Conf-9210219--1

NATURAL GAS CONTRACTS IN AN EMERGING
COMPETITIVE MARKET

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ANL/EAIS/CP--77643

DE93 002923

for presentation at the
14th Annual North American Conference of the
International Association for Energy Economics

October 26-28, 1992
New Orleans, Louisiana

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Ronald J. Sutherland

Natural gas is being viewed by many as the fuel of the 1990s and beyond because of its environmental qualities, relatively low cost and significant domestic resource base. However, in the Fall of 1991, a group of electric utility executives met with then Deputy Secretary of Energy Henson Moore and asserted that an inability to obtain long term gas contracts meant that supplies are unreliable and construction of gas-fueled generating stations is being discouraged. This study was requested by the Deputy Secretary to address the issues surrounding long-term gas contracts and supply reliability. The relationship between supply reliability and contracts is explained in terms of the number of buyers and sellers in a market. With the appropriate state regulatory policies, utilities can contract for gas and obtain reliable supplies at competitive market prices. Public utility commissioners are encouraged to permit utilities a free choice in signing gas contracts, but to allow only competitive market prices to be reflected in allowable fuel costs.

The alleged inability of electric utilities to obtain reliable gas supplies under long term fixed price contracts is explained by the increased competitiveness of the gas market that has made such contracts economically inefficient and obsolete. Prior to the early 1980s, such contracts were the conventional way to purchase and sell gas. In this market, wellhead gas prices were controlled and the pipelines were the only purchaser of gas from the producers, and seller of gas to utilities and to other customers. Under these conditions, long term contracts contributed to supply reliability at minimum transactions costs. Wellhead price decontrol (beginning in 1978) allowed market forces to be reflected in gas prices. FERC orders 436 and 500 resulted in the open access of natural gas pipelines where producers could sell

¹This paper is based on work supported by the U. S. Department of Energy, Office of Domestic and International Energy Policy, under contract W-31-109-Eng-38. Comments by Ken Malloy and Rod Lemon, Ken Costello, Russ Profovich, John Herbert, and Ned Dearborn and Skip Horvath are appreciated.

directly to large customers. This new market arrangement permitted the development of first a spot market for gas and then a futures market. In the spot market numerous buyers contract with numerous sellers for short term delivery. Supply reliability is achieved by a competitive market rather than with long term contracts. The significance of the futures market is that it discovers and conveys efficient market prices to any participant in the gas market. Futures prices are becoming the referenced price for gas transactions. Long term fixed prices are both economically inefficient and untenable in a competitive market. Natural gas supplies can be secured over a long term on a reliable basis either by successive spot purchases or by contracts of various duration, where the contract price is referenced to the futures price.

The natural gas market has been transformed significantly since the early 1980s in ways that affect the price and duration components of contracts. This market transformation is described briefly in Section 1. An important distinction is made between the duration and price components of a contract. The duration of contracts is explained in terms of "asset specificity" and minimizing transactions costs. Section 2 reviews the contract literature with the objective of explaining the duration of gas contracts that were written before the early 1980s and the gas contracts that will be written in the future. Historically, the price component of gas contracts was influenced by regulations from the wellhead to the burner tip. Prices set by regulation instead of market forces encouraged contracting at fixed prices. The development of the gas futures market means that economically efficient prices are discovered and they are conveyed to all participants in the gas market. The natural gas futures market and its implications with respect to gas pricing are discussed in Section 3. The implications of efficient contracting in a regulatory environment are discussed in Section 4. The conclusions are presented in Section 5.

1. AN OVERVIEW OF THE GAS INDUSTRY

The structure of the gas market has evolved significantly beginning in the early 1980s. The participants in the market - the producers, pipelines and distributors - have remained unchanged, but their business opportunities are different. Pipeline companies were typically gas merchants, buying under long term contract from producers and selling under long term contract to LDCs and other large users. Although there are a large number of producers and a large number of pipelines, producers had limited choices but to contract with a single pipeline. Producers were typically unable to sell directly to end users and LDCs. At the downstream end of the pipe, LDCs and electric utilities typically had access to a relatively few pipelines.

