

Research Brief on Energy

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Brazil Ethanol Industry

Historical Overview of the Brazilian Biofuel Industry

- During the 1930s, the Brazilian government established the Instituto do Acucar e do Alcool (IAA). The overarching purpose of the IAA was to spur the development of small and medium sugar growers and facilitate the (further) expansion of the Brazilian sugar industry. The IAA was imbued with powers to regulate sugar producers as well as set the prices for sugar and sugar-based commodities – especially alcohol products.
- During the 1960s, the Brazilian government took advantage of the Cuban revolution and the subsequent souring of Cuban/American trade relations by aggressively pushing its sugar exports to the US. Through the efforts of the IAA, Brazil was able to fill the US sugar supply gap left by Cuba. Overall sugar exports emanating from Brazil increased by 250% from 1965 to 1974.
- During the aforementioned period of export expansion, Brazilian sugar farmers established the Cooperativa Central dos Produtores de Acucar do Estado de Sao Paulo (COPERSUCAR). The COPERSUCAR afforded sugar farmers several advantages such as:
 - Increased access to formal financing
 - Increased access to (larger) markets
 - Economies of scale
 - Lower marketing costs
- During the 1980s, the global oil crisis induced a severe economic crisis in Brazil because of Brazil's dependence on imported oil. Given that Brazil imported approximately 80% of its oil supplies, the global oil crisis induced severe inflation in Brazil. The inflation, in turn, wrought havoc on Brazilian industries.
- The global economic downturn during and shortly after the global oil crisis resulted in the collapse of sugar prices in the world market. This, in turn, resulted in the contraction of the Brazilian sugar industry.
- The two aforementioned economic events could be viewed to have constituted the impetus for the restructuring of the Brazilian economy. In particular, the restructuring had to address the following:
 - Dependence on oil imports - and exposure to global price shocks in oil
 - Dependence on sugar exports – and exposure to global price shocks in sugar
- In 1975, the Brazilian government established Proalcool. The national program was designed to significantly increase the production of ethanol in order to accomplish the following goals:
 - Reduce oil imports, increase the supply of foreign exchange, and reduce exposure to global oil price shocks.
 - Jumpstart flagging demand in domestic sugar products
 - Extend the sugar value-chain in order to enhance the incomes of sugar producers.
 - Channel investments into land development in order to bolster overall agricultural productivity.
 - Develop the domestic capital good industries in areas such as agricultural equipment and alcohol distillation.
 - Diversify the Brazilian export portfolio with high (or higher) value exports such as ethanol.
- It is of note that alcohol-blending was not a new practice in Brazil during the 1970s. As early as the 1930s, Brazilians were already incorporating alcohol into their fuels. The practice, however, was motivated by a desire to support the domestic sugar market – not to wean Brazil from imported oil.
- Proalcool was met with fierce resistance by the Minister of Finance, Minister of Mines and Energy, the Central Bank of Brazil, Petrobras (a semi-public Brazilian multinational company involved in oil drilling, refining, and distribution) and a group of (free-market/neo-liberal) technocrats. The crux of their argument could be viewed to have been the implied economic inefficiency of a government dominated program and the distortion of functioning price signals. Additionally, those against Proalcool stoked fears that the massive government infusions into the ethanol industry would (1) create additional inflationary pressure and (2) result in the crowding out of private investment.
- Proalcool eventually passed with four key components:

