# A SHIFT-SHARE ANALYSIS OF REGIONAL AND SECTORAL PRODUCTIVITY GROWTH IN CONTEMPORARY MEXICO

Clark W. Reynolds

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## FOREWORD

Roughly 1.6 billion people, 40 percent of the world's population, live in urban areas today. At the beginning of the last century, the urban population of the world totaled only 25 million. According to recent United Nations estimates, about 3.1 billion people, twice today's urban population, will be living in urban areas by the year 2000.

Scholars and policy makers often disagree when it comes to evaluating the desirability of current rapid rates of urban growth in many parts of the globe. Some see this trend as fostering national processes of socioeconomic development, particularly in the poorer and rapidly urbanizing countries of the Third World; whereas others believe the consequences to be largely undesirable and argue that such urban growth should be slowed down.

As part of a search for convincing evidence for or against rapid rates of urban growth and urbanization, a Human Settlements and Services Area research team, working with the Food and Agriculture Program, is analyzing the transition of a national economy from a primarily rural agrarian to an urban industrial-service society. Data from several countries selected as case studies are being collected, and the research is focusing on two themes: spatial population growth and economic (agricultural) development, and resource/service demands of population growth and economic development.

This paper focuses on one of several case studies: Mexico. In it, Dr. Reynolds investigates the effects of labor force shifts on sectoral as well as regional total factor productivity growth. He shows that at the beginning of the 1940–1970 period substantial increases in productivity were achieved by movements of population between sectors and between regions. However, toward the end of the period, increases in productivity attributable to labor mobility declined.

A list of the papers in the Population, Resources, and Growth Series appears at the end of this publication.

ANDREI ROGERS
*Chairman*
Human Settlements
and Services Area

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# INTRODUCTION

A decade ago Mexico's rapid productivity growth was widely acclaimed as a "miracle." Among policy makers, questions of income distribution and social equity tended to take second place to those of productivity growth. Rapid increases in output were to provide a bounty that would assuage social pressures. Income would shift from high productivity sectors toward the poor through changes in the regional and sectoral pattern of employment. A neglected majority of workers in rain-fed agriculture would benefit from a concentration of investment in irrigated farming in newly opened regions, and urban migration would absorb the rest. (Little was said about emigration abroad.) Where the natural adjustment process might fail, through inadequate market forces, the government was expected to intervene within reason. But the very surplus needed to pay for such intervention depended, it was felt, upon the underlying growth process led by private investment in response to underlying market forces working in close cooperation with government.

The strategy prior to 1970 involved conscious government decisions to postpone fiscal reform, limit development expenditures, neglect traditional agriculture, delay land redistribution that had been promised for decades, and defer exchange rate adjustment despite evidence that the peso was becoming progressively overvalued. Although these policies served to buy time, they had an adverse impact on the long-run stability of the economy and society. One consequence was that a growing share of productive assets in Mexico was coming under the control of decision makers abroad as foreign direct investment gradually overtook that of the local elite. Another was that foreign borrowing was becoming increasingly necessary to fill the gap between investment and domestic savings.

Buying time then might have made sense if the resulting pattern of development had led to productivity growth that could eventually diffuse itself through the work force, thus raising the living standards of all Mexicans. In earlier decades there was evidence that such diffusion was gradually taking

place due to the responsiveness of the work force to opportunities elsewhere and the migration in the hundreds-of-thousands of those in search of better jobs. The diffusion of productivity growth, coupled with strong demand growth, had caused an impressive shift in the regional and sectoral structure of employment. In this paper, the so-called "shift factor" is studied from 1940 to 1970. The findings are analyzed in terms of their consequences for overall productivity growth, employment, and social welfare. Placed in the context of accelerating demographic growth and subsequent growth in the number of job seekers, the study asks the question whether or not the shift factor was sufficient for Mexico's sectorally and regionally unbalanced productivity growth to become more balanced.

In 1976 the incoming administration of Lopez Portillo inherited both the problems and promises of its predecessors. The recent prospects of a petroleum export bonanza have forestalled, if not eliminated, many of the problems while greatly accelerating expectations. The success with which Mexico's goals of growth and equity may be reconciled in coming years will depend on the level and composition of future productivity growth of the economy as much as on the political skill with which the surplus of petroleum is apportioned among competing interest groups. In dealing with recent regional and sectoral trends in productivity, it is hoped that this study will contribute to the achievement of Mexico's future goals of employment, growth, and social welfare. It is also hoped that the paper sheds light on the importance to Mexico's internal stability and growth of links with the United States.

The following chapters deal respectively with (1) proximate sources of productivity growth in Mexico from 1940 to 1970; (2) the methodology used in the shift-share analysis of total factor productivity growth; (3) a shift-share analysis of total factor productivity growth in the primary, secondary, and tertiary sectors from 1940 to 1970; (4) a shift-share analysis of total factor productivity growth from 1940 to 1970 in the six main areas of Mexico: North, Gulf, North Pacific, South Pacific, Metropolitan Mexico City, and Rest of Center; (5) a shift-share analysis of productivity growth from 1940 to 1970 in the three main regions: Border, Metropolitan Mexico City, and Rest of Mexico; and (6) a shift-share analysis of the primary, secondary and tertiary sectors of the three main regions of Mexico from 1940 to 1970.

The following analysis was made possible as part of the program of the Mexico Task Force of IIASA's Human Settlements and Services Area and is believed to have relevance well beyond the Mexican case.[1]

# 1 PROXIMATE SOURCES OF PRODUCTIVITY GROWTH IN MEXICO FROM 1940 TO 1970

In a recent paper, Professor Ansley Coale of Princeton University in the USA commented that Mexico had astonished the world with its sustained rapid productivity growth since 1955, despite increased fertility rates and accelerating population growth. He suggested that its recent economic performance might have been even better had demographic pressures been alleviated beginning in the mid-1950s rather than two decades later. He also predicted that the wave of job seekers generated by past population growth will flow forward into the labor force for at least another generation (Coale 1978). In order to assess the impact of increased labor supply on the level and diffusion of productivity gains, an analysis is made first of net productivity growth at the national level (Chapter 1) and then of sectoral and regional productivity growth (Chapters 3–6). The findings offer striking support for Professor Coale's hypothesis and have sober implications for government policies as well as for the level and pattern of private expenditures if goals of growth and income distribution are to be made consistent with accelerated expansion of the work force.

## MEASURING TOTAL FACTOR PRODUCTIVITY GROWTH

In this section we present new calculations of total factor productivity growth in Mexico from 1940 to 1975 based on the most recent available information on output and input of labor, capital, and land. The objective is to determine how total factor productivity has grown during periods of quite different patterns of employment and investment, government policy, and land use. The stress is on productivity growth as an essential element in the improvements of standards of living. The relationship between total factor productivity, labor productivity, and employment is crucial to the distribution of gains throughout the work force. But the first step is to determine whether output has continued to rise relative to *all* factor inputs, including capital and land. The basis of the calculations is a simplified "Denison production function" (Denison 1962) in which output is expressed as a function of labor ($L$), capital ($K$), land ($R$), and

a total factor productivity term ($e^T$). Thus, $Y = e^T L^a K^b R^c$ such that the logarithmic relationship $\hat{Y} = T + a\hat{L} + b\hat{K} + c\hat{R}$ permits one to use information on observed growth of the respective inputs of labor, capital, and land and on observed growth of output to derive the "unexplained residual" of total factor productivity ($T$), such that

$$\hat{Y} - a\hat{L} + b\hat{K} + c\hat{R} = T$$

Inputs $L$, $K$, and $R$ are weighted according to the assumptions of a Cobb–Douglas production function[2] in which case the constant returns to scale property ensures that the output elasticity coefficients with respect to each input ($a$, $b$, and $c$, respectively) sum to unity. Each coefficient represents the respective share of that factor in value added. Hence, we can use observed shares of value added in gross domestic product (GDP) accruing to each factor to represent that factor's elasticity of output $a$, $b$, or $c$. For example, if the share of labor income represents 60 percent of GDP, then the coefficient for labor inputs is assumed to be 0.6. For purposes of the following calculations, the factor shares applied to the Mexican case are[3]

$a$ = labor share = 0.60

$b$ = capital share = 0.35

$c$ = land rent share = 0.05

Growth of output is taken from the Bank of Mexico's GDP estimates expressed in constant prices. These figures are published in Bank of Mexico (1960–1976).[4]

Growth of the labor force is based on man-years of labor uncorrected for age, sex, skill, or degree of unemployment or underemployment, drawing upon census figures for the economically active population over 12 years of age (PEA) for the years 1940, 1950, and 1970. For 1960 major adjustments to the census figures were made by Altimir (1974), reducing the PEA by slightly over one million workers.[5]

The capital stock indexes for 1960 onward are calculated as follows. An initial capital stock is assumed, a hypothetical rate of depreciation is applied, and current gross investment (in constant) prices are added in order to derive the capital stock ($K$) at the end of the year (Table 1).[6]

In Table 2, proximate sources of productivity growth in the national economy are estimated in order to determine the residual attributable to increased total factor productivity.[7] Productivity gains at the national level, after rising steadily from the 1940s through the mid-1960s, have since sharply reversed their trend. The unexplained residual, which is a surrogate for net productivity growth in the economy, fell from a high of 3.4 percent per annum in the period 1960–65 to 2.9 percent per annum in the second half of the decade and further declined to 1.6 percent per annum in the 1970–75 period. This trend primarily reflects higher growth rates of labor and capital inputs in

TABLE 1 Capital stock estimates for the relevant years used in the productivity calculations.

| | Gross investment (million current pesos)[a] | Gross investment[b] $I$ (million 1960 pesos) | Capital stock $K$ (million 1960 pesos) | Gross domestic product $Y$ (million 1960 pesos) | Capital/ output $K_{t-1}/Y_t$ |
|---|---|---|---|---|---|
| 1959 | | | 331 124 | | |
| 1960 | 33 123 | 33 132 | 347 700[d] | 150 511 | 2.2 |
| 1961 | 32 829 | 31 750 | | 157 931 | |
| 1962 | 32 344 | 30 370 | | 165 310 | |
| 1963 | (34 426)[c] | 31 353[c] | | 178 516 | |
| 1964 | (36 642)[c] | 31 588[c] | 399 208 | 199 390 | |
| 1965 | 39 000 | 32 856 | 412 103 | 212 320 | 1.9 |
| 1966 | 50 400 | 40 843 | | 227 037 | |
| 1967 | 59 600 | 46 929 | | 241 272 | |
| 1968 | 65 700 | 50 538 | | 260 901 | |
| 1969 | 72 500 | 53 664 | 514 707 | 277 400 | |
| 1970 | 81 100 | 57 436 | 546 407 | 296 600 | 1.7 |
| 1971 | 75 500 | 51 254 | | 306 800 | |
| 1972 | 98 874 | 63 503 | | 329 100 | |
| 1973 | 123 300 | 70 456 | | 354 100 | |
| 1974 | 175 759 | 80 995 | 694 236 | 375 000 | |
| 1975 | 210 189 | 81 977 | 741 501 | 390 300 | 1.8 |

[a] At the official exchange rate a current peso in 1978 was worth about US$0.045. On a purchasing power parity basis a 1960 peso would be worth about US$0.25 (1978) value and a 1950 peso would be worth about US$0.50 today.

