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Managing Energy Vulnerability: Brazil's Adjustments to Oil Dependency

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***Abstract** Strategies developed to cope with energy vulnerabilities provide a critical measure to evaluate a state's capacity to adapt to changes in the international environment. This article examines the conditions shaping these strategies. The author argues that the requirements of domestic ruling coalitions underpin the selection of certain instruments and not others. Brazil's domestic response, given the political requirements of rapid economic growth in the 1970s, involved import substitution and the expansion of state entrepreneurship and exports. The international expression of these adjustments was heavy internal indebtedness as well as a conciliatory pursuit of bilateral arrangements with oil producers on one hand, and with capital and technology suppliers on the other. The article concludes with a brief comparison of Brazil's responses to that of other newly industrializing countries and an assessment of changing domestic conditions that might influence future adjustments.*

Brazil's involvement in the international economic system has increased remarkably since 1964.¹ The extent to which growing interdependence has diminished or strengthened the country's ability to adjust to a broad range of external challenges may be weighed by various yardsticks. Among these, its experience in the energy sector provides a critical measure of state capacity to adapt to changes in the international political and economic environments. Why were certain instruments of domestic and foreign policy selected and not others? What kinds of domestic arrangements influenced the balance of risks and opportunities embedded in different strategies?

Our first task is to define the nature of the threat to political coalitions and state structures posed by the 1973-1974 and 1979 oil shocks. Brazil's response to these challenges was underpinned by the requirements of its domestic political and institutional configurations. Adjustment strategies were inextricably linked to the macropolitical objectives of the military-technocratic regime installed in 1964. These included rapid economic growth through the accelerated integration of Brazil into the international economic system. The expansion of state entrepreneurship, high levels of external indebtedness, and import substitution were core instruments in this strategy which, at times, undermined the attempt to strengthen a national private industrial base. Thus, the strategy was not exempt from contradictions that eroded even further the political

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basis of the ruling coalition. In particular, domestic private entrepreneurs denounced increased statization. The regime's growing domestic weakness influenced the nature of immediate foreign policy responses. These took the form of an accommodating web of economic and political ties with oil suppliers and an emphasis on diversifying and deepening Brazil's relations with the industrialized world. Structural changes in the international system, including Brazil's new position as a rapidly industrializing country, reinforced a policy of moderation. The characteristics of Brazil's nuclear program further reflected the major parameters in domestic and foreign adjustment strategies. Some of the ambiguities embodied in Brazil's strategies were shared by other newly industrializing countries that placed energy resource scarcities at the core of their regional and global policy.

The Nature of the Threat

In the 1970s, no single event had a greater impact on Brazil's domestic and foreign policies than the energy crisis. It was perhaps one of the most important sources of foreign indebtedness, which by the early 1980s had helped turn the country into the largest debtor in the Third World. The "boom" of 1969-1973, with its 11% annual growth rates, was based on the expansion of manufacturing, which was export-oriented and dependent on cheap energy. Table 1 highlights some of the major parameters of economic performance between 1970 and 1982 and the nature of oil price increases.

Energy consumption patterns generally favored petroleum, 85% of it imported,

Table 1
Energy and the Economy in Brazil (1970-1982)

Year	Real GNP Growth (%)	Price Increases for Petroleum and Derivatives (%)	General Price Index	Trade Balance (U.S. \$billions)	Foreign Debt (U.S. \$billions)
1970	8.8	17.7	19.8	\$0.2	\$5.3
1971	13.3	26.5	18.7	-0.3	6.6
1972	11.7	23.8	16.8	-0.2	10.2
1973	14.0	14.7	16.2	0.007	12.6
1974	9.5	65.5	33.8	-4.7	17.4
1975	5.6	52.4	30.1	-3.5	22.0
1976	9.7	57.6	48.2	-2.3	29.0
1977	5.4	39.3	38.6	0.1	32.0
1978	4.8	30.2	40.5	-1.0	43.5
1979	6.8	67.8	76.8	-2.7	49.9
1980	7.9	159.4	110.2	-2.8	54.0
1981	-1.9	120.9	95.2	1.2	61.8
1982	1.3	71.5	99.7	0.8	69.7

Sources: Inter-American Development Bank, *Economic and Social Progress in Latin America*, 1988 Report; W. Baer, *The Brazilian Economy* (New York: Praeger, 1983).

Table 2
Cost of Oil Imports to Brazil 1971-1987 (Selected Years)

Year	Average Cost per Barrel (FOB)	Total Cost of Oil Imports (U.S. \$billions)	Cost of All Imports (U.S. \$billions)	Oil as Percentage of Imports
1971	1.88	11.4	3.2	11.6
1972	1.99	.5	4.2	11.1
1973	2.79	.8	6.2	12.4
1974	11.11	3.0	12.6	22.9
1975	10.49	3.1	12.2	25.2
1976	11.50	3.8	12.4	30.9
1977	12.30	4.1	12.0	33.8
1978	12.44	4.5	13.7	32.8
1979	17.11	6.8	18.1	37.3
1980	30.60	10.2	23.0	45.0
1981	34.37	11.3	22.1	51.0
1982	33.00	10.5	19.4	53.0
1983	28.00	8.6	15.4	56.8
1986	13.00	2.7	13.0	30.0
1987	17.1	3.8	15.0	25.6

Sources: George Philip, *Oil and Politics in Latin America*, (Cambridge: Cambridge University Press, 1982, p. 389); *Brazilian Monthly Economic Indicators*, Dec. 1983; *Economic and Social Progress in Latin America*, 1988 report; W. Baer, *The Brazilian Economy* (New York: Praeger, 1988).

which accounted for 41 % of Brazil's total energy requirements in 1972. In the wake of the 1973 oil price increase (1973-1983), Brazil had to set aside more than 30% of its export earnings to pay for foreign oil, thus turning an export-oriented strategy of economic growth into an export drive to meet import needs.² The origins of the country's current economic crisis can, to some extent, be traced to the pursuit of the fundamental objectives of ensuring energy supplies and softening the political and economic effects of dependence on foreign sources. The first wave of increases in price helped transform a bare trade surplus of \$7 million in 1973 into a \$4.7 billion deficit in 1974 (See Tables 1 and 2). Higher oil prices, however, accounted for only \$2 billion of the total deficit.

On the one hand, Brazil's energy priorities were linked to the most fundamental objectives of the military-technocratic coalition which took power in 1964: rapid economic growth and national security. President Castello Branco defined national security as "the preservation of development and internal political stability," and energy policies lay at the core of developmental priorities.³ On the other hand, the inflationary pressures of the energy crisis compelled the deceleration of growth targets in 1976 and 1979. The social and political corollaries of these strategies were costly for an authoritarian regime that sought domestic legitimacy through sustained economic growth. The threat, in other words, was not merely economic, but a challenge to the stability and legitimacy of a political model. Preserving large-scale productive capacity in energy-dependent intermediate goods sectors such as cement, petroleum refining, petrochemicals, steel, and aluminum, where the state had a commanding position, was a

central objective. Public enterprises subsidized inputs to other sectors, including private enterprise, and provided quasi-monopsonistic markets for capital goods, engineering, and other products and services.

In short, the energy shock had the potential of undermining the political and economic basis of support for the "model." The salience of energy policies was reflected in personal and institutional adjustments as Ernesto Geisel, a former head of the state oil firm Petrobrás (1969–1973), assumed the presidency of Brazil in 1974. Energy policies in general, and the nuclear program in particular, were subject to widespread criticism and polarized the scientific community, the technocrats, and the generals themselves.

Changes in Domestic Structures

The selection of crisis adjustment mechanisms was influenced more by macropolitical objectives than by the opportunities offered by Brazil's natural energy endowments. Import substitution backed by export expansion and external indebtedness were the dominant strategies of adjustment, allowing sustained economic growth between 1974 and 1978, albeit at lower and more variable levels than during the preceding five-year period.⁴ Import substitution in capital goods, petrochemicals and derivatives, steel, metal products, and energy opened up unique opportunities for domestic industry, but it was largely sustained by external borrowing. International financial markets made massive borrowing attractive as an initial response aimed at protecting the growth structure and the continuity of the political alliance in place since the 1960s. To avoid curtailing domestic consumption, domestic oil prices were not raised to world levels. Immediate income declines were not politically feasible, particularly in the delegitimizing environment reflected in the 1974 elections which doubled the strength of the opposition in the Chamber of Deputies. This outcome was of particular concern to President Geisel who had recognized the need for political liberalization (*distensão*).