The Federal Energy Regulatory Commission (FERC) has regulatory authority over interstate utility purchases and sales of gas and electricity. In 1985 the FERC issued Order 436 that provided interstate pipelines the option of becoming "common carriers" of natural gas. The objective of Order 436 was to provide competition in the industry by unbundling the transportation of gas from its ownership. With Order 436, pipelines were allowed to provide nondiscriminatory transportation service. By 1986, 28 pipelines applied with FERC for common carrier status (Kalt and Shuller, 1987, p. 7). By 1990, virtually all major pipelines in the U.S. provided transportation access to buyers and sellers.

The Interstate Natural Gas Association of America surveys pipelines on a regular basis to determine the amount of gas transported by carriage and the amount transported as sales. Carriage refers to gas transported by the pipeline, but owned by others; whereas sales refers to gas purchased by the pipeline company, transported and then re-sold. In the early 1980s, less than ten percent of the gas was transported as carriage, almost all of it was transported as sales. In the first half of 1991, the level of carriage reached 83 percent of interstate pipeline deliveries (Hoffman, 1991). The dramatic increase in the amount of gas transported as carriage is one of the most significant developments in the gas supply industry in the last decade. The growth of common carrier transportation has enabled numerous buyers and sellers to conduct business with each other. This new business relationship encouraged first, the development of a spot market in natural gas and then the gas futures market.

Trends in the volume of gas traded in the spot market are indicative of major changes in the gas market. Prior to 1983 and 1984 almost no gas was traded in the spot market. Prior to these years, gas was exchanged primarily under long term (fixed price) contracts with pipelines. The volume of gas traded on the spot market increased from 14 percent in 1984 to about 74 percent in 1988. Another trend may be beginning with the percent of spot sales apparently decreasing in 1990. Although specific numbers are difficult to confirm from alternative sources, the evidence from the trade press is that spot sales as a share of total sales have begun to decline. The share of gas purchases under contract has therefore increased.

2. THE FUTURES MARKET²

²An excellent description and analysis of the gas futures market is provided by Dearborn (1990). The significance of the gas futures market is discussed in Clark and Clark (1984).

In April 1990, a futures market in natural gas was opened by the New York Mercantile Exchange (NYMEX). A futures contract is a contract to purchase or sell 10,000 Btu of gas, plus or minus two percent.³ Prices are quoted in dollars and cents, such as \$1.75 per million Btu. Futures contracts vary in duration from a few months to a maximum of 18 months. The contracts are exchanged on a daily basis on the NYMEX, with trading terminated eight business days prior to the month when delivery begins. The contract point of delivery in this market is the Henry Hub in Louisiana, which is significant because it is a major physicals market and hub of a large transportation network. The market price of gas at other locations, including transportation costs, can be referenced to the Henry Hub price.

Utilizing futures prices in gas contracts does not require participating in the futures market or even understanding it. Futures prices are published daily in major newspapers such as the Wall Street Journal and Washington Post and can be read on a screen in real time. As key relationship between futures and physicals prices is

$$\text{Cash Price} = \text{Futures Price} + \text{Basis},$$

where cash price refers to the current cash price for physicals and the futures price refers to any future time for which the futures price exists. Basis includes the calendar value that differentiates a futures price from a spot price plus it includes transportation from the Henry Hub to any destination. Changes in transportation rates, seasonal loads and pipeline capacity constraints are reflected in changes in the basis.

The simplest and most effective way for electric and gas utilities to use futures prices requires first a decision by the public utility commissions that allowable fuel costs should be economically efficient and therefore determined by a competitive market process. Efficient prices are conveyed by the futures market, where an adjustment is made for a competitively determined basis price. An electric or gas utility could simply purchase gas under competitive procurement where the price is equal to a futures market prices plus a basis price that is determined by a competitive bidding process. Alternatively, a utility could obtain assistance from one of about 300 gas marketing firms to purchase gas. These marketing companies offer deals to producers and purchasers that reflect the NYMEX prices plus a basis price. If the gas contract is for monthly deliveries of up to the next 18 months, currently

³The complete specifications of a gas futures contract are defined in Energy In the News, Special Supplement, New York Mercantile Exchange, Spring 1991, p. 35.

published futures prices could be used. Contracts for longer duration could reflect future prices that are subsequently determined in this market.