[b] Converted from current values using implicit GDP inflator. Figures for 1972 to 1975 are from Fitzgerald (1977b) expressed as percentages of GDP, applied to 1960 value GDP estimates of the Bank of Mexico for the same years.

[c] Interpolated for 1963, 1964.

[d] Raymond Goldsmith (1966) estimated the physical capital stock ("structures and equipment") for 1960 to be 250 000 current pesos (cited in Reynolds 1970, Appendix Table D.8, 0.383).

SOURCES: The initial capital stock figure as well as the current value figures for gross investment 1960–62 were taken from Reynolds (1970, p. 7.9). Gross investment figures for 1965–71 in current values are from Fitzgerald (1977a) Table II. For 1972–75 (from Fitzgerald 1977a), investment percentages of GDP are applied to GDP figures from Bank of Mexico official estimates to derive gross investment estimates. The method of calculation of $K$ is described in the text.

contrast to slower growth rates of output in recent years. Since both the economic constraints on the ability of government to respond to social pressures and the capacity of the market to transmit productivity gains from leading to lagging sectors depend on net productivity growth, this is an alarming trend. It suggests that the Mexican economy may have reached a watershed in the mid-1960s, such that the previous pattern of development described earlier (Reynolds 1970) is now giving way to a new set of structural forces that will

TABLE 2 Proximate sources of productivity growth in the Mexican economy, 1940–70 (compound annual rates of growth).

| | 1940–50 | 1950–60 | 1960–70 | 1960–65 | 1965–70 | 1970–75 |
|---|---|---|---|---|---|---|
| *OUTPUT* | | | | | | |
| 1. Gross Domestic Product[a] | 5.8 | 5.9 | 6.8 (7.2)[b] | 6.9 | 6.7 | 5.5 |
| *INPUT* | | | | | | |
| 2. Man years of Labor[c] | 3.5 | 2.0 | 2.4 | (2.4)[d] | (2.4)[d] | (2.5)[d] |
| 3. Stock of Fixed Reproducible Assets | 2.8 | 5.5 | 6.0 | 5.3 | 6.7 | 6.7 |
| 4. Hectares of Land in Cultivation | 3.6 | 1.0 | 2.1 | 3.2 | −0.5 | (2.0)[d] |
| 5. Rate of Growth Attributable to Inputs 2, 3 and 4 above[e] | 3.3 | 3.2 | 3.6 | 3.5 | 3.8 | (3.9)[d] |
| 6. Rate of Growth Unexplained by Above Inputs ("Unexplained residual") | 2.5 | 2.7 | 3.2 | 3.4 | 2.9 | (1.6)[d] |

[a] The compound rates of growth of gross domestic product (GDP) for the periods 1940–50 and 1950–60 are based on GDP estimates used by Unikel (1976) and Appendini (1974 and private communication) in million 1950 pesos (1940: 22 889; 1950: 41 060; 1960: 74 215). These are taken from Solis (1970) and may be compared with other Bank of Mexico estimates used in Reynolds (1970) for 1940 in 1950 pesos: 21 658; 1950: 41 060; 1960: 74 317.

[b] Unikel's figure for 1970 is 152 341 which implies a rate of growth for 1960–70 of 7.2 percent per annum. However, the latest Bank of Mexico data (in million 1960 pesos) as cited in Table 1, imply a lower growth rate for 1960s of 6.8 percent per annum. Note that regional and national shift-share estimates of subsequent sections employ the Unikel–Appendini GDP estimates (in 1950 pesos), so that they almost certainly bias upward productivity growth during that decade.

[c] Based on economically active population (PEA) reported in the census for those 12 years of age and over for 1940: $5858 \times 10^3$; 1950: $8345 \times 10^3$; 1970: $12\,955 \times 10^3$. The 1960 census figure for PEA ($11\,253 \times 10^3$) was rejected in favor of the downward adjustment by Altimir: $10\,213 \times 10^3$. The growth of PEA for 1950–60 based on Altimir's adjustment is 2.0 percent per annum and that for 1960–70 is 2.4 percent per annum. On the basis of the official 1960 census figures for PEA the growth for the 1950s rises to 3.1 percent per annum and that of the 1960s falls to 1.4 percent per annum (too low and too high respectively, see text).

[d] Estimate based on extrapolation of trends (land and labor, 1975) or interpolation (labor, 1965).

[e] The weights used were labor (0.60), capital (0.35), and land (0.05), compared to Reynold's (1970) weights 0.66, 0.29, and 0.05 respectively which would give residuals of 1940–50: 2.5 percent per annum; 1950–60: 2.9 percent per annum; and 1960–70: 3.4 percent per annum. For the form of production function used see page 4. The factor shares applied in Table 2 reflect subjective considerations of underlying factor productivities in the absence of distortions in relative prices, subsidies, and other policies which bias upward the share of profits, interest, and quasi-rent. The actual labor share of GDP during the period was probably closer to 30 percent, while the capital share, including mixed income of owner-operated farm and nonfarm enterprises and depreciation allowances, was about 65 percent of GDP. The

imply slower output growth per unit of input.[9] Since this process of deceleration is occurring precisely at the time when pressures are mounting for wage increases, greater social outlays, more equitable agrarian policies, and other reform measures, an analysis of the factors underlying productivity growth is especially timely. Also the acceleration in demographic growth and urbanization in recent decades places a growing demand on the economy to absorb new entrants into the work force, exacerbating the problems caused by declining rates of output growth.

The preceding examination of productivity trends suggests that rapid expansion of the work force may have begun to place a significant drag on productivity growth as early as the mid-1960s. The turnaround in the "residual" reflecting net factor productivity growth may be due to the onset of diminishing marginal productivity of labor as growth in the supply of available workers began to outstrip demand growth. This is supportive of the suggestions by Coale (1978) that acceleration in population growth since 1940 would, with a lag, lead to a lower rate of productivity growth and social progress than would have been obtained under more moderate demographic conditions. The more detailed shift-share analysis of the following chapters provides additional evidence to support this conclusion.

Although both output and productivity growth have decelerated in the past decade, Mexico's rate of investment has continued to expand as shown in Table 3.

The investment share of GDP has risen progressively since 1940 as has the internal rate of savings, which in the 1970s was almost double that of the 1940s. Investment opportunities appear to have increasingly outstripped domestic savings capacity, leading to a growth of foreign borrowing. External borrowing (imports minus exports) has risen sharply as a share of GDP, from 0.2 percent in the 1940s to 1.8 percent and 3.1 percent in the 1960s and 1970s, respectively. As a share of total investment, external borrowing rose from under 2 percent in the 1950s to 10 percent in the 1960s and 15 percent in the 1970s. This is consistent with evidence that net productivity growth is decelerating, implying that the domestic surplus available for saving and investment is expanding at a lower rate, forcing increased dependence on foreign borrowing and foreign direct investment.

In Latin America total government expenditure has risen as a share of GDP in recent years. Mexico remains below the average as shown in Table 4 below.

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land rent share was about 5 percent of GDP. If these observed shares were used to weight inputs, productivity residuals would be 2.8 percent per annum for the 1940s, 1.7 percent per annum for the 1950s, and 2.1 percent per annum for the 1960s. For the period 1960–65 productivity growth would be 2.6 percent per annum, 1965–1970 would be 1.7 percent per annum, and 1970–75 would be 0.3 percent per annum, sharpening the downtrend in productivity growth observed in recent years.

Notes on sources and methods: Land inputs are derived from figures in Hewitt (1976) for total cropland of Mexico for 1960 and 1970.[8] Earlier years are from Reynolds (1970). The figures from Hewitt (1976) for total hectares cultivated are $7934 \times 10^3$ for 1940, $10\,753 \times 10^3$ for 1950, $12\,239 \times 10^3$ for 1960, and $15\,128 \times 10^3$ for 1970.

TABLE 3 Rates of investment and saving in Mexico (as a percentage of GDP).

| | Gross fixed capital formation | | | Gross saving | | |
|---|---|---|---|---|---|---|
| Average | public | private | total | internal | external | total |
| 1940–49 | 4.4 | 4.8 | 9.2 | 9.0 | 0.2 | 9.2 |
| 1950–59 | 5.4 | 10.8 | 16.2 | 15.0 | 1.2 | 16.2 |
| 1960–69 | 7.0 | 10.6 | 17.6 | 15.8 | 1.8 | 17.6 |
| 1970–76 | 8.4 | 12.0 | 20.4 | 17.3 | 3.1 | 20.4 |

SOURCE: Fitzgerald (1977a, p. 50).

TABLE 4 Public sector expenditure in Latin America, 1960–70 (as percentage of GDP).

| Country | 1960–61 | 1969–70 |
|---|---|---|
| Mexico | 16.7 | 21.9 |
| Argentina | 21.4 | 25.2 |
| Brazil | 25.3 | 33.3 |
| Chile | 29.3 | 34.6 |
| Colombia | 11.2 | 17.3 |
| Peru | 15.9 | 18.9 |
| All Latin America[a] | 20.7 | 25.7 |

[a] Average weighted by GDP in 1960.
SOURCE: Economic Commission for Latin America, cited in Fitzgerald (1978, p. 9).

TABLE 5 Consolidated federal government account, 1940–76 (as percentage of GDP).

| | 1940–49 | 1950–59 | 1960–68 | 1969–72 | 1973–76 |
|---|---|---|---|---|---|
| Current income | 6.5 | 7.7 | 7.5 | 8.2 | 9.8 |
| Current expenditure | 4.6 | 5.4 | 6.1 | 6.5 | 8.9 |
| Current account surplus | 1.9 | 3.2 | 1.3 | 1.6 | 0.9 |
| Capital expenditure: GDCF[a] | 1.7 | 2.0 | 2.0 | 2.2 | 3.2 |
| Other | 0.5 | 1.3 | 1.2 | 0.6 | 0.7 |
| Total capital expenditure | 2.2 | 3.3 | 3.2 | 2.8 | 3.9 |
| Total expenditure | 6.8 | 7.8 | 9.3 | 9.0 | 12.8 |
| Total deficit | 0.3 | 0.1 | 1.8 | 1.2 | 3.0 |

[a] Gross Domestic Capital Formation.
SOURCE: Fitzgerald (1978, p. 14).

The federal government, by far the dominant fiscal entity, has progressively increased both its current and capital expenditure shares, while the current account surplus is declining (Table 5). Although tax shares of GDP have risen, they have not grown as fast as current expenditures. Thus burgeoning capital formation of the public sector has increasingly been financed out of government borrowing from the financial sector, foreign credits, and an

"inflation tax" on the private sector, reflecting Central Bank discounting of otherwise unfunded fiscal deficits.

## CONCLUSIONS

This chapter indicates that in terms of total factor productivity growth at the national level, Mexico was losing ground by the 1970s with consequences for both private and public sector savings and investment. While increased rates of investment would be required to sustain the rate of output growth, the surplus needed to finance that investment was decelerating, even as social pressures for income redistribution increased. In the following chapters, an analysis is made of the underlying patterns of productivity growth by sector and region in order to determine some of the proximate causes of declining productivity growth.

