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The Transformation of Agriculture in a Semi-Industrialized Country: The Case of Brazil

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Brazil makes progress at night, when the politicians are sleeping.
—POPULAR SAYING

WE BEGIN THIS PAPER with a summary of the first four centuries of Brazilian economic history. During this period there were booms in certain agricultural and extractive products, but until the advent of coffee they failed to lead to permanent and sustained general economic development. We then turn to a review of the modern (post-1900) period, in which the state of São Paulo became Brazil's dynamic center of economic development, with a preeminence that was initially agricultural and later industrial-urban as well. We then arrive at the heart of our analysis, an original piece of research on the interrelationships between industrial-urban development and agriculture during the decade 1940–50, the most recent period for which the necessary detailed basic data as yet exist. We conclude with an appraisal of Brazilian public policy since 1950, with particular reference to its effects on the agricultural sector and the achievement of an integrated national economy.

THE FIRST FOUR CENTURIES: BOOMS AND RETROGRESSIONS

The discovery of Brazil at the turn of the sixteenth century, began an era during which the eastern coast was regularly visited by various expeditions of the Portuguese and other Europeans. The initial attraction was Brazil wood, from which the new colony derived its name. This wood was the source of a much valued red dye. Foreign competition soon forced Portugal to consider the establishment of permanent settlements to assure its possession of this new land. In 1534–36 the Crown created fourteen hereditary "captaincies" (*capitanias*). These administrative divisions, of which there were ultimately eighteen, were of varying width and continued to the country's then western limits. While many of these *capitanias* languished or progressed very slowly, that of Pernambuco (or New Lusitania) flourished from the outset, thanks to its effective leadership, its greater proximity to Europe, and the rapidity with which the fabulously profitable culture of sugar-cane was established.

The Sugar Boom, 1530–1700

Radiating from Pernambuco's first settlements, the towns of Igaraçu (1536) and Olinda (1537), cane production had by 1600 spread along the entire coast from Salvador (1549) to Natal (1599). The success of this first great European colonial enterprise based on agriculture rather than on precious metals or other extracted products was due, writes Furtado, to a very favorable conjunction of circumstances—the still largely unsatiated demand for sugar in Europe; the relatively advanced techniques that the Portuguese had already developed in cane production in their Atlantic islands and in sugar-making equipment; the merchandising and financial role of the Low-Country merchants (especially the Dutch) who acquired the raw sugar in Lisbon, carried it to Antwerp or Amsterdam for refining, thence distributed it through all of Western Europe, while financing an increasing share of the expansion of productive capacity in Brazil; and the command that the Portuguese had established over the African slave markets, thereby enabling them to solve the severe manpower shortage in the new colony.[1]

[1] Instituto Brasileiro de Geografia e Estatística (I.B.G.E.), Conselho Nacional de Geografia, *Geografia do Brasil,* Vol. III, Rio de Janeiro, 1962, pp. 156–57; Hélio Vianna, *História do Brasil,* Vol. I, São Paulo, 1963 (2nd ed.), pp. 86–89, 69–73, and 118–127; and Celso Furtado, *Formação Econômica do Brasil,* 2nd ed.,

Unfortunately, this very favorable situation was adversely affected by the union of the Portuguese and Spanish crowns in 1580. By this union, which lasted seventy years, the enemies of Spain became the enemies of Portugal as well, and the Brazilian colony was harassed by the British, French, and especially the Dutch. Most important was the Dutch invasion and successful occupation of the entire northeast coast from Sergipe to Natal and Fortaleza during 1630–54. Only the colonial capital of Salvador escaped their prolonged control. The principal economic consequence of this incursion was the establishment by the Dutch of a competitive sugar industry in the Caribbean. While in Brazil, they had made good use of the opportunity to familiarize themselves with the technical and organizational aspects of sugar production. Thanks to this competition, sugar prices were permanently halved and the volume of Brazilian sugar exports halved as well. Thus, by 1700—Brazil—with a total colonial population of perhaps 300,000 (100,000 Europeans)—and Portugal were undergoing a serious economic contraction.[2]

During its century or more of rapid expansion prior to 1650, however, the Brazilian sugar industry had given the first impetus to settlement of the interior. During this period, virtually all of the land suitable for cane in the littoral of Pernambuco (including modern Alagoas) and Bahia had been incorporated into this increasingly specialized industry. Yet the colonists and their slaves faced a growing need not only for food crops and meat, but also for the oxen, lumber, and firewood so essential to the production and processing of cane. Initially, the perennial lower reaches of the local rivers had not only served the transportation needs of the sugar industry, but also gave access to coastal lands that could provide food and production goods of agricultural origin. However, it was soon recognized that the use of the scarce cane lands for these secondary activities as well was uneconomic, the Portuguese Crown finally going so far as to prohibit cattle production in the

Rio de Janeiro, 1961, pp. 18–22. In the latter remarkable book, Furtado has estimated that, in 1600, the per capita income of the Brazilian population of European origin (constituting 30,000 of a total of 100,000 people) was U.S. $350—much higher than that then prevailing in Europe and not again achieved in Brazil until modern times—and that the profits of the Brazilian sugar industry were sufficient to finance a doubling of its productive capacity every two years (*ibid.*, pp. 58, 60, 91).

[2] Furtado, *op. cit.*, pp. 27–29. While seriously damaging the economy of the relatively long-settled Brazilian colony, the rapid growth of the sugar industry in the Caribbean gave great impetus to the growth of the North American colonies through the development of a triangular trade with the Antilles and Europe, increasingly transported in New England bottoms (*ibid.*, pp. 39–43).

sugar zone. With an almost inexhaustible supply of land to the west, it was only natural that this economic need should be met by settlement of the interior. As such economic incentives began to wane with the contraction of the sugar industry, the political need for improved land communications between Salvador and Recife and the tenuously held northern colonies became more apparent as a result of the long struggle against the incursions of the several European powers. Thus the spread of cattle raising into the interior was encouraged for different reasons at different times. Settlement was fostered by the award of *sesmarias* of land to new settlers.[3]

Meanwhile, the interiors of Ceará and Maranhão to the north had been explored and settled during the seventeenth century, with Salvador and Recife serving as the principal nuclei from which these pioneering activities originated. These bold new penetrations appealed most to colonists without financial resources, who saw in cattle raising an opportunity for a relatively rapid accumulation of wealth from a small initial investment. Cattle are self-reproducing and require a minimal labor force, which the indigenous population could easily and willingly provide. Among these colonists were not only the less privileged immigrants to the sugar capitals of Recife and Salvador, but also, and more important, the *vicentinos* from São Vicente (near present-day Santos and São Paulo), whose lack of remunerative export products and isolation from the mainstream of colonial Brazil had already made of them hardy and restless explorers of the most remote corners of the new land. While the *baianos* and *vicentinos* were settling the interior of Bahia, the north of Minas Gerais, and the more remote interior of Ceará, Piauí, and Maranhão—and putting down the strongly hostile Indian tribes in the process—the *pernambucanos* were active to the north and west of Recife. Besides blazing trails within this comparatively restricted area, they also showed particular interest in the neighboring areas of Paraíba, Rio Grande de Norte, and northeastern Ceará. Somewhat less rapidly and thoroughly, they penetrated the *sertão* (interior) of Pernambuco as far as the São Francisco River. By 1711, a contemporary observer reported more than 500 corrals and 800,000 head of cattle in Pernambuco and its dependencies.[4]

While the human population in the arid *sertão* remained sparse, the advent of cattle herds in the interior led to the establishment of trails for driving cattle and conducting *tropas* of burros. These trails ultimately

[3] *Geografia do Brasil, III*, pp. 156–57, 162; Furtado, pp. 70, 73.
[4] Furtado, p. 75; Vianna, *op. cit.*, pp. 228–31.

converged on Recife or Salvador. At places in the interior where they crossed or merged, usually where there were suitable resting, feeding, and watering grounds, small settlements developed, many of which grew into important cattle markets as well. Juàzeiro in Bahia and Petrolina, Salgueiro, and Arcoverde in Pernambuco are good examples within the *sertão.* More favored, however, were the settlements in the less arid intermediate zones between the *sertão* and the coastal sugar belt. Among these were Feira de Santana in Bahia and the major market towns of the *agreste*—particularly Campina Grande (Paraíba) and later Caruaru, some 100 miles from the coast. Upon such centers converged not only the cattle, dried beef, hides and leather from the *sertão,* but also, such surpluses of staple foods as the sugar zone could absorb. Because its climate was less arid than the *sertão,* the *agreste* itself was the main source of the staple food crops. Unfortunately, the initial impetus that the sugar boom had given to such development in the *agreste* and *sertão* had been markedly reduced during 1650–1700. The result was that the cattle industry increasingly took on a life of its own, moving toward self-sufficiency and economic isolation—with meat providing the principal food, and leather the basic raw material for clothing and most other subsistence needs. This was bound to happen in the more remote interior, far from the colonial population centers. But commercialization of the agriculture even of the *agreste* and closer *sertão* (up to 200 miles from the sea) slowed down greatly and even retrogressed as the sugar industry moved into a phase of economic stagnation and contraction after 1650.[5]

The Gold Boom of the Eighteenth Century

By 1700, Portugal and its Brazilian colony were in desperate economic straits. The value of the Portuguese monetary unit in terms of pounds sterling was one-third of what it had been in 1640. Hence, the discovery of gold in Minas Gerais (then in the *capitania* of São Paulo) at the turn of the new century was a godsend that quickly changed the face of the American colony. In the ensuing gold rush the long poor and isolated southern colonists moved *en masse* to Minas, and much of the redundant slave population of the northeast sugar zone was shifted to the gold fields. The first major spontaneous immigration of Portuguese of limited resources also got underway. Some idea of the importance of this immigration is conveyed by the estimates of Furtado, according to

[5] Vianna, pp. 228–31; Furtado, pp. 75–76, 80–81, 86.

which, in the eighteenth century it totaled 300,000, while the European population increased about ten-fold to perhaps 1,000,000 out of a total of 3,250,000. Unlike the silver mines of Peru and Mexico, the mines of Minas were small-scale and required little capital investment, nor did the slave population ever outnumber the free. As a result, the attractions for men of little or no financial resources were great. The gold rush also created an enormous new demand for food, cattle, and beasts of burden, a demand that far exceeded anything that prevailed during the most prosperous years of the sugar industry. In the northeast, the driving of cattle to the south caused a rapid rise in beef prices, provoking official protests by the sugar interests. But the major beneficiaries of this new market were in the south, whose old but rudimentary livestock industry became extremely profitable for the first time. Central Brazil, São Paulo, and Rio Grande do Sul were revitalized by the burgeoning demand for beef cattle, horses, and mules, while the development of food crops was greatly stimulated in the southern part of Minas (from 1720, an independent *capitania*), São Paulo's Paraíba Valley, and the State of Rio de Janeiro (to which sugar-cane production had already been shifting).[6]

By 1800, the richer and more accessible gold deposits had been virtually exhausted, but the gold boom had exacted a severe toll on the northeast. In particular, the economic and political power that Pernambuco and Bahia had long enjoyed, was greatly reduced. The shift of the colonial capital from Salvador to Rio de Janeiro in 1763 reflected the southward shift of Brazil's socio-economic center of gravity. To be sure, the Crown did not completely neglect the northeast. A royally chartered trading company (1755–78), created to stimulate the development of Maranhão and Piauí, proved to be highly successful, while a second trading company (1761–81) concerned with Pernambuco and Paraíba promoted with considerable success the production of tobacco and cotton and the rehabilitation of the sugar industry. In great measure because of these promotional activities, the northeast was in a position to respond positively to a series of favorable political events: the American Wars of Independence and of 1812 which disrupted England's normal sources of supply of cotton, rice, and tobacco; the French Revolution, whose reflexes in the slave revolt in Haiti brought a new stage of prosperity for the Brazilian sugar industry; and the Napoleonic Wars, which brought the Portuguese royal family to Brazil (1808) and opened its ports to all friendly nations. As a result, during the last decades before independence (1780–1822), when the south was rapidly

[6] Furtado, pp. 86, 89–94.

retrogressing to a subsistence economy following the collapse of the gold boom, the colony's agricultural exports nearly doubled.[7]

While this new period of prosperity in Pernambuco had a precarious base, it undoubtedly helped to stimulate the renewed development of the nearby *agreste*. In this less arid region, strategically located between the humid littoral and the very arid *sertão*, several important towns developed between 1772 and 1811. Henceforth, the *agreste* and littoral were to maintain some continuity in the growth of new urban nuclei, particularly with the spread of cotton culture, while the *sertão* region remained static. Even this sparse population, however, proved to be excessive during the calamitous droughts that frequently ravaged the *sertão*, often decimating both the human and animal inhabitants. Striking on the average about two out of every six years, these *secas* set off enormous migrations which often brought short-term profit as well as long-term population growth to the *agreste* and other areas (such as the Cariri Region) less severely affected. Otherwise, the prosperity of the *agreste* was ever more closely entwined with the economic progress of the littoral, although thanks to its rather broad base of subsistence agriculture, the inland region was somewhat less vulnerable to the vagaries of world commodity markets than was the sugar zone, with its highly specialized export agriculture.[8]

Political and Economic Readjustment, 1800–50

Brazil's declaration of independence in 1822, anticipating the constitutional monarchy formalized in the constitution of 1824, did not meet the wishes of its republican opponents. Of these, the most politically important were in Pernambuco, whose governor sought to enlist the whole northeast in favor of a republican form of government during the Revolution of 1824. This outbreak, like its abortive predecessor, the Revolution of 1817, was successfuly repressed. But the republican sentiment was a factor in the agitation that culminated in the abdication in 1831 of Dom Pedro I in favor of his infant son. In the process the real power passed to the dominant colonial landed class of the littoral. While doctrinaire free-traders, this class was to come increasingly into conflict with the English, who had achieved by treaties in 1810 and 1827 extraterritorial rights and preferential tariffs in Brazil. Initially, the landed interests benefited. Because of the treaties, it was possible,

[7] *Ibid.*, pp. 102–04, 107–10; Vianna, pp. 311–16.
[8] *Geografia do Brasil, III*, pp. 166–67, 170–72.

in the exportation of agricultural products, to bypass the onerous entrepôt of Lisbon. At the same time, the treaties made imported goods much cheaper and more abundant and credit facilities much ampler than before. However, with the restoration of peace in Europe and North America, the English gave renewed preference to the tropical products of their Caribbean colonies which, with the increasing suppression of the slave trade, looked upon Brazil's slave-produced sugar as unfair competition. English efforts to put an end to Brazilian slave imports were resented by the sugar interests and by tobacco producers as well, since the slave trade promoted the exchange of Brazilian tobacco for slaves in African markets.[9]

Furthermore, Brazilian producers of agricultural exports were again faced with competition in cotton, rice, tobacco, and even sugar-cane from the Southern United States, whose production, likewise based on slavery, was much more efficient. Because of these developments, the northeast was hard hit by a steady fall in sugar prices and an even sharper decline in cotton prices. Moreover, until the treaty with England expired in 1844, the Brazilian government was powerless to finance itself (and to discourage the high propensity to import) by raising import duties. At the same time the landed interests were politically too strong to permit an export tax. The result was heavy deficit financing and the rapid depreciation of the Brazilian monetary unit, with considerable civil unrest especially in the urban areas where small merchants, public servants, and the military were hard hit. Thus, during the second quarter of the nineteenth century, Brazil desperately needed to expand its volume of exports, especially in the face of a 40 per cent decline in its international terms of trade. Although the Brazilian sugar industry (despite many problems) succeeded in doubling its *quantum* of exports, the money value of those exports increased by only 24 per cent. Cotton exports dropped 10 per cent in volume but 50 per cent in value and, although exports of hides and skins doubled, their value fell by 12 per cent. Little wonder that Furtado concluded that "In Bahia and in Pernambuco, and even more in Maranhão, per capita income must have declined substantially during this period." [10]

The only hopeful development during 1822–50 was the gestation of the coffee boom. Coffee had first been planted in the Amazonian state of Pará in 1727 and quickly spread as far south as Rio de Janeiro. Until the Haitian revolt of 1789, however, it had been produced on a small scale for largely domestic consumption. By 1821–30, both sugar with 32

[9] Furtado, pp. 111–14.
[10] *Ibid.*, pp. 114–16, 126–27, 129–32.

per cent of the total value of Brazilian exports and cotton with 20 per cent still outranked coffee with 19 per cent. However, by 1841–50 coffee easily held first place with 41 per cent, while the shares of sugar and cotton had fallen to 27 per cent and 6 per cent, respectively. In the interim, coffee exports had expanded more than five-fold in *quantum* and more than three-fold in value. Thanks to coffee, the real value of Brazilian exports grew by 40 per cent in the second quarter-century. Even so, Furtado estimated that in 1850, per capita of the free population, it was probably little more than 50 per cent of its 1800 level. Furthermore the increasing rewards of coffee production were concentrated on the region centering on the state of Rio de Janeiro and the Paraíba Valley. In fact, this latter region, in the state of São Paulo, was able to recoup its loss of domestic markets following the collapse of the gold boom in Minas Gerais and to resume population growth.[11] Pernambuco and the northeast, on the other hand, largely escaped the boom.

Coffee Becomes King, 1850–1900

The second half of the nineteenth century saw a vast improvement in the Brazilian economy as a whole but a further deterioration in the economic position of Pernambuco and the northeast. By the 1890's Brazil was producing about 60 per cent of the world's coffee. Coffee now accounted for 64 per cent of Brazil's exports by value, and rubber, thanks to the boom then well under way in Amazonia, for 16 per cent. During the previous half-century, coffee exports had increased by 341 per cent by *quantum* and 742 per cent by value, as compared with 214 and 358 per cent for all exports. (Taking into account a reduction of about 8 per cent in import prices in the interim, the gains in total value of exports become 809 per cent for coffee and 396 per cent for all exports.) This spectacular development provided the basis for an average real growth rate in the coffee region, estimated by Furtado at about 2.3 per cent per capita between the 1840's and 1890's. This was a sufficiently dynamic rate of development to reintegrate much of the subsistence sector of central and southern agriculture into the national economy; the per capita annual real growth rate of the extreme south may have averaged one per cent.[12]

[11] *Ibid.*, pp. 132–33, 128; *Agricultura em São Paulo,* Vol. 8 (August 1961), Table 1, p. 21; I.B.G.E., Conselho Nacional de Estatística, *Anuário Estatístico do Brasil, 1958,* Rio de Janeiro, 1958, p. 234.

[12] Furtado, pp. 163–71.

