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The 1996–97 Gas Price Review in Argentina

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Argentina's natural gas industry was privatized at the end of 1992. Prior to divestiture, the state-owned monopoly Gas del Estado was divided into two transport and eight distribution companies, all of which were sold through international bidding.

An independent government body, Ente Naal Regulador de Gas (Enargas), was established to regulate the transport and distribution segments of the industry. As part of its mandate, Enargas is in charge of price reviews. These reviews, which occur every five years, determine the allowed tariffs for each transport and distribution company. The first such review took place in 1996–97, and the new tariffs went into effect in January 1998. This Note examines the methodology and outcome of this experience.

The Enargas price review is of interest for several reasons. First, it is the first of its kind in Argentina, and one of the first in a developing country. The outcome of the process provides a test of the regulatory framework adopted by the Argentine government, and may influence regulatory reform in other parts of the world. Second, as the first such event, the 1996–97 review set a precedent for methodologies and approaches to be used in future utility price reviews in Argentina. Finally, the approach used to calculate the cost of capital—as well as the other parameters used to set prices—provide an interesting illustration of how theoretical and practical methods from regulatory practice in industrial countries can be adapted to developing countries, where data availability and other restrictions prevent a direct transfer of techniques.

The regulatory framework

The tariff paid by final gas consumers in Argentina is composed of three parts:

Final price = gas wellhead purchase price
+ transport margin
+ distribution margin

Gas wellhead purchase prices are not regulated, but are determined by the contracts negotiated between gas suppliers and producers. Purchase costs are passed through to final consumers, subject to Enargas's approval of the prices as reasonable. There is, however, no formal mechanism to promote efficient purchases.

Price margins for transport and distribution are set by Enargas for five-year periods. The price control system is similar to the price cap regulation used in the United Kingdom. But unlike U.K. firms, Argentine firms do not have flexibility in setting individual prices subject to an aggregate revenue or tariff basket constraint. Enargas sets the maximum tariff for all individual services and customer categories. These tariffs must be sufficient to:

- Cover operating costs, taxes, and depreciation.
- Provide a reasonable rate of return on invested capital.
- Guarantee a secure supply by providing resources to fund system maintenance and expansion.

Tariffs are automatically adjusted every six months according to:

$$g = \text{PPI} - X + K, \quad (1)$$

where g is the percentage change of the tariff, PPI is the producer price index in the United States,[1] X is the efficiency factor, and K is the investment factor, both of which may differ across firms. The last two parameters may also differ for each six-month semester of the five-year period.

The efficiency factor (X) reflects the cost reductions that the regulator estimates can be achieved in the next five-year period, which are thus passed directly on to customers. The investment factor (K) is an adjustment to allow revenues to cover expected investments in improving and expanding network infrastructure. Company investment plans are first screened by Enargas. Once approved, they are assigned K factors. The K factors are project-specific and are contingent on the investment being undertaken. They come into effect only after a project has come on stream and is delivering benefits to customers.

Setting the new tariffs

Estimates of future cash flows for each firm are the starting point for the setting of new tariffs. The cash flow analysis should extend until the licenses expire, since this is the relevant time horizon over which owners can recoup their investment. At the time of the review, current licenses were set to expire in thirty-five years.

The net present value (NPV) of a firm's future cash flows is:

$$\text{NPV} = \sum_{t=1}^{35} \frac{T_t V_t - C_t - I_t}{\left(1+r\right)^t}, \tag{2}$$

where T_t is the tariff for transporting (or distributing) gas in period t, V_t is the volume of gas transported (or distributed), C_t is the operations and maintenance cost, I_t is additional investment, and r is the firm's cost of capital.

In the actual modeling of cash flows, T is a vector of tariffs and V is a vector of outputs, since there are different tariff zones, different parts to each tariff, and different types of outputs. Another simplification in the above formula is the omission of taxes. Cash flows should be net of taxes, since it is the posttax income that is relevant for the valuation of companies.

To give investors a fair rate of return on their invested capital, the regulator should set g in equation 1 (and therefore tariffs T_t) in such a way that the NPV is equal to the capital invested in the firm at the beginning of the review period. This initial investment was set equal to the price paid for the companies at the time of divestiture rolled forward to the review date by adding the new investments made during the interim period and subtracting depreciation.