## 2 METHODOLOGY USED IN THE SHIFT-SHARE ANALYSIS OF TOTAL FACTOR PRODUCTIVITY GROWTH

An important share of overall productivity growth in Mexico has been associated with a continuing shift of the labor force from lower to higher productivity occupations. This shift has occurred within production sectors, among sectors, and between regions of the economy, as well as from rural to urban areas. In an earlier work (Reynolds 1970), a measurement was made of the relative contribution of shifts of labor among the three main sectors of the economy – primary (agriculture, cattle, forestry, fishing), secondary (manufacturing, mining, petroleum, electricity), and tertiary (transport, communications, commerce, government, other services), – for the two decades since 1940. Subsequently, these calculations at the national level were updated to include the 1960s (Reynolds 1977). It is now possible to extend this analysis to the regional level permitting productivity growth to be linked to internal migration. To do this, shift-share analysis is applied to the main regions of the economy as well as to intra-regional shifts among the three production sectors for the three decades from 1940 to 1970. This permits one to determine the secular pattern of output, employment, and total factor productivity growth (increase in value added per worker) in response to changing market conditions and government policy. Extending the shift-share analysis to the regional level, first to six areas (North, Gulf, North Pacific, South Pacific, Metropolitan Mexico City, and Rest of Center), then to three regions (the Border States, Metropolitan Mexico City, and Rest of Mexico), substantially increases the usefulness of the analysis since major migratory trends can be taken into consideration. Trends in agricultural and tertiary sector productivity show sharp regional differentials as do related patterns of migration and employment.[10]

The method of estimating the shift-share component of total factor productivity growth is relatively straightforward. It takes advantage of the fact that growth in value added per worker in the economy as a whole (or in any region of the economy) is the sum of increases in output per worker multiplied by initial employment in the subsectors, plus the increase in sectoral

employment multiplied by initial output per worker in the subsectors, plus the cross products.

The model is as follows:[11]

$$Y_T = Y_1 + Y_2 + \ldots + Y_n \tag{1}$$

$$Y_T/N_T = Y_1/N_T + Y_2/N_T + \ldots + Y_n/N_T \tag{2}$$

$$Y_T/N_T = (Y_1/N_1)(N_1/N_T) + (Y_2/N_2)(N_2/N_T) + \ldots + (Y_n/N_n)(N_n/N_T) \tag{3}$$

where $Y_{ij} \equiv$ value added in sector or region $i$ in period $j$, where $i = 1, \ldots, n$; $N_{ij} \equiv$ employment in sector $i$ in period $j$, where $i = 1, \ldots, n$; and $T \equiv$ total economy. Let

$$A \equiv Y_1/N_1; \quad a \equiv N_1/N_T$$
$$B \equiv Y_2/N_2; \quad b \equiv N_2/N_T$$
$$\vdots$$
$$Z \equiv Y_n/N_n; \quad z \equiv N_n/N_T$$

and let $t \equiv$ period $t$; and let $t + j$ be the period $t$ plus $j$ periods; and let $\Delta \equiv$ change from period $t$ to period $t + j$; then

$$\frac{Y_{Tt}}{N_{Tt}} = A_t a_t + B_t b_t + \ldots + Z_t z_t \tag{4}$$

$$Y_T(t+j)/N_T(t+j) = (A_t + \Delta A)(a_t + \Delta a) + (B_t + \Delta B)(b_t + \Delta b) + \ldots + (Z_t + \Delta Z)(z_t + \Delta z) \tag{5}$$

$$Y_T(t+j)/N_T(t+j) = A_t a_t + \Delta A a_t + A_t \Delta a + \Delta A \Delta a + B_t b_t + \Delta B b_t + B_t \Delta b + \Delta B \Delta b + \ldots + Z_t z_t + \Delta Z z_t + Z_t \Delta z + \Delta Z \Delta z \tag{6}$$

therefore

$$Y_T(t+j)/N_T(t+j) - Y_{Tt}/N_{Tt} = \Delta Y_T/N_T = \Delta A a_t + A_t \Delta a + \Delta A \Delta a + \Delta B b_t + B_t \Delta b + \Delta B \Delta b + \ldots + \Delta Z z_t + Z_t \Delta z + \Delta Z \Delta z \tag{7}$$

This change can be divided into the own sectoral (or regional) productivity growth component, the intersectoral (or interregional) shift component, and the combined elements as follows:

$$A(Y_T/N_T) = \overbrace{\Delta A a_t + \Delta B b_t + \ldots + \Delta Z z_t}^{\text{own sectoral (or regional) factors}} + \overbrace{\Delta a A_t + \Delta b B_t + \ldots + \Delta z Z_t}^{\text{shift factors}} + \overbrace{\Delta A \Delta a + \Delta B \Delta b + \ldots + \Delta Z \Delta z}^{\text{combined factors}} \tag{8}$$

The model may be used to estimate the effects on productivity of the country as a whole from shifts in labor among sectors with different average productivities (shift factor) as distinct from the changes in total output per worker resulting from productivity growth within each sector (own factor). The term "total factor productivity" reflects the fact that the numerator (value added) represents the return to all factors of production, though only labor appears in the denominator. Hence, the increases in output due to factors such as physical capital, average hours worked per man-year, age, sex, and skill composition of the work force, and technological change are all included in the measure. Index number problems may bias output estimates owing to changes in relative prices and product mix. None of these factors is expressly considered here.

A simplifying assumption in the model is that changes in output per worker occur independently from employment changes. Hence, a once-and-for-all shift in average productivity of labor from period $t$ to $t + j$ is implied in $\Delta A$, $\Delta B$, . . . , $\Delta Z$, assuming average productivity to be invariant to subsequent changes in the quantity of employment in the sector (or region). This implicitly supposes that complementary factor inputs adjust in proportion to labor inputs under conditions of constant returns to scale for each sector and region.

One might alternatively assume that labor is subject to diminishing marginal productivity so that $\Delta A$ would be a declining function of $\Delta a$ and similarly for other sectors. There is evidence that investment growth has increased more rapidly than the demand for labor since the capital–labor ratio is rising in the economy as a whole. However, it is likely that capital deepening was disproportional among sectors and regions in Mexico and that the capital–labor ratio grew more slowly in the tertiary sector than in the secondary or primary sectors. It is also likely that capital deepening was more pronounced in the Border region and the Metropolitan Mexico City region than in the Rest of Mexico region. Unfortunately, comparable investment figures are unavailable at the sectoral or regional level, making it impossible to estimate the pure marginal productivity of labor by region and sector for the three decades studied. Hence, the total factor productivity model presented above is used for the analyses in Chapters 3–5.

## 3 A SHIFT-SHARE ANALYSIS OF TOTAL FACTOR PRODUCTIVITY GROWTH IN THE PRIMARY, SECONDARY, AND TERTIARY SECTORS FROM 1940 TO 1970

The pattern of total factor productivity growth among the three principal sectors of the economy is presented in Table 6 for four benchmark years, 1940, 1950, 1960, and 1970. It is evident that growth in output per worker was not balanced among the sectors nor did the same rank order of growth apply over time. In the 1940s the tertiary sector led with absolute productivity growth of 626 pesos per worker, followed by the primary sector with 550 pesos per worker.[12] The fact that 22 percent of overall growth was attributable to the primary sector (Table 7) and 44 percent to the tertiary sector was extremely important in permitting the economy to expand at the rate it did in the 1940s. In contrast, the secondary, which might have been expected to take the lead, fared least well despite its recovery from several decades of revolution and depression during the boom years of World War II. Productivity grew by only 148 pesos per worker in the secondary sector, though it accounted for one-third of total productivity growth in the economy. This is partially explained by the fact that capital deepening in manufacturing only began after World War II when machinery and equipment imports again became available. The lagged effects of these investments are seen in the data for the 1950s (Table 6) when the secondary sector took the lead, accounting for almost 40 percent of the nation's productivity growth (Table 7).

The primary sector, which had been given substantial injections of public infrastructure investment since the late 1930s, also showed increased productivity growth during the 1950s, though it lagged behind the rest of the economy. Its share of total productivity growth declined to one-half of the former rate or 11 percent in the 1950s. The relatively large and growing share of the labor force in the tertiary sector caused it to account for an ever-increasing share of national productivity growth reaching 50 percent in the 1950s and 64 percent in the 1960s (Table 7).

These data point to the key role of labor migration in Mexico's total factor productivity growth. They suggest that a "pull" factor operated

TABLE 6 Output, employment, and total factor productivity growth in Mexico, 1940–70.

| | | 1940 | 1950 | 1960 | 1970 |
|---|---|---|---|---|---|
| *Primary sector*[a] | | | | | |
| $Y_A$ | Output (value added in million 1950 pesos) | 5 171 | 9 242 | 13 917 | 17 712 |
| $N_A$ | Labor Force (PEA[b] × $10^3$) | 3 832 | 4 867 | 5 048 | 5 293 |
| $Y_A/N_A$ | Output per worker (1950 pesos) | 1 349 | 1 899 | 2 757 | 3 346 |
| $\Delta(Y_A/N_A)$ | Change in output per worker over past decade (1950 pesos) | | 550 | 858 | 589 |
| *Secondary sector*[c] | | | | | |
| $Y_B$ | Output | 6 788 | 12 466 | 24 603 | 52 198 |
| $N_B$ | Labor Force | 826 | 1 490 | 2 175 | 3 439 |
| $Y_B/N_B$ | Output per worker | 8 218 | 8 366 | 11 312 | 15 178 |
| $\Delta(Y_B/N_B)$ | Change in output per worker | | 148 | 2 946 | 3 866 |
| *Tertiary sector*[d] | | | | | |
| $Y_C$ | Output | 10 930 | 19 352 | 35 695 | 82 431 |
| $N_C$ | Labor Force | 1 200 | 1 988 | 2 990 | 4 223 |
| $Y_C/N_C$ | Output per worker | 9 108 | 9 734 | 11 938 | 19 517 |
| $\Delta(Y_C/N_C)$ | Change in output per worker | | 626 | 2 204 | 7 579 |
| *Total* GDP | | | | | |
| $Y_T$ | Output | 22 889 | 41 060 | 74 215 | 152 341 |
| $N_T$ | Labor Force | 5 858 | 8 345 | 10 213 | 12 955 |
| $Y_T/N_T$ | Output per worker | 3 907 | 4 920 | 7 267 | 11 759 |
| $\Delta(Y_T/N_T)$ | Change in output per worker | | 1 013 | 2 347 | 4 495 |

[a] Primary sector: agriculture, cattle, forestry, fishing.
[b] PEA stands for economically active population over 12 years of age.
[c] Secondary sector: manufacturing, mining, petroleum, construction, electricity.
[d] Tertiary sector: transport, communications, commerce, government, other services. (Banking services are included in the value added of the respective user sectors including services. Hence their inclusion in the tertiary sector is net of an adjustment for banking services in the primary and secondary sectors.)