Because of very favorable developments in tobacco and cocoa exports (the cocoa industry attracted a significant influx of people from the rest of the northeast) the state of Bahia probably brought its per capita exports during 1850–1900 up to the level of the rest of the northeast, although in per capita real income it held its own at best. During the same period, the rubber boom had outpaced even coffee development. In the two decades following the 1870's rubber's share of exports by value grew from 5.5 to 15.8 per cent. For 1900–10 the average was 27.9 per cent. During the period 1850–1900, the per capita annual growth rate of rubber-producing Amazonia was 6.2 per cent, despite the absorption of 260,000 immigrants (followed by approximately the same number during 1900–10), mostly from the northeast. As its high outmigration rates would suggest, the northeastern region did not share in this growing prosperity. During the second half of the nineteenth century, the *quantum* of Brazilian sugar exports had increased by a further 33 per cent, but prices fell by 11 per cent. Cotton exports (despite another brief period of precarious prosperity during the American Civil War, which temporarily exploded cotton's share of total exports from 6 per cent in the 1850's to 18 per cent in the 1860's) increased 43 per cent by volume and 89 per cent by value. In the northeast, decimated by outmigration and disastrous drought, these modest gains in terms of real income were insufficient to check the continued reduction (estimated by Furtado at 0.6 per cent per year) in per capita income during 1850–1900.[13]

The sugar zone of the northeast was also strongly affected by the abolition of slavery in 1888—a step that undermined the political power of the old slaveholding class, even though the backlash of that power was strong enough to oust the able and much loved Dom Pedro II from his throne. In the northeast the economic consequences of emancipation were relatively minor. For most of the freed slaves there was little access to land in the subsistence sector of agriculture without long-distance migration. Most of the lands of the *agreste* and *sertão* had been taken up and were already showing signs of demographic pressure. As a result, virtually all of the freed slaves remained on the sugar plantations at low wages, and there was no significant change in the organization of production or the cost of labor. In the hinterland of Rio de Janeiro, where a slave-based coffee industry had developed, most of the earlier coffee lands had been nearly exhausted by the new crop. Because of their familiarity with coffee production, the freed slaves could command higher wages than their fellow emancipates in the sugar region. But rather than

[13] *Ibid.*, pp. 152–53, 164–65, 168–69, 171.

migrate westward, most of them preferred to take advantage of the abundance of unoccupied land in the hills and mountains of the Rio hinterland and withdrew into the subsistence economy.[14]

At the time of abolition, while slaves still constituted most of the labor force in the monetized sector of Brazilian agriculture, a much larger number of free men made up the vast subsistence sector. Their subsistence plots were generally part of the extensive holdings of a major landowner, whose principal commercial interest, if any, was cattle production. With so much land capable of supporting a large tenant population able to feed themselves with virtually no capital and the most rudimentary techniques, the large landholder's principal reward was not economic but socio-political, with power and prestige proportioned, for example, to the number of votes or the degree of social obeisance he could command. While this subsistence sector provided a great pool of underemployed manpower whose productivity was very low, it was unable to satisfy the rapidly growing labor needs of the coffee region. In part this was due to the strong resistance of the landed *coroneis,* to public migration policy, and partly to the prevailing belief that the subsistence system lacked the work discipline essential to the large, well-capitalized, and intricately organized coffee plantations. In the south, the subsistence sector gradually adjusted its economic organization and productivity in response to the increased incentives to commercialize its output. In the northeast, there was little change, as the region was largely bypassed by the wave of European (largely Italian) and Japanese immigrants attracted to the coffee region through active recruitment and heavy public subsidies.[15]

Brazil in 1900

Brazil's first four centuries (apart from the rise of coffee) may be epitomized by a term recently applied by George Dalton to twentieth-century Liberia: "growth without development." With almost monotonous

[14] *Ibid.*, pp. 159–62.

[15] *Ibid.*, pp. 140–43, 144–49. In support of Furtado, it is interesting to consider trends in the combined populations of the five northeastern states of Ceará, Rio Grande do Norte, Paraíba, Pernambuco, and Alagoas and their capital cities during 1872–1900—a period of heavy migration from the northeast to the Bahia cocoa zone and Amazonia. During 1872–90, the population of the five capitals declined 7 per cent while the remaining populations of these states rose 25 per cent; during 1872–1900, the capitals gained 5 per cent and the remaining population of the states 40 per cent. These data suggest that, despite the effects of the various droughts (especially that of 1877–79) in driving rural people into the cities, such outmigration from the northeast as occurred affected these and other urban centers much more than it did in the hinterlands.

regularity, some agricultural or extractive product—Brazil wood, sugarcane, gold, cotton, cocoa, rubber—flourished for a time and produced enormous wealth, only to collapse with the exhaustion of the particular resource or the rise of competition from other countries more technically progressive and economically efficient. This economic pattern was accompanied by a speculative and exploitive spirit of "getting what you can while the getting's good," a psychology that accounts for the perennial failure to plow back even a small fraction of large current earnings into the capital improvements and better techniques that might have preserved the income base even within agriculture.

As in the southern United States, use of slave labor tended to favor a static and routinized production system; agricultural prosperity based on export markets fostered an agrarian outlook marked by contempt for industrial-urban life and a willingness to accept indefinitely a dependence on foreign industrial products. Compared to Brazil, however, the U.S. South was a paragon of agricultural development. The Calvinistic ethic of work and thrift and the experimental and progressive spirit that derived from the Age of Enlightenment in which the North American republic was born had left their mark on its plantation owners. With their very different cultural roots, Brazil's men of agricultural wealth preferred to preserve a European enclave on the South American continent, favoring industrial goods of European origin, educating their sons in Portugal, and spending much of their own lives abroad or in the court life of the national capital. When the most propitious time for capital formation in the agricultural lands under their control had passed, they could still maintain a materially satisfactory level of "genteel poverty," at which they could continue to enjoy socio-political prestige and influence.

While the stewards of Brazilian agriculture were playing a passive entrepreneurial role, in effect assuring that capital formation and technical advance in that sector would proceed at too slow a pace to prevent ultimate retrogression, industrialization also languished. Manufacturing of any kind was prohibited during colonial times by the mercantilistic policies of the mother country and until 1844 industrial protectionism was effectively prevented by the privileged trade position officially granted to England in 1810. The efforts made by Viscount Mauá during 1850–70 to diversify the Brazilian economy—through encouragement of the food and textile industries and the development of railroads, ports, and banks—met with only modest success and were viewed with scant sympathy by the agrarian-based power structure. Although Mauá actively sought to check the growing power of the new coffee monoculture,

the improvements in the infrastructure for which he was responsible had the reverse effect. With the emancipation of the slaves and the subsequent founding of the Republic (1889), the domestic agrarian political base was substantially weakened. At the same time, Brazil fell into disfavor with England and France, its traditional economic partner and cultural mentor, respectively. In search of an economic model, Brazil turned for the first time to the United States, and, impressed by the increasingly protectionist and nationalistic policies of the Yankees, enacted in 1897 an ultraprotectionist tariff. In the first decade of the Republic there were indications (largely in Rio de Janeiro and São Paulo) that industry was responding favorably to this policy. However, before the decade was over, inflation, widespread speculation, and fraud in the formation of new firms and banks had largely discredited domestic industrial development. Handicapped by the strong consumer preference for manufactures of foreign origin and the inclinations of the new coffee tycoons toward the traditional "free-trade" philosophy, Brazilian industrialization still faced a long uphill battle as the country entered the twentieth century.[16]

THE NEW DYNAMISM: THE RISE OF SAO PAULO, 1900–60

The nucleus of Brazil's modern economic development, both agricultural and industrial, has been the state of São Paulo. The ever-widening influence of this state has spread to the rest of the south and central west, with increasing repercussions even in the old, but long stagnant and poor regions of the north and northeast. Hence, we must now turn our attention to this developmental nucleus whose fabulously large agricultural surplus eventually became the basis of the general economic development of Brazil. It is this development and particularly the emergence of an industrial-urban complex that gives promise at last of serving as the instrument for modernizing a still largely traditional and static agriculture in the country at large.

São Paulo's Agricultural Development

In 1900, when Brazil's coffee exports by *quantum* were some four times their level of the 1840's, São Paulo already accounted for about 50 per

[16] Cf. Dorival Teixeira Vieira, "The Industrialization of Brazil" (unpublished manuscript of 1967).

cent of national production and over one-third of world production. In achieving this position, which was to be further strengthened, São Paulo rose from an unpromising backwardness. The state had been handicapped by sparsity of population, a largely subsistence and capital-poor agriculture, the lack of export experience and facilities, and inadequate transportation. During the nineteenth century, coffee production, which initially had flourished in the state of Rio de Janeiro adjacent to the port and capital city of the same name, gradually spread into the adjoining Paraíba Valley in eastern São Paulo. This slave-based coffee brought rapidly declining physical yields as exploitative techniques led to soil exhaustion, soil erosion, and land abandonment. Thus, coffee seemed to be following the familiar unhappy Brazilian pattern—with every prospect of receiving its *coup de grace* from the abolition of slavery. In fact, coffee might have shared the indifferent destiny of Brazilian agriculture in the second half of the nineteenth century, had it not been for the existence of vast virgin lands to the west, the transportation improvements that made these new lands accessible for exploitation and development, and the more venturesome spirit of the *paulistas* and the new immigrant class.

The opening in 1867 of a British-built railway connecting the port of Santos with the city of São Paulo marked the conquest of the state's only major physical barrier to railway development, the formidable coastal escarpment. This line initiated the railway expansion that was to pace the exploitative but persistent westward march of coffee across the state. By 1886, the center of production was north and northeast of the state capital, and the Paraíba Valley's share of São Paulo's coffee production had fallen to only 20 per cent. Thereafter, coffee expansion proceeded on the basis of *free* labor, attracted from abroad by a well-organized and effective recruitment campaign. Less hampered by tradition, which now weighed heavy upon those older regions that had once prospered under a slave-based agrarian system, the *paulistas* greatly invigorated by this influx of immigrants were at last in a position to turn their pioneer tradition of vigor and venturesomeness to good account. By 1920, coffee production in São Paulo was five times its level of 1886, accounting for 79 per cent of Brazilian output and 61 per cent of world production. Brazil as a whole supplied 75 per cent of world output while depending on coffee for about 76 per cent of its exports by value. With coffee production now centered in the middle third of the state, São Paulo's share of the national population had increased to 15 per cent from 9.7 per cent in 1890.

Production in São Paulo continued to increase and to move west-

ward until 1934, when it stood 80 per cent over 1918, with two-thirds coming from the westernmost third of the state. In this latter year the absolute level of the nation's production reached its historical high. Brazil's century-long coffee boom was approaching its end under the onslaught of world-wide depression, serious over-production, and the temporary suspension of national coffee price-support policies. During 1931–40, Brazil still accounted for 64 per cent of world production and São Paulo for 68 per cent of the Brazilian total. By the early 1950's, after sharp reductions in coffee production in the interim, these figures stood at 50 and 45 per cent, respectively. Production now followed closely the volume of exports, and this was still at its approximate absolute levels of the 1930's. But by now, coffee culture had crossed São Paulo's western borders and had spread southwestward to the virgin soils of the rich (but climatically more hazardous) northern region of the state of Paraná. With the highly favorable coffee prices of the 1950's, production rebounded sharply. By the end of the decade, it reached new all-time peaks far in excess of the increase in exports, creating a serious new surplus situation. In the process, however, leadership in coffee production passed suddenly from São Paulo to Paraná. In 1959 the former's rather moderate increase in production was completely eclipsed by the latter's five-fold increase. As a result, São Paulo's share of Brazilian production averaged only 22 per cent in 1962–64 as compared with Paraná's 48 per cent. By that time, while coffee still accounted for 53 per cent of the nation's exports by value, Brazil's world share had fallen to perhaps 41 per cent.[17] The recent decline in the relative importance of coffee in São Paulo marks the end of a prolonged period of coffee development that undoubtedly played a major role in getting a self-sustaining process of economic growth under way in the state and hence in Brazil. First, exploitative as the process was, it was because of the unrelenting quest for virgin soil for the expansion of coffee production that the entire state was at last completely settled. In the course of this development, an infrastructure and general economic climate were created in São Paulo that also favored the settlement and development of the states to the south, west, and north as they were drawn progressively into its economic orbit. Prior to the development of São Paulo, exploitative agriculture had left few long-run benefits in Brazil. But it enabled this state to establish an economic primacy, first in agriculture and then in manufacturing, that produced lasting fruits for

[17] These historical data on coffee developments are largely based on those published in *Agricultura em São Paulo* (Secretaria da Agricultura do Estado de São Paulo), Vol. 8, August 1961, Table 1, p. 21.

the entire nation. By 1960, São Paulo had 18.3 per cent of Brazil's population. The state still accounted for 23 per cent of the nation's value of agricultural production (down from 33.4 per cent in 1948–52) and produced 57.1 per cent of its value added by manufactures (up sharply from 33.8 and 47 per cent in 1920 and 1950, respectively). Altogether, São Paulo was responsible for 32.3 per cent of the national income, with a per capita income of about U.S. $605, 178 per cent of the national average of that time. That the benefits were beginning to spread to the rest of the country is shown, however, by the fact that São Paulo's advantage in per capita income had been considerably higher (221 per cent of the national average) a decade earlier.

Second, federal policy in regard to the coffee crisis of the 1930's had important, if unforeseen consequences, direct and indirect. Although clearly oriented to the special interests of the politically powerful coffee sector, it acted to stimulate diversification in both agriculture and the general economy. Brazil's price-support policy, under which the equivalent of about one-third of total production during the decade was destroyed, encouraged the loss of world markets to competing countries. However, this effect was partially offset by the similar effects of U.S. cotton price-support policy that gave Brazilian agriculture an incentive to substitute cotton for coffee on a substantial scale. Henceforth cotton resumed its rank as Brazil's largest export after coffee (14.3 per cent of total value in 1931–40, and 8.3 per cent in 1962–64).

Much more important, however, Brazil's coffee-defense policy provided the excuse for a tremendous injection of purchasing power—financed by correspondingly large increases in the money supply—into the coffee economy. The unprecedented magnitude of this expansionary monetary policy had a powerful anticyclical effect. With a sharp drop in commodity imports consequent on the foreign-exchange crisis, the demand for domestic manufactures was greatly stimulated. As a result, during the 1930's, idle resources were effectively turned to the production of agricultural and industrial goods for the internal market, with real increases of 40 and 50 per cent respectively during 1929–37, despite a halving of the value of exports. Investment was maintained at a moderate or better-than-moderate level, fundamental structural changes in the Brazilian economy were begun as agricultural savings were invested in the industrial sector, and dependence on foreign trade as the principal stimulus of national economic development was sharply reduced.

Coming hard on the heels of the Great Depression, World War II gave a more pronounced fillip to domestic manufactures than had

World War I. With foreign competition diminished, importable goods scarce, and a heavy wartime demand for many of its primary products, Brazil was able to reduce coffee stocks to manageable proportions during the 1940's while accumulating large foreign-exchange balances. Although the government failed to act as effectively as it might have to protect these balances, and consequently they suffered considerable dissipation through large-scale imports of consumer goods during 1947–50, industrial (physical) production increased by 40 per cent during 1944–50, with producer goods up 110 per cent and consumer goods 26 per cent.[18]

In 1953, now firmly committed to a policy of promoting import-substituting domestic manufactures, the Brazilian government established an elaborate system of multiple-exchange rates that discriminated against the traditional exports (coffee, cotton, and cocoa) while favoring imports of industrial machinery and producer goods. The purpose was clearly to capture a large portion of the exchange earnings of these agricultural exports for general development purposes, thereby furthering industrial growth under a policy of strong protectionism—a policy that was heavily reinforced by the tariff act of 1957. Brazilian agriculture derived some benefits from subsidized exchange rates on imports of fertilizer and petroleum products. But these gains could scarcely offset the substantial reductions in the domestic prices of agricultural exports and the even harder blow from the steep rise in prices of the other modern agricultural inputs, such as tractors and trucks, in the production of which highly protected domestic industries were an increasing factor. Even this exchange discrimination against coffee was not severe enough, with the abnormally high world price that prevailed in the 1950's, to prevent a very rapid expansion in coffee production in that era. Therefore, although late in the same decade the government was remunerating coffee exporters for only about half their actual foreign-exchange earnings, much of the surplus thus syphoned off was dissipated by the costs of the coffee price-support program. According to Baer, the subsidies more than compensated the coffee producers for the discrimi-

[18] Cf. Ruy Miller Paiva, "Contribuição da Agricultura ao Desenvolvimento Ecônomico do Brasil," *Agricultura em São Paulo*, Vol. 8 (August, 1961), pp. 46–49.

In emphasizing the contributions of the coffee-defense policy to Brazil's industrial development of the 1930's, we have followed the "accepted" interpretation of such authorities as Furtado and Baer. However, in a recent article ("A Balança Comercial, a Grande Depressão, e Industrialização Brasileira," *Revista Brasileira de Economia*, March, 1968), Prof. Carlos Pelaez presents strong evidence that this interpretation is substantially overstated or even wrong.

natory coffee exchange rate and contributed significantly to the inflation that had become the principal engine for financing industrialization.

If the government was partially thwarted in its objective of exploiting the agricultural surplus for the financing of industrial development, the fault lay not so much in the objective as in the failure to prevent the non-export (domestic food) sector of agriculture from becoming a serious bottleneck in the developmental process. With per capita physical food consumption increasing by 22 per cent and total population by 45 per cent during 1950–62, the terms of trade had turned in favor of agriculture, primarily because of a lag in the expansion of livestock and livestock products, whose higher managerial requirements and greater dependence on purchased inputs favored an inelastic supply response in the face of their higher income elasticities of demand. This condition resulted in the transfer of part of the savings of the nonagricultural sector to the commercial sector (agricultural middlemen) and large landholders, and a good percentage of this part probably found its way into investments in the nonagricultural sector as well as in land, farm machinery, and other tangible hedges against inflation. With the recent rapid increases in the relative costs of modern agricultural inputs, however, the low priority given by government policy to improving the productivity of domestic food production has discouraged the investment of such savings in the modernization of agriculture. In any case, it appears that the use of inflation as a technique of "forced saving" for financing the industrialization process served to transfer real income from the wage-earning class to the entrepreneurial class through the lag in the rise of real wages (a process that had about run its course by the early 1960's), with the heaviest burden falling on rural cash-wage workers.[19]

That the reallocation of agricultural resources has not been proceeding fast enough to meet the increasing domestic demand for food or the changing composition of the Brazilian diet does not mean that significant changes have not been under way. In 1948–52, coffee still held a marked lead in its contribution to São Paulo's gross farm income (32 per cent) followed by cotton (16 per cent) and cattle (13 per cent). Rice, corn, milk, and sugar-cane together accounted for another 23 per cent. Crops still provided 78 per cent of total income, as compared with only 22 per cent for livestock products. But the stage was now set for an acceleration in the diversification of São Paulo's agriculture. Thus, during the 1950's, coffee's share of gross farm income fell from 32 to

[19] Werner Baer, *Industrialization and Economic Development in Brazil,* Homewood, Illinois, 1965, pp. 48–58, 117–18, 161–62.

