergone fundamental changes since the collapse of the Soviet Union and its bureaucratic administrative structure, dominated by various branch Ministries. Sector restructuring began in 1991 and, as a result of this process, the monopoly in the Soviet oil industry has now been replaced by a number of oil companies, some of which have been privatized ('Lukoil', 'TNK', 'Yukos') or remained state owned (e.g. 'Rosneft'). Restructuring implied joint stock companies' creation and rapid privatization both through privatization auctions and voucher privatization. The current structure of the Russian oil industry is the result of a restructuring movement aimed both at oil

[1] This paragraph is based on various industry reports and wire press reports as well as interview with industry analysts and company managers

production and refining. The reorganization of these two sectors of the industry, each of which was headed by a minister under the Soviet system, gave rise to fourteen financial holding companies organized on the principle of vertical integration, from production through refining down to distribution. Though vertical integration of newly created corporations was the consequence of state policy, there were also a number of non-integrated oil companies and refineries that were acquired after privatization. Now there are only 10 large vertically integrated companies as a result of further industry concentration after initial stage of restructuring that focuses mainly on privatization. Though major Russian oil firms initially included some refinery plants, level of vertical integration increased significantly since early 90's due to aggressive merging policy of Russian oil firms in refinery sector - now they own 7 refineries in CEE region and all refineries in Russia. Therefore, it could be stated that strategy of oil firms after state restructuring and privatization focused on further deepening of vertical integration in the industry that agreed with simultaneous horizontal mergers.

As a result of this process, Russia's oil industry has bounced back over the past few years, posting strong profits and healthy increases in production. Buoyed by relatively high world oil prices in 1999 and 2000, as well as a decline in production costs following the August 1998 devaluation of the ruble, Russian oil companies ramped up production, and by 2001 the country was pumping out an average of 360 million tons - a 20% increase over the 1998 level, meaning that Russia is now the world's second largest crude oil producer.

It should not be considered, however, that Russian oil companies were similar to capitalist-type private enterprises, whose behavior is regulated by the demands of international competition. The reform of property rights has not been sufficient to create true private enterprises in Russia because of excess of state regulation as well as of a confusing tax and legal environment. State agencies regulate domestic prices for oil and its byproducts and impose strict control on oil export from the

country. There are two possible ways of restriction of oil export from the country: Export duty for oil and petrol, and constraints on oil transportation by pipelines owned by state monopolist company "Transneft". Usually, the state ministry and 'Transneft' issue 'licenses' or permissions each quarter for defined quantity of oil to transport outside the country. Other ways of oil transportation (mainly railway transport) cannot compete with pipelines because of substantially higher transportation cost and limited capacity.

As a result of implicit and explicit restrictions on oil export, companies are forced to sell a substantial part of oil production on Russian domestic market or transport to integrated refinery plants. But now when Russian oil producers do not export their crude oil - often because of the constraints of Russia's pipeline system or the government's limits on each company's exports - many choose to supply their own refineries rather than sell the oil on the open market. Due to large oil production (at least ten million tons), weak transportation and oil market infrastructure, oil companies often suffer overproduction and bear large costs of temporary oil wells shuts down.

Central and Eastern Europe.

Oil companies from CEE region are far different from their Russian counterparts because of drastic disparity in oil production and quantity of oil proved stocks. For instance, 'Petrom', the largest oil company from CEE region in terms of oil production, produce less than 10% of Lukoil's total oil output. Low resource endowments could explain the fact that most companies (except Romanian 'Petrom' and Ukrainian 'Ukrnafta') focus mainly on refining, and petrol retail activities and input capacity of their own refineries far exceed companies' oil production. In fact, most companies that focuses mainly on refinery stage import oil from Russian 'oil production' companies. Russian oil

export covers up to 80-90% of total oil demand (in case of Poland and Ukraine).

The second difference is that oil companies from Poland, Croatia, Hungary, Ukraine and Romania are still owned and controlled by the state. Restructuring process in early 90's was largely similar to the way of Russian oil companies - oil production units and refineries were consolidated under one company[2]. Surprisingly, state ownership did not mean less efficiency and profitability level, corporate governance of new firms is in some cases higher than in privately owned Russian companies. Now most governments in Eastern European countries dissipate state shares in oil companies through privatization. Industry restructuring through production units concentration results also in situation when both oil production and refinery industry are highly monopolized in the most countries of the region – state companies account for more than 50% of each market and in upstream industries these companies are 'pure' monopolist.