3. THE DURATION OF CONTRACTS

A view, widely held view in the gas industry, including the financial community, is that long term contracts are necessary to achieve reliable gas supplies at relatively stable prices. A large technical literature has been developed to explain the duration of contracts in various markets. This literature can explain the duration of natural gas contracts that have been written in the past and it can predict the duration of gas contracts that are likely to appear in the future. Historically, producers sold gas to pipeline companies under terms defined by long term contracts. Pipelines sold gas to local distribution companies, electric utilities and to other purchasers, also under long term contracts. More recently, gas has been exchanged with shorter term contracts and using the spot market.

The price component of a contract should be considered separately and independently from its duration. The significance of these terms is different and the factors that influence them are also different. The duration of a contract affects the transactions costs between the buyer and seller. The price component of the contract affects a third party - the ratepayer. Just as contracts differ in their duration, they differ in their price component. Long term contracts could have fixed prices, but they could just as well have flexible prices referenced to the futures market.

A large technical literature on contracts provides an explanation of the duration of the contract that is likely to correspond to various market conditions. Contracts serve an important function of minimizing transactions costs between buyer and seller. The "transactions cost" framework is developed to explain the duration of contracts observed historically in natural gas and other products. This framework predicts the duration of contracts that will characterize the gas market in the future as the market responds to regulatory changes. The price component of a contract requires a different explanation.

Consider first the markets for consumer goods and services. First, contracts are seldom used in consumer goods markets. Instead, consumers simply purchase goods and services on the spot. Second, the supply of goods, including the necessities of life, are highly reliable, without the use of contracts. Third, large capital investments are made to supply consumer goods and the financing of these investments is not backed by contracts with customers. Consumer goods are not unique in the sense of obeying different economic laws from intermediate goods. The fundamental characteristic of

the markets for consumer goods is a large number of buyers and sellers of relatively homogeneous goods. This characteristic reduces the need for contracts. In other markets with these characteristics, we would not expect the use of contracts.

The conceptual explanation of contract duration developed here is the basic model in the literature and it is developed initially by Williamson (1983, 1985). The analysis has been extended and applied by numerous others, but the work of Joskow (1987) on the duration of coal contracts with electric utilities is particularly notable. Buyers and sellers determine the contract duration with the overall objective of minimizing transactions costs. The numerous components of transactions costs include: negotiating, monitoring, enforcing and re-negotiating contract extensions. Additional costs include various risks, such as opportunistic behavior and breach of contract. The model is that buyers and sellers engaged in contracting consider all these costs and attempt to minimize them by writing a mutually beneficial contract of appropriate duration. The costs of a contract that is too short include re-negotiation costs and particularly the incentive for each party to hold the other hostage by demanding more favorable terms.

One cost of a contract that is too long is the cost of writing a contract that attempts to anticipate future uncertainties. Over the long term, actual market conditions will deviate from those initially anticipated in the contract. The resulting costs include opportunistic behavior, breach of contract and other enforcement costs. As the term of the contract increases, the difficulty of forecasting all possible outcomes also increases. Long term contracts become more complex and more costly to write. Individuals are intentionally rational, but actually behave with "bounded rationality" that limits their ability to write contracts that will cover all possible contingencies. With a long term contract there is an increased probability of eventual dissatisfaction, and a decreased probability of anticipating it. The parties dissatisfied with the terms of the agreement may be inclined to breach the contract. Enforcement costs can be high, particularly if they involve litigation.

Another cost of a long term contract is the possibility of "opportunistic behavior", where one party may take undue advantage of the other as circumstances warrant. The potential for opportunistic behavior arises when one party makes a large capital investment requiring a long term payoff (gas well, pipeline, electricity generating station) and that payoff depends on the performance of a second party. For instance, suppose that a LDC signs a long term fixed price contract in an effort to obtain reliable gas supplies. In the event of an extremely cold winter, such as December 1989, spot prices rise significantly and the physical delivery of gas becomes limited. A supplier who is technically able to perform under contract may behave opportunistically by

declaring a good faith effort but not making delivery at the fixed price. Instead, the available supplies may be sold on the spot market. In this case, opportunistic behavior results in a fixed price contract providing less reliable supplies than spot market purchases. Various other types of opportunistic behavior increase the risks and therefore transactions cost of long term contracts.