There is a further issue in determining the time profile of the tariff changes: changes could be gradual—through small changes each semester—or made all at once at the beginning of each five-year review period. Enargas decided that the full price reductions would occur on January 1, 1998. Thus the first X factor was set to achieve this tariff reduction, while the X factor for each subsequent biannual price adjustment was set to zero. This is in contrast to K factors, which are implemented gradually, as noted above.

Information requirements

Estimates of the growth in demand (that is, prediction of the parameter V in equation 2) are crucial for determining appropriate tariff levels. Enargas used information provided by other government departments (such as the Secretaría de Energía y Puertos) and the gas companies themselves. The available information was used to construct probable demand scenarios for each firm.

Detailed information on operating costs and revenues, as well as planned investments, was submitted to Enargas by each regulated firm according to a format provided by the regulator (Enargas 1996b).

Productivity increases were considered by the regulator when forecasting costs and, therefore,

setting the efficiency (X) factor. The exact approach used by Enargas is described below. Investments that expand the network will increase the volume of gas sold and will also affect future cost estimates. These activities are considered when setting the investment (K) factor and are also described below.

The cost of capital

A fundamental parameter that must be estimated before tariffs can be set is the cost of capital—that is, the cost to a firm of raising an additional unit of capital. Enargas estimated separate rates for the transport and distribution sectors but did not attempt to differentiate these rates across individual companies.

The aggregate cost of capital is a weighted average of the cost of debt capital and the cost of equity capital. The weights are the portion of debt and equity relative to company assets. Formally,

$$r_c = r_d\left(1-t\right)\frac{D}{V} + r_e\frac{E}{V}, \tag{3}$$

where r_c is the cost of capital, r_d is the nominal interest charged on the firm's debt, t is the profit tax rate faced by the firm (0.3 in Argentina), D is the debt of the firm, r_e is the opportunity cost of equity capital, E is the value of the firm's equity, and $V = D + E$. Debt and equity are measured by their market value. Where a firm's debt or shares were not traded in the market, information from financial statements was used. The equity and debt figures for the Argentine gas industry at the time of the review are presented in table 1. The final nominal and real capital costs for transport and distribution, as calculated by Enargas, are presented in table 2.

The cost of equity capital. The cost of equity capital must include a risk premium to compensate investors for the nondiversifiable volatility of the financial returns on a firm's equity. The higher the volatility, the higher the expected rate of return investors will demand to hold the asset. Calculating this risk premium for a regulated utility is a necessary but contentious aspect of any price review. A widely used tool in this endeavor is the capital asset pricing model.

TABLE 1 DEBT AND EQUITY IN THE ARGENTINE GAS INDUSTRY, 1996–97
US$ millions

Activity	Debt	Equity	Debt to equity ratio
Transport	874	1,512	0.58
Distribution	1,015	2,403	0.42

Source: Enargas 1996a, table 7.

TABLE 2 FINAL COST OF CAPITAL FOR THE ARGENTINE GAS INDUSTRY
Percent

Activity	Nominal capital cost	Expected inflation	Real capital cost
Transport	13.4	1.9	11.3
Distribution	15.2	1.9	13.1

Source: Enargas 1996a.

Use of the capital asset pricing model is problematic in countries where stock markets are underdeveloped or where the industry under analysis has not historically been quoted on the stock exchange. This was the case in Argentina. Only two of the ten gas firms had been quoted on the stock exchange at the time of the review, and even for these companies, the time series for stock market data was rather short. Recognizing these obstacles, Enargas used the following adjusted capital asset pricing model:

$$r_e = r_f + \beta_e(r_m - r_f) + \text{riskARG}, \tag{4}$$

where r_e is the cost of equity for an Argentine firm, r_f is the return provided by a risk-free asset in a reference industrial country, r_m is the return on a well-diversified portfolio in the reference country, β is a parameter proportional to the covariance between the return on the equity of the gas firm and the return on the diversified

portfolio in the reference country, and riskARG is a premium reflecting Argentina's sovereignty risk. Except for the last term, the above formula is the standard capital asset pricing model.

The risk-free interest rate (r_f) was taken to be the yield to maturity on U.S. Treasury bonds of the same average life as the Argentine gas companies. The sovereign risk premium (riskARG) was obtained by comparing the rate of return of a foreign currency–denominated Argentine bond with that of a U.S. Treasury bond. Enargas used Argentine euronote bonds as the basis for comparison. These bonds are denominated in U.S. dollars and in deutsche marks and were issued by the Argentine government in European financial markets. The risk premium of a well-diversified portfolio ($r_m - r_f$) was estimated as the difference between the return on a basket of stocks in the United States and the rates on U.S. Treasury bonds with long maturities.