19 per cent, cotton's share from 16 to 9 per cent, and rice's share from 8 to 6 per cent. The contribution of cattle production grew from 13 to 18 per cent, actually surpassing coffee in 1960 and 1961. The combined share of coffee, cotton, and rice dropped from 56 to 34 per cent. The combined shares of corn, sugar-cane, potatoes, peanuts, beans, and tomatoes increased from 18 to 28 per cent. Nonetheless, the share of all crops was reduced from 78 to 66 per cent, while the contribution of cattle, milk, swine, and eggs combined showed an increase from 22 to 34 per cent.[20]

Despite these recent changes, São Paulo in 1962 still ranked first among the states in the total output of cotton, sugar-cane, potatoes, bananas, oranges, fowl, and eggs; second in coffee and milk; third in number of cattle and in corn and beans; fourth in rice; and fifth in swine. São Paulo's agricultural economy was at last entering a new, more mature stage with the growth of the state's industrial-urban complex. Finally settled to its western limits, the state was in the process of replacing its previously migratory and exploitative export-oriented agriculture with a more stable and conservative system, oriented more toward supplying the rapidly growing food needs of domestic urban markets and more firmly based on modern scientific knowledge and the use of the purchased agricultural inputs, which the new industrial sector was now in a position to furnish, hopefully at remunerative prices.

Industrial-Urban Development in São Paulo

São Paulo's industrial-urban development lagged several decades behind its agricultural development. The manufacture of cotton textiles, Brazil's pioneer manufacturing industry, was at first concentrated in Bahia and other eastern and northern states. By 1900, however, this industry was centered in the city of Rio de Janeiro. Only after 1914 did São Paulo outstrip Rio in textile production, accounting by 1919 for 36 per cent of Brazil's textile output. In 1907, São Paulo had only 16 per cent of the nation's manufacturing workers: the Federal District (city of Rio) and adjoining state of Rio de Janeiro had 32 per cent. By 1919, these percentages were 34 and 31, respectively, underscoring São Paulo's dramatic strides in the interim. In the latter year, the state produced (by value of production) not only 36 per cent of Brazil's textiles, but also 55 per cent of its transportation equipment, 38–49 per cent of its nonmetallic mineral products, paper and fiberboard, metal-

[20] Rubens Araújo Dias, "Renda Bruta da Agricultura," *Agricultura em São Paulo*, Vol. 9 (Jan. 1962), Table II, p. 38.

lurgical products, clothing and shoes; and 22–34 per cent of its hides and leather, beverages, food products, furniture, rubber products, chemicals and drugs, and wood products. Of São Paulo's total value added by manufactures, textile products contributed the largest share (29 per cent), followed by food products (20 per cent), clothing and shoes (9 per cent), and beverages (7 per cent)—for a combined total of 65 per cent.[21]

During 1872–1900, the population of the state of São Paulo increased nearly three-fold and during 1900–1920 it doubled again, increasing the state's share of the nation's population from 8.4 to 15 per cent. During the earlier period, the population of the city of São Paulo jumped from about 31,000 to almost 240,000, doubling again to 579,000 by 1920—with the corresponding shares of the state's population at 3.8, 10.5 and 12.6 per cent in the three reference years. Such a high rate of population growth owed much to large-scale immigration. Approximately 1,765,000 foreign immigrants (nearly half Italian and another third Spanish and Portuguese) entered the state during 1880–1920, the equivalent of 77 per cent of the state's total population in 1900. Most immigrants whose ocean passage had been paid by the federal or state government were obligated to agricultural employment, but most nonsubsidized immigrants elected to remain in the cities. During the periodic crises in coffee (e.g., in 1902–08), the influx of foreign immigrants declined sharply, but urban growth continued on the basis of increased internal rural-urban migration of the foreign-born as well as native-born population. The large foreign-born component of this internal migration is reflected in the statistics for the city of São Paulo. By 1920 35 per cent of the population was foreign-born as compared with only 16 per cent for the rest of the state.[22]

Up to 1920, São Paulo had also attracted, besides this valuable human capital from abroad, an increasing flow of foreign investment capital directed toward developing coffee plantations (although foreign ownership was never a substantial factor), railways and electrical power installations, and a limited amount of manufacturing. It was during the war years 1914–20 that São Paulo's industrial development received its first major impetus. This happened largely under indigenous business leader-

[21] Cf. Simon Kuznets, Wilbert E. Moore, and Joseph J. Spengler (ed.), *Economic Growth: Brazil, India, Japan*, Duke University Press, Durham, N.C., 1955; especially the chapters contributed by George Wythe (pp. 37–41 and 49) and Stanley J. Stein (pp. 430–40).

[22] Vicente Unzer de Almeida and Octavio Teixeira Mendes Sobrinho, *Migração Rural-Urbana*, Secretaria da Agricultura do Estado de São Paulo, 1951, p. 80; and Kuznets, *et al.*, *op. cit.*, pp. 39–40 and 439–40.

ship, although the representation of foreign-born was probably higher than proportionate. The elimination of foreign competition in the face of the scarcity of industrial goods and shipping—combined with high wartime profits on exports of primary products and with high domestic purchasing power—provided the opportunity, promptly seized, for a considerable expansion of domestic manufacturing. As a result, by 1920 real industrial production in Brazil stood at about 250 per cent of its 1914 level and in São Paulo at about 340 per cent. Even so, in 1920, only 13 per cent of the Brazilian labor force was gainfully employed in "manufacturing," a category in which many small workshops and domestic handicraft operations were included.

The 1920's were not a very propitious period for further Brazilian industrial development. The renewed influx of foreign manufactures was a setback to Brazil's fledgling industries at a time when government policy, while protecting coffee producers to an extent that encouraged substantial overproduction, yielded to a resurgence of "free-trade" sentiment in the country and shunned industrial protection. Nonetheless, a number of large-scale industrial plants (including numerous branch factories of U.S. firms) were established, notably for automobile assembly and the production of electrical appliances, tires, cement, rayon, and corn products. As a consequence, São Paulo's real industrial production may have again trebled during 1920–29, although in 1928–29 it stood at only 50 per cent above its previous peak of 1923.[23]

In the onslaught of the Great Depression Brazilian exports were halved, but because of the protectionist aspects of the sharp drop in foreign exchange, such industrial production as Brazil already enjoyed, was hardly affected. Even at its low point in 1932, it was only 12 per cent below its 1928 peak for Brazil and only 20 per cent below for the state of São Paulo. Thereafter, the vast pump-priming operation associated with coffee-defense policy began to produce results. First, much idle plant capacity was brought into use, with very favorable effects on industrial profits. These made possible the purchase of second-hand machinery at low prices from abroad and subsequent new industrial investment, much of it probably of agricultural origin. Thus, we find that by 1940 Brazilian industrial output was 52 per cent above its 1928 high, while both exports and imports were still one-third below their level of 1926–30. During the period 1928–40, there was a significant increase in the variety of chemicals, metal products, processed foods, textiles, and paper produced, while the production of cottonseed oil and

[23] Baer, *op. cit.*, pp. 15–20 and Table 2–3 (p. 21); and Kuznets, *et al.*, *op. cit.*, pp. 40–41.

vegetable shortening grew in conjunction with expanded cotton culture. Nonetheless, while labor productivity had undoubtedly increased considerably since 1920, the growth of manufacturing employment had barely outpaced that of the total labor force, the former's share of the latter going from 13 to 14 per cent.

During 1919–39, manufacturing employment in São Paulo more than trebled. The state's share of the national total increased from 30 to 34 per cent and its share of national value added from 34 to 39 per cent. The combined share of value added by the city and adjoining state of Rio de Janeiro had remained constant at 28 per cent. Of the other states, representing secondary centers of industrialization, Rio Grande do Sul had declined in relative importance from 11.5 to 9.1 per cent while Minas Gerais and Pernambuco had shown gains, from 5.6 to 7.8 per cent and from 4.3 to 4.9 per cent, respectively. These four (excluding São Paulo) plus the Federal District (city of Rio) just about maintained their share of 49–50 per cent of the nation's total value added. In 1939 these states plus São Paulo accounted for 89 per cent. The primacy of São Paulo is shown by its contribution to the nation's value added, as follows: by manufactures of transportation equipment, electrical products, mechanical products, and textiles—66–87 per cent; by public utilities, chemicals and drugs, paper, clothing and shoes, furniture, metallurgical products, printing and publishing, and beverages—38–49 per cent; and by tobacco products, rubber goods, and food products—33–34 per cent. During 1919–39, the composition of São Paulo's total value added (excluding construction, public utilities, and extractive industries) had significantly changed. While textiles and food products still contributed 28 and 15 per cent, respectively, their combined share plus clothing, shoes, and beverages, had dropped from 65 to 52 per cent, while the combined share of chemicals and drugs, transportation equipment, nonmetallic mineral products, and metallurgical products had increased from 18 to 31 per cent.

During 1920–40, while the population of the state of São Paulo increased by 56 per cent (as compared with 35 per cent for the whole nation), the population of the city of São Paulo more than doubled to 1,326,261 (its share of the state's population growing from 12.6 to 18.5 per cent). By 1940, with 17.4 per cent of the nation's population, the state had 28.3 per cent of all cities of 10,000 or more (and 31 per cent of the population living in such cities) and 14.1 per cent of the rural population. This continued high rate of population growth had become increasingly a function of internal migration. Most of the 659,000 foreign immigrants (24 per cent Japanese, 22 per cent Portuguese, and

22 per cent Italian and Spanish) which the state received during 1921–46 entered before the more restrictive immigration policies went into effect after 1930. As a result, during 1920–40, the foreign-born share of the population dropped from 35 to 22 per cent in the capital city and from 16 to 9 per cent in the rest of the state. Even in 1940, however, about 60 per cent of São Paulo's population was still rural and employed in agriculture. Significantly, the illiteracy rate in São Paulo was 48 per cent, still relatively high, although the national average was 62 per cent.

With its decided headstart São Paulo was in an ideal position to take advantage of the Second World War and of the conscious shift of the Brazilian government to an all-out policy of industrialization that followed in the 1950's. Thus, São Paulo's share of the nation's manufacturing employment, 34 per cent in 1939, increased to 38 per cent in 1949 and attained 50 per cent by 1962; and its share of the nation's value added increased from 39 to 47 per cent during the 1940's reaching 57 per cent in 1962.

São Paulo may be considered part of a broader industrial complex that is growing up within the triangle defined by the cities of São Paulo, Belo Horizonte (Minas Gerais), and Rio de Janeiro. But considered without São Paulo, this area's share of national value added fell from 36 to 23 per cent during the period 1939–62. At the same time the share of the state of Rio dropped from 28 to 18 per cent and that of the state of Minas Gerais from 7.8 to 5.3 per cent. During the same period, the shares of the outlying industrial centers of Rio Grande do Sul and Pernambuco also dropped, from 9.1 to 6.7 per cent and from 4.1 to 2.4 per cent, respectively.[24]

By 1962, São Paulo's share of the nation's value added was as follows: by transportation equipment, rubber goods, electrical appliances, and mechanical products—75–89 per cent; by paper, plastics, chemicals and drugs, textiles, furniture, metallurgical products, nonmetallic minerals, and clothing and shoes—50–65 per cent; and, by printing and publishing, food products, and public utilities—41–46 per cent. Of the six leading industries in São Paulo, transportation equipment now led with 15.8 per cent of total value added, followed by textiles, down to 14 per cent; chemicals and drugs, 11.7 per cent; metallurgical products, 11 per cent; food products, down to only 9.6 per cent; and electrical goods, 7.8 per cent. Since 1940, the composition of São Paulo's industrial

[24] The data for 1939 and 1949 are based on the Censuses of 1940 and 1950; data for 1962 are from annual Industrial Register (*Anuário Estatístico do Brasil, 1965,* Rio de Janeiro, 1965, p. 104 *et seq.*).

production had shifted sharply toward the more skilled, durable-consumer-goods and heavy-producer-goods industries. The combined share of textiles, food, clothing and shoes, and beverages (65 per cent in 1919) fell from 52 to only 28 per cent during 1939–62; and the combined share of wood products, furniture, tobacco products, and hides and leather (10 per cent in 1919) fell from 7 to 4.4 per cent. These eight industries combined, which had accounted for 75 per cent of São Paulo's 1919 value added and still accounted for 40 per cent for all Brazil, accordingly dropped from 59 to 32 per cent in the same period.

By 1949, Brazil was already nearly self-sufficient (imports less than 5 per cent of domestic consumption) in processed foods, beverages, printing and publishing, and textiles. By that time, its domestic manufacture of paper, cement, and iron and steel were already sufficiently developed to require imports of only 18–25 per cent of domestic needs. On the other hand it was still heavily dependent (39–80 per cent) upon imports to meet its requirements for chemicals, machinery, electrical goods, motor vehicles and other transportation equipment, and nonferrous metal products. Ten years later, thanks to a drive to develop import-substituting industries, Brazil had attained virtual self-sufficiency in cement while continuing to import only 12–18 per cent of its paper, electrical products, motor vehicles, iron and steel, and chemicals. While Brazil still imported 57 per cent of its metal-working machinery (down from 69 per cent a decade earlier), it had cut its imports from 58 to 23 per cent for other machinery; from 80 to 37 per cent for nonferrous metal products; and from 60 to 38 per cent for transportation other than motor vehicle.[25]

In an evaluation of this recent period of government-induced industrialization in Brazil, Huddle has noted its high opportunity costs as the seeds of its undoing. It was only with the establishment of the multiple-exchange system and a policy of inflationary financing in 1953 that the government began to exercise a strong direct influence on the progress of industrialization. Under the new exchange policy, favored industries could import capital goods at one-fifth to one-sixth of the exchange cost to other industries while enjoying absolute protection against foreign competitors. The effects of inflation were, in turn, to transfer resources from the rest of the economy to the government, which loaned them to the same favored industries. With other sources of funds for long-term investment (including retained industrial earnings) insufficient, the government during 1953–59 extended to the favored industries heavily subsidized loans in an amount equivalent to the total private fixed-capital

[25] Baer, Table 3-13, p. 75.

formation in all industry during the same period. These public loans averaged 20–30 per cent of the profits of industry as a whole and a much higher percentage of the profits of the favored industries, which may have even reduced their own savings out of profits as a result of the government's generosity.

By the late 1950's, says Huddle, unfavorable factors began to appear. As industrialization widened, the original infant industries had to purchase more and more inputs from new, high-cost industries with unreliable delivery schedules. Furthermore, with agriculture neglected and the prices of agricultural inputs increased, food products began to rise and workers began to demand higher wages, more frequently adjusted for inflation. Efforts to neutralize this development through price controls and export restrictions on food products were unsuccessful and tended to reduce import capacity and to drive up the exchange price of imports. This happened despite a new policy of import-substitution in the automobile-parts industries, a policy whose effects (indirect as well as direct) reduced imports less than appeared on the surface. With this switch in public favor to the automotive industries together with the steady rise in food prices and wages, the nonautomotive industries found themselves in an increasingly difficult financial position. Moreover, the industries favored by the government were increasingly capital intensive, with a strong antiemployment bias that created a hardship for the unskilled, not only in the urban areas, but also in rural regions where workers could hope for nothing better, if they migrated to the cities, than employment in a low-productivity service industry. Huddle concludes that, if the new industrialization strategy of 1957–58 "had been focused instead upon removing disincentives in the agricultural and export sectors, while retaining the incentives earlier given to a broad spectrum of manufacturing industries, the post-1962 stagnation, as well as increasing unemployment and underemployment, might have been averted." [26]

Whether or not Huddle's pessimistic but plausible appraisal of Brazil's recent industrialization policy is fully justified, there can be little doubt that São Paulo was the major beneficiary. During 1940–62, the state's population again virtually doubled. Its share of the nation's population was 18.4 per cent, compared to 17.4 per cent in 1940 and 15 per cent in 1920. The 1950's saw the city of São Paulo finally pass the city of Rio to become Brazil's largest. In 1962 its population of 4,251,000 was

[26] This and the preceding paragraph are a summary of a recent preliminary paper by Don L. Huddle, "Notes on the Brazilian Industrialization: Sources of Growth and Structural Change 1947–1963," Economic Growth Center, Yale University ("Center Paper No. 30"), June 2, 1967 (mimeo.); particularly pp. 18–23.

30.7 per cent of the total for the state, compared to 18.5 per cent in 1940 and 12.6 per cent in 1920. During 1940–50, the number of cities in the state with a population of 20,000 or more increased from 16 to 28. By 1960, rural population was only 37 per cent of the total in São Paulo compared to 60 per cent in 1940 and 54 per cent in Brazil in 1960.

Much of this population growth resulted from internal migration from the poorer states, São Paulo gained some 557,000 native-born in-migrants (approximating the 581,000 lost by the northeastern states of Bahia, Ceará, and Pernambuco) during 1940–50 alone. To some extent this migration was rural-to-rural, with in-migration to the rural areas of São Paulo partially offsetting rural-to-urban migration of persons born in the state. Although the old Federal District (city of Rio) gained 788,000 in-migrants (clearly rural-to-urban) during the 1950's, rural-to-rural migration continued to be important throughout that decade because of the attraction of the remaining agricultural frontiers. Thus the three frontier states of Paraná, Goiás, and Mato Grosso—all within São Paulo's economic orbit—gained close to 900,000 people by net in-migration during 1940–50 and perhaps 2,000,000 or more during 1950–60. This is approximately one-third of the total rural-to-urban migration in Brazil during the two decades. During the same two decades, the northern state of Maranhão may have gained 250,000 or more by in-migration.[27]

The New Problem: Generalizing São Paulo's Development to All of Brazil

Clearly, if the state of São Paulo (with a per capita income of $605 in 1960) were a separate country, it would already be approaching (like Japan) a developed-country status. Unfortunately, as Brazilians have been saying for two or three decades, "São Paulo is the locomotive pulling twenty freight cars"—meaning of course, the other twenty states of Brazil. But the fact that Brazil finally *has* a locomotive, a state whose power is already substantially contributing to the economic development of the whole southeast region which it dominates, represents no mean achievement. The principal remaining problem is that of reducing the wide interregional income disparities. Those are dramatized by the comparisons of Table 1. There it will be noted that in 1960 the eight states constituting the "southeast" region (dominated by the cities in São Paulo and Rio de Janeiro) had 61 per cent of the nation's popula-

[27] Cf. a preliminary benchmark study on Brazilian agriculture by J. Edward Schuh and Eliseu Roberto Alves, mimeo. draft of June 1967, particularly pp. 21–25, and 42 of Chapter 1.

TABLE 1

Brazil: Per Capita Income, Population, and National Income – by Region, 1947 and 1960

Region[a]	Number of States	Percentage of Total Land Area	Population Growth, 1950–60 (1950=100)	Per Capita Income (in U.S. Dollars) 1947 Avge.	1947 Range[b]	1960 Avge.	1960 Range[b]	Avge. as per cent of 1947	Regional Distribution (percentage of national total) Population 1950	Income 1947	Population 1960	Income 1960
Southeast	8	17.7	141	315	151–742	456	218–989	145	59	79	61	80
Rio–Rio	2	0.5	144	403	225–742	653	323–989	162	9	19	10	18
S. Paulo–Parana	2	5.3	153	380	232–414	547	377–605	144	22	36	25	39
Other	4	11.9	130	207	151–274	296	218–408	143	28	25	26	23
Mid–West	2	22.1	165	126	103–178	211	187–265	167	3	2	4	2
Arid Northeast	8	14.3	122	115	83–142	180	99–204	157	32	16	28	15
Humid North	3	36.9	148	122	74–211	156	116–231	128	6	3	7	3
Brazil	21	91.0[c]	136	225	74–742	340	99–989	151	100[c]	100[c]	100[c]	100[c]

Source: Werner Baer, *Industrialization and Economic Development in Brazil,* Homewood, Ill., 1965, Table 7-7, p. 170.