- Petrobras was required to purchase a guaranteed amount of ethanol every year
- Bank of Brazil was required to provide low interest loans to alcohol distilleries
- The establishment of production quotas and export controls for sugar
- The subsidization and regulation of domestic ethanol prices
- The implementation of Proalcool was mired with problems. In particular, the cohesion implied by the mandate of Proalcool was absent during the first few years of its implementations. Government agencies involved in the program were largely viewed to have been motivated by diverging interests. The agencies tasked to promote the production of ethanol were impeded by the efforts of agencies who viewed the expansion of ethanol production as detrimental to their mandates (e.g. local oil). Additionally, the promised low interest loans were given at a glacial pace.
 - It is important to note that this is by no means an indictment of the Bank of Brazil. Instead, this is a natural consequence of the uncertainty implicit in the prospective loans. The bank could be viewed to have operated well within its operating parameters with regards to the loans.
- Nevertheless, Proalcool managed to build a thriving ethanol industry within a decade of its passage. During the late 1970s, Brazil was able to meet its ethanol supply targets – and perhaps more importantly, neared its 20% imported fuel substitution target.
- The expansion in the ethanol industry brought about by Proalcool, however, was observed to have slowed considerably during this time. Further expansion required substantial investments in larger and more sophisticated value-chain networks in the ethanol industry (i.e. larger distilleries, increased mechanization, etc.). In addition, the observed fragmentation among agencies made it more difficult to find a way forward for Proalcool.
- An argument can be made that OPEC paved the way forward for Proalcool. In 1979, OPEC announced a massive price hike. This effectively broke the deadlock in Brazil and gave President Figuerido the perfect justification for the expansion of Proalcool.
- The implementation and expansion of Proalcool led to the emergence of the Brazilian alcohol-based automotive industry. The observed (or imagined) potential of the industry prompted the Brazilian government to formulate and implement policies beneficial to the alcohol-based automotive industry. These included:
 - Imposing higher minimum ethanol fuel blends (up to 25%)
 - Imposing price controls over ethanol and gasoline (e.g. ethanol price at 65% of gasoline price)
 - Expanding credit lines for sugar mills and ethanol distilleries
 - Mandating the availability of ethanol in gasoline stations
- The policies above resulted in the rapid expansion of the alcohol-based automotive industry in Brazil as well as the emergence of forward-linkages pertaining to the maintenance of these vehicles as well as the conversion of gasoline vehicles. The policies (particularly the subsidies) dramatically altered consumer behavior. The shift in demand, in turn, led to the aforementioned expansions.
- The expansion of both the ethanol industry and the alcohol-based automotive industry as well as the subsidy structure that supported both industries, however, placed the Brazilian economy in a precarious position. The increase in domestic demand for alcohol, which was further bolstered by price controls on gasoline and ethanol, rapidly diminished ethanol reserves. This, in turn, prompted the further expansion of ethanol production. Given the profitability of ethanol, farmers shifted away from food production and into products that fed directly into the alcohol value-chain. This, in turn, resulted in inflation.
- The sharp decrease in global oil prices and the sharp increase in global sugar prices in the mid-1980s forced the Brazilian government to abandon existing policies.
 - The lower price of gasoline made insisting on alcohol-based vehicles untenable
 - The higher price of sugar diverted sugar stocks away from ethanol production
 - Given its dependence on alcohol-based cars, Brazil had to import ethanol
 - Ethanol became markedly more expensive as gasoline became markedly cheaper.
- Proalcool was officially terminated in 1991 – a few years after the dramatic change in global economic circumstances in the mid-1980s. The following years saw the retreat of the Brazilian government in the ethanol industry given its increasingly untenable position in the ethanol industry. Subsidies and controls part-and-parcel of Proalcool were gradually eliminated during the 1990s.
- After the aforementioned period of deregulation in the 1990s, the Brazilian sugar and ethanol industries stabilized and leveraged the growth they accrued throughout the implementation of Proalcool to expand at a steady pace. At present, Brazil is the top exporter of sugar and is among the top exporters of ethanol.
 - Advancements in the automotive industry that facilitated the incorporation of more and more ethanol into fuel blends facilitated the recovery and resurgence of the Brazil ethanol industry.
 - Growing concerns over climate change and fossil fuels have increased the demand for ethanol.
 - An argument can be made that the oil crisis in years past again facilitated the further expansion of the Brazilian ethanol industry.