Notes on sources and methods: GDP estimates in million 1950 pesos are taken directly from Unikel (1976) and Appendini (1974 and private communication) both of which refer to Solis (1970). There are now more recent estimates by the Bank of Mexico for years since 1960, reported in 1960 pesos. These later estimates may be compared to those of Solis (1970) by converting the former into 1950 pesos using the implicit GDP deflator between 1950 and 1960 of 0.477. This deflator is based on earlier official Bank of Mexico GDP series presented in Reynolds (1970, pp. 368–373). In that series, GDP for 1960 in current prices was 155 867 and in constant 1950 prices 74 317, giving an implicit deflator of 0.477.

continually from 1940 into the 1960s, drawing labor from primary into secondary and tertiary occupations and sustaining strong absolute and relative productivity gains in both sectors. A number of scholars have pointed to the potential for increases in output per worker in certain key tertiary activities due to capital deepening, technological progress, learning by doing, and the rising skill content of labor. Still the enormous upward productivity trend for the tertiary sector (Table 7) seems exaggerated. For this reason some alternative calculations were made for the present study based on more recent GDP estimates by the Bank of Mexico. While these updated data differ from those used for the regional estimates in the following chapters (the Unikel (1976)–Appendini (1974) breakdown of GDP at the state level is linked to earlier GDP estimates as shown in Table 6), the updated data are useful for checking possible biases in aggregate productivity growth estimates due to previous GDP estimates.

In Table 8, an alternative set of total factor productivity figures (Estimate B) is presented for all sectors, using the more recent GDP estimates. These data show somewhat more productivity growth in the tertiary sector during the 1950s and much less in the 1960s than those of Estimate A. The secondary sector, on the other hand, shows opposite changes, productivity growth being less in the 1950s and greater in the 1960s in Estimate B. Evidence of impressive growth in the manufacturing subsector during the 1960s is sustained by the new data, as is evidence of acceleration of productivity in the secondary sector.

| | Bank of Mexico (1977) | | | | Unikel* | |
|---|---|---|---|---|---|---|
| Sector | 1960 | | 1970 | | 1960 | 1970 |
| | (Million pesos) | | (Million pesos) | | (Million pesos) | |
| | 1960 prices | 1950† prices | 1960 prices | 1950 prices | 1950 prices | |
| Primary | 23 970 | 11 433 | 34 535 | 16 473 | 13 917 | 17 712 |
| Secondary | 43 933 | 20 956 | 102 154 | 48 727 | 24 603 | 52 198 |
| Tertiary | 82 608 | 39 404 | 159 911 | 76 278 | 35 695 | 82 431 |
| Total GDP | 150 511 | 71 793 | 296 600 | 141 478 | 74 215 | 152 341 |

* Used in Table 6.

† Converted by a factor of $\frac{1950}{1960}$ peso = 0.477.

There is probably a wide margin of error in GDP whatever the estimates adopted. For reasons of consistency with the Unikel–Appendini statewide breakdowns of GDP, which we employ in later sections of the paper, the Unikel series was chosen. Hence, growth in output for both the 1950s and 1960s is slightly higher in Table 6 than would have been obtained using the more recent revisions of GDP, see Table 6. The latter gives a compound annual rate of growth for 1960 to 1970 of 6.8 percent. The later estimates imply much less relative productivity growth in the tertiary sector in the 1960s, though it still leads in absolute terms.

Labor force estimates are for PEA from the censuses of 1940, 1950, and 1970, as presented in Unikel (1976). Data on PEA for 1960 are revised downward based on Altimir (1974), as discussed earlier. Data on PEA for 1970 are based on Altimir (1974). The author is indebted to Peter Gregory for calling attention to the adjustments required in the 1970 labor force estimates.

TABLE 7 Sectoral and shift elements underlying growth in output per worker, 1940–70. (All nonpercentage figures represent 1950 pesos per worker.)

| | 1940–50(%) | | 1950–60(%) | | 1960–70(%) | |
|---|---|---|---|---|---|---|
| *Primary sector* | | | | | | |
| $\Delta Aa$ (Sectoral) | 360 | | 500 | | 291 | |
| $\Delta aA$ (Shift) | − 95 | | − 169 | | − 234 | |
| $\Delta a\Delta A$ (Combined) | − 39 | | − 76 | | − 50 | |
| Weighted growth of output per worker | 226 | 22 | 255 | 11 | 7 | 0 |
| *Secondary sector* | | | | | | |
| $\Delta Bb$ | 21 | | 527 | | 823 | |
| $\Delta bB$ | 312 | | 284 | | 588 | |
| $\Delta b\Delta B$ | 6 | | 100 | | 201 | |
| Weighted growth of output per worker | 339 | 33 | 911 | 39 | 1612 | 36 |
| *Tertiary sector* | | | | | | |
| $\Delta Cc$ | 128 | | 525 | | 2221 | |
| $\Delta cC$ | 300 | | 535 | | 394 | |
| $\Delta c\Delta C$ | 21 | | 121 | | 250 | |
| Weighted growth of output per worker | 449 | 44 | 1181 | 50 | 2865 | 64 |
| *Total Mexico* | | | | | | |
| $\Delta Yn$ | 509 | | 1552 | | 3335 | |
| $\Delta nY$ | 517 | | 650 | | 748 | |
| $\Delta n\Delta Y$ | − 12 | | 145 | | 401 | |
| Total $\Delta(Y/N)$ growth of output per worker | 1014 | 100 | 2347 | 100 | 4484 | 100 |
| *Shift* (%) | | | | | | |
| $\Delta Yn$ estimated change in productivity with no shift in labor force | 509 | | 1552 | | 3335 | |
| Share of productivity attributable to the shift factor | $\frac{1014-509}{1014}=0.50$ | | $\frac{2347-1552}{2347}=0.34$ | | $\frac{4484-3335}{4484}=0.26$ | |

Notes: Definitions of sectors are given in Table 6. $\Delta A$, $\Delta B$, and $\Delta C$ refer, respectively, to changes in output per worker in the primary, secondary, and tertiary sectors based on data in Table 6. $a$, $b$, and $c$ refer to the share of the labor force in the primary, secondary, and tertiary sectors in the base year of each period. $\Delta a$, $\Delta b$, and $\Delta c$ refer to changes in the sectoral share of the labor force over each decade based on labor force data in Table 6.

A 1950 peso valued at the exchange rate in that year of 8.64 pesos to the US dollar, was then worth about US$0.11.6, which owing to US inflation would be equal to US$0.30 in 1977. Raising the 1950

But perhaps most notable is that the tertiary sector, which led the rest in productivity growth in the 1940s and 1950s, now lags behind the secondary sector. This provides important evidence that service employment may be beginning to place a drag on Mexico's overall productivity growth, helping to account for a turnaround in the "residual" as reported in Chapter 1. One might expect this, given the rush of job seekers to the urban sector, which reflects earlier demographic trends, recent lags in agricultural productivity growth, and a steady shift toward more capital-intensive cropping since the 1930s. Indeed, the primary sector has made a shockingly small contribution to national productivity, falling to 11 percent in the 1950s and to zero in the 1960s (Table 7). Even by more recent GDP estimates, which bias upward agricultural output growth in the 1960s to 3.7 percent per annum (compared to Unikel's figures of 2.4 percent in Table 8), the primary sector only accounted for 1 percent of national productivity growth in the 1950s and 4 percent in the 1960s (Table 9).[13]

Based on the data in Table 6, total factor productivity growth in Mexico increased steadily since 1940: from 2.3 percent per annum in the 1940s to 3.9 percent and 4.8 percent respectively in the 1950s and 1960s. These figures agree with the general trend of *net* productivity growth through the mid-1960s presented in Chapter 1 (Table 2), which also takes into account capital and land inputs. In absolute terms the increase in output per worker in the 1960s was four times that of the 1940s, or almost 4500 (1950) pesos in the course of the decade. This is equivalent to between 1200 and 2400 current US dollars, depending on the conversion factor used. In principle such growth should have greatly enlarged the economic "policy space" permitting higher rates of savings and investment together with improvements in real incomes of the work force. However, more recent GDP estimates show slower growth in the 1960s of about 3900 (1950) pesos per worker, or between $1000 and $2000 (1978 US dollars). (See Table 8 for a comparison of the two sets of estimates.) Of course these estimates do not take into consideration the turning point in the mid-1960s indicated by the analysis in Chapter 1.

Especially interesting is the contribution to overall productivity growth made by shifts in employment from lower to higher productivity occupations. This is one important element in the "unexplained residual" presented in Table 2. To the extent that there has been a shift of the work force toward more productive occupations, significant gains in national productivity growth could have been experienced without net gains in any specific sector. In Reynolds (1970) the shift element was estimated as a residual after deducting from total

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peso to its 1960 peso value, based on the Mexican implicit GDP deflator (1/0.477) and then converting to US dollars at the 1960 purchasing power parity rate of 8 pesos to the dollar would give a 1950 peso value of US$0.26 in 1960. At the US GDP deflator between 1960 and 1977 of 2.057, this would represent over US$0.50 today in terms of purchasing power (Reynolds 1970; US Government Council of Economic Advisors 1978). Hence one may estimate the value of 100 (1950) pesos to be between US$30 and US$50 in 1977.

TABLE 8 Alternative output and total factor productivity growth, Estimates A and B, 1960 and 1970.

| | 1950 | 1960 | | | | 1970 | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Est. A | Est. A | %[a] | Est. B | %[a] | Est. A | %[a] | Est. B | %[a] |
| *Primary sector* | | | | | | | | | |
| $Y_A$ Output (value added in million 1950 pesos) | 9 242 | 13 917 | 4.1 | 11 433 | 2.1 | 17 712 | 2.4 | 16 473 | 3.7 |
| $N_A$ Labor force (PEA $\times 10^3$) | 4 867 | 5 048 | | 5 408 | | 5 293 | | 5 293 | |
| $Y_A/N_A$ Output per worker (1950 pesos) | 1 899 | 2 757 | | 2 265 | | 3 346 | | 3 112 | |
| $\Delta(Y_A/N_A)^b$ Change in output per worker over past decade (1950 pesos) | | 858 | | 366 | | 589 | | 847 | |
| *Secondary sector* | | | | | | | | | |
| $Y_B$ | 12 466 | 24 603 | 6.8 | 20 959 | 5.2 | 52 198 | 7.5 | 48 727 | 8.4 |
| $N_B$ | 1 490 | 2 175 | | 2 175 | | 3 439 | | 3 439 | |
| $Y_B/N_B$ | 8 366 | 11 312 | | 9 636 | | 15 178 | | 14 169 | |
| $\Delta(Y_C/N_C)^b$ | | 2 946 | | 1 270 | | 3 866 | | 4 533 | |
| *Tertiary sector* | | | | | | | | | |
| $Y_C$ | 19 352 | 35 695 | 6.1 | 39 404 | 7.1 | 82 431 | 8.4 | 76 278 | 6.6 |
| $N_C$ | 1 988 | 2 990 | | 2 990 | | 4 223 | | 4 223 | |
| $Y_C/N_C$ | 9 734 | 11 938 | | 13 179 | | 19 517 | | 18 063 | |
| $\Delta(Y_C/N_C)^b$ | | 2 204 | | 3 445 | | 7 579 | | 4 884 | |
| *Total* GDP | | | | | | | | | |
| $Y_T$ | 41 060 | 74 215 | 5.9 | 71 794 | 5.6 | 152 341 | 7.2 | 141 478 | 6.8 |
| $N_T$ | 8 345 | 10 213 | | 10 213 | | 12 955 | | 12 955 | |
| $Y_T/N_T$ | 4 920 | 7 267 | | 7 030 | | 11 759 | | 10 921 | |
| $\Delta(Y_T/N_T)^b$ | | 2 347 | | 2 110 | | 4 495 | | 3 891 | |

[a] Rate of growth per annum.