External challenges forced the restructuring of domestic priorities and enhanced the position of state firms in the productive and financial areas. The twin aims of securing supplies and promoting energy independence were pursued through policies of substitution for oil through the development of alternative energy technologies such as hydroelectrical, nuclear, alcohol, biomass, and coal. The energy crises thus led to a broader reformulation of industrial policy affecting the capital goods, engineering, construction, and other industries. The following brief survey of these changes in the energy sector will place particular emphasis on patterns of accommodation between domestic and foreign resources. It will also examine the extent to which state behavior was market-displacing or market-conforming.⁵

The expansion of the state as an economic agent throughout the energy sector, much as in other areas of the economy (mining, steel, petrochemicals) was expressed in the prominent role played by state energy companies, particularly Nuclebrás, Petrobrás, and Eletrobrás. Electric power generation shifted from private to public hands in a single decade: State enterprises controlled less than 36% of power-generating capacity in the 1960s, more than 80% in the late 1970s, and close to 100% by the early 1980s.⁶

Petrobrás, Brazil's largest economic concern, was set up in 1954 to refine imported oil and generate financial resources to achieve self-sufficiency. It controlled petroleum exploration and imports and expanded into distribution and related new fields, often competing with private firms, through subsidiaries like Petroquisa (petrochemicals), Petromisa (minerals), and Braspetro (foreign oil prospecting and technical assistance).⁷

Rather than turning to private sector firms for transportation and construction, Petrobrás created its own subsidiaries. For more than 85% of its total capital goods requirements, the firm turned to domestic suppliers.⁸ Despite a long tradition of nationalist objectives expressed in the creation and evolution of Petrobrás, in an unprecedented reaction to the oil crisis Brazil granted exploration rights to foreign companies in 1975. Under these "risk contracts," which ultimately bore little fruit, exploration was allowed in exchange for a share of the oil discoveries, thereby undermining the historical monopoly of Petrobrás.

Eletrobrás is responsible for hydroelectric power, which accounts for 95% of electricity generation. Inducements for developing this potential include the availability of rivers as clean, nonpolluting, renewable resources as well as the possibility of significant reliance on domestic capital goods and engineering firms. Although it controls the biggest hydroelectric reservoir in the world (70,000 MW), Brazil has utilized only about 15% of its generating capacity. The hydroelectrical component in the energy balance has increased considerably, from 16.8% in 1969 to 28.3% in 1979, and 38% in 1985.⁹ Emphasis on the Amazon basin grew after the debacle over the nuclear program in the 1970s, and in 1984 the world's largest hydroelectric project, Itaipu Binational, was inaugurated. The environmental effects of some of those projects have involved Brazil in major controversies with environmental groups in both the North and South.¹⁰

Large-scale projects using advanced technology and imported machinery, with heavy World Bank and Inter-American Development Bank funding, were the norm in the 1960s and 1970s.¹¹ Thirty-three major plants, each with a capacity of nearly 1000 MW, were being built or enlarged in the early 1980s.¹² The emphasis on domestic supply of capital goods was reflected in that 80% of inputs to Eletrobrás came from local sources. The National Bank for Economic and Social Development (BNDES) provided effective support for projects achieving a domestic share of more than 85%. On the other hand, suppliers' credits and relaxed import policies in the areas of turbine and hydro generators contributed to the high levels of idle capacity at national firms in this sector, exacerbating their discontent.

Since Brazil depended on oil less for electricity generation than for transportation and for consumption in the commercial and residential sectors, alcohol proved an attractive substitute.¹³ Brazil pioneered in the development of alcohol fuels: methanol, obtained from coal or biomass gasification, and ethanol, from fermentation of sugarcane. By the mid-1970s, 7 million cars in Brazil, and 80% of all new Brazilian cars, were powered by a gas mixture containing 20% alcohol. In addition, over one million cars used hydrated alcohol as their exclusive fuel. State efforts in the alcohol sector were directed at strengthening private Brazilian entrepreneurs in the areas of sugarcane production, distilling, retail fuel distribution, capital goods supplies, and automobile manufacturing.

Advocates of alcohol fuels pointed to the savings in foreign exchange, the renewable quality, low environmental and transportation costs, generation of employment and income, reduction of individual and regional income disparities, and boosting of the domestic industry through the production of new refinery equipment.¹⁴ However, the eroding price-advantage of ethanol-fueled cars, and the growing social cost of the alcohol program, are giving way to renewed demand for oil-fueled automobiles. The alcohol program became a test case for the debate over increased state expansion, with private domestic and multinational firms challenging Petrobrás' aim to retain control over the liquid fuels sector.¹⁵ In the long run, it did little to alleviate demand for oil imports.

Coal accounts for only about 9% of Brazil's total energy needs; 40% of it comes from domestic sources. Estimates suggest that coal reserves will last well into the next century, even with a projected consumption level about 40 times greater than coal use in the mid-1980s, and about 2.5 times higher than the current total energy consumption in Brazil.¹⁶ The state firms Siderbrás (iron and steel), Petrobrás, and Caeeb market gasified coal at subsidized prices. In an attempt to substitute coal for fuel oil in industry, state intervention in this area was limited to providing transitional subsidies to coal producer and consumer (notably cement) firms, and to improving the transportation infrastructure between the two. Charcoal and firewood represented 35% of the primary fuel consumed in 1972, decreasing to 20% in 1980, when charcoal contributed only 2.5%. Exploitation of these resources bears some responsibility for the devastation of Brazil's natural forests.

As a tropical country of vast proportions, Brazil has a great potential for solar energy. Similarly, the country is endowed with one of the largest oil shale reserves in the world, although research on extracting and processing technologies has not been given high priority. Other biomass alternatives (alcohol derived from eucalyptus, sugar sorghum, manioc) were advocated because of their renewability and small capital investment requirements, their labor-creating potential in rural areas, and the lack of waste disposal problems. Finally, as very little oil was used for electricity generation, nuclear power offered no real substitute for oil in the energy crisis of the 1970s. Yet, an agreement was signed with West Germany in 1975 providing for the transfer of eight nuclear plants and the complete fuel cycle, and stressing self-sufficiency and technological advancement. (A more detailed analysis of the nuclear program follows.)

The oil price shock in 1979 forced a new series of adjustment strategies. The crisis was compounded by rising interest rates that aggravated the debt service outflow dominating the current account deficit, and by the world recession of 1980-1982.¹⁷ A concomitant erosion of the regime's political legitimacy accelerated when powerful industrial sectors assumed the leadership of a campaign against centralization and the expansion of state activities. The steps taken between 1974 and 1978 had not been successful in preventing an erosion of the 1968-1973 model; the average growth rate of the pre-1973 period declined toward the late 1970s, leading to the three-year recession of 1981-1983. President Joao Batista Figueiredo warned in 1979 that the oil crisis could compromise the country's stable development and international credibility and he called for increased production of domestic oil, coal, and ethyl alcohol from sugarcane.¹⁸ Hydropower was to have priority over nuclear generation, previously an untouchable, privileged item. While energy policies before 1979 were incoherent and unintegrated, the second oil shock led to a more comprehensive approach to energy alternatives.

The statistics suggest a marked qualitative change in the structure of oil dependence in Brazil in the last ten years. The volume of imports dropped from 950,000 barrels per day (bpd) in 1979 to 620,000 bpd in the first quarter of 1983. Domestic oil production grew from 340,000 bpd in 1983 to 609,000 in 1988. The costs of imported oil fell from \$8 billion in 1982 to less than \$4 billion in 1987 (see Table 2). Dependence on foreign sources dropped from 84.4% in 1979 to 73.7% in 1982, then to an estimated 45% in 1988.¹⁹ Petroleum's share of total energy requirements fell from 44% in 1975 to 24% in 1985. The relative success in oil conservation can be attributed to the substitution of alcohol fuels and coal. Yet, oil imports continue to account for about 30% of Brazil's total energy requirements by the late 1980s, up from 25% a decade earlier. Despite

diversification, increased domestic production, a drop in international oil prices, and increased Brazilian manufactured exports to the Middle East, a negative balance of trade with that region persists into the late 1980s.²⁰

In early 1982, President Figueiredo approved Plan 2000, which called for a slow-down in development of all nuclear facilities. The Iguape reactors (third and fourth out of the eight considered in the agreement with Kraftwerk Union) were indefinitely postponed.²¹ The alcohol program, instead, received significant governmental incentives. The projected 11.8% annual GDP growth rate was revised, since the economy which had expanded at an annual average of 6.5% between 1975 and 1979, declined dramatically in 1981–1982, and electricity consumption increased at half the rate predicted.²² More recently, the new Brazilian constitution approved in 1988 nationalized exploration for, and extraction of, oil and minerals, sectors where foreign firms were previously allowed to operate.²³ It also required oil companies to assume the financial risk of exploration, previously subsidized by the state.

The direct effects of energy planning on the foreign debt crisis are expressed in the considerable portion of the public debt accounted for by state firms in the energy sector. Petrobrás, Eletrobrás, Siderbrás, and Companhia Vale do Rio Doce relied on private foreign banks for 17% of their investment in the early 1970s, with internal resources accounting for 30–50%. The level of self-financing dropped to about 25% in 1980. Electrical utilities depended on foreign resources for about 30% of their total borrowing.²⁴ Eletrobrás alone was responsible for \$12 billion of the total debt in 1985. Its subsidiary Furnas had a \$2.6 billion foreign debt in 1983, and that of Nuclebrás approached \$4 billion in 1988.²⁵ The public sector as a whole accounted for close to 80% of the \$120 billion foreign debt in 1988. IMF conditionality schemes and other public and private creditors have applied pressure to reduce state enterprise deficits.