In case of Russia at least from the first view oil and refining industry are more competitive and concentration ratios are significantly less compared to CEE countries. Very high concentration ratios in the CEE region does not necessary lead to higher prices because of pressure from Western oil companies and usual returns for petrol market do not exceed 10%.

Though tendencies mentioned above are to large extent identical for all five countries, I focus on Ukraine since market analysis could highlight main incentive for firms to integrate vertically at least from point of stylized facts.

[2] In fact degree vertical integration after restructuring was higher in Eastern Europe compare to Russia and Ukraine.

Ukraine.

State owned company 'Ukrnafta', subsidiary company of large corporation 'Naftogaz Ukrainy', accounts for 66% of total country oil production. Ukraine's oil production volumes satisfy only about 25% of the country's domestic needs, making Ukraine highly dependent on foreign oil supplies. Although Ukraine's oil consumption has dried up dramatically since it began the transition to a market economy - decreasing by 58%, from 40 million tons in 1992 to 16.5 million tons in 2001 - the country's consumption still far outstrips its production capacity. Ukraine imports majority of its oil from Russia, with lesser amounts coming from Kazakhstan, transported through three major pipelines.

Industry restructuring began in 1994 when major oil production units were united in newly created state company 'Ukrnafta'. The present industry structure had been mainly formed before 1998-1999 and now consists of a state conglomerate "Naftogaz Ukrainy' that united oil companies 'Ukrnafta' and 'Chornomornaftogaz' (oil production in Black and Azov sea), 'Ukrtransnafta' (company that operates all oil pipelined including major Eastern European transit routes) and gas companies with operations activities ranging from gas production, transportation (including transit gas pipelines from Russia to Europe) to selling to final consumers. 'Naftogaz Ukrainy' now owns 50%+1 shares of 'Ukrnafta' and the rest of company is owned by private investors. Another oil firm from the sample - 'Poltava Petroleum Company' is a joint-stock company established by British JKX and State Property Fund of Ukraine – an agency that operates assets owned by government. The crucial difference of Ukrainian way of restructuring of oil industry was that refinery and production units were not initially consolidated, i.e. the government rejects idea of vertical integration during restructuring and opts for further privatization of

oil companies and refineries to Russian oil companies to assure oil supply to the country.

Ukraine has six refineries, with a combined crude oil refining capacity of just over 35 million tons per year. However, with domestic demand at just over 30% of the country's refining capacity, Ukraine's refineries are operating significantly below capacity. Until recently, Ukraine's refineries did not even receive enough crude oil supplies to supply the country's petroleum product demand.

Ukraine has begun to achieve better results in securing sufficient crude oil supplies for its refineries by offering oil exporters in Russia and Kazakhstan a stake in the country's refineries. Ukraine's recent success in privatizing its refineries has allowed the country to secure additional oil supplies to meet domestic demand, as well as to attract funds for necessary renovation work and to boost utilization rates at its refineries. Russian and Kazakh oil companies ('Lukoil', 'Tatneft', 'Kazmunoilgas' and 'TNK') own four out of six Ukrainian refineries that constitute more than 70% of country's total refinery capacity.

From this point downward vertical integration of Ukrainian refineries with foreign oil producers was a very positive process since it allowed to increase petrol production in country. But further vertical integration and concentration on Ukrainian petrol market when integrated oil companies build up own retail petrol stations would increase possibility of hold up problem. Monopolization of petroleum market would influence so called 'independent' retailers that own petrol stations but could be driven out of market by vertical integrated monopolists. For example, oil refineries could collude and set higher prices for its competitors or use transfer pricing inside the firm (between oil production unit and refinery, refinery plant and retail sale unit). Weak antitrust law enforcement and high import tax for petrol worsen situation on the Ukrainian petrol market. This preposition could be supported with the help of recent

trends when several Ukrainian retailers ('Sentoza', 'Alfa Nafta', "Kontinium') decided to integrate backward and bought minority stakes in two smallest and outdated Ukrainian refineries ("Naftokhimik Prykarpattya" and "Galychyna NPK"). 'Sentoza' and 'Alfa Nafta' also own 40% of national oil producer "Ukrnafta" and make a bid to buy government share (50%+1). Management board of 'Ukrnafta' has already declared set up of vertical integrated structure as dominant goal for next 5 year. The case of Ukraine is also very important for vertical integration study since Ukrainian petroleum market is less monopolized, concentration ratios both from supplier and buyer side are lower compare to other CEE countries and several firms that own or manage refineries face fierce competition both from foreign vertically integrated companies.