[b] Total factoral productivity.

Notes: Definitions of sectors are given in Table 6. Estimate A corresponds to Tables 6 and 7; the GDP figures for 1960 and 1970 are taken from Unikel (1976) using as sources Appendini (1974) and Bank of Mexico (1977), and the labor force data for 1970 are from Unikel (1976). For 1960 the Unikel figures are adjusted based on Altimir (1974). Estimate B uses more recent GDP estimates for 1960 and 1970 from the Bank of Mexico expressed in constant 1960 pesos and converted for this study using the implicit GDP deflator of 0.477 (1960) pesos = 1 (1950) peso as in Reynolds (1978). The Altimir and Unikel labor force figures for 1960 and 1970 are used in both Estimates A and B (see footnotes to Table 6 for details) whereas in Reynolds (1978) the adjusted 1960 and 1970 census figures were used.

TABLE 9 Alternative sectoral and shift elements in productivity growth, Estimate B, 1950–70. (All nonpercentage figures represent 1950 pesos per worker.)

| Sector and total Mexico | 1950–60 | % | 1960–70 | % |
|---|---|---|---|---|
| *Primary sector* | | | | |
| $\Delta Aa$ (Sectoral) | 213 | | 418 | |
| $\Delta aA$ (Shift) | − 169 | | − 193 | |
| $\Delta a\Delta A$ (Combined) | − 33 | | − 72 | |
| Total growth of output per worker | 11 | 1 | 153 | 4 |
| *Secondary sector* | | | | |
| $\Delta Bb$ | 227 | | 966 | |
| $\Delta bB$ | 284 | | 501 | |
| $\Delta b\Delta B$ | 43 | | 236 | |
| Total growth of output per worker | 554 | 26 | 1703 | 44 |
| *Tertiary sector* | | | | |
| $\Delta Cc$ | 820 | | 1431 | |
| $\Delta cC$ | 535 | | 435 | |
| $\Delta c\Delta C$ | 189 | | 169 | |
| Total growth of output per worker | 1544 | 73 | 2027 | 52 |
| *Total Mexico* | | | | |
| $\Delta Yn$ | 1260 | | 2815 | |
| $\Delta nY$ | 650 | | 742 | |
| $\Delta n\Delta Y$ | 200 | | 326 | |
| Total $\Delta(Y/N)$ growth of output per worker | 2110 | 100 | 3883 | 100 |
| *Shift component* | | | | |
| $\frac{\Delta(Y/N) - \Delta Yn}{\Delta(Y/N)} \times 100 =$ | | 40 | | 28 |

Note: Definitions of sectors are given in Table 6.

productivity growth in each sector the component that could be attributed to own sectoral increases in output per worker ($a\Delta A, b\Delta B, \ldots, z\Delta Z$). The remainder represents the sum of the pure shift ($\Delta aA, \Delta bB, \ldots, \Delta zZ$) and combined components ($\Delta a\Delta A, \Delta b\Delta B, \ldots, \Delta z\Delta Z$). It was found that the shift factor fell from 41 percent of national productivity growth in the 1940s to 24 percent in the 1950s (Reynolds, 1970: 66–68), indicating that although the movement of labor between sectors was extremely important in the first decade of rapid growth, it was much less so in the 1950s. It is now possible to carry this analysis forward due to more recent estimates of output and employment through 1970. The shift component, based on Estimate A (Table 7), appears to have been even more important than was earlier believed. It is now seen to have accounted for 50 percent of productivity growth in the 1940s, falling to 34 percent in the 1950s and 26 percent in the 1960s. Estimate

B (Table 9) also shows the trend declining in the 1950s when the shift component was 40 percent of productivity growth, after which it fell to 28 percent in the 1960s. However, the contribution of the secondary sector to the shift factors (shift and combined) relative to the tertiary sector increased significantly in the 1960s, its share of the shift factor rising from 38 percent in the 1950s to 69 percent in the 1960s (Table 9).

The implications of these results are that as much as half of the total factor productivity growth in the 1940s was associated with labor force shifts from lower to higher productivity occupations. However over the next two decades, the shift factor fell to one-fourth of total productivity growth. Hence, there is strong evidence that the shift contribution to Mexican productivity growth is declining. Also the relative importance of the tertiary sector for transmission of productivity growth through labor absorption is diminishing, notwithstanding sustained increases in income per worker within that sector. For future productivity growth to continue, greater stress must be placed on investments that are complementary to labor and on labor-absorbing technological progress in the primary and secondary sectors as well as in the tertiary sector since the shift factor cannot be expected to take up the slack as before. Data at the national level indicate that the gains from labor diffusion and internal migration are dwindling and that more attention must be directed to investment and innovations in those localities and occupations where labor is most redundant.

# 4 A SHIFT-SHARE ANALYSIS OF TOTAL FACTOR PRODUCTIVITY GROWTH IN THE SIX MAIN AREAS OF MEXICO FROM 1940 TO 1970

In order to determine the impact on productivity of internal migration of the labor force, shift-share analysis has been applied to output and employment data for the six major areas of Mexico.[14] The results are presented in Tables 10 and 11. They indicate that the regional shift factor does not appear to be of major importance in explaining productivity growth, especially when compared with sectoral elements as analyzed in Chapter 2. For example, the regional shift component in the 1940s was no higher than 16 percent, falling to 11 percent in the 1950s, and recovering to 14 percent in the 1960s (Table 11). This implies that at the most only one-seventh to one-tenth of the growth in output per worker could have been explained by movement of the work force from lower to higher productivity areas, with that share falling over the course of the three decades.

These figures also permit one to examine the effect of regional relocation of the work force on regional inequality in output per worker. The rank ordering of total factor productivity for the six areas remains almost unchanged over the four benchmark years, with the Metropolitan Mexico City area well ahead in each year followed by the North Pacific (Table 10). The North area, also including primarily border states with the USA, is third in all years except 1950, when it was temporarily displaced by the Gulf area (which includes the city of Veracruz and a major traditional oil producing region). In all other years the Gulf ranked fourth. The rest of the Center (which excludes Mexico City and the state of Mexico) ranked next to last in all years, followed finally by the Pacific South.

There is some evidence that the gap between richest and poorest regions is gradually narrowing since output per worker in the Metropolitan Mexico City area was 6.8 times that of the Pacific South in 1940. This multiple declined to 4.6 in 1950, rose again to 5.9 in 1960, and ultimately fell back to 5.0 in 1970. In the 1940s Metropolitan Mexico City accounted for only 24 percent of national productivity growth, but its share doubled to 56 percent in the 1950s

TABLE 10 Output, employment, and total factor productivity by area, 1940–70.

| Region | | 1940 | 1950 | 1960 | 1970 |
|---|---|---|---|---|---|
| *North*[a] | | | | | |
| $Y_N$ | Output (value added in million 1950 pesos) | 5 276 | 9 001 | 14 978 | 30 653 |
| $N_N$ | Labor force (PEA x $10^3$) | 1 121 | 1 631 | 1 954 | 2 350 |
| $N = Y_N/N_N$ | Output per worker (1950 pesos) | 4 706 | 5 519 | 7 665 | 13 044 |
| $\Delta(Y_N/N_N)$ | Change in output per worker over past decade (1950 pesos) | | 813 | 2 146 | 5 379 |
| $n = N_N/N_T$ | Labor force share | 0.191 | 0.195 | 0.191 | 0.181 |
| *Gulf*[b] | | | | | |
| $Y_G$ | Output | 2 556 | 5 483 | 8 400 | 13 477 |
| $N_G$ | Labor force | 711 | 973 | 1 174 | 1 496 |
| $G = Y_G/N_G$ | Output per worker | 3 595 | 5 635 | 7 155 | 9 009 |
| $\Delta(Y_G/N_G)$ | Change in output | | 2 040 | 1 520 | 1 854 |
| $g = N_G/N_T$ | Labor force share | 0.121 | 0.117 | 0.115 | 0.115 |
| *North Pacific*[c] | | | | | |
| $Y_P$ | Output | 1 710 | 3 730 | 6 774 | 16 358 |
| $N_P$ | Labor force | 362 | 549 | 748 | 1 034 |
| $P = Y_P/N_P$ | Output per worker | 4 724 | 6 794 | 9 056 | 15 820 |
| $\Delta(Y_P/N_P)$ | Change in output | | 2 070 | 2 262 | 6 764 |
| $p = N_P/N_T$ | Labor force share | 0.062 | 0.066 | 0.073 | 0.080 |
| *South Pacific*[d] | | | | | |
| $Y_S$ | Output | 998 | 2 142 | 3 164 | 5 543 |
| $N_S$ | Labor force | 769 | 1 088 | 1 295 | 1 375 |
| $S = Y_S/N_S$ | Output per worker | 1 298 | 1 969 | 2 443 | 1 375 |
| $\Delta(Y_S/N_S)$ | Change in output | | 671 | 474 | 1 588 |
| $s = N_S/N_T$ | Labor force share | 0.131 | 0.130 | 0.127 | 0.106 |
| *Metropolitan Mexico City*[e] | | | | | |
| $Y_D$ | Output | 8 329 | 13 959 | 30 538 | 65 491 |
| $N_D$ | Labor force | 946 | 1 545 | 2 111 | 3 223 |
| $D = Y_D/N_D$ | Output per worker | 8 804 | 9 035 | 14 466 | 20 320 |
| $\Delta(Y_D/N_D)$ | Change in output | | 231 | 5 431 | 5 854 |
| $d = Y_D/N_T$ | Labor force share | 0.162 | 0.185 | 0.207 | 0.249 |
| *Rest of Center*[f] | | | | | |
| $Y_C$ | Output | 4 018 | 6 746 | 10 361 | 20 810 |
| $N_C$ | Labor force | 1 948 | 2 558 | 2 922 | 3 478 |
| $C = Y_C/N_C$ | Output per worker | 2 062 | 2 637 | 3 546 | 5 983 |
| $\Delta(Y_C/N_C)$ | Change in output | | 575 | 909 | 2 437 |
| $c = N_C/N_T$ | Labor force share | 0.333 | 0.307 | 0.286 | 0.268 |

TABLE 10 *Continued*

| Region | | 1940 | 1950 | 1960 | 1970 |
|---|---|---|---|---|---|
| *Total Mexico* | | | | | |
| $Y_T$ | Output | 22 889 | 41 060 | 74 215 | 152 341 |
| $N_T$ | Labor force | 5 858 | 8 345 | 10 213 | 12 955 |
| $T = Y_T/N_T$ | Output per worker | 3 907 | 4 920 | 7 267 | 11 759 |
| $\Delta(Y_T/N_T)$ | Change in output | | 1 013 | 2 346 | 4 491 |
| $t = N_T/N_T$ | Labor force share | 1.00 | 1.00 | 1.00 | 1.00 |

[a] *North*: Coahuila, Chihuahua, Durango, Nuevo Leon, San Luis Potosí, Tamaulipas, Zacatecas.
[b] *Gulf*: Campeche, Quintana Roo, Tabasco, Veracruz, Yucatán.
[c] *North Pacific*: Baja California N., Baja California S., Nayarit, Sinaloa, Sonora.
[d] *South Pacific*: Colima, Chiapas, Guerrero, Oaxaca.
[e] *Metropolitan Mexico City*: Federal District (Mexico D.C.), State of Mexico.
[f] *Rest of Center*: Aguascalientes, Guanajuato, Hidalgo, Jalisco, Michoacán, Morelos, Puebla, Querétaro, Tlaxcala.