[a]The several states have been combined into the following regions and subregions: *Southeast* – The old Federal District (city of Rio) and the state of Rio de Janeiro; Sao Paulo and Paraná (the principal coffee states); and Minas Gerais, Espirito Santo, Santa Catarina, and Rio Grande do Sul. *Mid-West* – Goías and Mato Grosso. *Arid Northeast* – Ceará, Rio Grande do Norte, Paraíba, Pernambuco, Alagoas, Sergipe, Bahia, and Piauí. *Humid North* – Amazonas, Pará, and Maranhao.

[b]Lowest and highest per capita incomes within region.

[c]Excludes four territories with 9 per cent of the land area but only 0.47 per cent of the nation's population.

tion and, with a per capita income of $456, 80 per cent of its national income.

The two frontier states that composed the midwest region, sparsely populated yet clearly within São Paulo's orbit, ranked second with only $210, but, in respect to both population and per capita income, were expanding faster than any other region. As a result, per capita income in the midwest region, relative to the southeast's, rose from 40 to 46 per cent during 1947–60. Much more important in 1960, however, was the "arid northeast," made up of eight states with a per capita income of $180, only 39 per cent of that enjoyed in the prospering southeast region. This clearly disadvantaged region, with 28 per cent of the nation's population, received only 15 per cent of the national income. It was the only major region with a declining share of the population during 1950–60. Finally, the three states of the "humid north" region, largely in the Amazonian rain forest, had in 1960 a per capita income of $156, only 34 per cent of that of the southeast, as compared to 39 per cent in 1947. Even the northeast had succeeded in closing the income gap with the southeast slightly (from 37 per cent in 1947), thanks largely to its low rate of population growth (lowest of the four regions), a consequence of heavy out-migration. The north region's population, on the other hand, grew at a much faster rate, so that even though aggregate income increased, the effects of this gain on per capita income were partially canceled.

In the period 1947–60, five states (including São Paulo) within the southeast region enjoyed increases of 44–49 per cent in per capita income. By comparison the national average increase was 51 per cent. The state of Paraná had an increase of 62 per cent, far above the national average. Paraná doubled its population, chiefly because of large-scale settlement on its rich agricultural frontier. Three states, Minas Gerais, Santa Catarina, and the old Federal District, showed relatively low gains of 33–39 per cent. In both 1947 and 1960, the eight states of the southeast region ranked among the top ten in terms of per capita income. The highest ranking states in 1960 were the old Federal District ($989), São Paulo ($605), Rio Grande do Sul ($408), Paraná ($377), Rio de Janeiro ($323), and Santa Catarina ($306). Only the last two changed rank between 1947 and 1960. In 1947 the two remaining states of the southeast, Minas Gerais ($241) and Espirito Santo ($218) ranked ninth and tenth, while Amazonas (still enjoying the ephemeral wartime rubber boom) ranked seventh and Mato Grosso eighth. In 1960 the two southeastern states ranked eighth and tenth, with Mato Grosso ($265) in seventh and Amazonas ($231) still in ninth place.

In the latter year, Pernambuco led the northeast region with $204, having displaced the Amazonian state of Pará for eleventh place.

With 61 per cent of Brazil's population, the eight southeastern states in 1960–62 had 49 per cent of the nation's agricultural labor force, 62 per cent of its cropland, 91 per cent of its tractors, and 58 per cent of its cattle. They accounted for 65 per cent by value of the nation's crop production and 81 per cent by value of its milk production, and they slaughtered 72 per cent of the nation's cattle and 78 per cent of its hogs. With 82 per cent of Brazil's installed electrical generating capacity and 88 per cent of its personnel engaged in manufacturing, the southeast accounted for 89 per cent of all value added by manufacturing. This group of states had 72 per cent of those engaged in wholesale and retail trade in the nation and they handled 85 per cent of this trade. Thus, by 1960 the states of the southeast region had more or less generally entered into a phase of self-sustaining economic development. Coffee had provided the original impetus (as it was still doing in Paraná) but the subsequent substantial industrial-urban development in São Paulo and Rio de Janeiro had gradually spread to the other states of the region, further strengthening both the agricultural and the nonagricultural sectors.

By 1950 industrial-urban development had already had important favorable effects on agricultural incomes and productivity in São Paulo. This can be demonstrated by an investigation of the period 1940–50, before government policy had substituted a strong element of direction and control for the free play of market forces.

INDUSTRIAL-URBAN DEVELOPMENT AS A DYNAMIC FORCE IN TRANSFORMING BRAZILIAN AGRICULTURE, 1940–50

In 1961, Anthony M. Tang and the author completed a ten-year research project on the effects of industrial-urban development (via the factor markets) on agricultural productivity and income in the Southern Piedmont and the Tennessee Valley. Each of us studied a group of some twenty contiguous counties that had a common historical and cultural background, and that 50–75 years ago had approximately the same dependence on agriculture and roughly the same levels of output per farm worker. Each group was differentiated into counties

that had remained largely rural-agricultural (the control group) and those that had since experienced substantial industrialization.

We observed that, during the preindustrial period, initial income differences attributable to differences in "original" physical endowment tended to disappear through factor transfers (particularly labor) despite imperfections in the factor markets. We further observed, however, that over a half century, those counties that experienced differentially higher rates of industrial-urban development also enjoyed increasingly superior capital-labor ratios and labor productivity within their agriculture, while neighboring counties that lacked industrial-urban development also lagged behind on the agricultural side. These findings thus strongly support the view that local industrial-urban development makes an important positive contribution to the efficiency of the local factor and product markets, thereby greatly facilitating the transfer of excess labor from, and of needed capital to, agriculture, within the immediate environs of the growing industrial center.[28]

During 1961–62, I conducted a study of the state of São Paulo along similar lines, using data from the federal censuses of 1940 and 1950. This state, containing the industrial heartland of Brazil, was the natural choice, not only because of the level of nonagricultural development reached, but also because of the length of time over which the development had been going on—presumably ample in this case for the effects on agriculture to become fully apparent. As a substitute for the counties used as subareas in the U.S. study, I used the "twenty-three physiographic zones" distinguished in the 1950 census. Because of the inadequacies of earlier censuses, the analysis was limited to the decade 1940–50. Hopes of adding the decade 1950–60 have so far been thwarted by the long delays in publication of the 1960 census results.

Because it is many times larger than our previous twenty-county study areas, São Paulo has perhaps a somewhat smaller degree of historical, socio-economic, and cultural homogeneity. Much more serious, however, is the effect of the shorter time period. Because the analysis spans only a single decade, it was impossible to compare unindustrialized subareas with industrialized ones on the basis of similarities that existed in the preindustrial era. Hence in the São Paulo study there is no con-

[28] See Anthony M. Tang, *Economic Development in the Southern Piedmont, 1860–1950: Its Impact on Agriculture,* Chapel Hill, 1958; and the summary article, William H. Nicholls, "Industrialization, Factor Markets, and Agricultural Development," *Journal of Political Economy,* Vol. XLIX (August 1961), pp. 319–40.

trol group. Nonetheless, the results proved to be of sufficient interest to warrant presentation in summary form here.[29]

As in our previous analyses, per capita value added by manufacture in 1949 was used as the index of industrial-urban development. The twenty-three physiographic zones were ranked in terms of this index and of a large number of other indexes of nonagricultural development and agricultural and population characteristics in both 1939–40 and 1949–50. The former set of rankings were then systematically correlated with the latter sets.

Industrial Development and Structural Characteristics of Agriculture

Table 2 presents some of the interrelationships found between industrial development and various structural characteristics of agriculture. Although the comparisons shown by the averages for Brazil and São Paulo are also instructive, being generally consistent with São Paulo's higher level of industrial-urban development, we shall focus our attention upon the rank correlation coefficients for the twenty-three zones *within* São Paulo.

First, in regard to land utilization, we find that in both 1940 and 1950 São Paulo's more industrialized zones had relatively more of both cropland and pastureland than did the less industrialized. Having undergone an earlier agricultural development, and enjoying better market opportunities, they also had relatively less unused arable land and natural woodland. However, these distinctions weakened in most cases during 1940–50, a reflection, in all probability, of the clearing of woodland and the expansion of cropland and pastureland that were underway in the newer (and less industrialized) agricultural zones. (In our Tennessee Valley study, the more industrialized zones also tended to have more improved land—cropland plus plowable pasture—and less woodland; the comparable coefficients were .408 * and −.310, respectively, in 1950.[30]) Second, while there was not a very strong correlation between industrial development and particular *types of farming,* the more industrialized zones did have a significantly greater number (relatively) of livestock-feeding (finishing) farms and farms of mis-

[29] The detailed results were presented in a preliminary draft, William H. Nicholls, *Industrial-Urban Development and Agriculture in São Paulo, Brazil, 1940–50,* Nashville, Tenn., Dec. 1962, pp. 254.

[30] Hereafter, the comparable coefficients for the Tennessee Valley (TV) in 1949–50 will be inserted in various places in the text parenthetically and without comment.

cellaneous type and a somewhat less significantly greater number of livestock-breeding and crop-livestock farms with fewer crop farms.

Third, relative to their land resources, the more industrialized zones were not significantly different in number of cattle (TV .317). They did, however, show a consistently greater milk production (again reflecting greater market outlets) in both 1940 and 1950 than the zones of lesser industrial-urban development. While the more industrialized zones had significantly *less* chicken and egg production in 1939–40 relative to land area, this gap had nearly been closed by 1949–50. While poultry production is hardly dependent upon land area, it is probable that the farmers of the more industrialized zones were already less self-sufficient (producing less for home consumption) in 1940, and that the increase in commercial production noted in 1950 reflects the beginnings of their response to urban market demands. This increase was sufficient to offset the previous effect—a trend that probably continued in the 1950's to make the correlation coefficient significantly *positive*. However, the strong tendency for hog production per thousand hectares of cropland to be lower as the zone was more industrial, was only slightly weakened during 1940–50 (TV .459 **).

Fourth, in terms of the amount of cropland devoted to different crops (as measured by total physical production), the more industrial-urban zones produced relatively more coffee, sugar-cane, and cotton, crops on which they depended heavily—and produced relatively *less* of such major subsistence crops as beans, corn (TV −.256), and manioc. The lead of the first three crops was increased during 1940–50, but the inferiority of the latter crops decreased, perhaps because the later-settled, less industrialized zones were beginning to produce those products (and swine) on an increasingly commercial basis. In any case, the zones of greater industrial-urban development showed a much higher value of output per thousand hectares of all farmland than did the less industrialized zones. While the more industrialized zones did not as yet derive a significantly higher percentage of their total farm income from livestock and livestock products (and less from crops) than the more agricultural zones, developments during 1940–50 indicated a trend toward this stage. (In the Tennessee Valley, a marked shift in relative income from corn and tobacco—its major, labor-intensive cash crop—to livestock production took place during 1930–50. In 1949 coefficients in the more industrial countries were −.580 ** and +.580 **, respectively, for the crop and livestock shares of total income, indicating, perhaps, the direction of trends in São Paulo after 1950.)

In general, industrial-urban development was not significantly re-

TABLE 2

Structural Characteristics of Agriculture, Brazil and Sao Paulo: Selected Indexes with Comparisons between the National and State Averages, 1949–50, and with Coefficients of Rank Correlation Between These Indexes and 1949 Per Capita Value Added by Manufacture for Twenty-three Zones of Sao Paulo, 1939 and 1949[a]

Index Correlated with 1949 Value Added by Manufacture Per Capita	Average 1949–50[b]		Rank Correlation Coefficients	
	Brazil	S. Paulo	1939–40	1949–50
Percentage of all farmland (area) by use				
Cropland	8.2	22.4	.590**	.439*
Pasture	46.3	45.5	.399*	.359*
Unused arable land	14.8	12.4	-.367*	-.400*
Woodland – natural	23.6	13.0	-.445*	-.192
Woodland – reforested	0.5	1.6		.703**
Percentage of all farms (number) by type				
Livestock-feeding farms	1.4	2.0	–	.360*
Livestock-breeding farms	6.7	5.3	–	.293
Crop-livestock farms	29.0	22.2	–	.266
Crop farms	60.0	65.2	–	-.185
Other types	1.1	1.6	–	.483**
Production per 1,000 hectares pasture				
Milk (thousands of liters)	25.6	59.5	.582**	.513**
Head of cattle (excl. calves and oxen)	342	547	.184	.126
Production per 1,000 hectares of all cropland				
Coffee (tons)	102	203	.392*	.442*
Sugar-cane (tons)	1,200	1,123	.263	.486**
Cotton (tons)	40	105	.256	.258
Rice (tons)	146	174	.061	.120
Manioc (tons)	578	53	-.298	-.215
Corn (tons)	349	278	-.342	-.160
Beans (tons)	65	23	-.504**	-.394*
Eggs (thousands of dozen)	9.7	10.2	-.426*	-.033
Chickens	3,871	3,027	-.606**	-.179
Hogs (excluding pigs)	676	379	-.658**	-.607**
Value of farm output per 1,000 hectares farmland	n.a.	$31,267	.638**	.584**
Total value of output per farm	n.a.	$2,683	.658**	.638**

(continued)

TABLE 2 (continued)

Index Correlated with 1949 Value Added by Manufacture Per Capita	Average 1949–50[b]		Rank Correlation Coefficients	
	Brazil	S. Paulo	1939–40	1949–50
Percentage of total farm income from				
Crops	n.a.	81	.311	.107
Livestock	n.a.	19	-.311	-.107
Farmland per farm (hectares)	112.5	85.8	.200	.084
Percentage of all farms with farmland of				
Less than 2 hectares	7.9	1.3	.052	.230
2–99 hectares	84.2	85.5	-.160	-.151
Greater than 500 hectares	3.7	2.7	.286	.340
Greater than 5,000 hectares	0.22	0.09	-.005	-.144
Percentage of all farmland (area) in farms of				
Less than 2 hectares	–	–	–	–
2–99 hectares	16.6	24.7	-.077	-.268
Greater than 500 hectares	62.1	46.8	.130	.200
Greater than 5,000 hectares	26.7	10.9	-.168	-.354*
Percentage of farmland in largest 5 per cent of farms	68	57	.009	.066
Percentage of all farms (number) with cropland of				
Less than 2 hectares	25.4	6.1	n.a.	.061
Less than 100 hectares	99.4	97.5	n.a.	-.602**
Greater than 1,000 hectares	.01	.04	n.a.	.544**
Percentage of all farms, "large scale" farms by type				
All	9.5	17.6	n.a.	.520**
Crop-livestock	1.3	3.2	n.a.	.506**
Crop	4.7	12.6	n.a.	.279
Livestock	3.5	1.8	n.a.	.014
Percentage of all farms (number) operated by				
Hired administrator	5.6	7.9	.695**	.633**
Owner	75.2	64.6	.334	-.068
Cash-renter	9.0	24.0	-.309	.141

(continued)

TABLE 2 (concluded)

Index Correlated with 1949 Value Added by Manufacture Per Capita	Average 1949–50[b]		Rank Correlation Coefficients	
	Brazil	S. Paulo	1939–40	1949–50
Percentage of farm labor force supplied by				
All male workers	59.3	73.5	.476**	.302
Operator-family workers (males)	31.5	34.7	-.567**	-.388*
Permanent wage employees (males)	10.9	27.1	.605**	.629**
Resident share-croppers (males)	6.9	10.1		.085
Nonresident share-croppers (males)	1.9	0.9		.296
Temporary wage workers (males)	19.1	10.5	-.145	-.458*
Number of farm workers per farm	4.41	5.76	.583**	.483**
Value of field machinery per farm	$29	$91	.683**	.579**
Motorized vehicles per 1,000 hectares of cropland				
Field tractors	0.37	0.75	.420*	.400*
Motor trucks	1.29	2.18	.412*	.366*
Percentage of all farms (number) by type of power				
Animal	26.9	53.2	–	.405*
Animal and mechanical	0.3	1.2	–	.369*
Manual only	72.9	45.6	–	-.471*

Source: Brazil's General Censuses of 1940 and 1950.

[a]The statistical significance of the correlation coefficients is indicated at the 1 per cent level (**) and 5 per cent level (*).

[b]National and state average for each index. Units as indicated except that all values are in U.S. dollars, converted at the rate of 30 Cruzeiros per dollar.

lated to the *size distribution of landholdings*. The more industrial zones did show a more marked differentiation in size extremes, with relatively more farms of very small size (less than 2 hectares) and of large size (greater than 500 hectares). But, if we take land area into account, we find that these zones had less land held in huge (greater than 5,000 hectares) farms. There was no relationship between industrial development and concentration of land ownership, although if *cropland* only is considered, industrialized zones had relatively fewer farms with less than 100 hectares and relatively more with more than 1,000 hectares. In any case, the farms of the more industrialized zones were more intensively utilized, with significantly larger proportions classified by the census as "large-scale" farms (requiring rather modest minimum absolute levels of cropland and livestock numbers) and as "large-scale" crop-livestock farms, although the same was not true for "large-scale" crop or livestock farms.

While by far the most common *farm-operator* in all parts of São Paulo was the landowner (whether operating the unit through share-cropper subunits or as a single unit with his family and cash-wage workers), the moderate but nonsignificant tendency in 1940 for the more industrialized zones to have relatively more owner-operated farms and fewer renter-operated farms (TV .337 and −.337) had completely disappeared by 1950. However, the more industrialized zones in both years had relatively many more farms operated by hired administrators, suggesting a higher rate of landlord absenteeism and a more commercialized operation.

The tendency of industrial-urban development to bring with it a more highly mechanized and commercialized agriculture is reflected by the *changing composition of the farm labor force*. Thus, in 1940, the more industrialized zones clearly showed a heavier dependence upon male labor, probably reflecting the more mechanized nature of their agriculture. The subsequent weakening of this relationship is perhaps attributable to the extent to which manual operations declined even in the less industrialized zones. Otherwise, the most notable difference between the more and less industrialized zones was the former's much heavier relative dependence in 1950 on permanent (monthly or full-time) cash-wage employees and (reflecting the greater scarcity of casual labor in an industrial-urban zone) lighter relative dependence on *temporary* cash-wage day labor. While the more industrialized zones were not yet less dependent upon share-croppers than the more agricultural zones, this relationship probably turned significantly negative during the 1950's as more and more large landowners abandoned cropping on shares for

a system in which the entire landholding was operated as a single unit with considerable farm machinery and cash-wage workers. The weakening of the tendency for the more industrialized zones to draw a smaller proportion of their farm-labor force from farm-operator families than did the zones of lesser industrialization may reflect the fact that, as tractor-drawn machinery has displaced animal equipment and the hoe, landowners have proved more willing to participate personally in field operations.

It is also interesting to note that, while there was no significant difference between the zones of greater and lesser industrial-urban development in *average size of farm,* as measured by area of farmland (TV .000), the more industrialized zones in São Paulo had more farm workers (TV .326) and a higher value of farm machinery (TV .184) and total output per farm (TV .433 *) than the less industrialized. The more industrialized zones also had significantly more field tractors (TV .475 *) and motor trucks per 1,000 hectares of cropland. In all of these respects, however, the strength of the relationship diminished somewhat during 1940–50, reflecting the ever-widening influence of the growing urban centers, with its favorable effects in terms of intensity of land use and the degree of mechanization. Even in 1950, however, São Paulo's more industrialized zones had (relatively) a significantly greater number of farms using animal equipment or animal and tractor draft-power, with relatively fewer farms whose techniques were still wholly manual.