Joskow's (1987) analysis of coal contracts concludes that the duration of a contract depends on the extent the investment is "relationship specific." An extreme example is a single coal mine that produces coal for a single electricity generating station that is located near the mine. The investments in developing the coal mine and constructing the generating plants are relationship specific because the financial feasibility of the investment requires a long term business relationship. The economic value of the coal mine depends on its ability to sell coal to the utility. Similarly, the value of the generating station requires that it have access to reliable coal. In this case, the utility will purchase coal using a long term contract, where the duration of the contract may coincide with the economic lifetime of the investments. The long term nature of the investments (the mine and the generating plant) and the necessity of long term business relationships suggest a contract of commensurate duration. With the terms of purchases defined in a long term contract, repeated purchases of coal are made with relatively low transactions costs. These costs would be much higher if short term contracts had to be re-negotiated frequently.

The notion of a "relationship-specific" investment is developed by Williamson (1983), who notes three conditions under which an investment by one firm may be for the near-exclusive use by another firm. The first condition is "site specificity" which means that the investment is made at a place that is geographically convenient for the second firm and the asset is highly mobile. The second is "physical asset specificity" which means that the asset is designed and constructed for transactions with a particular customer. The third is "dedicated assets", which are investments that would not have been made in the absence of opportunity to sell to a particular customer. When there is a high degree of asset specificity, a long term business relationship can efficiently be conducted with a long term contract. Asset specificity means that the buyers and sellers have few options other than to deal with each other over a long period of time. An efficient way to conduct such business is with a long term contract.

The above three conditions of asset specificity have applied to each segment in the gas industry. Consider for instance gas producers, pipelines and gas fueled electricity generating stations. The assets are site specific, physically specific and each is dedicated for use by the other two. A gas well

is highly immobile and may have its gas gathered and transported by a single pipeline. A well could be developed to produce gas for one particular pipeline, if only one line were accessible. Gas fueled generating stations are also highly immobile and may be constrained to purchase gas from a single pipeline. Similarly, a generating station is immobile and physically linked to a pipeline if only one is accessible. Gas pipelines are also geographically and physically specialized because their economic value derives from transporting gas from one specific point to another. The station and a gas well could each be considered as "dedicated assets" if the initial investments would only have been made because of the existence of a single pipeline. The implication of asset specificity is that a long term contract may have lower transactions costs than a short term contract that is frequently re-negotiated.

The transactions cost interpretation of contract duration provides a compelling explanation of the long term contracts observed in the gas industry until the early 1980s. Producers needed contracts with pipelines because producers had specialized assets with no alternative but to contract with a single pipeline. Local distribution companies, electric utilities and other large buyers had large capital investments that required a reliable supply of gas and the only source of supply was a single (or at most a few) pipeline. The pipeline required contracts to obtain initial financing and continued to conduct business on this basis. Long term contracts reduced transactions costs relative to the alternatives, but prior to the early 1980s, there was no spot market and no feasible alternative. The economic usefulness of long term contracts changed drastically in the mid 1980s. Open access transportation, resulting from FERC Order 436, permitted numerous producer and marketers to sell gas to numerous large customers and to purchase transportation separately. In such a market, long term contracts have higher transactions costs than short term contracts or even spot purchases.

Asset specificity is defined in terms of the physical characteristic of the asset. However, the relevant characteristic is the number of market participants. Suppose the above coal mine example were changed so that several comparable mines had open access to several coal burning generating stations. No single coal mine is now dedicated for use by any particular generating plant. A long term business relationship between a particular buyer and seller is no longer necessary. A large number of buyers can do business with a large number of sellers. Long term contracts are unnecessary, because such contracts do not reduce transactions costs over short term or spot purchases.

Gas wells, pipelines, distribution systems and gas fueled generating stations are each large scale investments that had a high degree of asset specificity. When pipelines became common carriers, many buyers obtained

access to many producers. Assets, such as gas wells, pipelines and generating stations, were no longer uniquely linked to each other. The characteristic of a market with numerous buyers and sellers is that no participant needs to transact business with any other specific participant with a long term contract. When pipelines are dealers or merchants in gas, their assets are relationship specific and long term contracts minimize transactions costs. When pipelines became common carriers, asset specificity for the purchase and sale of gas disappears and with it the value of long term contracts. The market for the purchase and sale of gas can now be conducted efficiently without using long term contracts. However, the transportation of gas is undertaken by a limited number of pipelines and on a contractual basis. Pipelines lost most of their asset specificity when their services were unbundled and transportation was separated from purchase and sale.