Two tendencies seem to stand out in Brazil's domestic response to the oil crises of 1973 and 1979. First, displacement of private sector firms was more characteristic of state behavior than were market-conforming efforts, such as those in the alcohol sector, petrochemicals, and others, geared to encourage private sector participation. Subsidiaries of Petrobrás, Nuclebrás, and other state firms established as joint ventures with foreign partners became the most common institutional expression of this effort. Heavy state ownership in energy markets, usually justified as a function of the nature of the investment and private sector reluctance, is not unique to industrializing countries. Ownership is sought, in part, because it provides greater national control over volatile international markets, thus reducing external vulnerabilities. The state's ability to maintain control is strengthened by its comparative advantage over private interests in the conduct of foreign policy, by the high degree of standardization of energy markets, and by these markets' role as upstream suppliers of other industries.²⁶

Second, most of the investments of the period were possible because of the thriving financial markets of the 1970s, particularly in Eurodollars. These markets were the pillars of Brazil's initial refusal to allow rising oil prices, through price controls and other cushions, to impinge on the continuous growth of basic industries and infrastructure. However, as Albert Fishlow's analysis of Brazil's management of the oil crisis suggests, foreign-financed public investments were more a sign of state weakness than strength, and continuous reliance on external indebtedness reinforced that state of affairs. Against the contradictions of the domestic background, we turn now to the international expression of energy adjustments and to the instruments of foreign policy adopted to manage a new international environment.

Adjustment in Foreign Policy Instruments

Economic growth, or a rising share of the world's GNP, is assumed to increase state power and upward mobility in the international arena.²⁷ Brazil's share of world income increased from 1.16% in 1967 to 1.77% in 1976 and 2.7% in 1988.²⁸ Moderate as they may seem, these changes have placed Brazil on par with Australia, Canada, and some smaller European countries with respect to their contribution to the world's GNP. Yet, whether because of internal political and economic weaknesses or of external vulnerabilities such as dependence on foreign energy, capital, and technology, the country has exercised only moderate international influence relative to its growing capabilities. This disparity is particularly evident in its accommodating reactions to the OPEC onslaught.

Brazil was not as active as it could have been in encouraging economically powerful but oil-poor industrializing states to coalesce in a common response to OPEC.²⁹ It did not seek to join or promote a consumers cartel, stayed away from military solutions advocated by a few at the time, and opted for extensive borrowing to finance oil imports. It mildly encouraged multilateralism while pursuing aggressive bilateral arrangements. It resisted attempts to upgrade the country's international credentials in ways that would impose burden in the name of responsibilities. Brazil's foreign policy was conciliatory and determined more by considerations of economic growth than by the desire to exert political influence. As Selcher suggests, the "business of Brazilian foreign policy is business."³⁰ Overcoming difficulties in achieving commercial competitiveness, attracting foreign investments and technology, and securing energy supplies were regarded by Brazil's ruling coalition as primary strategies, requiring a cautious and restrained performance. The guiding principles of "responsible pragmatism" and "no automatic alignments" were based on the conception that "material efficiency rather than formal coherence is the standard of policy evaluation."³¹

The notion of a fundamental interdependence between Brazil's foreign policy and energy considerations is the underlying premise of the brief assessment of global and regional diplomacy that follows. The view that foreign policy, if wisely formulated and skillfully applied, could produce economic benefits, guided the military-technocratic regime since its inception in 1964. Diplomatic action aimed at the expansion of foreign markets and the attraction of foreign investments became popularly known since the 1960s as "the diplomacy of prosperity." The 1973 energy crisis reinforced this preoccupation with economic issues and brought about a reassessment of Brazil's position vis-à-vis OPEC countries, the rest of the Third World, the advanced industrialized countries, and its own neighbors. The shift to economic diplomacy was accompanied by institutional changes. Many of the tasks previously performed by the Foreign Ministry (Itamaraty) were transferred to the Ministry of Mines and Energy, the Ministry of Industry and Commerce, the Ministry of Finance, and the state companies Petrobrás, Nuclebrás, and Eletrobrás.

A major foreign economic policy instrument to offset the impact of oil imports on the balance of trade was the promotion of exports to oil suppliers. Interbrás was created to promote and sell Brazilian manufactures and commodities and even barter them for energy resources. By 1978, Brazil had multiplied the value of its 1972 exports to the Middle East and Africa by a factor of ten. It was among the world's top ten largest manufacturers of weapons in the early 1980s, with more than 50 countries providing a market for its armored vehicles, the Cascavel, Urutu, and Jararaca. The buyers included Iraq, Iran, and Libya, which had extended opportunities to test them on the battlefield, and, more recently, Saudi Arabia. Other military exports include the Astros II rocket and

the Tucano trainer. Arms and equipment sales of over \$1 billion in 1982 represented an increased share of all Brazilian exports.³² Brazil's attractiveness as a weapons supplier stems from the simplicity and effectiveness of its technology and the lack of ideological strings attached to the sales.

In addition to raw materials and manufactured goods, Brazil has pursued an aggressive policy of exporting technology and services, particularly in oil exploration and construction. By 1976 the Petrobrás' subsidiary Braspetro had negotiated agreements, and successfully drilled wells, in Iraq, Iran, Algeria, Angola, the Congo, and Colombia. It received authorization from the Nicaraguan government for oil exploration and research, and it signed a risk contract with South Yemen. The Petrobrás trading company Interbrás provided engineering, financing, and commercial services, particularly to oil suppliers, in mostly government-to-government transactions.

Middle Eastern countries remain Brazil's main oil suppliers, accounting for about 75–80% of its total imports in 1986, with Saudi Arabia and Iraq furnishing 30% of the total respectively. Iran, the United Arab Emirates, Qatar, Libya, and Kuwait provided another 18%.³³ The outbreak of the Iran-Iraq war brought about the loss of 400,000 barrels per day in 1980, signaling the importance of Venezuela and Mexico as alternate suppliers. In 1981, Brazil signed three energy agreements with the USSR for coal technology and the production of methanol alcohol from wood. Yet, by the mid-1980s, the Soviet Union, Venezuela, Ecuador, and Mexico were supplying only a little over 4% of Brazil's oil imports. The price advantage of Middle East oil was the justification for the shift away from Venezuelan oil during the 1960s, and it continues to be at the root of dependence on Middle Eastern suppliers. Negative trade balances with the Middle East persist into the late 1980s.³⁴

One of the political and diplomatic expressions of these economic relationships has been, since 1973, Brazil's movement away from a position of "equidistance" in the Arab-Israeli conflict. Accordingly, it supported the 1975 United Nations anti-Israeli vote equating Zionism with racism, while 18 other Latin American countries either casted a negative vote or abstained.³⁵ Relations with Libya's Mu'ammar Qaddafi provide a striking example of policy reversal, from negligible links before 1973 (when Qaddafi sponsored Brazilian antiregime exiles) to close military and commercial ties. The results of this strategy of cajoling oil suppliers were mixed, despite a modest increase in exports, since no advantage in oil prices was gained, and the expected petrodollar investments by Arab countries never materialized.

In Africa, Brazil was among the first countries to recognize Angola's Marxist (MPLA) government, headed by Agostinho Neto, in 1975. President Geisel hoped that Petrobrás would play a part in the exploitation of the Cabinda oil fields, a matter discussed with the MPLA before recognition.³⁶ Rather than stressing openly the strategic-economic potential of alliances with oil-producing countries such as Angola, Nigeria, and Gabon, or of securing a foothold in the little-tapped consumer markets of Africa, Brazil used the commonalities of the Portuguese colonial tradition as vehicles to strengthen its association with former Portuguese colonies in Africa. The pragmatic approach dictated by commercial considerations is again evident in the growth of bilateral trade with South Africa, from \$7 million in 1972 to \$150 million in 1980.

Adaptation to the constraints imposed by the regime's model of economic development is also reflected in Brazil's regional policies. Many concepts from its school of geopolitical thought have been incorporated into foreign policy principles.³⁷ Its essence is linking security and development as the military's core mission. Developmental goals, in turn, are related to the ability to ensure energy supplies. Issues of integration, the

conquest of the Amazon heartland, and the South Atlantic Narrows are intertwined with priorities such as access to energy and natural resources.

In his seminal work *Projecao Continental do Brasil*, Colonel Mario Travassos argued in the 1930s that by projecting itself into the Amazon Basin and Bolivian heartland, Brazil could fulfill its "continental destiny." The prominent geopolitician and 1964 regime ideologue, General Golbery do Couto e Silva, the first director of the National Intelligence Service and strategist at the Escola Superior da Guerra (Higher War College), conditioned Brazil's achievement of international influence on the following principles: regional and Third World cooperation, national integration, expansion into the interior, peaceful external projection, and participation in the defense of Western civilization. The Escola Superior da Guerra's doctrine of "development and security" has consolidated these theories and disseminated their essence through the socialization of the military-technocratic elite.³⁸ Its orientation has shifted away from cold war considerations and its influence has waned since the late 1960s.