In sum, monopoly power of major oil companies is significant in sample countries though concentration ratios for Russian and Ukrainian oil and refinery markets are lower than for other CEE countries. However, we could claim from recent trends in industry that the hold up problem is more important for Ukraine than for other countries. Competition policy is more efficient in Poland, Croatia, Hungary and Romania and it leads to lower profit margin on retail market though concentration ratio for oil and petrol market is much higher compare to Russia and Ukraine.

Section 3.2.

The data description

Data set consists of 16 oil companies from Russia, Ukraine and Central and Eastern Europe (Romania, Poland, Croatia and Hungary). This sample covers above 90% of oil production and refining activities in Central and Eastern Europe (CEE) region. My study covers 1998-2001 years, when initial concentration and privatization processes in industry are almost complete

although we could expect further expansion (both in horizontal and vertical direction). Improved corporate governance in the sample countries till these years provides us with more reliable statistics compare to previous years.

Most data on production were collected from the sample companies' sources like annual and quarterly production reports, industry reviews from several investment banks. Country indicators and price information was obtained from state statistic offices, International Energy Agency (IEA) and 'Argus Petroleum Agency' that provides day-to-day information on oil production, export and price.

Bias for Russian oil companies (50% of sample) is caused by large oil reserves and production in Russia that serves as main source of oil for most countries of the region. For example, Ukraine's oil production constitutes only 15 % of the domestic oil market and the rest are imported from Russia and Kazakhstan. Crude oil production of the largest Russian oil corporation 'Lukoil' are more than 6 times higher than all other countries of the CEE region and Ukraine could extract.

The other question is concerned with the quality of the collected data. Although the quality increased significantly during the last years mainly due to a rise in financial transparency and financial market development, I suspect that measurement errors and omissions are still significant. For example, there could be significant misreporting of production or export oil flows due to tax evasion esp. for Russian and Ukrainian companies. Another problem common for all companies is so called 'transfer price' system when prices for intermediate goods (oil) inside the corporation are much lower than market prices. As usual, firms do not report these prices and it creates difficulties in research.

Section 3.3.

Model Description

Empirical investigation is based on hypothesis testing of different incentives for vertical integration. As a dependent variable I use form of internal production organization of particular oil firm. There are several approaches to reflect vertical integration in industrial organization studies but unfortunately none of them is perfect. The most common way is the use of a dummy one/zero variable to show that firm is vertical integrated. One critical disadvantage of this method is that it does not reflect the degree of vertical integration, and, therefore, could be used only in specific cases when we develop models for vertical integration on plant level (Lieberman (1991) or inputs level (see Montaverde and Teece (1982) and Masten (1984) for details).

In early studies the degree of vertical integration was measured as the ratio of value added to total sales. If a firm is more vertically integrated than this ratio will be higher since value added increases in case of vertical integration and it includes in fact value added from several integrated production processes. But, according to Perry (1989) the ratio of value added to total sales does not account for several factors that could influence both the denominator and the nominator: such as managerial efficiency and particular market conditions. Also this measure could be biased because 'treats backward and forward integration asymmetrically' (see Levy (1985) and Perry (1989) for discussions).

The third measure focuses on production data: quantity of input produced by firm itself, input obtained from external suppliers through market operations and total output. In this work I implement the latter approach that allows for variation in degree of vertical integration and use VI variable - ratio of oil output

refined on firms' integrated plants to total firms' oil output[3].

Dependent variables are grouped according to approaches that explain incentives for internalization of production in one firm. As it was mentioned there are three main groups of incentives for vertical integration:

(1) Transaction cost approach or asset specificity approach. We introduce average refinery plant capacity for each of the oil firm (AVCAP) as a measure of asset specificity. If the firm ex ante owns a large refinery plants than it ought to assure supply of oil for this plants to avoid loss from idle production facilities, and vertical integration index for this firm is higher than for firm with lower average refinery capacity. Firms with lower average capacity of refinery plants could use some plants as 'buffer' capacity to compensate peak loadings and, therefore, bear lower costs from possible fluctuations of oil supply. Hence, positive sign of coefficient is expected for this variable. This measure differs from others presented in Lieberman (1991), Mac Donald (1985), Levy (1985). The main explanation for this is that in other studies sample consists of firms from different industries. It allows to introduce asset specificity variables that imply industry specific factors[4].