The Impact of Industrialization on the Local Capital Market

Let us now turn to those indexes most closely related to capital resources and to the efficiency of the local capital market in transmitting some of the benefits of industrial-urban development to the capitalization of the nearby agriculture (Table 3).

First, the data indicate that São Paulo's zones of greater industrial-urban development enjoyed distinct advantage in the per capita value of total payrolls and capital (both fixed and inventory capital) in their nonagricultural sector. They also had, even more than their counterparts in the Tennessee Valley, higher per capita bank deposits (TV .729 **) as well as higher per capita bank loans. The more industrialized zones also had a superior infrastructure (as measured by railroad density) and greater human capital as the result of greater investments in primary education (TV −.671 ** for illiteracy rate in 1930) and public health (TV −.200 for infant mortality rate). Their

TABLE 3

Local Capital Market, Brazil and Sao Paulo: Selected Indexes with Comparisons between the National and State Averages, 1949–50, and with Coefficients of Rank Correlation between These Indexes and 1949 Per Capita Value Added by Manufacture for Twenty-three Zones of Sao Paulo, 1939 and 1949[a]

Index Correlated with 1949 Per Capita Value Added by Manufacture	Average 1949-50[b]		Rank Correlation Coefficients	
	Brazil	S. Paulo	1939–40	1949–50
Nonagricultural sector, per capita				
Total payrolls	$16.3	$38.5	.939**	.930**
Fixed capital	55.9	123.4	n.a.	.936**
Inventories	30.0	61.3	n.a.	.751**
Bank deposits	49.5	99.8	n.a.	.840**
Bank loans	42.6	74.1	n.a.	.594**
Kilometers of railroad per 1,000 sq. km. land area	4.4	29.6	n.a.	.863**
Percentage foreign-born				
Total population	2.3	7.6	.518**	.406*
Farm operators	6.3	25.7	.501**	n.a.
Percentage of males 10+ completed primary school	15.0	27.2	n.a.	.856**
Percentage of population 5+ illiterate	57.3	40.4	-.879**	-.896**
Crude rate of stillborn births, 1939–42	n.a.	2.45	-.433*	n.a.
Infant mortality rate, 1939–42	n.a.	175	-.290	n.a.
Persons employed per establishment				
Manufacturing	16.5	23.1	.799**	.701**
Wholesale trade	7.1	8.7	.826**	.597**
Retail trade	2.1	2.3	.740**	.737**
Agriculture	4.4	5.8	.583**	.483**

(continued)

TABLE 3 (continued)

Index Correlated with 1949 Per Capita Value Added by Manufacture	Average 1949–50[b]		Rank Correlation Coefficients	
	Brazil	S. Paulo	1939–40	1949–50
Value of output per establishment				
Manufacturing (value added)	$19,867	$34,470	.880**	.933**
Wholesale trade (sales)	143,660	228,500	n.a.	.334
Retail trade (sales)	8,580	13,477	.755**	.747**
Agriculture (gross output)	n.a.	2,683	.658**	.638**
Value of capital per establishment				
Manufacturing (fixed capital)	19,277	30,617	.880**	.933**
Wholesale trade (fixed capital)	5,923	7,577	n.a.	.334
Wholesale trade (inventories)	28,703	46,437	n.a.	.611**
Retail trade (inventories)	3,057	4,677	.410*	.607**
Agriculture (fixed capital)	n.a.	7,762	.657**	.575**
Capital per person employed				
Manufacturing (fixed capital	1,168	1,325	.375*	.044
Wholesale trade (fixed capital)	835	869	n.a.	-.299
Wholesale trade (inventories)	4,050	5,327	n.a.	.620**
Retail trade (inventories)	1,480	2,021	.308	.430*
Agriculture (fixed capital)	n.a.	1,348	.659**	.468*
Horsepower per person employed in manufacturing	2.14	2.30	n.a.	.154
Output per person employed				
Manufacturing (value added)	$1,204	$1,492	.493**	.488**
Wholesale trade (gross sales)	20,263	26,217	.516**	.519**
Retail trade (gross sales)	4,157	5,820	.770**	.742**
Agriculture (gross output)	n.a.	466	.592**	.479**
Value per hectare all farmland of				
Crop & livestock production	n.a.	$31.3	.638**	.584**
Land and buildings	$20.6	61.2	.685**	.658**

(continued)

TABLE 3 (continued)

Index Correlated with 1949 Per-Capita Value Added by Manufacture	Average 1949–50[b]		Rank Correlation Coefficients	
	Brazil	S. Paulo	1939–40	1949–50
Value per hectare of cropland all				
Crop production	n.a.	$113.3	.194	.396*
Fertilizer purchased	$1.00	$2.80	n.a.	.538**
Insecticides purchased	0.47	1.22	n.a.	.416*
Harvested output (kg/ha.)				
Coffee	790	720	n.a.	-.401*
Rice	1,390	1,250	n.a.	.034
Potatoes	3,540	5,220	n.a.	.289
Cotton (unginned)	440	630	n.a.	.179
Corn	1,250	1,250	n.a.	-.164
Sugar-cane (thousands)	26.9	36.1	n.a.	.442*
Beans	630	550	n.a.	.168
Percentage of pastureland in planted pasture	13.9	42.7	n.a.	.068
Milk production per cow milked (liters per year)	484	621	n.a.	.520**
Per farm value				
Land and buildings	$2,323	$5,247	.687**	.588**
Livestock and machinery	n.a.	2,515	.580**	.209
Crop production	n.a.	2,177	.623**	.549**
Milk and eggs	n.a.	215	.607**	.598**
Animal production	n.a.	292		.089
Land per farm worker (hectares)				
All farmland	25.5	14.9	-.251	-.629**
Cropland	2.10	3.34	.110	.259
Cropland and pasture	13.9	10.1	.233	.489**
Capital per farm worker				
Land and buildings	$527	$911	.660**	.663**
Vehicles and workstock	32	48	.344	.703**
Productive livestock	n.a.	220	.175	-.177
Field machinery	7	16	.603**	.418*
Stationary machinery	5	8		.517**
Value, all nonrealestate capital	n.a.	292	.428*	-.140

(continued)

TABLE 3 (concluded)

Index Correlated with 1949 Per-Capita Value Added by Manufacture	Average 1949–50[b]		Rank Correlation Coefficients	
	Brazil	S. Paulo	1939–40	1949–50
Value of production per worker				
Crop production	n.a.	$378	.550**	.445*
Milk and egg production	n.a.	37	n.a.	.411*
Animal production	n.a.	51	n.a.	-.135
Rural dwellers per room (average)	1.23	1.17	n.a.	-.493**
Rural housing amenities; percentage with				
Electric lights	1.4	3.9	n.a.	.685**
Piped water	3.6	12.7	n.a.	.781**
Toilet apparatus	10.4	21.8	n.a.	.672**

Source: Brazil's General Censuses of 1940 and 1950.

[a]The statistical significance of the correlation coefficients is indicated at the 1 per cent level (**) and 5 per cent level (*).

[b]National and state average for each index. Units as indicated except all values are in U.S. dollars, converted at the rate of 30 Cruzeiros per dollar.

higher percentage of foreign-born population (TV .646 **) was probably also an asset in both the urban and rural sectors, since this element of the population could be expected to bring with it levels of education, skills, and motivation above those of the native-born population.

It is clear that, as late as 1949–50, the average manufacturing establishment in São Paulo was relatively small scale and the average agricultural establishment (at least in number of workers) fairly large scale. However, the size of establishment—whether measured by number of workers, capital, or output—in São Paulo's more industrialized zones, was on the average greater not only in manufacturing and in retail and wholesale trade, but also (although to a somewhat lesser degree) in agriculture as well. The advantage of the industrial zones in average size of establishment did tend to decline in most instances during 1940–50, notably in agriculture. The principal exception was manufacturing, in which establishment size as measured by capital and output (but not

number of workers) was relatively larger in the more industrialized zones in 1950 than in 1940, suggesting some shift toward more capital-intensive types of manufacturing. However, if we look at capital per worker, we find that a moderately higher value had prevailed in 1940 in manufacturing in the more industrialized zones, but that this difference had disappeared by 1950, a finding confirmed by the alternative physical measure of motive force (horsepower) per manufacturing worker. In contrast, capital per worker was significantly higher in the industrial zones not only in wholesale and retail trade but also in agriculture (TV .615 **). This lead in capital per worker had strengthened in retail trade although it had weakened in agriculture during 1940–50. Nonetheless in 1950 as well as in 1940, labor productivity (output per worker) was significantly higher in the manufacturing sector of the more industrialized zones, perhaps because of their greater human capital. The same was true in wholesale and retail trade and in agriculture (TV .525 **), although the productivity advantage of agriculture in the more industrialized zones weakened somewhat during 1940–50.

The fact that the zones of greater industrial-urban development generally enjoyed larger capital resources (and higher labor productivity) undoubtedly reflects their large debt to the earlier successful development of nearby agriculture. The agricultural sector in turn had benefited from the availability of more capital resources (probably on more favorable terms as well) consequent on the proximity of the growing industrial-urban centers. That the agriculture of São Paulo's more industrialized zones did benefit is supported by most of the remaining, more detailed indexes presented in Table 3.

First, the more industrialized zones had a significantly higher value of output per hectare of all farmland. This was reflected (along with the stronger nonagricultural demand for land) in higher per hectare farmland values. The same zones also had a higher value of crop production per hectare of cropland, although the lead was less pronounced than was the case for all farmland. This relationship was due partly to the fact that, while still at very low levels, the per hectare expenditures for fertilizer (TV .445 * for all farmland) and insecticides were significantly higher in the more industrialized zones. Even so, the soils in the latter had been heavily depleted in the westward march of coffee in the state, a depletion still reflected in their significantly lower coffee yields in 1950. The yields of sugar-cane (which was being produced in São Paulo by the most modern techniques) and to a lesser extent of potatoes (much of which crop was produced by relatively advanced techniques, particularly in conjunction with irrigated rice production in the Paraíba

Valley), did tend to be higher in the more industrialized zones. In rice, cotton, corn, and bean yields, however, these zones were no more than holding their own in 1950—although this was no mean achievement in light of the virgin tracts just then coming under cultivation in the highly agricultural western frontier zones. However, in view of more recent improvements in techniques (particularly in irrigated rice and cotton), the more industrialized zones may have shown a relative advantage in these latter crops by 1960.

Second, in value of livestock production per hectare of pastureland, the more industrialized zones had a relative advantage only in milk production. While the state of São Paulo had by 1950 already gone a long way in substituting more productive planted pastures for low-quality natural pastures, there was no significant difference between the more and less industrialized zones in the proportion of planted pastures or (as we saw earlier) in the number of cattle per thousand hectares of pasture. However, in the light of their greater investment in the dairy breeds (primarily Holstein) and greater amounts of purchased feed rations in response to a growing urban demand for milk, the more industrialized zones did have a strong relative advantage in milk production per cow milked and in milk production per thousand hectares of pastureland.

Third, for the average farm of the more industrialized zones, investment in both real estate (land and buildings) and nonreal estate (livestock and machinery) was significantly greater than for the average farm in the less industrialized zones (TV .711 ** for real estate capital). However, both relationships weakened during 1940–50, suggesting that the relative increase in land values and nonreal estate on the recently settled agricultural frontiers was at least temporarily outpacing that in the older agriculture of the more industrialized zones. The weakening of the second relationship was especially marked—the relationship was no longer significant in 1950—although this change may to some extent reflect the fact that our efforts to estimate the *value* of livestock (not reported by the 1950 census) were not sufficiently accurate. The average farm of the more industrialized zones did, however, produce a greater value of both crops and livestock—although with the latter most of the value was apparently derived from the livestock products (milk and eggs) rather than from the sale of the animals. This relationship was somewhat less strong in 1950, perhaps again because of inaccuracies in our estimates of gross value of production (particularly of animals) based on the physical data (excluding values) of the 1950 census.

More important, although subject to the same errors of estimation for 1950, were the resources and output of the average farm worker in the several zones. In 1940, the physical land resources that the average farm worker had to work with were not significantly different in the industrialized and nonindustrialized zones. By 1950, however, there was distinctly less total farmland per worker in the more industrialized zones. Nevertheless, perhaps because of increasing intensity of land use and the increasing substitution of animal and mechanical power for labor, the average farm worker in these zones actually had more crop and total productive (crop and pasture) land to work with in 1950, by which time this relationship had become highly significant. In value terms, however, the more industrial zones showed more real estate investment per farm worker, a pronounced lead that was almost the same in 1940. While the more industrialized zones also showed a moderately greater nonreal estate investment in 1940, this lead had disappeared by 1950, largely because of the (estimated) livestock components. Nonetheless, both in 1940 and 1950, there was significantly more farm (field and stationary) machinery per worker in the more industrialized zones, although there was some decline in the latter's advantage during the decade as farm mechanization spread to the zones of lesser industrialization. In per worker investment in vehicles and work animals, on the other hand, the superiority of the more industrialized zones became distinctly greater during 1940–50, undoubtedly because of their earlier use of motor trucks, facilitated in turn by somewhat better highways and mechanical service facilities. Finally, the superiority in crop production per farm worker in the industrialized zones, while somewhat weaker than in 1940, was still moderately strong in 1950 as was per worker production of milk and eggs. Once again, however, per worker income from animal production (assuming our estimates were accurate) in these zones was not significantly different from that of the more rural-agricultural zones.

Our last indexes of capital investment relate to housing. Housing is usually a consumption good under urban conditions. However with production and family living more closely interrelated in the rural sector, housing (particularly worker housing) is considered a "nonproductive" part of agricultural investment. While São Paulo's rural housing was in general not only more crowded but also lacking in the amenities of modern life, the rural (like the urban) housing was significantly better in the more industrialized zones. Thus, in 1950 rural housing, as measured by the average number of persons per room in the more industrial zones, was significantly less crowded. (In urban housing, no such

advantage existed.) The rural domiciles of the more industrial zones also showed (despite small absolute differences) a strong superiority over the less industrialized zones in extent of piped water, electric lights, and toilet facilities (TV .729 ** for rural level of living index).

Our findings from analyses of the impact of industrial-urban development on agriculture, via the local capital markets, in the Tennessee Valley and the State of São Paulo were surprisingly similar for both areas. However, one important difference should be noted. In São Paulo, the per worker value of farm capital was less closely related to industrial development in 1950 than in 1940, whereas in the Tennessee Valley the comparable coefficient steadily increased from 1900 to 1950, the period in which most of its industrial-urban growth took place. Perhaps this difference is largely attributable to the fact that, during 1900–50, both capital and labor flows in the Tennessee Valley were between the rural and urban sectors, while in São Paulo as late as 1940–50 they were in considerable part from the older to the newer *rural* zones. (During 1890–1910, our Tennessee Valley study area did experience a somewhat similar phenomenon. Some of its most rural counties temporarily prospered and attracted considerable in-migration on the basis of lumbering and coal-mining, a process about as exploitative as that more recently followed by the expansion of agriculture in São Paulo's western frontier zones.) Such cross-currents in factor flows within São Paulo tended to obscure the rural-urban relationships. Part of the reason for this lies in the fact that agricultural settlement had only been completed recently. In the Tennessee Valley where the settlement process had long since ceased, these relationships had become more clearly drawn. With the settlement completed as of about 1950, it seems reasonable to expect that the influence of industrialization on agriculture in São Paulo will approach more closely to that already observed in the Tennessee Valley, even with the antiemployment bias of the artificially stimulated industrialization that became a factor in São Paulo after 1950.

Industrialization and the Local Labor Market

Finally, let us consider those indexes most closely related to local labor resources and to the efficiency of the local labor market in relieving the problem of low agricultural incomes and low farm-labor productivity by facilitating the transfer of excess farm labor resources to nonagricultural employment. Most of these indexes are presented in Table 4, although certain of them (particularly those on per worker capital or output)

in Table 3 could just as appropriately have been placed in Table 4. Where there is such an overlap, such as in capital per worker, the previous entry was concerned with factors affecting the numerator of the index, whereas we are here concerned with the factors affecting the denominator.

In Table 4, we first find that the more industrialized zones (as measured by 1949 per capita value added) were also far more urban and less rural (TV .806 ** and −.806 **), with far higher population densities (TV .748 **). They also had far higher per capita wholesale and retail sales (TV .651 ** and .818 **) although their advantage in these indexes weakened somewhat during 1940–50, especially in wholesale trade. (The latter trend is more easily understood in the light of the fact that in São Paulo farm products accounted for 39 per cent of wholesale sales and food products for 18 per cent more. Much of the wholesale trade, therefore, involved the assembly of agricultural products in the more rural areas.) Nonetheless, during 1940–50, the more industrialized zones not only greatly strengthened their lead in percentage of male workers in the secondary (manufacturing and construction) industries (TV .938 **), but also further strengthened their lead in employment in the tertiary (service) industries, with the subgroup "commodity trade" showing the greatest increase (from .682 ** to .783 **). At the same time, of course, the more industrialized zones showed relatively fewer males gainfully employed in the primary (agricultural and extractive) industries (TV −.788 **), a relationship that was strongly marked and increasing.

Reflecting their generally higher labor productivity (Table 3 above), the more industrialized zones also had significantly higher annual wages per worker in all nonagricultural employment and in manufacturing (TV .802 **), but again this lead was weaker in 1950 than 1940. Female participation in the labor force was also considerably higher in the industrialized zones in terms of all employment and manufacturing (TV .905 ** and .460 **), although in agricultural employment, these zones had relatively lower female participation. In educational achievement, in terms not only of completion of primary school (Table 3) but also completion of the middle school (TV .708 **) and university courses as well, these zones also enjoyed higher indexes. With a predominantly white population in the state as a whole, São Paulo had a moderately larger (relatively) white population (TV −.325) in 1940, but this factor disappeared during 1940–50.