These regional orientations provide a useful frame of reference for analyzing Brazil's relations in South America. Because national security is defined in terms of development, industrialization, and integration, strategic concerns vis-à-vis its neighbors reflect the pragmatism characteristic of Brazil's policies toward the rest of the world. In the regional context, Brazil has secured a paramount position through a series of agreements with the "buffer states" (Uruguay, Paraguay, and Bolivia), thereby creating a security perimeter and privileged area of economic activity. Central America and the Caribbean are of lesser concern to Brazil, even though countries like Guyana and Nicaragua have sought its help in developing their own versions of energy models.

Despite the hegemonic, expansionist labels often applied to its regional policies, Brazil has relied most often on negotiation, persuasion, and prestige, and downplayed confrontation.³⁹ Not surprisingly, since 1973 the initiatives toward neighboring countries have been launched in connection with energy resource needs. An agreement with Colombia addressed the development of its coal reserves, another with Caracas provided for joint marketing of Venezuelan oil, while a tripartite agreement with Colombia and Venezuela dealt with development of the Amazon region. Other arrangements enables Petrobrás to buy natural gas, petroleum, and electricity from Bolivia and to conduct oil exploration in Ecuador and Paraguay. Colombia provides Brazil with coal and is interested in Brazil's alcohol and uranium mining technology. In 1978, Brazil and Venezuela signed a \$2 billion agreement to construct a 9 million kilowatt dam in Venezuela's Guyana region, the world's third largest dam. In 1983, they signed a cooperation agreement in the area of nuclear energy for peaceful uses, under which Venezuelan technicians began training in Brazil. In 1982, an agreement was signed with Guyana concerning the hydropower station of Wamakuru.

The Amazon project launched by President Emílio G. Medici in 1970 was justified on the basis of economic, infrastructural, and rural developmental potential, but was deeply rooted in its perceived military-strategic relevance. Andean Pact countries regarded this project as destabilizing the previous geopolitical balance in an attempt to "project" Brazil's influence toward its northern borders.⁴⁰ Brazilian diplomacy (and Itamaraty's professionalism), however, succeeded in downgrading these perceptions of threat through a new series of bilateral treaties of friendship, trade, and cooperation and the multilateral Amazon Pact Treaty of 1978. Regional projection has been accompanied by the settlement of about 80,000 Brazilians in Paraguay, northeastern Bolivia, and northern Uruguay through informal migrations and land purchases.⁴¹

Brazil's economic expansion into the buffer states eclipsed Argentina's influence.

Brazil has four times Argentina's population and three times its GNP, a historically more stable political leadership, and a more rapidly expanding economy. The territorial competition between the two dates from the early colonial expansionism of the Spanish and Portuguese crowns, which continued after independence in the early nineteenth century.⁴² Two of the most critical issues in their friction during the 1970s were the two countries' respective nuclear and hydroelectric energy projects. This priority lends substance to the proposition that issues of development and integration, to which energy sources are subservient, set the tone in the countries' regional and global security and cooperation policies.⁴³

Until 1960, Argentina, Uruguay, and Brazil agreed on a system of mutual consultations regarding their respective hydroelectric planning. In the late 1960s, Brazil expressed its reluctance to submit what it considered its sovereign and unilateral right to exploit its hydroelectric potential to the approval of the other countries of the Plata Basin. Yet, partly in view of vigorous Argentine protests, Brazil, Argentina, and Paraguay signed a tripartite agreement in October of 1978, on the conditions for the operation of the Itaipu hydroelectric plant, to ensure navigation and safe water levels on the lower Paraná River. The settlement of the dispute over the exploitation of the Paraná in late 1979 opened the way for the 1980 visit to Argentina by President Figueiredo, the first by a Brazilian president in 45 years, which resulted in a series of agreements on hydroelectric and nuclear power, scientific and technological development, and various other economic and cultural issues.⁴⁴ The possibilities of Argentine exports of natural gas to Brazil and of joint petroleum exploration in Argentina were explored. A series of presidential-level meetings, particularly between Raul Alfonsín and Jose Sarney, and, more recently, between Sarney and Saul Menem, has led to significant steps toward economic integration since the mid-1980s.

The role of Brazil in the South Atlantic has been discussed in the context of its technical and military capabilities and its economic goals.⁴⁵ Historically a major trade route, the South Atlantic became the vital petroleum lifeline for Europe and the United States with the closure of the Suez Canal in 1967. Supertankers continued to use that route even after the reopening of the canal in 1975. Considering Brazil's dependence on Middle Eastern and Nigerian oil and the increasing importance of West Africa and Angola as export markets, it is hardly surprising that even Brazil's South Atlantic strategies are conditioned by economic needs in general and energy considerations in particular. These interests seem to outweigh the advantages of the proposed South Atlantic Treaty Organization in cooperation with Argentina and South Africa, a proposal that has never been given serious attention. Brazil cannot afford to ignore South African racial policies, not only because of its own ethnic composition but also because of its commercial interests in black Africa, and has therefore shied away from any such agreement.

In its relations with the United States, Brazil has sought new options to deal with problems of development. Under the impact of the energy crisis, the trend toward greater autonomy has accelerated, putting an abrupt end to the "special relationship" that had existed between the two countries, buttressed by the experience of a joint brigade in World War II. Nuclear energy and trade became two major areas of friction in the 1970s, intensifying Brazil's search for new trade and investment partners, particularly among Western European nations and Japan.⁴⁶ The Carter administration attempted to prevent, and later to disrupt, the implementation of the 1975 nuclear agreements with West Germany, which provided for the transfer of sensitive enrichment and reprocessing technologies to Brazil. In 1977, Brazil abrogated the 1952 military assistance treaty with the United States as proof of its reduced need for foreign military supplies and its dismay

at U.S. complaints over Brazilian human rights abuses. This move was designed to preempt an almost certain cut in U.S. military aid to Brazil. Commercial ties with Moscow, Angola, Cuba, and Libya were not only financially lucrative, but a useful signal of independence. U.S.-Brazilian relations, however, are still intense, with the United States providing the largest single-country market for Brazilian exports. Under the Reagan administration, disagreements over Brazil's nuclear program subsided, but Brazil's supply of weapons in the Iran-Iraq war and to Libya was high on the bilateral agenda.⁴⁷ Debt, trade, services, and technology issues remain the leading disputes at the end of the decade.

At the level of global interactions, energy vulnerabilities may have constrained Brazil's transition to more assertive participation in world politics. Efforts at rationing, oil exploration, diversification, and export policies were accompanied by an attempt to placate its preferred providers. Policies with respect to North-South issues were characterized in the 1970s by a reluctance to assume leadership positions and to give automatic support to raw materials cartels or regulation of foreign investment. As Selcher suggests, Brazil avoided taking a political lead in most major international issues because such issues are polarizing and have the potential of alienating "the diverse and demanding constituencies on which it depends."⁴⁸

While Brazil's extraregional policies have attempted mainly to temper destabilizing impacts, within the regional context there has been greater willingness to exercise influence. The competition for control of economically important territory is at times considered a major source of tension in South America. However, through quiet and consistent diplomacy, Brazil has been able to minimize regional conflict and at the same time carry out its developmental designs along its borders. Even though it declared Latin America to be a priority region for its national diplomacy, in practice Brazil's more pressing international economic commitments seem to take precedence. Its regional policies aim more at enhancing its influence through cooperation than at displaying hegemonic designs by challenging or threatening the neighboring countries. Yet there is a tacit source of threat: its nuclear capabilities.

Neither Pygmy Nor Pariah: Brazil's Nuclear Policy

Although stimulated by the 1973 energy crisis, Brazil's plans to acquire atomic power can be traced to 1951, when the National Research Council (CNPq), under the direction of Admiral Alvaro Alberto, assumed control of the nuclear sector. Stressing autonomous development and limitation of mineral exports, President Getulio Vargas, in 1952, approved directives to the National Security Council calling for "specific compensations" (technical aid and delivery of equipment and materials) in return for sales of uranium and thorium to the United States. However, following the ascendancy of President Joao Café Filho in 1954 and his dismissal of Admiral Alberto, two nuclear agreements were signed transferring the monopoly over uranium research and extraction to the United States. In the same year, Washington prevented the transfer of ultracentrifuge enrichment equipment from Bonn to Brazil.

Presidents Jânio Quadros (1961) and João Goulart (1961–1964) encouraged national research and control of resources, and diversification of external sources of technology. Translating these political guidelines into technical options meant reliance on natural uranium, and French natural uranium reactors were viewed as a possible option. At this point, there was agreement between nationalist sectors and the scientific community as to the nature of the technical path to be pursued.⁴⁹ The military coup in 1964 marked the

beginning of a new phase, favoring reliance on imported fuel and technology. By 1968, the decision was made to opt for a pressurized water reactor (PWR) of the light-water type, later purchased from Westinghouse as a turnkey. The decision in favor of enriched uranium was coupled with a purge of physicists in research centers who favored a more autonomous program based on natural uranium, thorium, and domestic technology.