Another measure of asset specificity (DIST) refers to site specificity factor. According to Joskow (1985) site specificity is one of the types of transaction specific investment. Contrary to Joskow (1985) that includes a dummy for

[3] This variable is especially useful for industries where particular input accounts for larger part of production. It could be oil refining industry (where price of oil constitute about 75% of petrol price), aluminum production industry (there are two major inputs – aluminum oxide and electricity), energy sector (oil, coal, gas or nuclear products are crucial resources for energy plants), or food industry (for example production of diary products or sugar).

[4] For example, Levy (1985) used MES (minimum efficient scale relative to industry sales) to support transaction cost approach. The second measure includes number of firms on each stage of production and reflects small number bargaining problems.

generation plants that are situated near coal mines, I apply 'share of oil transported more than 500 km out of oil fields to firms' refinery plants' as a measure of site specificity. This measure was developed by Levy (1985) and Weiss (1972). This measure is suspected to be significant for several reasons. First of all, site specificity implies higher transportation/logistic costs – companies that own field in Eastern Siberia or in Caspian sea need to transport oil usually for 3-5 thousands km for major refineries in Europe. As a mean of transportation pipelines, railway tanks and sea tankers are used. Naturally, it implies very high level of asset specificity (pipelines, oil terminals and railway lines) and opportunistic behavior of owners of transportation companies that are usually state owned.

Secondly, site specificity results also in higher risk of incomplete contracts because of transportation. I could mention only some examples: Russian state monopolist 'Transneft' could voluntary change quotas for oil transportation for oil companies, main sea routes depends on weather, transportation cost through major pipelines from Siberia to Western Europe is highly vulnerable to tariff policy of four governments etc. Of course these numerical obstacles not only increase a risk but also raise direct costs of signing multilateral contracts. Transportation cost, for example, for Russian oil, is about $3-5 per barrel (price of barrel fluctuates around $15-25 in recent years in Western Europe).

The simplest strategy in this case for oil companies is to acquire transport stage to diminish risk connected with asset specificity. But actually this is not viable option because most states refuse to privatize pipelines and consider them strategic for state security. Therefore, firm chooses acquiring of the refinery stage. From one point, integration with less distant refineries is more preferable because of lower costs and risks. From other side, even integration

with distant plants could significantly reduce costs connected with site specificity – firm could propose long-term contracts for oil transportation companies since it know destination and future quantity of oil flows.

PROD variable that measures oil output is used as a control variable for economy of scale. Use of this variable could be justified from the point of view costs of idle production capacities. Firm with more oil production is more interested in assuring demand for output since costs from idle oil wells increases with scale of firm.

(2) Demand variability. This approach shed lights on incentives for vertical integration when high variability in demand or prices could induce firm to internalize production functions. As a measure of variability in demand (and consequently variability in prices and profits) price uncertainty index (PRICEVAR) was included in the model. PRICEVAR is calculated as standard deviation of residuals from detrending regressions $P_{i.t}=a+b*t+u$ or $P_{i.t}=a+b*t+c*t^2+u$. PRICEVAR is proxy for demand/price variability proposed by Lieberman (1991)[5]. In our particular case this variable was calculated for three regional markets – Russia, Ukraine and Central and Eastern Europe (CEE). Each regression contains data on average yearly prices for crude oil from 1990 to particular year in sample. For example, estimation procedure for year 1999 looks as follows: data set of dependent variable P (average yearly oil price for years 1990-1999) is regressed on time variable t and t^2. Choice of particular functional form depends on regression characteristics though standard deviations of residuals in each of 12 regressions seem to be robust to changes in

[5] Lieberman (1991) implied a more complicated measure of demand variability. First of all, fluctuations in total industry output were used instead of price variability. Also variability were estimated both for upstream and downstream markets. Price variability consists of two components: (1) variability that doesn't depend on changes in subsequent market (downstream in case of variability is estimated for upstream market), and (2) variability that relates to downstream market fluctuations

functional form.

(3) Market imperfection approach. Concentration variable (C4) is calculated as a share of four largest firms on country's/region's oil market. Higher ratio means more monopolistic market for oil that induces a firm to acquire downstream production facilities (refineries) in order to assure demand for oil and to avoid holdup problem. Variable STATE is the measure of state ownership in oil sector – a state's share in firm capital. Since there is significant part of state owned or controlled firm in our sample and it could influence our results we should control our regression for state regulation.