The final parameter needed is the beta coefficient (β_e). This parameter is proportional to the correlation between the returns on the firm's equity and those on the market portfolio. Estimated betas were available in the United States only for gas distribution companies. The average beta coefficient for these companies was 0.58 (Enargas 1996a). The estimated beta coefficients for the United States were adjusted for two factors before being applied to Argentina. Both adjustments relate to differences in the risk characteristics of the companies in each country:

- First, the financial gearing of a firm will influence the beta coefficient. Unless firms in Argentina have the same financial gearing as firms in the United States, the beta coefficients for U.S. firms are not applicable to Argentine firms.
- Second, gas distribution firms in the United States are regulated by a rate-of-return system. This regulatory regime may be considered inherently less risky for investors than the price cap regime practiced in Argentina.

An adjustment for the first factor requires the use of a formula that relates the beta coefficient to the gearing ratios of firms. Details on this adjustment can be found in Enargas (1996a). The adjustment for the differences in regulatory regimes is undertaken by examining the beta coefficients for firms regulated under different regimes in Britain and the United States.

The final result was an average beta coefficient for Argentine gas distribution companies of 0.78. For gas transport companies there was no equivalent information on beta coefficients from the United States. Instead, the parameter for this sector was obtained by rescaling the beta coefficient for the distribution sector by the relative standard deviation of the returns to each type of activity in Argentina. (Details can be found in Enargas 1996a.) The result is an estimated beta coefficient for gas transport companies of 0.58. This accords well with prior expectations. Gas transport is less risky than the more competitive distribution sector, and so should have a lower risk premium.

The cost of debt capital. The cost of debt capital was estimated as r_f + riskARG, the sum of the risk-free interest rate (measured by the rate of return on U.S. Treasury bonds of similar average life as the Argentine gas firms) and the sovereign risk premium for Argentina. The cost of debt capital amounted to 12.56 percent for transport and 13.02 percent for distribution.

Determining the efficiency factor

Enargas analyzed three sources of information on potential efficiency gains to forecast costs and set efficiency (X) factors:

- Efficiency-enhancing project and restructuring plans submitted by the firms.
- Global productivity trends in the industry.
- Financial models to check the consistency of results.

Legislation requires Enargas to identify and quantify the impacts of specific efficiency projects as a basis for setting the X factors. To that end Enargas, with the help of independent con-

sultants, analyzed detailed programs that allowed for reliable estimates of efficiency gains. Examples included inventory control programs, changes to firms' input purchasing strategies, and changes in billing systems.

In this respect, the legislation requires Enargas to adopt a method that requires detailed knowledge of the management of firms, and thus contradicts the spirit of arm's-length regulatory control. The problem with this approach is that asymmetric information prevents the regulator from identifying all the efficiency improvements that a company could introduce and that, moreover, not all efficiency gains can be linked to specific programs. For these reasons, Enargas also analyzed historical total factor productivity in setting the *X* factors. However, since license conditions required that the *X* factors be based on clearly identified and quantified projects, Enargas had to expend some legal effort in justifying the application of total factor productivity analysis in setting the factors.

The final *X* factors for each company are shown in table 3. These factors are applied once at the beginning of the five-year period. Thus on January 1, 1998, tariffs were reduced by the full amount of the efficiency factor.

Determining the investment factor

Investment (*K*) factors, if positive, increase tariffs each semester. Their purpose is to stimulate investment in improving and expanding the gas system. Investment projects are approved by Enargas if they:

- Have reasonable costs and schedules.
- Cannot be funded with the original tariffs and so require additional investment.
- Expand the system—maintenance investment is considered when setting the efficiency (*X*) factor—and improve the quality and security of supply beyond the requirements stipulated in the license conditions.
- Benefit the majority of the firm's customers.
- Are structured so that companies assume all construction cost risks.

The transport and distribution companies presented investment projects worth 1,774 million pesos, of which just 192 million pesos were approved by Enargas and qualified for a *K* factor. Because Enargas was still evaluating many projects at the time of the final tariff determination, it retained the power to approve further projects up to ninety days after this date.