In 1975, Brazil embarked on an ambitious attempt to master the entire nuclear cycle through an agreement with the West Germany firm Kraftwerk Union (KWU). The comprehensive arrangement provided for the transfer of eight nuclear plants of 1200 MW each; mining and uranium processing activities, including enrichment; plutonium reprocessing; and a joint venture in heavy components fabrication.⁵⁰ The most prominent arguments favoring this course included fulfillment of energy needs in the post-2000 era, reduced dependence on foreign sources of fuel, and the presumed multiplier effects of a nuclear industry. The light-water, enriched uranium path was justified through a mixture of economic and technological advantages, notably its lower cost and greater technical reliability when compared with alternative cycles. Mastery over the entire fuel cycle would prevent dependence on imported fuel supplies, of particular sensitivity because the United States had ceased its transfers of enriched uranium to Brazil in 1974.⁵¹ Brazilian industries would take over an increasing share (up to 90% participation by 1990) of both power plant construction and components manufacture.

The agreement with KWU was criticized in Brazil on several grounds. The jet nozzle enrichment procedure was considered a great risk as the technology was not commercially proven, and its electricity consumption was high. The scientific community backed a more independent approach, possibly along the natural uranium, heavy-water lines (such as the Argentine program), stressing the advantages of a thorium-based cycle, because Brazil had considerable reserves of thorium, as well as in incipient national technology. Domestic entrepreneurs in the capital goods and engineering sectors were far from satisfied with the role they were allocated in the joint ventures with the German partners. In its political, economic, and technical nature, the arrangement expressed the encroachment and supremacy of the economic ministries in shaping sectoral policies in tune with the Brazilian regime's broad macropolitical objectives.⁵²

The exorbitant rise in the cost of the nuclear program, from an original estimate of about \$10 billion in 1975 to \$40 billion in the early 1980s generated widespread criticism.⁵³ Compounded by disclosures of mismanagement and corruption, mounting economic difficulties, poor selection of sites, and lack of adequately trained personnel, the implementation of the 1975 agreement was delayed and finally sharply contracted in the mid-1980s. Criticism also focused on KWU's poor record in technology transfer, leading to the resignation of two directors of Nuclebrás subsidiaries.⁵⁴ General Dirceu Lacerda Coutinho, director of Nuclei (Isotopic Enrichment), forwarded a report to the National Security Council, the National Information Services, and to President Geisel, but received no reply, and later testified in a congressional investigating committee on German reluctance to transfer technology effectively.⁵⁵

By 1988, the accomplishments of the 1975 nuclear agreement could be summarized in the inauguration of (an idle) heavy components factory (Nuclep), a fuel element fabrication plant, and two unfinished power stations. A uranium concentrate plant designed by the French company Pechiney Ugine Kuhlman was inaugurated in 1982. Following the May 1980 Argentine-Brazilian nuclear cooperation agreements, Argentina commissioned Nuclep to weld and assemble the lower part of the pressure vessel for its Atucha II plant. Through its partnership with KWU, Nuclep also participated in the bidding for the supply of two reactors to Mexico.⁵⁶ Brazil also signed an agreement in

1980 to provide Iraq with natural and low-enriched uranium, equipment, personnel training, and technology for reactor construction, and reportedly shipped natural uranium to Iraq.⁵⁷ Brazil's export potential, however, ultimately may be seriously constrained by limited global demand and a thriving competition.⁵⁸

Critics of the nuclear program within the technocracy rallied around General Costa Cavalcanti, director of Eletrobrás and Itaipu Binational, who advocated the development of Brazil's hydroelectric potential.⁵⁹ With the appointment of Antonio Delfim Netto, one of the architects of the liberal economic policy, as minister of planning, this group succeeded in reversing priorities in favor of hydroelectricity in the late 1970s. The decline of Nuclebrás and the official program with KWU can be contrasted with the rise of the National Nuclear Energy Commission under National Security Council protection. The commission headed a "parallel program," invigorated in the early 1980s, designed to advance indigenous nuclear technology.⁶⁰ Among its achievements was the inauguration in 1988 of a uranium enrichment facility under navy control. Its projects, unlike those of the German agreement, are not covered by international safeguards which would prevent Brazil from diverting fuel or replicating technologies to obtain weapons-grade materials. The Brazilian air force has a nuclear research institute in the Centro Técnico Aeroespacial in São José dos Campos, and the army reportedly concentrates on the use of nuclear energy in the propulsion of satellites in its own large research center, the Centro Tecnológico do Exército (Centex).⁶¹ In September 1983 Navy Minister Admiral Maximiano da Fonseca announced that Brazil would begin construction of its first atomic submarine in the early 1990s.⁶²

Most analyses of the cluster of incentives which might drive Brazil to acquire a nuclear capability have traditionally focused on issues of international status, prestige, and independence, particularly independence from the United States.⁶³ Neither the "pariah" nor the "pygmy" characteristics of other countries on the nuclear threshold apply to Brazil.⁶⁴ Its declaratory policy points to the denial of nuclear technology to nonsignatories of the Nonproliferation Treaty as part of a general attempt by the nuclear powers to perpetuate international stratification. At least some Brazilians may regard an independent nuclear weapons capability as a useful diplomatic tool to increase both Brazil's stature among developing countries and its leverage vis-à-vis the developed world. Such capability would portend, in this view, an upgrading of its credentials as a major contender in the international and regional arenas. However, prestige as an incentive may be offset by the need to come to terms with severe socioeconomic effects of many of the grandiose schemes undertaken in the 1970s. Economic and political viability, not *grandeza* (greatness), is the adjusted objective of the late 1980s. Moreover, there is growing understanding among nuclear-capable Third World countries that an overt military nuclear capability may be of decreasing strategic value. Once capabilities are in place, intentions remain under a cloud of ambiguity, as in the case of Pakistan, broadening the repertoire of nuclear postures as an instrument of foreign policy.

Few studies agree on the impact of regional security considerations, more specifically, the Argentine factor, on Brazilian incentives.⁶⁵ In the aftermath of Argentine defeat in the Malvinas/Falklands War, arguments citing an Argentine effort to regain lost capabilities acquired greater currency in Brazil. Yet the significance of this factor seems to have been overstated in light of the relatively benign security environment of the Southern Cone of South America, especially in comparison with other regions such as the Middle East and South Asia. The series of agreements on nuclear technology cooperation between Argentina and Brazil since 1980 has led to presidential-level mutual visits to sensitive facilities.⁶⁶ Brazil supplied Argentina with the pressure vessel and steam

generators for the Atucha II plant, and Argentina supplied Brazil with zircaloy tubing and loaned it 240 tons of uranium for Angra I, part of which was returned after production started in Poços de Caldas.

The military establishments in both Brazil and Argentina are often cited for efforts to accelerate their respective nuclear programs, but in recent years the levels of antagonism have been low. The armed forces control strategic technical areas including nuclear technology, telecommunications, weapons, aeronautics, and computers.⁶⁷ However, the Brazilian military is no monolithic entity, and there are growing ideological cleavages concerning broad economic policies, state control, global alliances, and the objectives of the nuclear program. The foreign policy of caution and restraint on the part of former Argentine president Alfonsín helped diffuse concerns among the Brazilian military.

Whether the bilateral agreements of the 1980s (including joint development of a breeder reactor) reflect tactical cooperation geared to oppose foreign pressures on their nuclear programs, or truthful signs of sincere rapprochement, the two countries have set in motion a process of mutual accommodation which reduces the proliferation incentives linked to regional competition. Like economic interdependence and cooperation, prestige derived from nuclear competence can be seen as a positive sum game. Competition between Argentina and Brazil is more likely to occur at the level of nuclear technology exports to other less developed countries, particularly in Latin America. However, cooperation in the form of joint ventures with third partners, including possibly Cuba, is also feasible.⁶⁸

Nuclear power may not be the most efficient solution to Brazil's energy problems, at least in the short run. Economic and sociopolitical realities impose severe constraints on capital-intensive nuclear-related activities, peaceful and otherwise. Yet its rationale is embedded in the perception that, in the words of a Brazilian colonel, "A nuclear program is fundamentally, and almost exclusively, a matter of national security. The harnessing of energy from a nuclear reactor is secondary."⁶⁹ Brazil has not signed the Nonproliferation Treaty (NPT), and there is broad domestic consensus, even among critics of the nuclear program, that vertical proliferation (additions to superpowers' arsenals) poses a much greater threat to humanity than horizontal proliferation (growth in the number of nuclear powers), and that the NPT is designed primarily to perpetuate a discriminatory distribution of power. Moralistic fallacy or not, many Brazilians view the real danger to the survival of mankind as lying in the mushrooming arsenals of the superpowers, not in disarming the unarmed.

In 1962, under a civilian regime, Brazil proposed to the United Nations the creation of a nuclear-free zone in Latin America, which eventually resulted in the Treaty of Tlatelolco. In 1978, Brazil ratified the treaty but chose not to waive the requirements of article 28, paragraph I, and in practical terms the treaty is therefore not in force as far as Brazil is concerned.⁷⁰ From the legal standpoint, once the treaty comes into force for a country, it is obliged to negotiate a full-scope safeguards agreement with the International Atomic Energy Agency. Brazil perceives the treaty as not impinging on the signatories' right to conduct peaceful nuclear explosions.⁷¹ The safeguard provisions of the 1975 West German agreement were consistent with the prevailing guidelines of the Zangger Committee on nuclear exports. Brazil did not, however, accept full-scope safeguards covering its entire nuclear industry. In practical terms, moreover, the agreement with West Germany allowed room for movement of nuclear materials in and out of safeguarded facilities, under article VII.