As noted earlier in (Table 3), the more industrialized zones also led in foreign-born population (TV .646 **). There were, however, distinct

TABLE 4

Population and Labor Market, Brazil and Sao Paulo: Selected Indexes with Comparisons between the National and State Averages, 1949–50, and with Coefficients of Rank Correlation between These Indexes and 1949 Per Capita Value Added by Manufacture for Twenty-three Zones of Sao Paulo, 1939 and 1949[a]

Index Correlated with 1949 Per Capita Value Added by Manufacture	Average 1949–50[b]		Rank Correlation Coefficients	
	Brazil	S. Paulo	1939–40	1949–50
Per capita value added by				
Manufacture	$35.3	$94.4	.922**	1.000**
Wholesale sales	74.3	166.6	.873**	.719**
Retail sales	61.4	111.8	.848**	.810**
Residential classification of population; percentage				
Urban	25.0	39.9	.910**	.928**
Suburban	11.2	12.7	.469*	.515**
Rural	63.8	47.4	-.799**	-.890**
Population density per sq. km.	6.1	37.0	.786**	.742**
Percentage of gainfully employed males in				
Primary industries	65.8	47.8	-.726**	-.839**
Secondary industries	13.7	22.6	.599**	.872**
Tertiary industries	20.2	29.5	.727**	.748**
Per worker annual earnings in				
Manufacturing (nonadmin.)	$350.4	$404.9	.679**	.550**
Wholesale trade (nonadmin.)	678.9	785.8	.666**	.103
Retail trade (nonadmin.)	278.6	327.2	.737**	.572**
All nonagricultural (all)	307.7	437.7	.892**	.719**
Percentage of male population of 10+ completed				
Middle school	2.74	4.78	n.a.	.800**
University	0.80	1.20	n.a.	.724**
Females as percentage of labor force in				
Manufacturing	16.3	21.2	n.a.	.658**
Agriculture	26.5	21.4	-.454*	-.302
All sectors	20.7	18.6	n.a.	.898**

(continued)

TABLE 4 (continued)

Index Correlated with 1949 Per Capita Value Added by Manufacture	Average 1949–50[b]		Rank Correlation Coefficients	
	Brazil	S. Paulo	1939–40	1949–50
Ethnic classification of population (percentage)				
White	61.7	85.6	.395*	.198
Italian	n.a.	3.0	.782**	n.a.
Portuguese	n.a.	2.2	.586**	n.a.
Spanish	n.a.	1.7	.649**	n.a.
German	n.a.	0.5	.210	n.a.
Japanese	n.a.	1.8	-.073	n.a.
Percentage of population by religion				
All Noncatholics	6.5	9.3	n.a.	-.223
Protestant	3.3	3.5	n.a.	-.187
Spiritualist	1.6	2.7	n.a.	.158
Jewish	0.1	0.3	n.a.	.671**
Orthodox	0.1	0.3	n.a.	.529**
Moslem	0.01	0.02	n.a.	.090
Buddhist	0.3	1.4	n.a.	-.144
Female fertility				
Twelve and over, bearing children				
Percentage bearing live children	n.a.	55.9	-.792**	n.a.
Average number children per mother	n.a.	5.1	.211	n.a.
Percentage of total male population in age range 0–4	16.4	14.6	-.594**	-.518**
Crude birth rate	43.7	31.8	-.437*	-.686**
Crude death rate	20.6	14.3	-.517*	-.599**
Crude natural increase	23.1	17.5	-.137	-.140
Net immigration rate, 1940–50	n.a.	+6.7	n.a.	-.116
Rate of population growth, 1940–50	126.0	127.3	–	.035
Population, all ages; male – female ratio				
Nationwide	99.3	103.6	-.213	-.290
Rural	104.1	111.7	n.a.	.253
Urban	89.8	95.6	n.a.	-.072

(continued)

TABLE 4 (concluded)

Index Correlated with 1949 Per Capita Value Added by Manufacture	Average 1949–50[b]		Rank Correlation Coefficients	
	Brazil	S. Paulo	1939–40	1949–50
Population, age range 20–39				
Male-female ratio	96.4	105.7	-.109	n.a.
Percentage of male population	28.7	31.0	.307	n.a.
Percentage of female population	29.6	30.7	.546**	n.a.
Population, age range 40–59				
Male-female ratio	107.0	116.1	-.265	n.a.
Percentage of male population	13.8	14.4	-.047	n.a.
Percentage of female population	12.8	13.0	.056	n.a.

Source: Brazil's General Censuses of 1940 and 1950 and various federal and state publications on vital statistics.

[a]The statistical significance of the correlation coefficients is indicated at the 1 per cent level (**) and the 5 per cent level (*).

[b]National and state average for each index. Units as indicated except all values in U.S. dollars, converted at the rate of 30 Cruzeiros to the dollar.

differences by nationality. In 1940 these zones had relatively the largest numbers of people of Italian, Spanish, and Portuguese birth, but their percentages of Japanese- and German-born population were not significantly different. The Italian-born population has been particularly outstanding in the development of the city of São Paulo. The Portuguese- and Japanese-born have shown a stronger preference for agriculture, and are prominent in such small-scale operations as fruit and vegetable growing near the major cities. Lately the Japanese have been moving in increasing numbers into the urban centers or have joined the Syrian-Lebanese to become one of the two major ethnic groups participating in the assembly and first processing of farm products in the more rural zones. Comparable data at the local level were not available in 1950, although data on religious preference in the latter year (despite the predominantly Catholic affiliation of the Italians, Portuguese, and Span-

ish) are a partial substitute. While there is some evidence [31] that Brazil's small Protestant minority has as a group, attitudes more favorable to hard work and thrift than the predominant Catholic population, São Paulo's more industrial zones if anything tended to have relatively fewer Protestants and noncatholics. As for other religious minorities, the more industrial zones showed a significantly larger (relatively) population of the Jewish and Orthodox faiths (the latter including most of the Syrian-Lebanese), but no significant differences in relative numbers of Moslems (Syrian-Lebanese) and Buddhists (Japanese). In the Tennessee Valley, the Presbyterians and Quakers played a leading role in local industrial development.

More important for present purposes are the various rather fragmentary indexes of vital statistics, migration, and age-sex distribution that are presented in Table 4. First, we observe that as early as 1940 São Paulo's more industrialized zones had much fewer females (relatively) who had borne one or more live children (TV $-.620$ **). While this index perhaps reflects a later age of marriage and higher incidence of spinsterhood, it was not matched by longer run lower fertility rates, since the average number of children per mother (TV $-.762$ **) was if anything higher in the more industrialized zones. That the latter index was not very reliable for São Paulo is suggested by the fact that the percentage of the total (male) population in the age class 0–4 was lower to a marked degree in the more industrial zones in 1940 and (to a somewhat lesser degree) in 1950 as well (TV $-.549$ **). The latter relationship is further confirmed by the finding that the crude birth rate for 1939–42, after adjustment for underregistration of births, was significantly lower in the more industrialized zones, a tendency that was further strengthened for the decade as a whole (1940–50 average). However, since the crude death rates (unadjusted) for the same dates were also lower to a marked degree in the more industrialized zones, the effect on the crude rate of natural increase was such that in neither period did the industrial zones tend to have significantly lower rates of natural increase (TV $-.605$ ** in 1940).

While the state of São Paulo's net in-migration during 1940–50 amounted to 6.7 per cent of its average population of that decade, it is curious to learn that the net in-migration rate or rate of population growth (TV .842 ** and .735 **) of the state's zones of greater indus-

[31] Emilio Willems, "Protestantism as a Factor of Culture Change in Brazil," *Econ. Dev. and Cultural Change*, Vol. III (1955); and "Protestantism and Culture Change in Brazil and Chile," *in* W. V. D'Antonio and F. B. Pike (ed.), *Religion, Revolution, and Reform: New Forces for Change in Latin America*, New York, 1960.

trialization did not differ significantly from those of lesser industrialization. Clearly the growth of the urban population of São Paulo (largely in its industrial zones) during 1940–50 required a substantial rate of net in-migration. It is possible that much of this was short-distance (intrazonal) rural-urban migration. At the same time much of the interstate movement was probably rural-to-rural, attracted by the state's rapidly developing agricultural frontier areas. In any case, given the peculiar circumstance of uncompleted agricultural settlement, the less industrialized zones still tended to have net in-migration rates comparable to those of the zones of greater industrial-urban development.

To what extent were these migratory movements sex- or age-selective? For São Paulo as a whole, the male-female ratio for the population of all ages in 1950 indicates that the rural areas with net *in-migration* had gained relatively more males and those having net *outmigration* had lost relatively fewer males, while the net *in-migration* to urban areas had involved relatively more females. Among our twenty-three zones within São Paulo, however, the rural population of the more industrial zones had relatively more males, but this factor was so moderate as to be statistically nonsignificant, while there was virtually no difference in male-female ratios in the urban populations of the more and less industrialized zones. If alternatively we look at the 1940 population in the age range 20–39 (the most productive), the indication is that earlier in-migration to the state had been slightly male-selective, but that within the state there was no difference in terms of the male-female index between the zones of greater and lesser industrialization.

However, the more industrialized zones showed a moderately higher percentage of their total male population—and a significantly larger population (relatively) of females—in the 20–39 age range, suggesting that for these zones previous in-migration had been age-selective for both sexes. This means that the more industrialized zones had tended to attract from the less industrialized (or from other states at a rate higher than the less industrialized) both males and females as they reached adulthood. (The comparable relationships found in the Tennessee Valley——.746 **, .788 **, and .878 **, respectively—were much stronger, however.) For the age-class 40–59, however, the relative male and female populations did not differ between the zones of greater and lesser industrial development. The more industrialized zones did, however, show lower male-female ratios, which suggests that (insofar as not attributable to higher life expectancy among women who have survived the child-bearing years) still earlier in-migration had brought relatively more females.

Let us return for a moment to the two indexes that are most important to the present analysis: per worker farm capital and farm output. We have already noted that in 1950 São Paulo's more industrialized zones enjoyed higher per worker farm capital (.468 *) and higher per worker farm output (.479 **) than did the less industrialized—results similar to those (.468 * and .479 **) found in our study of the Tennessee Valley. Thanks to the longer historical span of the earlier study and the existence of a control group, we could with more or less certainty trace a cause-and-effect relationship (at least for 1900–50) in which industrial-urban growth influenced agricultural development by improving the efficiency with which the capital, labor, and product markets functioned. While the degree of association between industrialization and the agricultural indexes in São Paulo was approximately the same, it is not yet possible to assess cause and effect with similar ease on the basis of a single decade.

Furthermore, an improvement in per worker farm capital or per worker farm output can come about through increased capital or more remunerative product markets (the numerator) or through a reduction in the farm labor force (the denominator), or all in combination. While the Tennessee Valley area experienced all three types of adjustments, the most important undoubtedly was the reduction in the size of the labor force, both through local occupational shifts and outmigration and through the declining fertility rates associated with urbanization. In São Paulo, while similar adjustments of a substantial nature were also evident, as yet none of these latter indexes of labor adjustment has been as closely related to industrial-urban development as in the Tennessee Valley. In part, this result probably reflects a greater efficiency in the operation of the national labor market in the U.S. and the existence in this country of more adequate nonfarm job opportunities (because of which, even the Tennessee Valley study area suffered as a whole considerable net *outmigration*) than in Brazil. Furthermore, unlike the Tennessee Valley, São Paulo is itself the mecca in which most of the nation's surplus farm population must be absorbed. The above result, however, is probably attributable in much greater part to the fact that São Paulo's expansion of nonagricultural employment was in 1950 still far from sufficient to absorb the large rural surplus, while its own agricultural frontiers (and those in neighboring states) were still capable of attracting much of the surplus population of the older agricultural regions. The fact that the differential advantage of São Paulo's more industrialized zones in per worker farm capital and output *weakened* substantially between 1940 and 1950 undoubtedly reflects the competition from this agricultural frontier which, despite its lack of industrial-

urban development, offered sound inducement to, and attracted considerable amounts of, not only labor but also capital in purely agricultural development.

The comparable, largely agricultural counties of the Tennessee Valley (being much older) were clearly overpopulated by 1950. These counties needed even higher outmigration rates as well as substantial outside capital if their small-scale, labor-intensive farms were to be reorganized on a more productive basis. Undoubtedly, some of São Paulo's older zones were facing a similar problem insofar as they had lagged behind other zones in industrial-urban development. But, with the old and new agricultural zones grouped indiscriminately in our analysis under the heading, "less industrialized," the effects of industrial-urban development on agricultural incomes and productivity—particularly on such important population characteristics as fertility rates, migration rates, and age-sex structure—were considerably obscured for the decade 1940–50. That our results were nonetheless so similar during that period for São Paulo and the Tennessee Valley, despite such important differences in circumstances, underlines the importance of further industrial-urban development as a factor in transforming Brazilian agriculture. As settlement of the frontier zones is completed in the states of Paraná, Mato Grosso, and Goias—as it has been in São Paulo since 1950—conditions will approach more closely to those in which the Tennessee Valley found itself several decades earlier. It will then become more evident that even these new areas cannot, without industrial-urban development of their own, avoid the rural overpopulation and the agricultural undercapitalization that already plague the northeast and other older and stagnant agricultural regions of the country.

Summary

We may conclude from this analysis of São Paulo that (abstracting from the countereffects of an agricultural frontier that has not yet disappeared), local industrial-urban development—by facilitating the flow of capital into, and the flow of labor out of, agriculture—had by 1950, already exercised an important influence in raising the incomes and productivity of nearby farmers—an influence that has probably been considerably strengthened during the subsequent eighteen years.

On the *capital* side, São Paulo's industrial-urban development during the 1950's increased personal incomes and savings, thereby raising the total resources of the local banking and credit institutions, while creating a greater demand for income-elastic foods and other consumer goods. The nearby agriculture clearly benefited from these changes, which facili-

tated investments in land improvement, the development of more profitable capital-intensive enterprises (particularly milk, poultry and eggs, and specialty crops), the raising of capital-labor ratios, and an increased scale of farming operations—all of which increased farm output and incomes per worker relative to those in the (older) zones of lesser industrial-urban development. The nearby agriculture also benefited from the favorable effects of increasing population density and of the expanding tax base within the urban-oriented infrastructure, which improved both the quantity and quality of electricity, railroads and highways, education, and health facilities available to the nearby rural people.

On the *labor* side, the productivity of farm labor was raised by nearby industrial-urban development, not only because of concomitant higher rates of capital formation in agriculture, but also because of the greater facility with which excess farm labor could move into higher-income, nonfarm employment. Furthermore, farms located near industrial-urban centers could use the labor that remained in agriculture more productively. Thanks to their greater access to nonreal estate capital and to more favorable markets for local products, they could concentrate on more land- and capital-intensive products that utilized farm labor more fully, with a resultant rise in productivity that sufficed to cover the now higher opportunity cost of farm labor as determined by nonfarm wage levels.

In all probability all of these effects strengthened after 1950, but it is likely that they did so at a slower pace than they might have, given the shortcomings of public policy, in particular the government's allocation of the real resources that it succeeded in capturing through its system of multiple-exchange rates and its inflation-derived forced-savings policy of 1953–64. We shall conclude this paper with a brief and somewhat speculative appraisal of how Brazilian agriculture fared under the national public policies of this more recent period.

BRAZILIAN AGRICULTURAL DEVELOPMENT SINCE 1950: THE EFFECTS OF FORCED-DRAFT INDUSTRIALIZATION ON AGRICULTURE

Relative to Brazilian agriculture generally, the agriculture of São Paulo must have gained most (or suffered least) from the official policy of forced-draft acceleration of the growth of the industrial sector during

1953–64. Clearly, the state of São Paulo was the major beneficiary of the resources that the government allocated to industrial development. To a lesser extent the state also benefited differentially from the resources diverted to subsidized imports of tractors (discontinued in 1960 in favor of a domestic tractor industry), fuels, and fertilizers (discontinued in 1964) and to coffee price-supports. The farmers of São Paulo therefore must have received substantial direct and indirect benefits from the new policies, primarily through the resultant favorable effects on the urban demand for farm and food products.

From a financial point of view, however, these benefits were rather ephemeral and, from the standpoint of encouraging fundamental resource adjustments and increased efficiency in agriculture, were even less satisfactory. This was because of the unfavorable effects of public policy on employment. First, the particular capital-intensive industries that were promoted kept farm wages relatively low even in the more industrial zones, as in-migration outran remunerative nonfarm job opportunities. Second, the heavy import subsidies in effect for a time on certain agricultural inputs favored excessive mechanization. This mechanization received further stimulus from the tendency to invest agricultural savings (apart from those put into agricultural land, driving up land values) in farm machinery as a convenient hedge against inflation. This is scarcely a useful practice from the standpoint of optimum allocation of resources.

To be sure, the perceptive farm manager could detect that the terms of trade (insofar as middlemen were not capturing the benefits) were turning in his favor, particularly in the livestock-products sector, and many began to shift their resources accordingly. Unfortunately, however, these improved terms of trade reflected the government's continued neglect of agriculture, a neglect that took the form of insufficient and badly administered agricultural credit, research, and extension services. The coffee price-support policy was *not* an effective substitute. It did help to spread some of the benefits of economic growth to São Paulo's less industrialized frontier zones and to a much greater degree to the northern section of the state of Paraná. While it may have stimulated industrial development in these areas, the coffee price support policy may also have been biased against employment in agriculture, insofar as coffee land was diverted to planted pasture under the stimulus of changing relative prices, public production-control measures, and most of all, unfavorable weather. In any case, if the resources allocated to the coffee price support policy had been devoted to improved agricultural services, many more improvements in the allocation of agricultural resources would have resulted than actually did.

Lacking these improvements, São Paulo's agriculture has since 1950 made far less progress in raising its productivity, particularly in the far more complex and less familiar livestock sector, than it might otherwise have done. Livestock and livestock products are income elastic. For most producers laboring under inefficient production techniques, higher relative prices did not mean greatly increased profits. Therefore the supply of such income-elastic products was much less price-elastic than it should have been, while the supply schedule was shifting downward slowly if at all. This problem was further compounded by the increasing resort to consumer food-price controls as an anti-inflation measure while the prices of important agricultural inputs (upon the increased purchase of which, modernization of the livestock industries so much depended) rose unrestrained. The recent end to subsidies on fuel and fertilizer imports (an anti-inflation measure) and the increasing abandonment of cheap foreign sources of other major agricultural inputs in favor of strongly protected domestic sources have also increased the difficulties of transforming and modernizing Brazil's still relatively backward agriculture as well as of promoting the spread of mechanization insofar as this is economic at still low farm wage rates. (In fact mechanization was already economically justifiable with the price structure that prevailed in 1963, at least in some areas of southern Brazil.)

Our emphasis on the livestock rather than the crop sector of Brazilian agriculture may appear excessive, in view of the fact that the Brazilian diet still depends predominantly on food products of vegetable origin. Furthermore, crop production in Brazil (including most of São Paulo) is still largely based on technically backward methods. The generally low physical crop yields have, if anything, tended to decline, insofar as the initially high yields of virgin land on the frontiers have failed to offset the declining yields in the older agricultural areas, which have lagged in increasing their use of fertilizer, improved seeds, insecticides, and other modern agricultural inputs. However, to an increasing extent—even in the northeast—I have found that farmers are not only profit-motivated, but are also eager to accept such improved techniques if they have adequate technical assistance in their effective use and if the relative prices of farm products and purchased inputs make such improvements pay financially. In any case, since 1950 agricultural progress has enabled food-crop output to expand at a rate sufficient at least to maintain constant (though not lower) relative prices to urban consumers. Even this was a relatively satisfactory performance, considering the fact that Brazil's rate of population increase had risen to 3 per cent per year during 1950–

60, while the urban population was expanding at 5.4 per cent per year.