The *K* factor is broken down by project and semester. It is activated only when an investment project has been completed according to its original specification and it meets the objectives for which it was proposed. The *K* factor for each project is estimated as the percentage increase in tariffs that would be required so that the value of the firm is the same with and without the project.

Tariff increases for system expansion apply only to customers who benefit from the investment. Consequently, *K* factors are specific to each

TABLE 3 FINAL EFFICIENCY (*X*) FACTORS FOR TRANSPORT AND DISTRIBUTION FIRMS
Percent

Firm	*X* factor
Transportadora de Gas del Sur	6.5
Transportadora de Gas del Norte	5.2
Distribuidora de Gas Cuyana	4.8
Gas Natural BAN	4.8
Litoral Gas	4.7
Metrogas	4.7
Distribuidora de Gas del Centro	4.7
Camuzzi Gas del Sur	4.6
Camuzzi Gas Pampeana	4.5
GASNOR	4.4

Note: For transport firms the *X* factors apply to all interruptible supply and firm supply tariffs. For distribution firms the *X* factors affect residential, general small, general, compressed natural gas, and subdistribution tariffs.
Source: Enargas 1997.

TABLE 4 INVESTMENT (*K*) FACTORS APPROVED FOR GAS DEL NORTE, 1998–2002
Percent

Tariff zone	1998		1999		2000		2001		2002	
	First semester	Second semester	First semester	Second semester	First semester	Second semester	First semester	Second semester	First semester	Second semester
Salta	0	0.84	0.52	0.74	0.46	0	0	0	0	0
Tucuman	0	1.74	0.61	0.82	0.55	0	0	0	0	0
Central	0	1.85	0.65	0.87	0.58	0	0	0	0	0
Litoral	0	1.83	0.64	0.86	0.57	0	0	0	0	0
Aldea Brasilera	0	1.81	0.63	0.85	0.57	0	0	0	0	0
Gran Buenos Aires	0	2.56	1.38	1.55	1.24	0	0	0	0	0

Note: These factors are for a project to reinforce gas mains in some areas with high population densities. Gas del Norte proposed two other projects that were still pending approval by Enargas at the time the new tariffs were formally announced.
Source: Enargas 1997.

TABLE 5 INVESTMENT (*K*) FACTORS APPROVED FOR METROGAS, 1998–2002
Percent

Tariff affected	1998		1999		2000		2001		2002	
	First semester	Second semester	First semester	Second semester	First semester	Second semester	First semester	Second semester	First semester	Second semester
Residential	0	0.57	0.54	0.51	0.48	0.45	0.42	0.40	0.37	0.35
Commercial and industrial	0	0.41	0.39	0.37	0.35	0.33	0.31	0.29	0.27	0.26

Note: These data are provisional *K* factors for two of the three projects presented by Metrogas. The factors are provisional pending the evaluation and approval of the third project.
Source: Enargas 1997.

geographic tariff zone. In addition, only tariffs for services that benefit from an investment project are affected.

Final *K* factors for the northern transport firm (Transportadora de Gas del Norte) and for Argentina's biggest distribution company (Metrogas) are presented in tables 4 and 5.

It must be borne in mind that *K* factors are applied to tariffs in the semesters when the corresponding investment projects are under way. Thus the dates shown in tables 4 and 5 may not be the effective ex post dates if projects fall behind schedule.

Conclusion

The 1996–97 Enargas price review offers a sophisticated approach to the price regulation of natural monopolies. An extremely complex procedure, the review was based to the extent possible on objective information and rules. Its well-defined procedures and methodologies turned out to be very helpful in resisting pressure from lobbies and preventing regulatory capture.

The review also set important precedents for future price reviews in the Argentine gas industry, as well as subsequent utility price reviews in other countries and sectors.

A point of interest in the Enargas review is the adaptation of methods developed in the United States or Europe to overcome the lack of data in Argentina. In particular, the methodology adopted for estimating the cost of capital may be relevant to other developing countries.

Gas transport and distribution licenses require Enargas to identify projects that will lead to efficiency gains in order to set the *X* factors. This approach is unlikely to detect the full range of efficiency improvements that could potentially be made, and furthermore may lead to excessive micromanagement of firms by the regulator. To overcome these problems, Enargas used a more aggregate method (total factor productivity analysis) to determine companies' potential efficiency gains. The use of this methodology was contested by the industry, however.

[1] Legal restrictions prevent domestic price indexation in Argentina. But because of the country's currency board system, domestic inflation is not expected to differ from international inflation.

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