Brazil's position with respect to the NPT and Tlatelolco, its refusal to agree to full-scope safeguards, and its insistence on its right to conduct peaceful nuclear explosions

point to a policy stressing national autonomy and strategic flexibility.⁷² Cooperation through agreements on hydroelectrical and other natural resources development, including nuclear technology, have served Brazilian interests better than an arms race, at both the global and regional levels. According to one analysis of military competition in South America, Brazil's military expenditures, about 1% of its GDP, are the only ones in the region compatible with peacetime growth.⁷³

Brazil, the Newly Industrializing Countries, and Adjustment Patterns

During hard times, argues Gourevitch, "patterns unravel, economic models come into conflict, and policy prescriptions diverge."⁷⁴ Brazil's responses to the oil shocks of the 1970s contributed to the expansion of its state enterprises, the deepening of its foreign financial indebtedness, the intensification of countertrade strategies, and the sobering of the ruling coalition's own evaluation of its macropolitical model of economic change. Some of Brazil's solutions increased its external vulnerability and fomented friction with environmental and nonproliferation groups in North and South alike; the domestic social costs were even higher. If anything, the energy crisis highlighted, for Brazil as for others, the interdependence of politics and economics, and of global and domestic, in the definition of states' response to external challenges.

Brazil was only one among those affected by the oil crisis that helped truncate the rapid economic advancement of the pre-1973 period. In the absence of a multilateral challenge to OPEC, Brazil's ruling coalition chose to rely primarily on its own efforts at domestic restructuring. The emphasis on domestic strategies of adjustment was largely molded by Brazilian decisionmakers' perception that the state's capacity to internalize the costs of adjustment was greater than its international ability to help shape a new regime via, for instance, mobilizing support against OPEC among other Third World countries.⁷⁵ Brazil's diplomacy was thus characterized by a pragmatic and technocratic bargaining style, in which fluid policies tended to rely on bilateral relations as being more dependable than multilateral cooperation.

Beyond the domestic rationale advanced in this paper, three system-level types of mutually reinforcing explanations can be put forward to explain Brazil's selection of instruments of adjustment to the external challenges of energy markets. First, its mild reactions could buttress the contention that developing countries' support for common political objectives such as global restructuring of international regimes (in this case by Third World oil producers), can override concerns with their own economic performance.⁷⁶ In its response, however, Brazil tacitly yielded to a transformed energy market without pressing for the creation of an authoritative international regime that would render predictable, if not secure, resource transfers to affected developing countries.

A second explanation may be found in the country's structural position in the international political economy. As part of what is at times labeled the *semiperiphery*, Brazil is caught in the ambiguity that the advantages of an upgraded international status may create.⁷⁷ Although not yet reaping the benefits of a full-fledged member of the advanced tier, its interests increasingly diverge from those of less developed countries left behind. It expects to maintain smooth ties with the industrialized world, which supplies it with the capital, technology, and export markets on which its growth is dependent, while securing Third World export markets and sources of raw materials.

Finally, Brazil's response to the energy debacles of 1973 and 1979, not unlike that of other oil importers in the industrialized world, can be interpreted as reflecting an inexo-

rable shift of the international system from a military to a trading world.⁷⁸ Diplomacy and reciprocity, financial flows, domestic adjustments, and export drives prevailed over more bellicose alternatives.

Brazil's energy predicament, which turned it into the Third World's largest oil importer, may be compared to that of other energy-poor developing countries with nuclear programs. These countries' relative vulnerability to changes in oil prices and supplies is linked to their respective resource endowments, degrees of energy dependence, and patterns of economic development.⁷⁹ Less developed countries undergoing rapid structural change and increasing energy consumption are particularly vulnerable. In light of their rising position in the international economic system and their energy dependence, they face similar challenges, leading, at times, to similar responses. For instance, both India and Brazil changed their policies regarding oil exploration and self-reliance by inviting foreign companies to participate, but both failed in attracting OPEC investments. Yet level of vulnerability to foreign oil supplies does not seem to be associated with uniform patterns of state intervention and entrepreneurship. Thus, the expansion of state firms in Brazil in the 1970s can be contrasted with the market-conforming strategies of South Korea, which allowed private firms greater opportunities in energy markets.

Most East Asian NICs, including South Korea, Taiwan, and Singapore, were struck by the quadrupling of oil prices in 1973, but the domestic costs of adjustment were lower for their smaller, flexible, trading economies, and their relatively more egalitarian social structures. Their responses leaned more on fundamental economic restructuring and acceptance of lower initial growth to limit imports while promoting exports to allow economic recovery than, as in the case of Brazil, on foreign indebtedness.⁸⁰ Despite these instrumental differences, however, most NICs responded by maintaining centralized authoritarian political models backed by military force. Their ability to impose costs on domestic groups may decrease with political liberalization, compelling democratic regimes to search for a different mix of domestic and international, including multilateral, solutions. A particularly constraining factor for Latin American NICs has been their external indebtedness, which increases their vulnerability to external leverage in shaping political and economic objectives.

Beyond their common concern with energy considerations, NICs vary not only with respect to the vulnerability of their economic infrastructures and the state's ability to steer investment patterns, but also in the levels of regional security threats. In South America, regional power politics and deterrence are far less relevant than are other international considerations. The security factor sets Brazil apart from India, Israel, Taiwan, Pakistan, South Korea, and South Africa. There has been little serious probability of superpower entanglement in the Southern Cone, even in the era before glasnost, which reduced even further the incentives for regional military competition.

The availability of alternative sources of energy in Brazil, as in Argentina and India, seriously calls into question the major commitments to nuclear power by at least some NICs. The decisions to embark on such programs were associated more with "pull" (domestic considerations) than "push" factors (suppliers' intervention). The programs' political, economic, and technical characteristics were shaped by the countries' respective domestic structural and institutional arrangements. The avenue of acquiring a nuclear weapons option through a civilian power program, as the case of India appears to suggest, inextricably links questions of security with issues of economic growth and technological development. In most cases, nuclear power has been seen as a litmus test of independence, sophistication, and industrial technological advancement. Yet the con-

tribution of nuclear power to the broader modernization of these countries' industrial structure has been limited in most cases, while the nuclear sector has absorbed resources far greater than the economic benefits it could provide.⁸¹

Diverging trade, financial, and strategic considerations have placed NICs, in some areas at least, at opposing ends of multilateral bargaining processes. Domestic structures and policy networks shaped different state capacities and proclivities. These two, in turn, defined the balance of incentives and constraints associated with different strategies, and ultimately influenced the nature of the country's adjustments to increased interdependence. Changing economic and technological capabilities for the group as a whole may reduce external vulnerabilities with regard to energy, while global changes, notably the decline of East-West tensions, may provide new opportunities for expansion of their economic and political relations, ignoring ideological considerations in much the pragmatic style adopted by Brazil during the first oil shock in 1973.

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Notes

1. Such integration occurred not exclusively via exports but also through increased imports of capital goods, intermediate inputs, technology, capital, and foreign investment. Albert Fishlow, "Latin American Adjustment to the Oil Shocks of 1973 and 1979," in *Latin American Political Economy*, eds. J. Hartlyn and S.A. Morley (Boulder, CO: Westview Press, 1986), pp. 54-84; Celso Lafer, "Politica Exterior Brasileira: Balanço e Perspectivas," *Dados* 22 (1979): 49-64.

2. Petroleum imports were never higher than 12% of total imports until 1973. On the draining effects of oil imports see James H. Street, "Coping with Energy Shocks in Latin America: Three Responses," *Latin America Research Review* 17(3) (1982): 128-74; Albert Fishlow, "A Tale of Two Presidents: The Political Economy of Crisis Management," and E. Bacha and P. Malan, "Brazil's Debt: From the Miracle to the Fund," in *Democratizing Brazil*, ed. A. Stepan (New York: Oxford University Press, 1989), pp. 83-119.

3. William H. Courtney, "Nuclear Choices for Friendly Rivals," in Joseph A. Yager, *Nonproliferation and US Foreign Policy* (Washington, D.C.: Brookings Institution, 1980).

4. Fishlow, "Latin American Adjustment." The average annual rate was close to 6.5% in this period.

5. In other words, did the state attempt to control energy companies or to strengthen them without direct intervention? I have adopted these categories from Richard S. Samuels, *The Business of the Japanese State-Energy Markets in Corporative and Historical Perspectives* (Ithaca: Cornell University Press, 1987).

6. W. Baer, *The Brazilian Economy* (New York: Praeger, 1983). For a comprehensive energy profile of Brazil see Kenneth P. Erickson's "The Energy Profile of Brazil," in *National Energy Profiles*, ed. Kenneth R. Stunkel (New York: Praeger, 1981) and his "State Entrepreneurship, Energy Policy, and the Political Order in Brazil," in *Authoritarian Capitalism: Brazil's Contemporary Economic and Political Development*, eds. T. C. Bruneau and P. Faucher (Boulder, CO: Westview Press, 1981), pp. 141-77.

7. Shares in net assets of petroleum refining and distribution were 4% for domestic firms, 12% for foreign ones, and 84% for state companies in 1981.