Model is estimated as follows:

$VI_{i,t} = f$ (AVCAP $_{i,t}$, PROD $_{i,t}$, DIST $_{i,t}$, PRICEVAR $_{i,t}$, C4 $_{i,t}$, STATE $_{i,t}$, $PRICEDIF_{i,t}$)

where i – number of firm (i=1…16)

t – time period (t=1998…2001)

Chapter 4

RESULTS AND DISCUSSIONS

First of all, variable PRICEVAR was estimated for three markets (Russia, Ukraine and CEE) using detrending regression ($P=a+b*t+u$ or $P=a+b*t+c*t^2+u$) for yearly oil prices for the time period from 1990 to each year from the sample respectively). There are 12 regressions (three markets for 4 years)[6]. Results are presented in table below:

Table I. Price variation for oil markets (1998-2001).

	1998	1999	2000	2001
Russia	2.27	2.77	2.74	2.718
Ukraine	2.19	2.5	2.47	2.48
CEE	4.2	4.76	5.08	4.79

Sources: authors' estimates

As we can see from Table 1, price variations for oil increase in all markets from the sample. Steady increase in oil price variation for given time period (beginning in 1990) to large extent could be explained by two factors. Firstly, oil prices in given region are closely correlated with fluctuations on the world oil market that are characterized by increased price fluctuations during 90's. Secondly, transition period for post communist countries also result in large price adjustment for all goods and resources.

Empirical tests for vertical integration's incentives are based on panel data approach. According to Kennedy (1998), panel data has several positive features since it allows for heterogeneity in micro units, and panel data combines cross section and time series variability.

[6] More detail regression results available from the author upon request. I don't report results of 12 regressions to avoid overburden of technical details.

It also should be noted that the main purpose of our model is not to build forecast or investigate power of particular factor in explaining vertical integration. Explanations for this are small sample, quality of data and practical considerations: numerical forecast for future periods for degree of vertical integration in business seems senseless. Hence, we are interested only in testing the significance of coefficients and their signs.

Table II. Empirical results.

	Common intercept	Fixed effect	Random effect
C4	-0.37 (-2.13)	-0.005 (-1.03)	0.0004 (0.16)
PROD	$-2.93*10^{-8}$ (-0.02)	$-1.57*10^{-6}$ (-0.717)	$-2.05*10^{-6}$ (0.16)
AVCAP	$1.08*10^{-6}$ (0.129)	-6.32*10-6 (-0.8)	$-1.65*10^{-6}$ (-0.22)
DIST	0.003 ††† (3.64)	0.0032 †† (2.18)	0.0027 †† (2.3)
PRICEVAR	0.315 † (8.51)	0.06 ††† (1.8)	0.0114 †† (3.95)
STATE	$-5.57*10^{-5}$ (-0.08)	0.006 (0.85)	0.006 (0.93)
PRICEDIF	-0.000152 (-0.11)	-0.002 (-0.43)	$-9.09*10^{-6}$ (-0.18)
R squared	0.72	0.98	0.97

† - significant at 1%
†† - significant at 5%
††† - significant at 10%

Table II reports the empirical results of our regression. Three models were estimated with common intercept, fixed and random effects respectively. Although results from our three empirical models in part of significance of coefficients don't vary much (two variables DIST and PRICEVAR are

statistically significant at 5-10% level), we could employ two tests to choose between three models.

Then I apply common intercept test to see whether we can use cross-section effects (i.e. fixed or random effect models). The null hypothesis is that there is no difference between using cross section specific effects and using common intercept. The most common way to test that all cross section coefficients are similar is to apply F test. According to F test H_0 is rejected at 99% and, therefore, model with different intercepts - fixed or random effect is more relevant.

Our sample exhausts all population of oil companies in region, and it is natural to choose fixed effects model due to conventional rule of thumb. Also we could apply a variant of Hausman test to verify whether random effects is different from fixed effects. According to reported statistics (99.643 that is significantly higher than critical value from chi distribution with 7 degrees of freedom at 5% level of significance) we could reject H_0 and, therefore, random effect estimators are biased. Consequently, I choose fixed effects model estimators.

Nevertheless, some conclusions could be formed without referring to particular model since all coefficients (DIST and PRICEVAR) are statistically significant in all three models and their values do not differ to large extent (though we are interested only in significance and signs of coefficients).

Variables DIST and PRICEVAR are significant at 1% and 5% levels and other variables seem to be insignificant in explaining degree of vertical integration. Note, that statistical insignificance doesn't necessarily imply that concentration ratio or average refining capacity were not meaningful as incentive at all at least during first stage of industry restructuring (in 1990-1998 i.e. out of our sample).