SOURCES: GDP and labor force by region are aggregated from state level data estimated by Unikel (1976) and Appendini (1974).

and remained high at 46 percent in the 1960s (Table 11). It appears that labor absorption by Metropolitan Mexico City in the 1940s was accompanied by relatively slow productivity growth. One may presume that had agricultural policy been delayed during that crucial decade, causing urbanization to have been even greater than it was, the resulting drag on productivity growth would have seriously undermined political and economic stability and have increased pressure for migration to the USA. The timing of public investment policy, in agriculture first, then in manufacturing, was of the utmost importance in preventing premature urbanization.

Hence, there was a reduction in the gap of regional income inequality between 1940 and 1950, a widening during the 1950s, and a narrowing again in the 1960s. Despite the small regional shift factor, some of this reduction in inequality may well be due to internal migration as suggested by Unikel (1976: 182). He refers to Mexico's possible confirmation of the Williamson model (Williamson 1965) in which urbanization may widen income gaps in the short run but will narrow them in the long run. Unikel notes that migration was from lower productivity regions to those with higher incomes per capita, and still the productivity growth in the leading areas continued to outstrip the in-migration of labor. This finding is supported by shift-share analysis for the six areas since those areas with a negative shift factor (due to declining labor force shares) tended to be the poorest, namely the South Pacific and Rest of Center. The behavior of the North and Gulf areas is ambiguous since both had negative shift factors in two of the three periods, the Gulf in the 1940s and 1950s and the North in the 1950s and 1960s.

The following are the means and standard deviations of output per worker in the six areas for the four benchmark years. The ratio of the mean to the standard deviation indicates the inverse of the degree of dispersion of productivity.

TABLE 11 Sectoral and shift elements underlying growth in output per worker by area, 1940–70. (All nonpercentage figures represent 1950 pesos per worker.)

| Region | 1940–50 | % | 1950–60 | % | 1960–70 | % |
|---|---|---|---|---|---|---|
| *North* | | | | | | |
| Regional | 155 | | 418 | | 1027 | |
| Shift | 19 | | − 22 | | − 77 | |
| Combined | 3 | | − 9 | | − 54 | |
| Total | 177 | 18 | 387 | 17 | 896 | 20 |
| *Gulf* | | | | | | |
| Regional | 247 | | 178 | | 213 | |
| Shift | − 14 | | − 11 | | 0 | |
| Combined | − 8 | | − 3 | | 0 | |
| Total | 225 | 22 | 164 | 7 | 213 | 5 |
| *North Pacific* | | | | | | |
| Regional | 128 | | 149 | | 494 | |
| Shift | 19 | | 48 | | 63 | |
| Combined | 8 | | 16 | | 47 | |
| Total | 155 | 15 | 213 | 9 | 604 | 13 |
| *South Pacific* | | | | | | |
| Regional | 88 | | 62 | | 202 | |
| Shift | − 1 | | − 6 | | − 51 | |
| Combined | − 1 | | − 1 | | − 33 | |
| Total | 86 | 9 | 55 | 2 | 118 | 3 |
| *Metropolitan Mexico City* | | | | | | |
| Regional | 37 | | 1005 | | 1212 | |
| Shift | 202 | | 199 | | 608 | |
| Combined | 5 | | 119 | | 246 | |
| Total | 244 | 24 | 1323 | 56 | 2066 | 46 |
| *Rest of Center* | | | | | | |
| Regional | 191 | | 279 | | 697 | |
| Shift | − 54 | | − 55 | | − 64 | |
| Combined | − 15 | | − 19 | | − 44 | |
| Total | 122 | 12 | 205 | 9 | 589 | 13 |
| *Total Mexico* | | | | | | |
| Regional | 847 | | 2091 | | 3845 | |
| Shift | 171 | | 153 | | 479 | |
| Combined | − 8 | | 103 | | 162 | |
| Total | 1010 | 100 | 2347 | 100 | 4486 | 100 |

TABLE 11 *Continued*

| Region | 1940–50 | % | 1950–60 | % | 1960–70 | % |
|---|---|---|---|---|---|---|
| Estimated change in productivity with no shift in labor force | 847 | | 2091 | | 3845 | |
| Share of productivity attributed to shift factor | $\frac{1010-847}{1010}=0.16$ | | $\frac{2347-2091}{2347}=0.11$ | | $\frac{4486-3845}{4486}=0.14$ | |

Note: Definitions of areas are given in Table 10.
SOURCE: Figures in this table are calculated from data in Table 10.

| | | 1940 | 1950 | 1960 | 1970 |
|---|---|---|---|---|---|
| $\mu$ | Mean productivity of the six areas (1950 pesos per worker) | 4 200 | 5 265 | 7 390 | 11 370 |
| $\sigma$ | Standard deviation of productivity of the six areas (1950 pesos per worker) | 1 193 | 860 | 1 921 | 2 771 |
| $\frac{\mu}{\sigma}$ | Ratio of mean to standard deviation; indication of narrowing of productivity differentials among regions | 3.5 | 6.1 | 3.8 | 4.1 |

These ratios evidence a sharp reduction in regional inequality between 1940 and 1950, after which the earlier pattern was recovered. Between 1960 and 1970 there is evidence that regional disparities narrowed again, providing modest support for the Williamson hypothesis. In order to test the results still further, GDP is broken into rural and urban income shares in Table 12. The results are then compared with rural and urban population shares to estimate trends in relative income shares associated with rapid urbanization since 1940 (Table 13).

One would expect from the importance of the shift effect in gradually leveling area incomes that there might have been a narrowing of the gap of productivity (and income) between the rural and urban sectors of Mexico over the same period. This would hold if the pull factors were dominant in urban migration, such that labor drawn out of the rural sector by higher income possibilities in the cities would cause the rural marginal productivity of labor to rise together with capital- and land-labor ratios. This then would have been reflected in the relative growth of rural income shares. However, there is an additional element, namely, the demand for rural output. If rural physical productivity rose but demand for farm output lagged, the rural terms of trade

TABLE 12 Rural/urban income shares, 1960–75 (%).

| | 1960 | 1965 | 1970 | 1975 |
|---|---|---|---|---|
| Shares of gross domestic product imputed to rural areas | 28 | 27 | 22 | 20 |
| 1. Agriculture | | | | |
| Share of total GDP | 15.9 | 14.2 | 11.6 | 9.6 |
| Rural GDP share | 14.3 | 12.8 | 10.4 | 8.6 |
| 2. Extractive industries | | | | |
| Share of total GDP | 4.9 | 4.9 | 5.2 | 5.5 |
| Rural GDP share | 1.7 | 1.7 | 1.8 | 1.9 |
| 3. Commerce and transportation | | | | |
| Share of total GDP | 34.5 | 34.8 | 35.0 | 35.1 |
| Rural GDP share | 6.2 | 5.6 | 4.7 | 4.2 |
| 4. Manufacturing, construction, and electricity | | | | |
| Share of total GDP | 24.3 | 26.4 | 29.2 | 30.3 |
| Rural GDP shares | 0 | 0 | 0 | 0 |
| 5. Government | | | | |
| Share of total GDP | 4.9 | 5.6 | 5.8 | 7.2 |
| Rural GDP share | 0 | 0 | 0 | 0 |
| 6. Other sectors | | | | |
| Share of total GDP | 15.5 | 14.1 | 13.1 | 12.2 |
| Rural GDP share | 7.6 | 6.4 | 5.4 | 4.9 |

Sources and methods: Distribution of shares is as in Reynolds (1970, Table 2.7), where

1. Agriculture: 90 percent rural.
2. Extractive Industries: 35 percent rural based on 1950 input–output table for Mexico.
3. Commerce and transport $= \frac{(3)}{10\% \text{ GDP } (3)} \times 1/2$ rural share of GDP in other sectors.
4. Manufacturing, construction, electricity: all urban.
5. Government: all urban.
6. Rent and other: proportional to population share in rural sector 1960: 0.493; 1965 (est.): 0.452; 1970: 0.414; 1975 (est.): 0.400.

Derived shares are from GDP estimates of Bank of Mexico (1977) (1960 pesos) corresponding to those in Estimate B. For this reason the 1960 shares for agriculture and rural GDP are well below those in Reynolds (1970, p. 72), which were 18.9 (c.f. 15.9) and 32 (c.f. 28), respectively.

(prices of farm products relative to goods and services) might decline, thus offsetting this favorable trend of growth of rural income shares. In the estimates in Table 12 constant value indexes of rural and urban GDP have been used so as to minimize the terms of trade effects.

With this adjustment the real output of the rural sector per rural dweller fell relative to that of the urban areas in all periods except for the 1940s and the interval from 1960 to 1965 (Table 13). Indeed, the situation as of 1975

TABLE 13 The distribution of GDP and population rural and urban, 1940–75 (%).

| Share | 1940 | 1950 | 1960 | 1965 | 1970 | 1975 |
|---|---|---|---|---|---|---|
| 1. Rural share of GDP | 40 | 36 | 28 | 27 | 22 | 20 |
| 2. Urban share of GDP | 60 | 64 | 72 | 73 | 78 | 80 |
| 3. Rural share of population | 65 | 57 | 49 | 45 | 41 | 40 |
| 4. Urban share of population | 35 | 43 | 51 | 55 | 59 | 60 |
| 5. Rural share of GDP/Rural share of population (Row 1/Row 3 = Row 5) | 0.62 | 0.63 | 0.57 | 0.60 | 0.53 | 0.50 |

SOURCE: Table 12 for 1960–75 and Reynolds (1970, p. 74) for 1940–50. Owing to the latest GDP estimates used for 1960–75, the 1960 ratio of rural GDP to population falls from 0.65 (Reynolds 1970) to 0.57.

indicates that relative rural per capita output was only half that of the urban sector, compared to over 60 percent in 1940.