8. Petrobrás accounts for close to 40% of local demand for capital goods (*Brasil Energia*, Feb. 1984). For a comprehensive study of the formative years of Petrobrás and their legacy, see John D. Wirth, ed., *Latin American Oil Companies and the Politics of Energy* (Lincoln: University of Nebraska Press, 1985); Peter S. Smith, *Oil and Politics in Modern Brazil* (Toronto: Macmillan of Canada, 1976); and Philip, *Oil and Politics in Latin America: Nationalist Movements and State Companies* (Cambridge: Cambridge Univ. Press, 1982).

9. *A Questão Nuclear-Aspectos Conjunturais da energia*, Brazilian Senado Federal, 1983. See also *Índice do Brasil, 1979-1980, O Banco de Dados*, 1981, p. 36, and *New York Times*, Mar. 3, 1989. For a landmark study of the hydroelectric sector in Brazil see Judith Tandler, *Electric Power in Brazil: Entrepreneurship in the Public Sector* (Cambridge, MA: Harvard University Press, 1968).

10. The World Bank in fact withheld a \$500 million loan for the energy sector until environmental safeguards are provided.

11. Thomas J. Trebat, *Brazil's State-Owned Enterprises: A Case Study of the State as Entrepreneur* (Cambridge University Press, 1983).

12. There are plans to build 70 new dams in the Amazon Basin and to transfer electricity from there to the energy-intensive areas of the southeast.

13. Diesel and gasoline for transportation account for over 50% of total oil consumption

14. The Proalcool program, created in 1975, saved about \$4.5 billion in crude oil imports and created 148,000 new jobs, most of them in the agricultural sector, in 1980 alone (*Monthly Letter*, Banco do Brasil S.A., no. 49, Jan. 1983, p. 2; *Brazil Energy*, July 28, 1982, p. 5). However, its social costs were noticeably high, particularly in its displacement of agricultural labor in favor of capital-intensive sugar cane.

15. Michael Barzelay, *The Politicized Market Economy* (Berkeley: University of California Press, 1986).

16. Coal mining started in Brazil in 1966; the increase in production has been minimal. Afonso da Silva Telles, "Participação do carvão na produção de energia elétrica—estudo para planejamento," in *Energia, Tecnologia e Desenvolvimento*, ed. L. Pinguelli Rosa (Petropolis: Vozes, 1978).

17. Fishlow, "Latin American Adjustment." Rising oil prices and interest rates accounted for over half of the \$4 billion deterioration in the current account in 1979.

18. Erickson, "The Energy Profile," p. 231.

19. *Brazilian Monthly Economic Indicators*, Planning Secretariat of the Presidency, Jan. 1983, May 1983, Jan. 1984; *Monthly Newsletter*, Central Bank of Brazil, Oct. 1988.

20. In fact, the trade deficit with the Middle East more than doubled between 1986 and 1987. *Monthly Newsletter*, Central Bank of Brazil, Feb. 1988.

21. Third and fourth, respectively, of the eight originally included in the agreement with West Germany.

22. GNP growth does not necessarily depend on exponential growth in energy consumption. Nazli Choucri, *Energy and Development in Latin America* (Lexington, MA: Lexington Books, 1982), p. 10.

23. The latter were given four years to adjust to new regulations, which tend to be more flexible in areas where raw materials are processed in Brazil.

24. Trebat, *Brazil's State-Owned Enterprises*. A \$500 million loan to Eletrobrás approved by the World Bank in 1988 has been delayed because of the transfer of nuclear plants to Eletrobrás' jurisdiction (Foreign Broadcast Information Service Worldwide Report: Latin America, Jan. 13, 1989).

25. *O Estado de São Paulo*, Oct. 22 and Dec. 21, 1985. Thirty percent of the \$9 billion in direct investment in the Itaipu hydroelectric project has been financed through external debt. Brazil was paying \$1 billion per year in interest and other charges related to the nuclear sector. *Correio Brasiliense*, July 16, 1986; *New York Times*, Dec. 21, 1987.

26. G. John Ikenberry, "The Irony of State Strength: Comparative Responses to the Oil Shocks in the 1970s," *International Organization* 40(1) (Winter 1986): 105-137. Samuels, *The*

Business of the Japanese State, p. 18; Harvey B. Feigenbaum, *The Politics of Public Enterprise: Oil and the French State* (Princeton: Princeton University Press, 1985).

27. A. F. K. Organski, *World Politics*, 2d ed. (New York: Knopf, 1986).

28. U.S. Arms Control and Disarmament Agency, *World Military Expenditures and Arms Transfers, 1967-1976* (Washington, DC: 1978).

29. Brazil, India, Taiwan, South Korea, Egypt, and Mexico account for 75% of the total rise of LDC oil consumption between 1974 and 1978; P. Kemezis and E. J. Wilson III, *The Decade of Energy Policy* (New York: Praeger, 1984), p. 54.

30. Wayne A. Selcher, *Brazil in the Global Power System, Occasional Papers Series, Center of Brazilian Studies, Johns Hopkins University, Nov., 1979*. For other authoritative studies of Brazil's foreign policy see Riordan Roett, ed. *Brazil in the Seventies* (Washington, D.C.: American Enterprise Institute for Public Policy Research, 1976), and Ronald M. Schneider, *Brazil: Foreign Policy of a Future World Power* (Boulder, CO: Westview Press, 1976).

31. Wayne A. Selcher, *Brazil's Multilateral Relations between First and Third Worlds* (Boulder, CO: Westview Press, 1978), p. 14.

32. Iraq is said to have paid about \$1.2 billion between 1976 and 1981 in Brazilian military equipment (*Los Angeles Times*, Nov. 15, 1981). According to Scott Tellefson, reported estimates of \$2-5 billion in annual arms exports for the early 1980s are exaggerated ("Brazilian Arms Sales and Foreign Policy: The Search for Autonomy," Ph.D. dissertation, Johns Hopkins University, SAIS, forthcoming).

33. *Brazil Energy*, July 28, 1982. See also Tollefson, "Brazilian Arms Sales."

34. *Monthly Newsletter*, Central Bank of Brazil, Sept. 1988. More than 30% of Brazil's total imports came from the Middle East by 1981, as opposed to 5% in 1970. See Baer, *The Brazilian Economy*, p. 163.

35. George Philips, *Oil and Politics*.

36. *Latin America Political Report* 12(22) (1978): 4.

37. John Child, "Geopolitical Thinking in Latin America," *Latin America Research Review* 14(2) (1979).

38. M. Travassos, *Projeção Continental do Brasil* (Sao Paulo: Companhia Editora Nacional, 1947).

39. This statement applies less to the early 1970s, particularly with regard to Argentina, Uruguay, Bolivia, and Chile, than to the post-1974 era. The hegemonic aspects of Brazilian foreign policy are stressed in Juan E. Guglielmelli, *Argentina, Brasil y la bomba atómica* (Buenos Aires: Tierra Nueva, 1976); William Perry, *Contemporary Brazilian Foreign Policy: The International Strategy of an Emerging Power* (Beverly Hills, CA: Sage Publications, 1976); Phillip Kelly, "Geopolitical Tension Areas in South America: The Question of Brazilian Territorial Expansion," in *Inter-American Relations: The Latin American Perspective*, ed. R. E. Biles (Boulder, CO: Lynne Rienner, 1988); and J. Child, *Geopolitics and Conflict in South America: Quarrels Among Neighbors* (New York: Praeger, 1985). On Brazil's reluctance to assume a hegemonic role in South America see Wayne A. Selcher, "Brazil and the Southern Cone Subsystem," in *South America in the 1990s: Evolving International Relationships in a New Era*, ed. Pope Atkins (Boulder, CO: Westview Press, 1989), and William Perry, "Brazil: A Local Leviathan," in *Emerging Powers: Defense and Security in the Third World*, eds. Rodney Jones and S. Hildreth (New York: Praeger, 1986).

40. Thomas E. Skidmore, *The Politics of Military Rule in Brazil, 1968-85* (New York: Oxford University Press, 1988); David J. Myers, "Brazil: Reluctant Pursuit of the Nuclear Option," *Orbis* (Winter 1984): 881-911.

41. Howard Pittman, "Geopolitics and Foreign Policy in Argentina, Brazil and Chile," in *Latin American Foreign Policies: Global and Regional Dimensions*, eds. E. G. Ferris and J. K. Lincoln (Boulder, CO: Westview Press, 1981).

42. The conflict over the Banda Oriental resulted in the creation of Uruguay as a buffer state. In the 1932-1935 Chaco War between Bolivia and Paraguay, Brazil and Argentina supported opposing sides struggling for control over territory of presumed economic importance.

43. Hydroelectric projects are seen not merely as an answer to national energy requirements but as a developmental goal in themselves, due to their presumed infrastructural, industrial, and other socioeconomic spinoffs.

44. The completion of Itaipu in early 1983, however, sealed off the higher Paraná from navigation southward, diminishing the economic importance of the Argentine section of the river and reducing the electricity production capability of the Argentina Corpus dam. The nuclear aspects of the Brazilian-Argentine competition will be evaluated later in this article.