Empirical findings support at least two of three approaches – asset specificity (developed by Coase and Williamson) and demand variability approaches (pioneered by Carlton).

Positive sign of PRICEVAR variable means that large oil price fluctuations lead to higher level of vertical integration. Increase in price variability level by 1 will

lead to increase in VI coefficient by 0.06 in the fixed effects model. Expected positive sign of PRICEVAR variable supports main conclusion of Carlton's model that increase in input price variability will lead to higher level of vertical integration between upstream and downstream producers.

Positive relationship between DIST and VI means that firm, that transports a larger part of its oil output out of 500 km range, tends to 'integrate' and not to establish long-term contracts or sell oil on spot market. This conclusion could be incorporated in our previous discussions in 'Industry review' subsection. Since transportation for a long distance increases oil price and is controlled by state (or to be precise by several states), risk of incomplete contracts increases and encourages firm to integrate vertically in both direction (forward and backward). Surprisingly, it is quite opposite to result obtained by Joskow (1985) where plants near coal mines tend to be more integrated with these mines in one firm. One possible explanation is the difference between oil/refinery and a coal/energy generating industries. Joskow did not include in his model other distance measures like distance to major consumer regions because transportation of electrical energy is low cost, and there is no difference between power stations near major consumer regions and near coal mines i.e. site specificity factor with the respect to the distance between electric producers and consumers is negligible.

In case of oil/refinery industries geographical structure of production implies that all refineries are situated near major consumers and only some of them are near oil wells. Therefore, integrating plants that are situated near oil production fields implies higher cost of transportation of oil products for final consumers, and certainly firm choose to transport oil by pipelines rather than to transport petrol by railways. This fact explains why Russian firms buy refineries in CEE countries when their own refineries near oil fields operate with lower capacity utilization level.

Other explanation for positive sign of DIST variable is that larger distance

between oil production and oil refining units means higher risk of failed contracts due to larger cost and risks of transportation. Therefore, firms prefer to integrate these 'distant' plants than rely on market.

Another measure of the asset specificity – AVCAP (average capacity of refinery plants) is insignificant in explaining incentives for vertical integration. One possible reason for this is that the asset specificity does not play significant role in transition period when firms' formation still under the way, and most firms tolerate higher cost of underutilization of refinery capacities. In practice, we could observe that most refineries operate on 50-70% of its capacity.

Empirical testing also fails to support market imperfections approach. All variables (C4, STATE and PRICEDIF) are statistically insignificant. Moreover, negative sign of C4 (concentration ratio) coefficient shows that higher level of concentration ratio does not lead to higher level of vertical integration. One explanation is concerned with fact that C4 concentration ratio is calculated for country market when in case of large countries like Ukraine and Russia concentration ratio for oil and retail petrol market varies from region to region. As Dashevsky (2001) noted:

> 'refineries such as Omsk, Achinsk, Khabarovsk and Komsomolsk serve the sparsely populated eastern Siberian and Far East regions, maintaining a virtual monopoly on deliveries there. Their market strength is reflected in prices that exhibit less volatility than the national average and consistently exceed it by 20%-25%. Similarly, Surgut's Kirishi refinery maintains strong control over northwestern Russia, reflected in its prices, trending 20%-25% above average European Russian levels. For such refineries, monopoly pricing considerations imply that lower volume sales at higher prices are preferable to slightly higher volumes at lower prices.' [p. 19]

Therefore, statistical insignificance of C4 variable does not necessary indicate absence of relationship between monopolization of market and vertical integration at least in particular regional markets or even countries as we can see that from industry review. In general, with respect to all sample, there is no

strong empirical support for significance of this factor in determination of vertical integration level. The same logic could be applied for explaining insignificance and opposite to the expected sign of PRICEDIF variable. PRICEDIF has expected negative sign but is statistically insignificant. Therefore we cannot conclude that the restriction on oil export induce domestic oil producing firm to move in refinery sector to increase profitability though we could observe such situation at least in some countries.

STATE variable is statistically insignificant but has expected positive sign, indicating lack of support to hypothesis that state controlled enterprises (and management of these companies) have different incentives for vertical integration compared to private oil companies. Nevertheless, in some cases there are close connection between government policy esp. in competition and antitrust areas, and degree of vertical integration. As I noted in 'Industry review' section, the Ukrainian government chose restructuring and privatization schemes where the oil producers and refineries were divided into separate companies.