4. CONTRACTS WITH REGULATED UTILITIES

Long term fixed price contracts with regulated utilities result in an inefficient allocation of resources. The regulated firms include natural gas LDCs and electric utilities that purchase gas. The costs of purchasing gas are recoverable through retail prices if utility commissioners judge them to be prudently incurred. Gas and electric utilities may each prefer long term contracts and with a fixed price. Utility commissions may have an incentive to allow such contracts, even though they are not in the interest of the ratepayer.

Regulation is justified on the grounds of reducing market failures. However, the approval of fixed price fuel purchasing contracts by utility commissions may actually introduce a market failure. The market failure, termed the principal agent problem, results when an individual (principal) retains an agent to act on his behalf, and the agent (who has his own objectives) does not efficiently represent the principal.

The literature on contracts indicates that the duration of contracts is selected so as to minimize transactions costs between buyers and sellers. An hypothesis is that regulation imparts a bias in efficient contracting by encouraging contracts of extremely long duration. Long term contracts of 10 and 20 years are observed primarily in regulated firms, such as utilities purchasing gas and coal. Industries with a similar degree of asset specificity such as the newspaper publishing and petrochemicals (Palmer, 1991) are characterized by contracts that rarely exceeded five years duration. The principal agent problem suggests that regulated firms may prefer longer term contracts than unregulated firms. The extended duration may appear to provide reliability and security to the regulated firm. The risks of inefficient prices may be shifted to customers if the contracts are judged prudent by

regulators (Sutherland, 1990). The regulatory bias in favor of long term contracts with fixed prices probably resulted in transactions occurring at economically inefficient prices over a long period of time.

The issue of regulatory bias and contract duration is of some historical interest, but the more important question is whether any regulatory changes should be made to affect contract length. The answer is no. The suggested regulatory change is that fuel should be purchased at competitive market prices, as revealed in the futures market. If the contract price of fuel is an efficient price, the duration of the contract becomes irrelevant as a regulatory issue. Utilities should have complete freedom in choosing short term or long term contracts or using the spot market. Utilities should also be able to make any fuel purchases they prefer, including investing in storage or buying gas in the ground.

Requiring LDCs and electric utilities to account for fuel costs at competitive market prices would improve economic efficiency. This proposal eliminates four limitations with the current regulatory system. (1) There is no market failure requiring regulation and a prudence review of the fuel purchasing decision. The market failure characterizing electric and gas utilities is the natural monopoly, or declining average costs associated with distribution. Certainly, this market failure provides no rationale for regulation of fuel purchases. (2) A market failure may be introduced by such regulation in the form of a principal agent problem. The LDC and the utility commissioners may have an incentive towards long term fixed price contracts that are not in the interest of the customers, but are in the interests of the utility. (3) The economic function of a market price system is to send the correct signals to market participants so that economically efficient decisions are made. Price flexibility is the mechanism by which a free market economy operates. The inefficiencies resulting from fixed price gas contracts are obvious. First, if the contract price is below subsequent market prices, consumers are encouraged to use too much gas. Consumers are also discouraged from undertaking the conservation measures proposed by demand side planners. If contract prices turn out to be too high, consumers are adversely affected and may be inclined to switch fuels. (4) Stockholders should bear the risks of any deviation between contracted fuel prices and market prices. The LDC and electric utility should be free to reflect stockholder interests, with the caveat that customers always pay current market prices. Customers should pay for gas at prices that reflect purchases at market prices - either spot prices or prices referenced to the futures market - because the utility can obtain reliable supplies with this purchasing strategy. Stockholders bear no fuel price risks with this strategy. However, the LDC could speculate by signing fixed price contracts in hopes that the future market price exceeds this fixed price. If the LDC speculates profitably, the

stockholders should benefit. However, if market prices fall below the contracted price, stockholder dividends are reduced accordingly. Fuel purchases should become an unregulated business, just like any other business.