Thus far, this achievement in the crop sector probably owes more to relatively elastic supply functions for the major staple crops, given an abundance of cropland, than to higher productivity. Furthermore, on the demand side, the pressures of urban population growth have been less strongly augmented by the additional element of income elasticity of demand. Of the traditional staple foods of vegetable origin, those for which the highest elasticities in the *urban* sector were found in 1962–63 were products of wheat (0.36)—of necessity largely imported—and rice (0.21). Beans, corn meal, and manioc flour had elasticities close to zero. (Relative to the rural sector, the urban sector had a much higher per capita consumption of wheat and potatoes, a slightly smaller consumption of rice, and a far smaller consumption of beans, corn, and manioc; the urban sector also consumed more oranges and vegetable oils per capita but less sugar and bananas.) The only vegetable products with urban income elasticities *higher* than wheat (0.36) were oranges and bananas (0.64–0.74), vegetable oils (0.55), and potatoes, margarine, and manioc root (0.40–0.48); the only livestock products with elasticities *less* than wheat were powdered milk (0.35), sundried beef (0.15), lard (0.08), and salt pork (−0.04).[32] Nonetheless, with the prospect of

[32] Fundação Getulio Vargas, Instituto Brasileiro de Economia, *Projeções de Oferta e Demanda de Produtos Agrícolas para o Brasil*, Rio de Janeiro, January 1966, pp. 37 and 44. Comparable data are also presented (p. 45) for the rural sector (0.40 for all foods as compared with 0.55 in the urban sector). It is interesting to note that, for most categories of food, the income elasticity of demand was lower in the rural sector than the urban sector, suggesting (insofar as the results do not reflect the greater difficulties of collecting the basic data) the generally easier accessibility of the food supply to the lower-income rural population. The only significant exceptions—elasticity higher in the rural area—were found for lard and salt pork (*toucinho*), rice 0.33, wheat products 0.41, and potatoes 0.59. Except for potatoes, the rural elasticity was 0.50 or more only for butter 1.09, cheese 0.68, eggs 0.57, and fresh beef and fresh milk 0.50 each.

Comparable data were also shown for three regions—the south, the east, and the north-northeast—the ranges in elasticities for *all foods* being from 0.62 to 0.50 (urban) and from 0.44 to 0.36 (rural), with the north-northeast the highest and the south lowest in both sectors. The urban north-northeast had the largest number of foods with elasticities exceeding +1.0—cheese 2.33 and chickens 1.91; wheat flour, margarine, and fresh pork 1.23–1.39; and fresh milk, potatoes, wheat pastes, oranges, and butter 1.00–1.10. Other high-ranking products were eggs 0.95 and canned meats, powdered milk, bananas, fresh beef, and canned fish 0.71–78. Only manioc flour had a negative elasticity −.10. The *urban south* had a much shorter list of products with elasticities greater than +1.0—chickens 1.45, butter 1.26, cheese 1.11, and canned fish 1.05; or between +0.7 and +1.0—pork 0.93, fresh fish 0.83, canned meats 0.81, and fresh beef 0.79; while three of its products, lard, corn meal, and manioc flour, had *negative* income elasticities of −0.10 to −0.11.

continued rapid growth of the population, both total and urban, and with the best agricultural land at last taken up, there is a growing necessity (as well as an increasing economic opportunity) to modernize crop production, particularly in the older and less remote agricultural regions. Even more urgent, with the low *price* elasticities of demand for most staple food products, is the expansion of storage facilities. Such facilities permit the stabilization of crop supplies (and prices) for the benefit of both farmers and consumers. If all these improvements are to come about, the Brazilian government must commit substantially more resources to the public agricultural agencies serving the long-neglected food-crop-producing sector than it heretofore has.

Even so, it is Brazil's livestock sector that stands in the greatest need of stimulation and development, and, therefore, of public assistance. The fact that the relative prices of livestock products have *increased* substantially in recent years reflects both the technological backwardness of the livestock sector and the evident desire of the urban consumer to substitute livestock products for cereals as his income rises. While geographically the most widespread agricultural enterprise in Brazil, beef-cattle production remains perhaps the most backward and traditional sector of agriculture. Even with its high degree of inefficiency, however, the Brazilian cattle industry has thus far managed to produce beef cheaply enough to enable even the nation's poorest to eat much more meat than most of the world's poor. Nonetheless, the rate of cattle increase in Brazil was only half that of population growth during 1950–60 in the face of very high income elasticities: 0.72 in the urban and 0.50 in the rural sector. While improved transportation probably increased the proportion of fresh-beef output available in the urban centers, these facts make it clear that a vast improvement in the efficiency of beef production—through better breeding stock, more effective disease

The rural north-northeast (Brazil's poorest sector) had few products with income elasticities of +0.70 or higher (wheat flour 2.01, potatoes 1.80, butter 1.25, and eggs 0.73) but a somewhat larger number between 0.50 and 1.00 (cheese and wheat bread 0.63; whole milk and wheat pastes 0.56–0.57; and rice, edible manioc root, and salt pork 0.52–0.53). However, it had the longest list of products with *negative* income elasticities. Barely negative were beans and vegetable oils ranging *minus* 0.01–0.03; slightly more negative were dried milk, oranges, (dried) fish, and corn meal, *minus* 0.08–0.10; and highly negative were the traditional sundried beef −0.72 and the crude plantation-produced staples of the back-country sugar-cane industry, brown sugar cake −0.35 and aguardente −1.13. For the *rural south*, only butter 1.03 and cheese 0.70 had elasticities greater than +0.70; three between 0.50 and 0.70 (lard 0.68, fresh beef 0.59, and brown-sugar cake 0.63); and only molasses and manioc flour had *negative* elasticities, *minus* 0.16–0.17.

control, improved pastures, and more adequate forage crops—is urgent if prospective domestic demand is to be met. (Although it is generally regarded as unlikely that Brazil will become a significant exporter of beef products in the foreseeable future, the country certainly has the potential, given sufficiently radical improvement in the productive efficiency of its huge cattle industry.)

Needs and opportunities are also great in the production of milk, poultry, and swine. Brazil's dairy industry faces very high urban income elasticities for its milk products (cheese 1.38, butter 1.21, and fluid milk 0.76) but, even in the major urban milksheds—where milk producers are following many improved practices—annual production per cow averages only about 2,500 lbs. for animals with considerable Holstein blood and about 1,000 lbs. for Brahma (Zebu) animals. (The lowest ranking U.S. states, Mississippi and Louisiana average about 3,400 lbs.) Brazil's poultry industry (facing income-elasticities of 1.31 for fowl and 0.70 for eggs) is, in general, even less well organized. Finally, swine production (with a very favorable urban income elasticity for pork)—despite much good Duroc stock, relatively good disease-control practices, and good feeding practices—still requires per hundred pounds of output (under the best conditions) 35 per cent more physical input (in corn-equivalent), including the breeding stock, than U.S. farmers had achieved as early as 1910–14. Yet, with a very large total output of corn (whose yield has increased significantly in the south with the rapid adoption of hybrid seed) and manioc—both of which have income elasticities near zero or even negative in human consumption—Brazil has a very good potential for achieving an efficient commercial swine industry. In places where market opportunities exist, there is already a surprisingly large number of milk, pork, and even poultry producers who are following many of the improved practices of their American counterparts. In general, however, the lack of adequate and reliable public technical assistance, compels the Brazilian producers to tackle managerial problems of enormous complexity on a purely empirical basis. So long as such assistance continues lacking, the increasing desire of Brazil's urban consumers for these products will be frustrated by the highly inelastic (and very slowly downward-shifting) supply schedules in these important industries.[33]

[33] For a detailed documentation of these matters, for crop as well as livestock production, see the series of reports on seven major agricultural regions, now being issued by the Graduate Center for Latin American Studies, Vanderbilt University, under the general title: William H. Nicholls and Ruy Miller Paiva, *Ninety-Nine Fazendas: The Structure and Productivity of Brazilian Agriculture, 1963.*

Toward an Integrated National Economy

While the close observer of Brazilian agriculture can find good reason to be critical of the backwardness of its production techniques, there is, on balance, much reason to be optimistic, provided that the Brazilian government does its part in lending agriculture a helping hand. Much of this optimism must rest on the progress that Brazil has made since 1940, toward a single integrated market for farm products and agricultural inputs. Thus far this movement has taken place primarily within the midwest and southeast regions dominated by the development centers of São Paulo and Rio, but today it is spreading over the northeast as well.

What is perhaps most remarkable is that Brazil, despite the most inadequate transportation and communication facilities, remained politically unified during the four centuries that elapsed before it began the process of effective economic integration. This feat of preserving the consciousness of nationhood over so vast a territory bodes well for the future of Brazil, since, of all Latin American countries, it has the greatest potential (in terms of "extent of the market") for realizing the economies of large-scale manufacturing.

As we have already seen, this relatively modern phenomenon of internal economic integration began with the march of coffee westward from Rio de Janeiro and through São Paulo, an expansion intimately bound up with railway development. As railways were extended, large, highly-capitalized and well-managed coffee plantations were established; marketing and financial intermediaries emerged; and São Paulo's coffee economy became well integrated into the national and even the world economy through transportation, storage, and standardization facilities which soon constituted a highly sophisticated marketing system. However, so thoroughly did coffee dominate the economy of southern Brazil that, in spite of indirect benefits from railway construction, food crops and livestock products for the growing internal market lagged far behind coffee in the efficiency of their production and marketing. To be sure, local assembling and processing firms were gradually developing along the railways, but standardization of product was minimal, storage capacity grossly inadequate, local transportation primitive, and the railroads themselves woefully unsatisfactory, particularly for livestock and fresh meat. As a consequence, in São Paulo and to a greater degree in the rest of the south, there was much physical waste and little incentive for expanding commercial farm production, while the prices of farm products differed widely between regions and showed extreme fluctuations both seasonally and year-to-year.

Commerce between the south and north of Brazil was extremely difficult, relying almost exclusively on sea and river transportation. Coastal shipping was inefficient and expensive and river transportation, by and large confined to the Amazon Basin, was subject to seasonality in certain areas. These shortcomings made the northeast, which imports from southern Brazil much of its wheat and rice and—in its frequent drought years beans, corn, and other staples—especially vulnerable to adversity. Within the northeast, railways were less developed and integrated than in the south, with most transportation between interior points by donkey trains and cattle drives, and between the coastal cities by sailboat. Certain strategically located towns came to serve as the major central markets receiving most of the farm products of the hinterland and then channeling them into the major urban centers, these operations being conducted in regular street fairs.

During the last two decades, however, this picture of a primitive and ineffective system of marketing has begun to change significantly, largely because of recent highway development and the rapid growth of truck transportation. The transformation was, of course, most striking in the south where it affected many sleepy old provincial towns within 100 miles of the city of São Paulo. Although they received their initial developmental impetus from the railroad extending from that metropolis, these towns were nonetheless only tenuously integrated into the regional economy until recently when they were linked to the state capital by major arteries, largely paved. While local farm-to-market roads remained underdeveloped, truck transportation grew in importance because of its advantages in speed, flexibility, and reliability over the less costly but poorly equipped and hopelessly administered public railway system.

As a result of these improvements in transportation in conjunction with burgeoning urban demand for food products, the southeast is fast approaching the achievement of a well-integrated regional economy for both food products and agricultural inputs. The independent truck owner-operator has become Brazil's modern pioneer. He is introducing an important new competitive element into the local assembling, transportation, and distribution of food products, while assuring farmers improved access to the important manufactured farm inputs that constitute his return load. Along with the independent trucker, we have that other remarkable catalyst in the modernization of agriculture in the southeast, the ubiquitous traveling salesman from São Paulo. Some of the most valuable agricultural extension work in Brazil is being done by the sales representatives of private firms as they push the sales of such products as protein supplements, insecticides, vaccines and veterinary medicines, chemical fertilizers, motors and pumps, and improved seeds.

In several southern states, a network of state agencies has been established to supply farmers with seeds, vaccines, fertilizers, and other farm supplies at subsidized prices. But despite their price advantages, these agencies have not wrested the market from private firms, which continue to compete on the basis of higher quality or better quality control. (Except among the Japanese, agricultural cooperatives have played a very minor role.)

Storage capacity for cereals (much of it public) has also been expanded considerably in the southeast. But even apart from its frequent diversion to accommodate coffee surpluses, this storage capacity still remains below desirable levels for purposes of supply and price stabilization. Storage, grading, and standardization have been developed further for rice than for most other food products, but in general remain at an inferior stage, handicapping the development of price reporting, specification buying, warehouse warrants, commodity exchanges and futures trading—devices essential to modern marketing and to the implementation of price support policies such as have long since been in effect in Brazil's coffee industry. Even so, considerable progress in cereal marketing has been underway in southern Brazil. With urban expansion, the commercial production of perishable products has been growing up rapidly around the major cities. Chief among these products are milk, poultry and eggs, and fruits and vegetables. Indeed such areas as the Paraíba Valley (between the cities of Rio and São Paulo with excellent highway and railroad connections to both) are now undergoing the same kind of agricultural rehabilitation—with increasingly sophisticated marketing and production techniques—that New England experienced, as the increasingly important advantages of favorable location gradually overcome the drawbacks of poor or incompletely recovered soils and unfavorable topography. In such local processing operations as cotton-ginning and rice-hulling, considerable excess capacity is now common. This encourages local price agreements, which are especially hard on the small farmer who does not have (as his large-owning neighbor often does) substantial interests in such local commercial enterprises. Once again, however, the growth of the trucker-buyer as a factor is probably having an ameliorative effect on these local monopolies. At the retail level, neighborhood food stores continue to be small-scale, high-margin marketing units. They are, however, subject to the competition of not only the traditional, primitive, ambulatory street markets still popular even in Rio and São Paulo—a competition still relatively severe because so many of the marketeers, lacking better job opportunities, are willing to work for very low net wages—but also of chain stores and supermarkets. The growth of these

latter reflects the increasing number of automobiles and home refrigerators and even the slowly worsening scarcity of domestic servants in the largest cities.

Thus, it is clear that in São Paulo, for a half a century in the vanguard of Brazilian industrial-urban development, the single integrated market for both farm commodities and farm inputs (including labor) began. Today the extent of that market has spread beyond the borders of the state, and with the cities of São Paulo and of Rio as its centers, has continued to expand, until it now embraces most of the southeast and even much of the frontier midwest.

By 1964, with only 2.9 per cent of the national territory, the state of São Paulo had 18.8 per cent of the nation's mileage in public roads (federal, state, and the equivalent of county) and the eight-state southeast (as defined in Table 1), with 17.7 per cent of the land area, had 66.9 per cent of such roads, whose total extent was about 340,000 miles. Over three-fourths of the nation's public roads were low-quality and casually maintained county roads but, even of these, São Paulo had 21.2 per cent and the southeast 70.2 per cent. These high figures reflect the greater density of rural populations in the southeast. Undoubtedly, they also reflect the willingness of local political units in that part of the country to accept responsibility for land communications of a class which, in much of the rest of Brazil, are ignored as mere "trails" and left out of the statistics. Of the nation's 76,400 miles of federal and state roads—by far the most important for long-distance communication—São Paulo had 10.7 per cent (of which, 37 per cent paved) and the southeast 55.3 per cent (of which, 20 per cent paved). The 44.7 per cent remaining for the vast balance of the national area was only 9.1 per cent paved.[34] Even so, within the southeast region, it is already possible to drive on paved highways from the city of São Paulo (via Rio) to Salvador in the northeast, to Brasília to the north, almost to the Uruguayan border to the south, to Maringá in the north of Paraná to the southwest, and to several points on São Paulo's western borders for connections with roads serving the major agricultural regions in southern Mato Grosso. The city of Rio is linked with this system via São Paulo and also has all-paved connections with Salvador, Vitória, Belo Horizonte, and Brasília. The importance of this recent highway development to regional economic integration can hardly be exaggerated.

Improved transportation is the principal instrument in the economic fusion that is beginning to take place between the north and northeast

[34] These and subsequent highway statistics are computed from data presented in *Anuário Estatístico do Brasil, 1965*, p. 246.

and the dynamic southeast of Brazil. The 1940's saw the creation of one of the world's oldest and most extensive networks of airways, bringing for the first time the remotest corners of the nation into effective communication with the center. In 1960 came the nearly overnight creation of the new federal capital, Brasília, in the interior. This undertaking was an act of sheer economic madness from whose short-run fiscal and monetary consequences Brazil has still not fully recovered. From a broader historical perspective, however, the establishment of the new capital is probably justified as a great integrative measure, of key importance in peopling the nearly empty interior and in linking all parts of this continental nation into a single economic entity. The most important short-run benefit from Brasília has been the initiation of the arterial highways needed to connect the city with the rest of Brazil. A new system was constructed by paving old roads in the southeast and by blazing new roads in the interior. Of the 14,400 miles of federal highways now open to traffic outside of the southeast, a large percentage owes its existence to Brasília. Of course, the establishment of a new capital was not logically required for this highway construction. It is difficult, however, to imagine any other imperative for the rapid execution of this ambitious program in a nation whose outlook is still essentially coast oriented. While only about 10–12 per cent of these new federal highways are paved, they are all-weather roads which are attracting a rapidly growing volume of truck traffic. The consequence is that, with Brasília tied to the major cities of the north and northeast, these regions are at last enjoying effective land communication with São Paulo, Rio, and the whole southeast as well.

The effects have already been remarkable. As the new federal highways are being completed to the north, northeast, and west of Brasília, human settlement and the agricultural development of the hinterlands are increasing apace. The manufactures and farm products of the southeast are moving in large volume by truck to the northeast, and both primary products and human migrants make up the return traffic. Many of these migrants are bound for the newer agricultural regions where farm labor is relatively scarce and well remunerated, and where well-organized farm-labor markets exist to meet the joint needs of the migrants, truckers, and agricultural employers. It is true that long-distance truck transportation, although highly competitive, is still relatively expensive, especially for south-north traffic. Hence, improving the efficiency and lowering the cost of coastal shipping are essential to the process of national economic integration, and recently, significant efforts have been made in this connection. (The extent to which similar efforts are appro-

priate for the railway system is more problematic—given its present sad state and the huge capital outlay that creation of an effective and efficient system would require.) Even so, the beneficial effects of highway development in the midwest, north and northeast have already been substantial. Almost everywhere in Brazil, agricultural products of every description have gained in value because of greater access to markets, and a vast variety of consumer goods manufactured in the southeast are now widely available in the street fairs and stores of the most remote towns. In the northeast, the greater availability of manufactured products —and the lower truck tariffs for return trips to the south—are a great stimulus for the monetization and commercialization of agriculture. The social benefits that have come from the cheap rubber-thong sandal and transistor radio have also been substantial.

Within the north and northeast, the anticipation of improved roads has created a transportation revolution even before the expectations have been fulfilled. On the local level, trucks are rapidly displacing donkeys, bringing such comparatively remote states as Maranhão, Piauí, and the whole vast interior into effective communication with the major regional capitals of Belém, Fortaleza, Recife, and Salvador. The result has been growth in marketable surpluses of staple food products. While crop and livestock production techniques remain primitive and almost entirely manual, they are receiving a stimulus to modernization through the spread of trucking. As part of the return loads brought back by truckers, manufactured farm inputs as well as feed concentrates and improved breeding stock are finding their way increasingly to the more remote areas.