Unfortunately, this empirical model does not take in to account several other factors that could influence businessmen decision to integrate. Firstly, managers could initiate merging with another firm to increase their own power though it could lead to lower profits and efficiency. Especially, it could be true for firms in transition economies where weak corporate governance institutions allow for such scenario. Secondly, in empirical model I do not take into account government regulations as a reason for oil firms to integrate vertically – for instance, firm could use *transfer price* system if it owns refinery and oil wells. At least logic for such firm behavior could be explained with the help of industry facts. Transfer pricing in Russia and others CEE countries refers to the scheme in which oil producers sell their crude at an "intracorporate" price to their holding company, which then either exports the crude or resells it to its own or third-party refineries. A number of non-income taxes, such as mineral use tax

(royalty), mineral restoration tax, housing fund tax, road fund tax as well as some other taxes are levied based on upstream sales values; thus, transfer pricing generates significant corporate tax savings.

Table III. Transfer and market prices for crude oil (as of March 1, 2001 $/bbl).

	"Intracorporate"	Third-party refineries	Market prices - Russia	Deliveries to CIS refineries	Urals Med fob
TNK	7.6	-	14.8 - 15.3		20.8
Slavneft	7.2	-	14.8 - 15.3	15.6	20.8
Yukos	5.7	-	14.8 - 15.3		20.8
Lukoil-Western Siberia	8.8	-	14.8 - 15.3		20.8
Surgutneftegaz	14.8	-	14.8 - 15.3	16.0	20.8
Lukoil	11.9	-	14.8 - 15.3		20.8
Orenburgneft	7.6	-	14.8 - 15.3		20.8
Tatneft	-	14.3	14.8 - 15.3	17.8	20.8
Bashneft	-	11.9	14.8 - 15.3		20.8
Udmurtneft-Sidanco	7.2	10.3	14.8 - 15.3		20.8

All Russian prices are shown gross, with VAT and excise tax

Source: Dashevsky (2001)

As we can see from Table III with the exception of 'Surgutneftegaz', 'Tatneft' and 'Bashneft' intracorporate prices are 50% below domestic market prices and 65% below export prices. Dashevsky (2001) estimated also direct financial benefits from transfer prices. Under some reasonable assumptions (80% of crude oil delivered to Russian refineries is sold at a transfer price 7.3 $/bbl and fixed gross operating tax at 23%), author finds that 'oil companies underpay approximately $2.85bn to the budget (in 2001)'.

Tab IV. Tax payments under market and transfer prices (for Russian oil firms as for 2000 year)

	"Intracorporate" price	Domestic market price
Gross price, $/bbl	7.32	15.27
VAT (20%), $/bbl	1.22	2.55
Excise , $/bbl	0.26	0.26
Net price, $/bbl	5.84	12.47
Total operating taxes (23%, $/bbl)	1.34	2.87
Total taxes, $/bbl	2.83	5.68
80% of deliveries to local refineries, mn bbls	1,001.24	1,001.24
Tax payment, $mn	2,829.30	5,682.26
Underpayment, $mn		2,852.96

Source: Dashevsky (2001).

Total government losses in other countries are only suspected because companies naturally show reluctance to present information on transfer prices**.** Taking into account present estimation of benefits from transfer prices ($2.58 billions per year) that are the lowest margin for transfer prices benefits, there are persuasive evidences that oil companies would decide to integrate vertically only for avoiding taxes even if the influence of other factors was negligible. Benefits of vertical integration in this case clearly outweigh possible losses from inefficiency that arises from substituting market for firm's internal distributional mechanism.

It is quite clear that this work does not exhaust all explanations for vertical integration and highlights only some of them esp. those that are specific to oil industry. Future research, that will investigate vertical integration not only in one industry but rather across line of industries, could shed light on incentives that are common to all productive sectors. In case of oil industry we could move further to focus on plant and contract level, or to develop models that will cope with integration on retail gasoline market.

The question of practical interest is how vertical quasiintegration, that becomes

dominant strategy for oil firms, will influence consumers and should a government regulate this process. But at present moment implications for antitrust policy with respect to Ukraine remain ambiguous – the main problem is to reveal 'true' cost structure and information on contracts of oil firm to investigate whether they pursue opportunistic behavior during vertical integration. In Ukrainian context it means to reveal whether merging policy of Russian oil firms is not coordinated and whether it leads to foreclosure of 'independent' retail firm and refineries. Another problem is above discussed *transfer price* system leading to lower budget revenues. Thus, vertical integrated firms could monopolize refinery and retail stages – integrated plants could obtain oil for lower prices and effectively drive out other firms from the market. But I should note that it is question of further research and there is no empirical justification for opportunistic behavior of oil firms.

