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Brazil: Seizing the Opportunity to Compete?

Human Capital and Innovation: Key Contributors in the Growth Agenda

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Brazil has made considerable progress toward macroeconomic stability since reform measures began to take hold in the early 1990s, and its economy has produced stronger growth as a result—an average of 2.5 percent annually over the past decade. Nevertheless, from an international perspective, Brazil's level of economic growth is still a matter of significant concern. Compared with either OECD countries or competitors such as China or India, Brazil not only is growing slowly, it is falling farther behind. In 1980, Brazil's per capita purchasing power parity was about 42 percent that of OECD countries. Twenty-five years later, it had fallen to under 29 percent of OECD countries.

Where Growth Comes From

Economic growth is widely understood as the interaction between physical and human capital. Investment in either generally increases growth; moreover, when physical and human capital interact more efficiently, growth occurs more rapidly. Economists generally attribute this incremental efficiency-based growth to Total Factor Productivity (TFP). During the exceptional high-growth era of the "Brazilian Miracle" (1960–80), TFP was critical to growth; however, since then, TFP has declined dramatically. Growth-accounting exercises show that the ratio of Brazil's TFP compared with that of the United States dropped from 1.07 in 1975 to 1.02 in 1980, to 0.80 in 1995, and to 0.73 in 2000.

The macroeconomic shocks of the 1970s and the debt crisis of the 1980s are important factors in explaining the slowdown in Brazil's growth. A new report¹ argues that the decline in TFP was a similarly important cause. Why did it happen? Brazil's low rate of investment is one part of the answer. Low productivity is another. A critical factor, however, is that a new global "knowledge economy" has been emerging; and Brazil, despite its relatively successful implementation of adjustment policies in the mid-1990s, was not prepared to compete.

In the new paradigm for middle-income countries, knowledge—not natural resources or cheap labor—increasingly constitutes the core of a country's comparative advantage. As well illustrated by dramatic success stories such as Bangalore, the capital of the Indian software industry, technical innovation and knowledge can work hand in hand to lead a country from suffocating poverty to strong productivity and competitiveness. Indeed, the proportion of goods in international trade with a medium-high or high technology content rose from 33 percent in 1976, to 54 percent in 1996, and to 64 percent in 2003. This period was the same one during which Brazil muddled through slow trade liberalization and weak labor reforms, and paid little attention to its lagging basic education system. Had more radical reforms been undertaken, Brazil would have been much better able to take advantage of domestic and international opportunities to spur growth, as did competitors such as China.

Brazil can no longer ignore the knowledge economy—and it is not. An ongoing national dialogue is taking place on reforms to sustain strong macroeconomic performance, further open trade, improve the physical infrastructure, strengthen the judicial system and legal environment, and deal with weak and inequitable education system that is not producing the kind of human capital required by today's global competition. The report emphasizes that Brazil has indeed made significant progress; yet the hard reality is that Brazil's competitors have too—only faster. The question has become not only how Brazil can make further progress, but how it can catch up.

Consolidating the Macroeconomic Environment

The Brazilian economy has remained stable as a result of prudent macroeconomic management—including fiscal and monetary policy, as well as debt management. Improved macroeconomic fundamentals have reinforced the

1. Extracted from "Brazil: Knowledge and Innovation for Competitiveness", (June 2007), Brazil Country Management Unit, Human Development Unit, Latin America and the Caribbean Region, World Bank Report 40011-BR

benefit of favorable external demand for Brazil's primary commodities, raising international reserves to unprecedented levels. Fiscal restraint, which has included a cap on public investment, has translated into yearly primary surpluses and macroeconomic stability. However, the country's infrastructure now needs upgrading in order to increase productivity and avoid jeopardizing growth.

The challenge facing Brazil is to continue reducing public debt and improving the quality of the fiscal adjustment (that is, ensuring adequate resources for key public investments and poverty alleviation programs)—while improving the efficiency of public expenditures to create the fiscal space necessary for pro-growth investments.

Boosting Innovation

Brazil's growth depends strongly on the export of manufactures and commodities, a dependence that is likely to continue. Yet with few exceptions, Brazil's manufacturing base lags with respect to innovation—especially when Brazil is compared with China or India, countries that have taken giant steps in growth-enhancing innovation. If recent trends continue, Brazil would continue to be mainly a supplier of primary commodities in world markets and an exporter of manufactured products to Mercosur and other Latin American countries. In other words, Brazil risks missing the opportunity to become a serious, diversified global competitor. Becoming so would require Brazil to adjust its path—emphasizing higher value added to products in the sectors in which Brazil already has some comparative advantages, and engaging in higher-value, more-income-elastic manufactures and services. Brazil needs not only to diversify and add value to its commodities, but it must improve its competitiveness in manufacturing and service exports as well.