The prevailing structure of agriculture and land-tenure arrangements in the northeast is to a great extent reflected in the structure of the region's local farm-product markets. Cattle production (and in the major urban milksheds, milk production) are typically the principal interest of the large landowners, who reserve most of the available pasturelands, forage crops, and crop residues for their own account. Because they have more capital and knowhow at their disposal, these large producers (particularly when urban outlets for milk are good) are most likely to improve their techniques in livestock production. In crop production—largely delegated to tenant families (under varying arrangements) using almost completely manual techniques—improved production practices are seldom found, except where the landowner reserves a substantial part of his cropland for direct operation with cash-wage labor, some mechanization, and—although this is rare—somewhat better, purchased inputs. By either system the large landowners concentrate rather considerable

quantities for sale. This produce comes more often from purchases of the tenant's product and from crop-shares received for the use of the plantation's own processing facilities (especially in sugar-cane and manioc) than from explicit land rents, which in many cases in the northeast are surprisingly low. Thus they have substantial bargaining power both in the acquisition and the sale of their produce. Today it is a common practice for the landowners to truck their products, either to the nearest towns, in whose assembling and first-processing enterprises they often have a commercial interest, or (generally in hired trucks) direct to major urban markets.

Small independent farmers, of which there are relatively few in most regions, often depend on their large neighbors for facilities to process their produce as well as for its purchase or transportation. However, the increasing prevalence of independent truckers or trucker-buyers is improving their bargaining power. Small farmers fortunate enough to live near major market towns usually sell directly in the large street fairs, bypassing the middleman at the cost of one or two days' absence from their farms each week. In such areas small farmers are found in larger numbers, often with their own primitive processing equipment. (In certain more remote areas, where the alternative of occupying free public lands still exists, many families prefer to work on large holdings. There is a great complex of social as well as economic reasons for this, but undoubtedly the small farmer's more limited access to market outlets and farm-processing equipment is a factor.)

More generally, it is clear that the marketing structure of the northeast is inferior to that of the south. Its much greater dependence on major street fairs reflects the comparative lack of standardization, a deficiency that makes purchase by inspection mandatory. Processing facilities are fewer, less efficient, and less competitive, and waste of byproducts is greater, particularly in cattle slaughter. In a region characterized by frequent and often disastrous droughts, storage facilities are still quite inadequate even for seasonal price stabilization. Fewer farmers have easy access to the purchased farm inputs necessary to agricultural modernization. Frequently public agricultural services are inaccessible, making efficient use of the inputs difficult or impossible, and even where possible, too expensive for most farmers because low volume demand for such inputs keeps their price up. Nonetheless, even within the northeast, one can perceive at least the beginnings of regional (and national) economic integration and a more efficient marketing system as transportation improvements and regional urban growth proceed apace.

In addition, the increasing toll of outmigration has tended to unite the citizenry (including even the large landholders) of many provincial towns in the necessity of local industrialization to keep their young people at home.

Finally, the federal government, both through the large regional development agency (SUDENE) and directly, is at last making a major effort, administrative and financial, to improve the infrastructure of the northeast, particularly its highways, education, and electric power. It is also trying to help the area catch up in the race for economic development, promoting industrialization primarily through very generous income-tax exemptions to private enterprise for building new plants in this disadvantaged region. The problems of establishing economically viable industrial plants in the northeast are still formidable, and one can easily find arguments against using scarce capital resources there, rather than in the still only partially developed southeast. However, on balance, it would appear that the time has arrived for the southeast to be thrown back largely upon its own resources (except that public support of measures for raising its agricultural productivity should continue, with readjustments for better balance). Undeniably, the policy of subsidization must be wisely administered. (The recent establishment of an automobile assembly plant in Recife gives the optimist pause on that score.) However, the northeast's indirect subsidization of the south at the price of the neglect of its agriculture and the loss of its sons—consequences of a public policy that hit that largely rural area harder than any other—has perhaps continued too long. In the northeast, even more than in the southeast, planning for industrial development should aim above all for greater nonfarm employment, and should probably give full consideration to the agricultural resources—particularly in the form of a high potential productivity in raw materials—with which the region is endowed. A balanced industrial-development program will also require much additional public investment in the northeast's agricultural agencies (especially those concerned with research) as well as in primary education and public health.

A Concluding Parable

Although the northeast's Golden Age in the preindustrial era came to naught, São Paulo and the southeast have clearly entered their own Golden Age of self-sustaining economic development. It seems not unreasonable to expect that they can expand this prosperity to encompass

fully the rest of Brazil. As Brazil continues to enlist the economic assistance of the more advanced nations in this endeavor, it would appear quite appropriate for these other nations to insist, as a *quid pro quo,* that Brazil's richer regions lend a helping hand to the poorer. The *paulista* of today, aware of his undisputed energy and present economic superiority, has a tendency toward excessive provinciality and egocentricity. These attitudes are untrue to the pioneering tradition of the *paulistas,* whose leading role in the exploration and settlement of an entire nation could well be paralleled within the very different context of current development.

Perhaps the *paulista* should reevaluate the appropriateness of his joke that São Paulo is the locomotive pulling twenty freight cars—the other states. Certainly this was accurate enough when that locomotive was Coffee, and for a time it remained accurate even when a stronger locomotive (Industry) was added. Somewhere along the line, however, the older locomotive was put on a siding where, though it was no longer pulling anything, someone kept its steam up. Meanwhile, the newer locomotive pulled faster than ever. The accelerated movement was due in part to the excellence of the engineer (a *paulista,* of course) but, in even greater part, to the fact that half of the cars (the north-northeast) had been uncoupled and their contents removed and used to fuel the Industrial locomotive—and, occasionally, the old Coffee locomotive as well! When the *paulista* (with his southern neighbors close behind) became aware of the rapidly increasing gap between his own train and the abandoned cars at a standstill far to the rear, he was faced with a difficult choice. He could try to forget them, he could back up, or he could look for a second locomotive and engineer for the stalled cars. While debating the alternatives, he made a new discovery: Someone had added a caboose (Agriculture) to each train, with the one on the rear train much heavier and considerably more in need of new ball-bearings and axle-grease. What should he do?

In our story, at least, the *paulista* found for the second train another engineer and a locomotive of the Industrial type at least half as good as his own, filled up the empty cars, and—substituting additional competent engineers and pusher-locomotives of the Agricultural type for the drag of the two cabooses—arrived at a wholly successful solution. Shouldn't one hope for as much in the Brazilian reality of today?

Comment

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Nicholls' paper is in four parts. In the first part he discusses the repeated booms and retrogressions that characterized the first four centuries of Brazilian history. In the second part he turns to the rise of São Paulo since the beginning of the twentieth century. In the third he examines the role of industrial-urban development in transforming Brazilian agriculture in the decade 1940–50, and in the fourth and final part he surveys Brazilian agricultural development since 1950.

I have chosen to direct most of my attention to part three. Here we find the heart of his analysis in what Nicholls has indicated is an original piece of empirical research on the interrelationships between the industrial and agricultural sectors of the Brazilian economy.

Before turning to this, however, I would like to compliment Professor Nicholls on an excellent job of integrating a great deal of empirical knowledge and background material into a fascinating story of the development of Brazil. Professor Nicholls is most knowledgeable on the Brazilian agricultural sector. He has gained this knowledge through an extensive study of the Brazilian literature as well as empirically, through his continuing research activities on the country. He approaches the wealth of empirical data at his fingertips with the aid of a broad analytical framework that enables him to integrate and synthesize these data in a most effective way. As a result, his work is full of fruitful insights.

The first part of the paper treats the repeated booms and retrogressions of the first four centuries of Brazil's history. Although they played a major role in the shaping of modern-day Brazil, none of these periods of strong economic activity were self-sustaining nor did they lead to self-sustaining development. The perplexing problem to the development economist, of course, is why?

Nicholls speculates as to possible reasons for this. In part he feels that the cycles themselves resulted in a speculative and exploitive spirit of "getting what you can while the getting's good," with a perennial failure to plow back even a small fraction of large current earnings into the capital improvements and better techniques which might have preserved the income base even within agriculture. In addition, he suggests as im-

portant factors: (1) the static and routinized production system which arose because of the dependence on slave labor, (2) an unwillingness to protect local industry with tariff walls, (3) an agrarian philosophy that viewed industrial-urban life with contempt, and (4) the very strong orientation of the Brazilian settlers to their European homeland—in contrast to their North American counterparts. These factors were complicated by the outright prohibition of manufacturing by Portugal during the colonial period and the effective prevention of industrial protectionism at a later date by the privileged trade position given to England.

After this long series of booms and busts, however, one boom finally led to the development of an industrial-urban complex which appears to have the potential for putting Brazil on the road to self-sustaining growth and development. What is the explanation for this? Once again, the boom was of agricultural origin, and in its early phases it did not seem to be greatly different from the previous cycles. Nicholls once again provides insights into the factors that made the difference.

He argues that the existence of vast virgin lands for continual exploitation of coffee, the transportation improvements that made these lands accessible, and the more venturesome spirit of the *paulistas* and new immigrant class were contributory factors lacking in the earlier cycles. Perhaps of more importance, he suggests, was the recognition of the validity of industrialization as a goal, a willingness to imitate the industrial protectionist policies of the United States, and a series of fortuitous events, such as the two world wars, that stimulated the development of domestic industry. Industrial development was facilitated by policies designed to siphon the surplus from the agricultural sector into industrialization.

In a capsule, then, agriculture served as the *base* for Brazil's rapidly growing industrial sector. For a long period this industrialization was evolutionary, but in the last two decades it has been largely government induced. It is highly concentrated in the state of São Paulo, and this high concentration has led to large regional disparities in per capita income levels, despite the fact that subsequent industrial-urban growth has been spreading into other states.

In the next section of his paper Nicholls addresses himself to the problem of how this rather highly concentrated development can be transmitted to the remainder of the country. This is the basis of part three of his paper in which he examines the role of industrial-urban development in transforming the agricultural sector.

At this point there is a significant shift in the investigative approach. Whereas previously he had emphasized the role of agriculture in the de-

velopment of the industrial sector, the author now turns to a discussion of how industrial-urban development affects agriculture.

The Industrial-Urban Hypothesis

The analytical framework that Nicholls uses in this part of his paper is based on the conception of Dr. Schultz, as expounded in his book, *The Economic Organization of Agriculture*.[1] Schultz was concerned with two aspects of the agricultural development of an already mature economy, that of the United States. The first of these was the tendency for agriculture to experience secular low-income problems as the country developed. This he explained on the basis of (a) the low-income elasticity of demand for farm products, (b) labor-saving technological change in farm production as elsewhere in the economy, (c) farm-product-saving technological changes in the marketing and consumption sectors, and (d) the high fertility rate of farm relative to nonfarm people. These factors require a continual adjustment of the labor force out of the agricultural sector, and the mechanism by which this is accomplished in a market economy is through low relative incomes for farm people.

The second aspect of agricultural development that concerned Schultz was the spatial difference in labor incomes within the agricultural sector. Most obviously significant, of course, was the fact that the poverty problems of U.S. agriculture had significant regional dimensions. On investigation it turned out that the low income factor connected with U.S. agriculture was concentrated in the South, and was not characteristic of the agricultural sector as a whole.

To explain this Schultz developed a theory of spatial development that has come to be known as the industrial-urban hypothesis. Briefly summarized, this hypothesis is as follows: (a) economic growth in a country occurs at different locations and at different times, (b) the centers of growth are primarily industrial-urban in composition, (c) the existing economic organization functions best at or near the center of a particular matrix of economic development and also in those agricultural zones situated favorably in relation to such a matrix.

Thus, the income level of agriculture in a community which experiences industrial-urban growth can be expected to increase relative to that in a community which does not experience such growth. Moreover, because of a spatial adjustment lag, the closer a community is to an

[1] Theodore W. Schultz, *The Economic Organization of Agriculture*, New York, 1953.

industrial-urban center, the higher would be the income level of agriculture in the community.

Schultz goes on to argue that there are three factors accompanying industrial growth which create regional income disparities:

(1) An increase in the proportion of the population engaged in productive work.

(2) An increase in the productivity of the labor force, from such factors as increased investments in education.

(3) A reduction in the impediments to factor-price equalization, or a reduction in the imperfections in the factor and product markets faced by agriculture.

This hypothesis has been tested in the United States economy by Ruttan,[2] Nicholls,[3] Tang,[4] Sisler,[5] Bachmura,[6] Sinclair,[7] and Bryant.[8] The results of these studies have not been uniformly favorable to the hypothesis, and as a result the theory has been refined and extended to a more general framework.

The results, in brief form, are as follows: Ruttan, Nicholls, and Tang, each of them working with the Southeastern United States, found the data to be consistent with the hypothesis. Bachmura obtained similar results for the lower Mississippi Valley, as did Sinclair for the South as a whole. Sisler and Bryant, extended the analysis to include the total United States and found the hypothesis to be lacking. Sisler found that the hypothesis was borne out by the data from east of the Mississippi, but not by the data from west of the Mississippi. Bryant, using a larger analytical frame of reference and a different set of data, obtained results similar to those of Sisler. He found that east of the Mississippi River, the closer a county is to an industrial complex and the larger the complex, the higher are the earnings of farmers. However, the reverse is true in the

[2] V. W. Ruttan, "The Impact of Urban-Industrial Development on Agriculture in the Tennessee Valley and the Southeast," *Journal of Farm Economics* 37:38–56, February 1955.

[3] William H. Nicholls, "Industrialization, Factor Markets, and Agricultural Development," *Journal of Political Economy* 69:319–340, August 1961.

[4] A. M. Tang, *Economic Development in South Piedmont, 1860–1950,* Chapel Hill, 1958.

[5] D. G. Sisler, "Regional Differences in the Impact of Urban-Industrial Development on Farm and Nonfarm Income," *Journal of Farm Economics* 41:1100–13, December 1959.

[6] Frank T. Bachmura, "Migration and Factor Adjustment in Lower Mississippi Valley Agriculture: 1940–50," *Journal of Farm Economics* 38:1024–42, November 1956.

[7] Lewis S. Sinclair, "Urbanization and the Incomes of Farm and Nonfarm Families in the South," *Journal of Farm Economics* 39:510–516, May 1957.

[8] W. Keith Bryant, "Causes of Inter-County Variations in Farmers' Earnings," *Journal of Farm Economics* 48:557–577, August 1966.

divisions west of the Mississippi. Hence, the hypothesis not only failed for the western part of the United States, but a relationship was found which operated in the opposite direction to that postulated.

In understanding the Schultz analytic method and Nicholls' application of it, it is important to put them both in their proper frame of reference. Schultz was writing from the standpoint of a mature economy, as most of us would define it, but an economy in which there were substantial regional income disparities within the agricultural sector. He was not concerned with the problem, currently receiving so much attention in developing countries, of how agriculture can be made more productive so that it can contribute to the industrial development of the country.

Nicholls, in the present study, also examines the part of an economy on its way to development; one in which a strong industrial sector is in place, and in which wage rates are much higher than can be obtained in the agricultural sector. When this fortunate situation exists, the question arises, "How can the gains from industrial development be distributed on as wide a base as possible?" In the U.S. economy, the work of Nicholls and others has led us to argue that *local* economic development programs should be tied to nearby growth centers. The important point to recognize is that under these circumstances the problems encountered are quite different from those connected with the agriculture of most of the underdeveloped world.

With this as a background, I would like to consider three aspects of the analysis in part three of Nicholls' paper:

The Direction of Causality

The frame of reference of the analysis is such that causality flows from industrialization, as a process *exogenous* to agriculture, to the agricultural sector. Nicholls does admit, however, that the cause-effect relationship between industrialization and the agricultural indexes in São Paulo is not at all clear. I would agree. In fact, I would argue strongly for a reverse direction of causality.

The Tennessee Valley, where Nicholls successfully used the industrial-urban hypothesis to show what was taking place, offered a set of conditions greatly different from those in the state of São Paulo. In the Tennessee Valley, the agriculture at the beginning of the study period was largely stagnant. The process of industrialization was imposed from the outside, and came largely as an exogenous shock to the system. Clearly this had an impact on the agricultural sector, and the *a priori* evidence on the direction of causality was rather clear.

The case of São Paulo is quite different, however. The state ranks high in agricultural resources. The agricultural sector has been dynamic and growing rapidly, with rather large increases in total factor productivity over time. Moreover, the evidence from numerous sources is that agriculture contributed heavily to the development of the industrial complex of São Paulo. Not only did the government transfer substantial capital from agriculture to industry through an ingenious use of multiple exchange rates and outright confiscation of exchange earnings, but agricultural entrepreneurs also invested rather heavily in the industrial sector. This was very important in the period covered by Nicholls' study. At the present time, some seventeen years later, it is my impression that the net flow is still from agriculture to industry, although there may be some areas of the state in which the direction is opposite. This makes me question whether causality can be assumed to run in the direction that Nicholls has postulated.

The Role of Increased Efficiency in the Factor and Product Markets

In their work on the Southeastern United States, both Tang and Nicholls have stressed the third set of factors accompanying industrial growth as originally stressed by Schultz—these can be summarized as follows: that industrial growth reduces the imperfections in the factor and product markets faced by agriculture and hence raises farm income per worker. Nicholls has carried this over to his Brazil work and argues that what is happening is a reduction in the imperfections in the markets.

Keith Bryant [9] has argued rather effectively that the role of imperfections has been overemphasized in these analyses. He demonstrates that in the case of the United States many of the observed relationships can be understood as a straight-out influx of capital from the industrial sector and that no appeal need be made to the reduction of imperfections in the markets. On the contrary, he argues, the evidence on a reduction in market imperfections is simply not there.

In addition, he maintains that the effect of industrial-urban development on agriculture is in large measure a question of *agglomeration.* The literature on agglomeration emphasizes the effects of economies of scale, localization economics, and urbanization economies on firms in industrial-urban complexes. The counterparts in the agricultural case are as follows:

[9] W. Keith Bryant, "Industrial-Urbanization and the Spatial Distribution of Income in Agriculture," Proceedings, *Workshop on Income Distribution Analysis,* North Carolina State University, June 1966.

(1) The expansion of the nonfarm labor markets increases the numbers and kinds of jobs available to prospective migrants. This speeds up the migration process as the opportunity cost of labor rises and thereby forces the reorganization of agriculture.

(2) A similar set of forces works in the credit market, with more credit at lower interest rates being made available to agriculture.

(3) The local demand for farm products grows as the urban population expands. At some point the market is large enough so that local agriculture can operate at a lower average cost—either because of increased specialization or because of the realization of economies of size.

(4) With the agglomeration, more social-overhead capital is provided. This means roads, which lower transportation costs, and improved educational facilities, which increase labor mobility and raise labor productivity.

These are the same kinds of factors that turn up in Nicholls' discussion. But it is important to recognize that they do not necessarily imply a reduction in market imperfections.

The Policy Implications

Nicholls' paper is somewhat disappointing in its failure to distill out the policy implications of his findings. One is led by implication to believe that industrialization may be important in transforming or modernizing the agricultural sector. Yet I doubt very much whether this is the solution in most underdeveloped countries. It seems to me that the development in many cases has to start with the agricultural sector, where most of the resources are, and proceed to raise the productivity there so that the resources for industrialization become available.

To make the issue clear, I would pose the question: "Where should we put the next $1 million of developmental resources for the northeast of Brazil—in agricultural research and extension, or in industrialization?"