5. CONCLUSIONS

Gas and electric utilities will eventually purchase gas at competitive market prices as revealed by the futures market. Utility commissioners have recently encouraged spot market purchases because of low spot prices. The wide dissemination of futures prices and their acceptance as competitive prices will be difficult for utility commissioners to ignore. Any consumer advocacy group can contrast utility purchase costs of gas with those published in the newspaper and note the discrepancy. If the utility signs a gas purchase contract at non-market based prices, the purchase price will at some point exceed the published market price. The utility will then have to explain its purchase at an above market price. For example, consumer advocates in California have alleged that Pacific Gas and Electric overpaid Canadian gas suppliers more than half a billion dollars and that customers should be refunded accordingly. The alleged cause is that the company "...had no incentive to fight the producers because until recently it could pass on higher costs to California ratepayers." (Marshall, 1992). This lack of incentive is explained here as the principal agent problem. The "discovery" of competitive market prices by the futures market ensures that the California experience will be repeated. As more of these cases occur, utilities and their commissioners will also discover the value of competitive market prices.

Gas supply portfolios of electric and gas utilities in the future will include a mix of spot purchases and short and medium term contracts. The maturity profile should not be a concern to regulators or to customers because there are no third party effects. The important component of the contract is the purchase price of fuel because of its effect on customers. The implication of this analysis for federal and state policies is that regulated and unregulated businesses be permitted to make any fuel purchase decisions that they choose, but regulated utilities should be required to expense fuel purchases at competitive market prices regardless of cost. Public utility commissioners should encourage electric and gas utilities to purchase fuel competitively by referencing fuel prices to the futures market. The "allowable" fuel cost should be referenced to the futures market and include an adjustment for a basis that is determined by competitive procurement. If the utility wishes to purchase gas at fixed prices, or even gas in the ground as a speculative investment, it should be allowed to do so, but only at stockholder risk. The outcome of the investment should be reflected as dividends or as losses, but not in terms of allowable fuel costs.

Two major issues in utility purchases of fuel are incentive regulation and the fuel adjustment clause. The idea of incentive regulation is to give utilities an incentive to purchase fuel at a minimum cost. The issue of the fuel adjustment clause is whether the purchased cost of fuel should automatically be passed on to customers. Fuel purchases at efficient market pricing solves both of these issues. If fuel purchases at competitive market prices were allowed by PUCs without review, regulations designed to encourage low fuel cost purchases would become superfluous. The best that a utility can do is purchase fuel at a competitive market price, and utilities can make purchases without special incentives. If utilities expense fuel at competitive market prices, incentives are superfluous. If utilities have an automatic fuel adjustment clause at competitive prices, both the utility and its customers are operating in a more competitive market.

REFERENCES

Clark, Nolan E. and Glenn W. Clark, Governments, Markets and Gas, Energy, Economics and Environment Institute, Arlington Va., 1984.

Dearborn, Ned W., "The Developing Natural Gas Futures Market and Its Potential Impact on Domestic Natural Gas Markets" Natural Gas Monthly, Energy Information Administration, March, 1990, pp. 1-21.

Ellis, David J. "Futures Trading in the Natural Gas Industry From the Regulator's Viewpoint", Energy In the News, Special Supplement, New York Mercantile Exchange, Spring 1991, pp 14-15

Energy In the News, Special Supplement, New York Mercantile Exchange, Spring 1991, p. 35.

Hoffman, Paul, "Carriage Through the First Half of 1991" Issue Analysis, Interstate Natural Gas Association of America, Washington DC, Report No. 91-5, November 1991.

Joskow, Paul L., "Contract Duration and Relation-Specific Investments: Empirical Evidence From the Coal Market" American Economic Review, Vol. 77, No. 1, 1987, pp. 168-185.

Kalt Joseph P. and Frank C. Schuller, Deregulating the Natural Gas Industry, Quorum Books, New York, 1987.

Marshall, Jonathan, "Critics Say PG&E Overpaid Canadian Gas Suppliers", San Francisco Chronicle, January 24, 1992.

Palmer, Karen, Peter Fox-Penner, David Simpson and Michael Toman, Contracting Incentives In Electricity Generation Fuel Markets, Resources For the Future, Washington DC, draft, November, 1991.

Sutherland, Ronald J. "Economic Efficiency in the Emerging Market for Independently Produced Power", Energy Systems and Policy, Vol. 14, 1990, pp.167-181.

"Question II: Gas Procurement Strategy", Public Utility Fortnightly, October 25, 1990, pp. 49-59.

Williamson, Oliver E., "Credible Commitments: Using Hostages to Support Exchange", The American Economic Review, Vol. 73 September, 1983, pp. 519-40.

Williamson, Oliver E., The Economic Institutions of Capitalism, New York: The Free Press, 1985.

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