- Commitment to Policy or Policy Consistency:
 - Regardless of whether one agrees with the price and supply controls imposed under Proalcool, the manner of implementation remains notable. The Brazilian government chose to deploy a set of policy tools that were largely consistent with one another (i.e. increase the production of ethanol via subsidies and then commit to lowering the domestic price of ethanol in order to increase the demand for ethanol).
 - Proalcool lasted for more than a decade and was underpinned by decades of sugar-related policies. This observation underlines the importance of policy consistency in developing a globally competitive industry. Three-year and six-year cycles such as those observed in the Philippines are incongruent or incompatible with the long-term time horizons of ambitious industrial development plans such as Proalcool.
- Responsiveness to Global Market Forces:
 - Global market forces create problems but also opportunities. Brazil demonstrated that global shocks can be used as means to push a national-level policy forward.
 - Brazil responded to the US-Cuba trade cessation by pushing its export portfolio
 - Brazil responded to oil crises by expanding its agricultural productivity, alcohol distillation capabilities, and its alcohol-based vehicle industry.
 - Brazil has demonstrated that national-level policy can be implemented to reduce dependence on critical imports. The experience of Brazil illustrates the manner in which a developing country can dramatically reduce its exposure to global price shocks.
- Inter-agency Cooperation and Commitment:
 - Many of the problems encountered in the implementation of Proalcool could be viewed to have emanated from the lack of cohesion among government agencies.
 - The experience of Brazil with Proalcool underlines the importance of a coordination framework that is underpinned by an enforcement mechanism. All relevant government agencies must be committed to a national-level policy – not to its parochial concerns.
- Recognition of Backward and Forward Linkages
 - The formulation and implementation of Proalcool could be argued to have been guided by a recognition of the value-chain that can be created from sugar. The Brazilian government cultivated the development of industries that would create the demand for the sugar and ethanol that they intended the country to produce. Examples of value chains include:
 - Sugar – Ethanol – Alcohol-Based Cars – Automotive Technologies
 - Sugar – Milling Equipment – Milling Technologies
 - Sugar – Ethanol – Distillation Equipment – Distillation Technologies
 - Sugar – Biotechnology Research
 - Sugar – Ethanol – Biotechnology Research
 - It is of note that the Brazilian government also encouraged the development of research institutions. The success of the Brazilian ethanol industry in the past decade and a half is a testament to the capabilities of their research sector. It has managed to keep them ahead of the curve – and magnify the productivity of the Brazilian agricultural sector.
- Development of Functioning Formal Private Organizations
 - Part of the success of Proalcool and the Brazilian ethanol industry is the presence of formal sugar producer organizations. These organizations afford farmers with greater access to credit and scale economies.
 - The openness of these organizations to technological change as well as the receptiveness of these organizations to long-term government programs also hugely impact the types of policy strategies that a government can adopt.
 - Resistance to technological change can effectively prevent the usage of advances in biotechnology or modern agricultural methodologies to increase overall yields.
 - Resistance from holdouts to overarching national plans can stymie multi-year plans designed to bolster the productivity of the entire sector. In this regard, special interest groups can hold entire agendas hostage to the detriment of the majority.

- The implementation of a program that is similar to Proalcool in the Philippine setting can be argued to be exceedingly difficult - if not outright impossible. The passage and (partly) successful implementation of Proalcool was made possible by a confluence of factors:
 - The existence of a thriving, expansive, and mature agricultural (sugar) industry
 - The existence of an agricultural sector that is receptive to new technologies and responsive to prevailing market forces
 - The emergence of a coalition of powerful/influential private and public forces
 - A multi-year commitment to a national-level policy with a clear (uncompromised) direction
- All of the aforementioned factors that led to the (partial) success of Proalcool and the eventual emergence of an ethanol powerhouse in Brazil are absent in the Philippine setting.
- Put differently, addressing the aforementioned issues could be viewed as a critical prerequisite to developing an ethanol or a biofuel industry that can compete alongside Brazil in the global economy.
- Additionally, the level of maturity of the global economy makes it difficult to establish a niche – especially in agriculture which does not have particularly insurmountable technical barriers to entry.
- Despite the arguments in the preceding discussion, the Philippines still stands to gain a tremendous amount of value should it invest heavily in research.
 - Given the limited availability of arable land, it is important to squeeze as much productivity from every hectare of farmland. If the agricultural sector is already pushing at hard land, labor, and capital constraints, the only way to increase productivity is through research.
 - Research provides opportunities for the development of technologies that are suited for the Philippine setting (e.g. climate-specific, drought/flood resistant). Research thus serves to further bolster productivity through (1) reducing wastage and (2) allowing crops to be grown on previously inhospitable land.
 - Research can be viewed as an industry. As such, it extends the domestic ethanol value chain and can allow the development of additional forward linkages. These, in turn, creates more jobs and exportable outputs (e.g. research papers, researchers).
 - The development of a robust research industry affords the Philippine sugar and ethanol industries greater access to the research industries of other countries. The domestic research industry would serve as the conduit between industry players and global leaders in research.
 - Innovations revolving around the Philippine ethanol industry can result in positive spillover effects on the energy industry. Similar to the Brazilian case, significant technological advancements in the Philippine ethanol industry could result in decreased reliance on imported fuels. This, in turn, would have positive repercussions on the foreign exchange position of the Philippines as well as the resilience of the Philippine economy to fuel price shocks on the world market.