Clearly, the process of migration of the work force has failed to narrow the relative rural–urban income gap. Of course, since real income in both rural and urban areas has multiplied several times, the absolute gap has widened even more. To the extent that migration decisions are made on the basis of expected income, the absolute rather than relative gap may be more relevant to a study of the relationship between productivity growth and migration. Output per capita rose from 3600 (1960) pesos in 1960 to almost 5000 (1960) pesos in 1970, a gain of between 575 and 800 current US dollars, depending on the conversion factor used. However, the gap between Mexico's rural per capita output and real wages in US agriculture paid to temporarily migrating Mexican workers remains double or triple that amount.

In order to determine the relative importance of migration to the regional pattern of employment, a hypothetical regional labor supply estimation was made for which it was assumed that there had been no migration. In the absence of migration it was assumed that the economically active population over 12 years of age (PEA) in each region would have grown in direct proportion to its initial labor force at the beginning of each of the three decades from 1940 to 1970. The difference between this hypothetical growth of labor supply and observed increases in active population in each region gives a crude indicator of net regional migration of labor. Of course, this indicator is sensitive to errors in the underlying assumptions of proportional changes in demographic factors among regions and proportional shifts in labor participation rates. However, the results are suggestive of general trends in labor force migration and hence are used to estimate the relative importance of such shifts in regional patterns of productivity growth.

It can be seen from Table 14 that total internal migration estimated in these terms has amounted to a steadily increasing share of labor force growth.

TABLE 14 Estimates of labor force growth assuming no net migration among the six areas, 1940–70 [labor force ($\times 10^3$)].

| Region | 1940 | 1950 | | | 1960 | | | 1970 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Observed labor force[a] | Observed labor force[a] | Estimated labor force[b] | Estimated migration | Observed labor force[a] | Estimated labor force[b] | Estimated migration | Observed labor force[a] | Estimated labor force[b] | Estimated migration |
| 1. North | 1 121 | 1 631 | 1 594 | + 37 | 1 954 | 1 990 | − 36 | 2 350 | 2 477 | − 127 |
| 2. Gulf | 711 | 973 | 1 010 | − 37 | 1 174 | 1 194 | − 20 | 1 496 | 1 491 | + 5 |
| 3. North Pacific | 362 | 549 | 517 | + 32 | 748 | 673 | + 75 | 1 034 | 947 | + 87 |
| 4. South Pacific | 769 | 1 088 | 1 093 | − 5 | 1 295 | 1 327 | − 32 | 1 375 | 1 647 | − 272 |
| 5. Metropolitan Mexico City | 946 | 1 545 | 1 352 | + 193 | 2 111 | 1 888 | + 223 | 3 223 | 2 685 | + 538 |
| 6. Rest of Center | 1 948 | 2 558 | 2 779 | − 221 | 2 922 | 3 133 | − 211 | 3 478 | 3 709 | − 231 |
| Total labor force Mexico | 5 858 | 8 344 | 8 344 | | 10 204 | 10 204 | | 12 956 | 12 956 | |
| Net migration | | | | ± 263 | | | ± 299 | | | ± 630 |
| Net migration/growth in labor force (%) | | | | 11 | | | 16 | | | 23 |

Note: Definitions of areas are given in Table 10.

[a] Observed labor force is from Table 10.

[b] Estimated labor force for region $A$ in year $t + j = N_{A_t}/N_{T_t} \times N_{T_{t+j}}$.

That share, which was only 11 percent in the 1940s, increased to 16 and 23 percent respectively in the 1950s and 1960s. Without going into the underlying causes of this labor movement, it is evident that regional patterns of productivity growth have been closely associated with increased internal migration. The most notable relationship is the strong apparent link between labor force migration and regional productivity growth. Two of the three leading areas in overall productivity growth, Metropolitan Mexico City and the North Pacific, also showed net labor in-migration in each of the three decades (Table 11). However the North, which was second in productivity growth in both the 1950s and 1960s, had a net outflow of labor in both periods. This is almost certainly associated with impoverished agriculture in the arid regions throughout the North, which caused rural out-migration to outstrip urban growth in Monterrey and the border cities. On the other hand, in the 1940s the North was a net attracting area for emigration. Third place shifted to the Gulf, which after losing labor at decreasing rates in the 1940s and 1950s, became an area of net in-migration by the 1960s. With the recent petroleum boom, this pattern continues.

In no case did permanent internal labor migration represent an important share of the total work force, the percentage actually falling between the 1940s and 1950s from 3.2 percent to 2.9 percent. However, the share of migration in labor force growth has steadily increased to almost one-fourth of net growth in the 1960s. By that decade the absolute share of migration (1960–1970) had risen to 5 percent of the 1970 labor force. The amount of temporary migration is of course missing from these figures since they are based on decennial census data. However, there is strong evidence that seasonal migration is very important, especially, in the rural labor market. Thousands of workers move back and forth, many of them hundreds of miles, during the harvest seasons, and many of them also travel across the border on a seasonal basis as temporary migrant workers in the USA.

# 5 A SHIFT-SHARE ANALYSIS OF PRODUCTIVITY GROWTH IN THE THREE MAIN REGIONS – METROPOLITAN MEXICO CITY, BORDER, AND REST OF MEXICO – FROM 1940 TO 1970

In view of the large and growing importance of migratory relations between Mexico and the United States, it was decided that the shift-share effects of regional output and employment changes for Mexico's two major regions of in-migration, the Border states plus Metropolitan Mexico City, vis à vis the rest of the country, should be estimated. The breakdown is justified by the findings in Chapter 4 which indicated that the North and Pacific North have disproportionately large increases in output per worker and that the Pacific North together with Metropolitan Mexico City consistently experiences net in-migration. One may expect that the greater the imbalance in regional output growth, the more migration (shift factor) will serve to diffuse productivity gains through the work force. On the other hand, the more proportional the growth among regions, the more regional productivity factors will dominate. Where the "pull factor" is relatively strong, initial differentials in regional output growth will be maintained despite rapid shifts of the labor force from lower to higher growth regions. Where the "push factor" dominates, labor force migration could dampen potential regional inequalities in productivity growth by forcing down the marginal productivity of labor in the receiving regions while allowing it to rise in the sending regions.

The gravity model of labor force movement, together with trade in goods and services and capital flows, suggests that the shift factor will work to equalize factor incomes. Given the fact that the United States enjoys much higher output per worker than Mexico and is relatively accessible to Mexican labor, the gravity model would imply that the Mexican work force should gradually displace itself northward and shift into the sphere of influence of the US labor market. Indeed, there is strong evidence from the data on the Border region that labor force growth in areas adjacent to the Border has been much greater than elsewhere. Some of this movement has been within the Border states, from rural areas to urban centers located on the

frontier, which are connected to US service economy through tourism and which have recently established a number of Border industry assembly plants (*maquiladoras*). These plants are linked with US manufacturers, and duty is charged only on the value-added components for re-export. Since the North also serves as a staging area for migration into the USA, it (especially the North Pacific) has had a net attraction effect on migration from the center and south of Mexico only exceeded by that of Metropolitan Mexico City.

This chapter presents a cursory view of the implications of North/South regionalization in terms of shift-share analysis. Table 15 reorganizes earlier data

TABLE 15 Output, employment, and total factor productivity by region, 1940–70.

| Region | | 1940 | 1950 | 1960 | 1970 |
|---|---|---|---|---|---|
| *Border*[a] | | | | | |
| $Y_B$ | Output (in million 1950 pesos) | 4755 | 9127 | 16838 | 37482 |
| $N_B$ | Labor force (PEA x $10^3$) | 778 | 1225 | 1630 | 2120 |
| $B = Y_B/N_B$ | Output per worker (1950 pesos) | 6112 | 7451 | 10330 | 17680 |
| $\Delta B$ | Change in output per worker over past decade (1950 pesos) | | 1339 | 2879 | 7350 |
| $t = N_B/N_T$ | Labor force share | 0.133 | 0.147 | 0.160 | 0.164 |
| *Metropolitan Mexico City*[b] | | | | | |
| $T_M$ | Output | 8329 | 13959 | 30538 | 65491 |
| $N_M$ | Labor force | 946 | 1545 | 2111 | 3223 |
| $M = Y_M/N_M$ | Output per worker | 8804 | 9035 | 14466 | 20320 |
| $\Delta M$ | Change in output per worker | | 231 | 5431 | 5854 |
| $m = N_M/N_T$ | Labor force share | 0.161 | 0.185 | 0.207 | 0.249 |
| *Rest of Mexico*[c] | | | | | |
| $Y_R$ | Output | 9803 | 17975 | 26839 | 49359 |
| $N_R$ | Labor force | 4134 | 5575 | 6471 | 7612 |
| $R = Y_R/N_R$ | Output per worker | 2371 | 3224 | 4148 | 6484 |
| $\Delta R$ | Change in output per worker | | 853 | 924 | 2336 |
| $r = N_R/N_T$ | Labor force share | 0.706 | 0.668 | 0.634 | 0.588 |
| *Total Mexico* | | | | | |
| $Y_T$ | Output | 22887 | 41061 | 74215 | 152332 |
| $N_T$ | Labor force | 5858 | 8345 | 10212 | 12955 |
| $T = Y_t/N_t$ | Output per worker | 3908 | 4921 | 7267 | 11758 |
| $\Delta T$ | Change in output per worker | | 1013 | 2346 | 4491 |
| $t = N_T/N_T$ | Labor force share | 1.00 | 1.00 | 1.00 | 1.00 |

[a] Border: Baja California N., Baja California S., Coahuila, Chihuahua, Nuevo Leon, Sonora, Tamaulipas.
[b] Metropolitan Mexico City: Federal District (Mexico D.C.) and State of Mexico.
[c] Rest of Mexico: All other states.
SOURCE: Figures are calculated from data in Table 10.

so as to permit an examination of the three major regions: Border, Metropolitan Mexico City, and Rest of Mexico. One can quickly see the immense and growing gap between output per worker in the Border region and that of the Rest of Mexico. The difference in labor productivity rose from 3741 (1950) pesos in 1940 to 11 196 pesos in 1970, notwithstanding the fact that the productivity growth rate in the Rest of Mexico was 3.4 percent per annum over the 30 year period, almost equal to that of the Border, which was 3.5. This is due to the simple mathematics of growth, whereby even though values subject to wide absolute differentials grow at almost the same rates, their absolute gap may widen substantially over time. The gravity process may be working in Mexico, however, since Metropolitan Mexico City has grown at a slower rate than the Rest of Mexico in productivity terms (2.8 percent per annum) between 1940 and 1970. However, here again a disturbing element is that the absolute productivity gap, which was wide between the Border and Rest of Mexico (11 196 pesos in 1970), was even greater between Metropolitan Mexico City and the Rest of Mexico, rising from 6433 (1950) pesos in 1940 to 13 836 (1950) pesos in 1970. Since the purchasing power parity of a 1950 peso is today (1978) about US$0.50, the comparable value of this differential in productivity between the Border and the Rest of Mexico in 1970 is about $5600 in 1978 US dollars and between Metropolitan Mexico City and the Rest of Mexico about US$7000.