Until the 1990s, the productive sectors in Brazil operated within a relatively protected economy. The government provided few incentives for private sector investment in innovation; yet that mattered less because protection from competition made private sector investment in innovation relatively less necessary. The report argues that two factors—a bias toward overly “theoretical” research in publicly funded universities, and significant underinvestment by a shielded private sector spared the need to compete—lie at the heart of Brazil's current relative underperformance in innovation.

The report proposes a three-stranded typology of innovation, (a) creation and commercialization of new knowl-

edge and technology; (b) acquisition of knowledge and technology from abroad for local use and adaptation; and (c) the dissemination and effective application of knowledge and technology (whether domestically created or acquired from abroad) that is already available in country though not broadly utilized. As used here, innovation refers not just to new products and processes, but also to new business processes and new ways of carrying out productive activities. Innovation to improve TFP should not be understood simply as invention or the first use globally of a new technology, but also as the first application of a product or process in a specific setting.

Creating and commercializing new knowledge and technology. In Brazil, investment in technological innovation comes mainly from the public sector—about 55 percent of the total, compared with about 30 percent in the United States. A research culture that is heavily and reliably financed by the public sector has excelled in the production of conceptual knowledge—for example, Brazil accounts for nearly 2 percent of articles published in internationally recognized research journals (roughly on par with Brazil's 2 percent of world GDP). On the other hand, substantial public expenditure has been far less successful at energizing technological innovation—for example, patents that can be commercialized. According to the World Intellectual Property Organization (WIPO), Brazil accounted for about 0.18 percent of patents in 2000. This compares with 3.4 percent of patents attributable to Sweden—that is, nearly 19 times more patents than Brazil despite a much smaller population.

Ironically, Brazil invested in R&D infrastructure far earlier than most other developing countries. Yet the report finds that an intellectual and practical “disconnect” has now emerged in Brazil that is not typically found elsewhere. The public universities and labs where most government-funded research is conducted primarily pursue “pure” conceptual knowledge. Private sector activity does not articulate with these universities and labs, unlike in other countries where entrepreneurial scientists and engineers typically have a foot in both worlds. Moreover, the private sector's own research capacity has been diminished by underinvestment from companies protected by trade barriers from foreign competition. The net result is that Brazil needs to pay far greater attention to what is produced through public investment, what happens to new knowledge once it is created, and how the private sector can be mobilized as an active partner. Strengthening the institutions and norms that protect intellectual property and supporting business incubators would help immediately.

Acquiring and adapting global knowledge and technology. For countries not already on the cutting edge, it is generally more practical to acquire rather than invent new knowledge and technology. Transfer of technology can be accomplished through several means—direct foreign investment; licensing; technical assistance; technology embodied in capital goods, components, or products; copying and reverse engineering; foreign study; published technical information, especially on the Internet; twinning; cooperative training partnerships; distance learning; and more. Trade is probably the most direct and critical means of acquiring knowledge and technology—importing the latest versions of hardware, machinery, and software. Brazil is still struggling to reconcile the relative comforts of protectionism with the inevitable need to compete in global markets. In this respect, Brazilian firms are just awakening to the full benefits that acquired foreign technology can bring.

The capacity of firms to put acquired technologies to productive use points to the challenges of human capital formation. Technology stands little chance of being adopted and adapted successfully if workers lack the basics in reading and math; or at a higher level, the ability to reason conceptually, think outside the box, and apply the scientific method. Workers with these skills are no less critical than higher-level managers who can quickly adjust to computerization or imaginatively redesign a production strategy. If firms cannot trust in the adaptability of their employees, they necessarily become risk-averse, opting for the low road to economic survival—heavier exploitation of cheap, unqualified labor. In essence, both basic and advanced skills are needed for a firm to maximize the rewards of acquired innovation.

Disseminating and using knowledge and technology that is already available in-country. While the study found that some Brazilian firms were innovators, mainly large enterprises with many employees and strong outputs, in general, Brazilian firms were found to innovate less than those of other countries. There is relatively little demand for innovation in the unsophisticated internal market. Protection continues to undercut the need for innovation and creative risk taking. Firm productivity is low, and dispersion of productivity is enormous, much greater than in most other countries for which data were available, including India and China.

The report argues that using the knowledge already in Brazil provides the quickest and most-promising route for increasing productivity and competitiveness to spur growth. Through this third type of innovation—which is

arguably the least expensive and most accessible—Brazil could increase productivity across all sectors. This requires relatively greater effort at disseminating knowledge through channels such as industrial and service extension programs, technical information centers, and cluster-based technology improvement programs. While some innovation requires newer machinery and better physical inputs, as well as better management and organization, what matters is what happens on the shop floor. Can workers observe new practices first-hand, and is there an environment that rewards increased efficiency and productivity? Indeed, can workers accomplish the same things through better use of the equipment and inputs that they already have?