As I tried to show in this work, applying modern industrial organization theory even to such 'hostile' to researchers area as transitional economies and corporate sector in these economies could not only add just another empirical justification for well known theories but also to highlight stylized facts that were left in shadow during previous works (I mean influence of transfer price scheme on vertical integration process).

Section 5

CONCLUSIONS

This study indicates that both transaction costs and demand variability approaches are important in explaining vertical integration. With respect to model specification it means that variability in oil prices and distance between oil fields and refineries are significant factors that induce firms in oil sector to integrate in both direction – forward (when upstream firm buys refinery plants) and backward (downstream firm moves in oil production). Degree of vertical integration in oil industry is positively related to variability of prices in world oil market. Transition from planned to market economy and subsequent price adjustment, therefore, lead also to 'internalization' of market by oil firms through vertical relationships. Site specificity also proved to be significant in explaining vertical integration – oil firms with higher distance of between oil wells and plants tend to be more interested in vertical integration as dominant firm strategy.

We failed to prove empirically that oil firms integrate in order to avoid opportunistic behavior of other firms – market concentration variable is insignificant in explaining degree of vertical integration.

Stylized facts from oil industry also supports hypothesis that firms could internalize subsequent production units to avoid government regulation in form of taxes.

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APPENDIX

Table V. Sample Statistics.

Variable	Description	Country/Region	Observations	Mean	Minimum	Maximum	Standard deviation
VI	Degree of vertical integration, measured as ratio 'oil produced by firm and refined on own refineries/total firm oil production'	Overall sample	64	0.5364	0	1	0.3124
		Russia	40	0.47034	0.0163	0.7974	0.2228
		Ukraine	8	0.11016	0	0.2561	0.1188
		Central Eastern Europe	16	0.9149	0.7226	1	0.1137
PROD	Oil production, thosands tonns	Overall sample	64	18183.62	76	78300	19931.11
		Russia	40	27 795.55	9135	78300	19657.98
		Ukraine	8	1449.75	76	2992	1502.75
		Central Eastern Europe	16	2495.75	186	6764	2377.22
PRICEVAR	Price uncertainty index – standard deviation of residuals from detrending regressions $P=a+b*t+u$ or $P=a+b*t+c*t^2+u$	Overall sample	64	3.1184	2.19	5.08	0.9563
		Russia	40	2.6245	2.27	2.77	0.2081
		Ukraine	8	2.41	2.19	2.5	0.1363
		CEE	16	4.7075	4.2	5.08	0.329

Table V. Sample Statistics (contd.).

Variable	Description	Country/Region	Observations	Mean	Minimum	Maximum	Standard deviation
PRICEDIF	Difference in oil prices between domestic and market (world) prices, USD/tonn	Overall sample	64	27.6398	0	68.7	23.53
		Russia	40	39.5625	18.625	68.7	18.9
		Ukraine	8	23.3	3.375	54.3	20.36
		CEE	16	0	0	0	0
STATE	Measure of state ownership in oil sector - state share in firm capital (%). Percants.	Overall sample	64	49.43	0	100	42.67
		Russia	40	35.83	0	100	40.47
		Ukraine	8	58.45	33.8	100	26.61
		CEE	16	97.5	60	100	10
C4	Share of largest four firm in oil market. Percents.	Overall sample	64	65.09	45.2	100	18.425
		Russia	40	53.95	50.63	55.66	1.98
		Ukraine	8	75.25	73.8	76.4	1.065
		CEE	16	87.86	45.2	100	21.82+
AVCAP	Average capacity of refineries of particular oil company (total output of refineries divided by number of refineries). Thousands tons.	Overall sample	64	4799	0	17000	4530

Table V. Sample Statistics (contd.).

Variable	Description	*Country/Region*	Observations	Mean	Minimum	Maximum	Standard deviation
AVCAP	Average capacity of refineries of particular oil company (total output of refineries divided by number of refineries). Thousands tons.	Russia	40	6240.5	400	17000	4992
		Ukraine	8	319.375	0	720	343.11
		CEE	16	3435	1867	6532	763
DIST	Share of oil transported more than 500 km out of oil fields to firms' refinery plants. Percents.	Overall sample	64	26.59	0	100	39.20
		Russia	40	42.55	0	100	42.27
		Ukraine	8	0	0	0	0
		CEE	16	0	0	0	0