45. Margaret Daly Hayes, *Brazil and the South Atlantic: Perspectives on an Emerging Issue*, Occasional Papers Series, Center of Brazilian Studies, Johns Hopkins University, n.d.

46. Riordan Roett, "The Political Future of Brazil," in *The Future of Brazil*, ed. William H. Overholt (Boulder, CO: Westview Press, 1978), pp. 71-102; Thomas E. Skidmore, "Brazil's Changing Role in the International System: Implications for U.S. policy," in R. Roett, *Brazil in the Seventies*.

47. A series of accords signed by Secretary of State George Shultz in Brazil in Feb. 1984 approved U.S. participation in a \$4 billion hydroelectrical project and a \$50 million helicopter coproduction deal; *Los Angeles Times*, Feb. 7, 1984. On tensions regarding nuclear policy, trade, and human rights see Robert Wesson, *The United States and Brazil* (New York: Praeger, 1981); and Albert Fishlow, "The United States and Brazil: The Case of the Missing Relationship," *Foreign Affairs* 60(4) (Spring 1982): 904-23.

48. Wayne A. Selcher, "Brazil in the World: Multipolarity as Seen by a Peripheral ADC Middle Power," in Ferris and Lincoln, *Latin American Foreign Policies*, pp. 81-102.

49. The Instituto de Energia Atomica (São Paulo), Instituto de Pesquisas Radioativas (Belo Horizonte), and the Comitê Nacional de Energia Atomica (CNEN; Rio de Janeiro) were created in this period.

50. West Germany would receive 20% of any ore initially discovered and a larger share at a later date.

51. Brazilian negotiators argued also that reprocessing and enrichment would lead to considerable savings in uranium consumption and to a reduction in waste-related problems. It would also provide them with the knowledge required to obtain weapons-grade fuel; *Jornal do Brasil*, Feb. 17, 1979; Jose Goldemberg, *Energia nuclear no Brasil* (Sao Paulo: Hucitec, 1978); Joaquim F. de Carvalho, *O Brasil Nuclear* (Porto Alegre: Tchê!, 1987).

52. Etel Solingen, *Bargaining in Technology: Nuclear Industries in Brazil and Argentina* (in preparation).

53. By 1980, the cost of the second and third plants (Angra II and III) was calculated at \$3.1 billion each, over twice the original estimate. The costs of a nuclear-generated kilowatt shot up from \$200 in 1970 to \$2800 in 1983. A former director of Nuclebrás' engineering subsidiary Nuclen, Joaquim de Carvalho, claimed that by the late 1970s the program was no longer geared to the production of economically priced energy but to building plants "at whatever cost." *Brazil Energy*, July 10, 1980; Mar. 24, 1981; Oct. 10, 1981.

54. Cesar Cals, minister of mines and energy, declared in 1971 that "nuclear plants do not obey energy criteria but criteria of absorption of technology"; *Jornal do Brasil*, Aug. 8, 1981. Yet, former director of Nuclen (Nuclebrás Engineering) Joaquim de Carvalho claimed that Nuclen serves only to coordinate the production of German-designed components and supervise their assembly, "nothing more"; *Brazil Energy*, Mar. 24, 1980.

55. *Worldwide Report: Nuclear Development and Proliferation*, Foreign Broadcast Information Service no. 193, June 24, 1983, pp. 14-15. The poor performance of Westinghouse's Angra I exacerbated sensitivities regarding effective technology transfer. After 12 years of delay, the plant, Brazil's first, has never been fully operational due to technical deficiencies which brought the utility Furnas to file a suit against Westinghouse.

56. *Brazil Energy*, Dec. 24, 1981.

57. *Brazil Energy*, June 24, 1981 and *Jornal do Brasil*, September 27, 1979.

58. For a full description of Brazil's nuclear industrial capabilities, including export potential, see Etel Solingen, "Technology, Countertrade and Nuclear Exports," in *International Nuclear*

Trade: The Challenge of the Emerging Suppliers, ed. W. C. Potter (Lexington: Lexington Books, 1990).

59. Capital costs represent 70% of a power station. In Brazil, the generating costs of nuclear facilities were between two and three times those of the hydroelectric sector; Luiz Pinguelli Rosa, *Nuclear Energy in Latin America: The Brazilian Case*, United Nations University, 1980.

60. *Latin American Weekly Report*, Feb. 11, 1983. According to Myers, "Brazil: Reluctant Pursuit," and F.B.I.S. reports, CNEN's director, Rex N. Alves, the liaison with the National Security Council, was reportedly the man behind the delivery of uranium to Iraq.

61. *Latin America Regional Reporters*, Brazil, Feb. 5, 1982.

62. *O Estado de Sao Paulo*, Sept. 24, 1983.

63. A long-standing effort to increase autonomy was reinforced by the American violation in 1974 of a 1972 agreement to supply enriched uranium for the Westinghouse plant.

64. Richard Betts, "Paranoids, Pygmies, Pariahs and Nonproliferation," *Foreign Policy* 26 (Spring 1977): 157-83.

65. Ernest W. Lefever, *Nuclear Arms in the Third World* (Washington, DC: Brookings Institution, 1979); George H. Quester, *Brazil and Latin American Nuclear Proliferation: An Optimistic View* (Los Angeles: UCLA Center for International and Strategic Affairs, ACIS Working Paper 17, 1979); Courtney, "Nuclear Choices"; John H. Rosenbaum, "Brazil's Nuclear Aspirations," in *Nuclear Proliferation and the New Nuclear Countries*, eds. Onkar Marwah and Ann Schulz (Cambridge, MA: Ballinger, 1975), pp. 255;-77. For an alternative view on the impact of the regional system on proliferation, see Ashok Kapur, "The Proliferation Factor in South America: The Brazil-Argentine Cases," in *International Nuclear Proliferation—Multilateral Diplomacy and Regional Aspects* (New York: Praeger, 1979); and Regina Lucia de Moraes Morel, *Ciencia e Estado—A política científica no Brasil* (Sao Paulo: T. A. Queiroz, 1979).

66. The meeting between Presidents Figueiredo and Jorge R. Videla, the first visit to Argentina by a Brazilian president since 1945, was considered a turning point in the relationship between the two countries. It resulted in a series of cooperative agreements on hydroelectric natural gas, alcohol, and nuclear technology.

67. Simon Schwartzman, *Ciencia, Universidade e Ideologia—A Política do Conhecimento* (Rio de Janeiro: Zahar, 1981).

68. After 1979, Brazil accelerated its nuclear cooperation program with Venezuela and Chile in an attempt to trade nuclear technology for oil and utilize Nuclep's idle capacity.

69. Erickson, "The Energy Profile."

70. Until certain requirements are fulfilled, namely, ratification by all Latin American nations (Argentina and Cuba have not yet ratified the treaty); John R. Redick, "Nuclear Proliferation in Latin America," in *Latin America's New Internationalism—The End of Hemispheric Isolation*, eds. Roger W. Fontaine and James D. Theberge (New York: Praeger, 1976) and "The Tlatelolco Regime and Nonproliferation in Latin America," in *Nuclear Proliferation: Breaking the Chain*, ed. George H. Quester (Madison: The University of Wisconsin Press, 1981), pp. 103-34.

71. The contention has been that the latter are important in developmental projects such as the extraction of oil from shale; the linking of the Plata, Amazon, and Orinoco rivers to integrate South America; and the construction of dams and canals. Even in 1967, the Brazilian interpretation of Tlatelolco's Article 18 was that it allows signatories to undertake "by their own means or in association with third parties, nuclear explosions with peaceful purposes including those presupposing devices similar to the ones utilized in military weapons"; Kapur, "Proliferation Factor."

72. Courtney, "Nuclear Choices."

73. Emilio Meneses, "Competencia Armamentista en América del Sur 1970-1980," *Estudios Públicos* (Santiago) 7 (1982): 5-42.

74. Peter A. Gourevitch, *Politics in Hard Times: Comparative Responses to International Economic Crises* (Ithaca: Cornell University Press, 1986).

75. In this sense, Brazil's reactions closely resemble those of statist models like France, in its emphasis on national control over energy production and supply, state-induced commercial and barter agreements with suppliers, and the adoption of an ambitious nuclear energy program; G.

John Ikenberry, *Reasons of State: Oil Politics and the Capacities of American Government*. (Ithaca: Cornell University Press, 1988).

76. Stephen D. Krasner, *Structural Conflict: The Third World Against Global Liberalism* (Berkeley: University of California Press, 1985).

77. Peter Evans, *Dependent Development: The Alliance of Multinational, State and Local Capital in Brazil* (Princeton: Princeton University Press, 1979); Immanuel Wallerstein, "Semi-peripheral Countries and the Contemporary World Crisis," *Theory and Society* 3(4) (1976): 461-84.

78. Richard Rosecrance, *The Rise of the Trading State* (New York: Basic Books, 1986).

79. Joy Dunkerley et al., *Energy Strategies for Developing Nations* (Baltimore: Johns Hopkins University Press, 1981).

80. Fishlow, "Latin American Adjustment." South Korea's foreign indebtedness, however, grew considerably as well.

81. Solingen, *Bargaining in Technology*.