The fact that job tenure in Brazil is generally low—and lower still for less-skilled workers—might be expected to increase the flow of good practices between firms. In reality, however, this does not appear to be happening. Lack of basic skills among workers is probably the single most significant obstacle to the use of new technology and equipment or the free flow of innovative practices across firms. Unskilled workers are likely to be risk-averse and more comfortable with the simple routine of procedures that do not demand additional formal training. While Brazilian firms do invest significant time and resources training their employees, in most cases this training focuses upon basic skills deficits that should have been addressed by the formal education system.

One notable exception is the production chains that have been developed by SMEs that act as suppliers to large innovative firms such as Embraer, Petrobrás, Gerdau, Ford, and others. These smaller firms frequently are able to enhance their productivity by using technologies adapted from the larger innovative companies. Cases such as these tend to occur in specific geographic clusters. The local qualifications of human resources—both advanced and basic—are crucial to these processes, as the experience of Embraer demonstrates.

Improving Skills across the Labor Force

Brazil's unemployment rates worsened for all workers during the 1990s—ranging from those with no education through those with primary, secondary, and tertiary education. The proportion of unemployed university graduates rose to 16.4 percent, compared with an unemployment rate of 9.3 percent for the population at large, highly suggestive of a mismatch between the skills of formal educational system graduates and the needs of the labor market. The

extremely high rate of secondary school dropout similarly reflects weakness in the school-to-work transition.

Strengthening tertiary education. It is well accepted that more and better education improves employability and earnings. However, average educational attainment for the Brazilian population 15 and older is still only 4.3 years. Only 8 percent of the labor force has tertiary-level educational qualifications and the system is heavily skewed toward upper-income families

Despite the existence of a number of centers of excellence at the tertiary level, the overall lack of consistent high quality is critical. Brazil is the world's eighth-most-populous country, yet no Brazilian university is to be found among the 100 top-ranked universities worldwide.

- Research production is concentrated in a very small group of elite public or state universities.
- In the vast majority of small under-funded private universities—quality is worse than uneven and serious research is neither financed nor rewarded.
- The vast majority of academics have not been trained in research through doctoral training, and have virtually no opportunity to participate in publicly funded basic R&D.
- The university and private sector realms remain remarkably segregated and do not intersect, much less cross-fertilize.
- Only a relatively small minority of Brazilian faculty study abroad. In 2005, only 2,075 students were officially sponsored for graduate studies outside Brazil.

Other postsecondary training is offered by private providers and, in particular, by a set of institutions that form the “S-system.” Present in about 60 percent of Brazilian municipalities, the S-system offers an estimated 2,300 courses per year and enrolls about 15.4 million trainees annually and could serve as the cornerstone for a lifelong learning framework in Brazil.

Improving basic education. There are a number of reasons why the nation's primary and secondary schools are failing to provide the minimum literacy and numeracy skills necessary for active citizenship and productive participation in a technology-based labor market.

- Nearly a third of those who teach Brazil's 45 million students have not completed university training, and only about 20 percent hold masters degrees. For the most part, the training of those who are university-educated tends to be very strong in pedagogical

theory—but very weak in the applied art of teaching.

- Over the past 20 years, the number of places in primary and secondary schools has increased dramatically; and access to primary education is now virtually universal. It is less certain, however, that the quality of education has increased. This is related less to absolute lack of financial resources (public educational expenditure rose from 3.9 percent of GDP in 1995 to 4.3 percent of GDP in 2005) than to management factors.
- Pedagogical and curricular factors also contribute to low quality in basic education. Classroom teaching at the primary level (especially in rural areas) is still conducted very much as it was a generation ago. That means students passively copy what the teacher writes on the board and are expected to learn by rote memorization, an approach diametrically opposite to the kind of active learning that rewards flexible thinking, conceptual reasoning, and problem-solving skills—in other words, the very traits that adult workers need for competitiveness in a knowledge economy.

From Analysis to Action: Who Needs to Do What?

The report proposes concrete actions in six key areas—the enabling environment, knowledge creation and commercialization, acquisition of foreign knowledge, leveraging and dissemination of technology use, basic education and skills, and tertiary education (advanced skills). Taken together, these recommendations represent a first step toward a comprehensive national plan for innovation. Continued analysis, increased public awareness, and a vigorous national debate can translate these recommendations into an integrated national strategy to foster innovation-led growth.

What is clear is that Brazil needs to undertake a broad, systemic reform process in order to increase the competitiveness of its economy and to accelerate growth. There is a danger that the recently improved trade performance—driven by the current boom cycle in commodity prices—will improve economic performance enough to temporarily justify complacency. Given the fundamental changes that are taking place globally, that short-sighted approach would be costly.

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