Most noteworthy about the evidence from Table 15 is that the gravity process appears to be narrowing the absolute productivity gap between the Border and Metropolitan Mexico City from 2672 (1950) pesos in 1940 to 2640 (1950) pesos in 1970. This has resulted from a much faster migration of labor over the 30-year period to the Metropolitan Mexico City region (4.1 percent per annum), while output growth was about the same in both regions (6.9 percent per annum). The spillover of labor from the Border region into the US labor market is not measured. There is no place for migrants to Metropolitan Mexico City to go but back home or northward. Hence it is likely that the gravity effect is more successful in leveling income between Metropolitan Mexico City and the Rest of Mexico than between the Border and the Rest of Mexico. This will continue as long as income differentials between the Border and the USA remain so much greater in absolute terms. Since output and productivity in the US economy are growing much more slowly than in Mexico, and especially in Mexico's two major regions of attraction, it would not be surprising if the gravity process eventually began to show a leveling effect between the two countries. However, as we have seen, where absolute income differentials remain so large it will take decades before growth rate differentials will narrow absolute income gaps. Until this happens, wide gaps in earnings will drive the forces of migration. Indeed, the findings presented in this chapter indicate that the lure of Metropolitan Mexico City may well begin to give place to that of major Border areas and the USA as

TABLE 16 Sectoral and shift elements underlying growth in output per worker by region, 1940–70. (All nonpercentage figures represent 1950 pesos per worker.)

| Region | 1940–50 | % | 1950–60 | % | 1960–70 | % |
|---|---|---|---|---|---|---|
| *Border* | | | | | | |
| Regional Productivity Growth | 178 | | 423 | | 1176 | |
| Shift | 86 | | 97 | | 41 | |
| Combined | 18 | | 37 | | 29 | |
| Total | 282 | 28 | 557 | 24 | 1246 | 28 |
| *Metropolitan Mexico City* | | | | | | |
| Regional | 37 | | 1005 | | 1212 | |
| Shift | 202 | | 199 | | 608 | |
| Combined | 5 | | 119 | | 246 | |
| Total | 244 | 24 | 1323 | 56 | 2066 | 46 |
| *Rest of Mexico* | | | | | | |
| Regional | 602 | | 617 | | 1481 | |
| Shift | − 90 | | − 110 | | − 191 | |
| Combined | − 32 | | − 31 | | − 107 | |
| Total | 480 | 48 | 476 | 20 | 1183 | 26 |
| *Total Mexico* | | | | | | |
| Regional | 817 | | 2045 | | 3869 | |
| Shift | 198 | | 186 | | 458 | |
| Combined | − 9 | | 125 | | 168 | |
| Total | 1006 | 100 | 2356 | 100 | 4495 | 100 |
| Share of productivity growth attributed to shift factor between regions | 0.19 | | 0.13 | | 0.14 | |

Note: Definitions of regions are given in Table 15.
SOURCE: Figures are calculated from data in Table 10.

Metropolitan Mexico City's productivity gap begins to decline vis à vis that of the Border. Hopefully, if new centers of growth are fostered within Mexico, this could considerably alter the path of migration.

How much has migration mattered in terms of overall productivity growth? In Table 16 the own regional productivity growth and interregional shift factors are measured for the three decades. Here again, as in the analysis of the six areas of Mexico in Chapter 4, there is evidence that the interregional shift factor declined as a share of total productivity growth from 19 percent in the 1940s to 13 percent in the 1950s and remained at 14 percent in the 1960s. In short, the role of regional labor movement was important in raising overall productivity in the 1940s but has played a smaller role since then. In regional terms the contribution of Metropolitan Mexico City to the overall shift factor has risen substantially from 70 percent of the positive shift component in the

1940s to 93 percent in the 1960s (the remainder being attributed to the Border). Hence while the Border region continues to exhibit "pull" tendencies, the Metropolitan Mexico City region may well begin to be dominated by "push" forces as labor moves there in a desperate search for release from rural poverty and underemployment in other regions. In terms of its contribution to total productivity growth in Mexico, Metropolitan Mexico City has risen from one-fourth in the 1940s to over one-half in the 1950s, though this share declined somewhat to 46 percent in the 1960s, while the Border recovered its earlier 28 percent share. Interestingly, the Rest of Mexico with 70 percent of the work force in 1940 contributed one-half of total productivity growth in that decade, while its contribution declined to only 20 percent in the 1950s as Metropolitan Mexico City mushroomed in terms of both population and output. However, by the 1960s the Rest of Mexico's productivity share began to rise again, increasing to 26 percent, while its labor share fell to 58 percent. This augurs favorably for the continuation of the diffusion of Mexican productivity growth from the center to the periphery. The process is consistent with the gravity model of migration since output per worker in the Rest of Mexico grew by 3.4 percent per annum since 1940 compared with only 2.8 percent in Metropolitan Mexico City. Indeed the Rest of Mexico did almost as well as the Border region (3.5 percent per annum). Notwithstanding this performance, pockets of poverty and stagnation remain throughout the countryside and particularly in the northern desert regions, the central plateau, and the eroded areas of the south. Most of the rural areas are subject to erratic rainfall, and many small- and medium-sized urban centers have long since lost their comparative advantage for growth and will remain so in the absence of major new state development efforts, which include incentives for investment and technical progress suited to the special conditions of the regions.

While the analysis throughout this monograph has related migration to output and productivity rather than to income, it is recognized that among economic incentives labor movement is primarily responsive to expected wages and that wages are not necessarily related to total factor productivity, especially in a country in which the supply of labor from impoverished areas is so abundant. Indeed, it is possible for output per worker to rise considerably while real wages remain low or even decline (especially during periods of inflationary growth). However, total factor productivity gives some idea of the output per employed worker capable of supporting improvements in infrastructure, eduction, and other investments, which will eventually permit income to be diffused more broadly. This may occur through private expenditures by the recipients of profit and rental income as well as through increased capacity of the government to tax and spend on activities favoring social and economic progress. Moreover, the availability of urban amenities and other nonwage benefits, which attract labor to new locations, tends to be highly correlated with total factor productivity, even though real wages of unskilled labor may lag. Furthermore, the ability of workers to organize and

TABLE 17 Estimates of labor force migration, 1940–70 [labor force (× $10^3$)].

| Region | 1940 | 1950 | | | 1960 | | | 1970 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Observed labor force[a] | Observed labor force[a] | Estimated labor force[b] | Estimated migration (1940–50) | Observed labor force[a] | Estimated labor force[b] | Estimated migration (1950–60) | Observed labor force[a] | Estimated labor force[b] | Estimated migration (1960–70) |
| Border | 778 | 1 225 | 1 110 | + 115 | 1 630 | 1 501 | + 129 | 2 120 | 2 070 | + 50 |
| Metropolitan Mexico City | 946 | 1 545 | 1 344 | + 201 | 2 111 | 1 889 | + 222 | 3 223 | 2 680 | + 543 |
| Rest of Mexico | 4 134 | 5 575 | 5 891 | − 316 | 6 471 | 6 822 | − 351 | 7 612 | 8 205 | − 593 |
| Total Mexico | 5 858 | 8 345 | | | 10 212 | | | 12 955 | | |
| Net migration growth in labor force (%) | | 13 | | | 19 | | | 22 | | |

[a] Observed labor force from Table 15.
[b] Estimated labor force – see Table 14 and text referring to Table 14. Estimates do not agree due to rounding.
Note: Definitions of regions are given in Table 15.

bargain collectively is directly related to the surplus (rental income including excess profits) earned per worker that is available to be bargained between labor and capital. Hence labor incomes may be increased in those subsectors of the labor market where such "economic rents" (broadly defined) are generated, and the increase in labor income tends also to be directly related to sectoral productivity growth (more appropriately, to "net" sectoral productivity growth after subtracting a normal return to capital).

Finally, in Table 17, estimated net labor force migration among the three regions is shown for the three decades. Here again, as in Chapter 4, migration is shown to have steadily increased as a share of labor force growth even after the net flows are restricted to the three main regions. Indeed, the shares remain about the same as those among the six areas (Table 14) since most net regional migration has been toward the Border and Metropolitan Mexico City. (The North Pacific is the only other main region of net in-migration and then only since the 1950s.) Most net labor migration in the 1960s was to Metropolitan Mexico City (92 percent), though in earlier decades the Border accounted for about 36 percent. Again, this may be due to increasing evidence of under-employment in the border towns, notwithstanding their rapid growth in output, as well as to the desperate poverty of agriculture in most border regions and finally to the "passing on" of regional migration to the USA.

The rank correlation is weak between growth in productivity and growth in migration among the three regions since the Border and Rest of Mexico show much faster productivity growth than Metropolitan Mexico City over the three decades, though the latter experienced the major share of in-migration. However, when one looks at absolute productivity differentials, the correlation becomes more perfect since Metropolitan Mexico City has led throughout the period in both absolute income per capita and in-migration, followed by the Border, which is catching up in income per capita. The Rest of Mexico, which still lags behind the other two regions by over 10 000 (1950) pesos per worker, continues to register an important rate of out-migration amounting to almost 600 000 workers between 1960 and 1970, or one-third of the increase in its labor force.

# 6 A SHIFT-SHARE ANALYSIS OF THE PRIMARY, SECONDARY, AND TERTIARY SECTORS OF THE THREE MAIN REGIONS OF MEXICO FROM 1940 TO 1970

In this chapter the same regionalization is used (Border, Metropolitan Mexico City, and Rest of Mexico) to determine those intraregional shifts that caused the respective growth patterns of the main sending and receiving regions. For this purpose, the change in output and employment of the main production sectors – primary, secondary, and tertiary – is analyzed for each region. Tables 18 to 20 present the underlying data on output, employment, and total factor productivity, and Tables 21 to 23 provide estimates of the sectoral and shift components of productivity growth for each of the three regions. The results are as follows.

In the Border region there is important evidence that the internal shift factor as a share of the region's productivity growth fell from almost one-half (48 percent) in the 1940s to one-third (33 percent) in the 1950s and to less than one-tenth (9 percent) in the 1960s (Table 21). Hence, the Border region has been increasingly unable to generate overall productivity growth simply by moving its work force from an impoverished agriculture to more productive employment in manufacturing and services. Migration among sectors has continued (Table 18) but the sectoral productivity component has grown from one-half to 90 percent of growth in output per worker. In the 1960s the Border states' manufacturing sector (secondary) accounted for most of the relative increase, its share rising from 28 to 37 percent of productivity growth, which is a very healthy sign (Table 21). This contrasts sharply with the Metropolitan Mexico City region where the share of productivity growth from the secondary sector fell from 57 percent in the 1950s to 27 percent in the 1960s (Table 22). The establishment of border industries linked to the US economy plus growth of industry in Monterrey almost certainly had much to do with this impressive performance of the Border region. Industry in Metropolitan Mexico City, on the other hand, grew on the basis of production through tariffs and quotas. Oriented toward import substitution, industry in Metropolitan Mexico City showed much less productivity growth in the 1960s

TABLE 18 Output, employment, and total factor productivity growth in the Border region, 1940–70.

| | | 1940 | 1950 | 1960 | 1970 |
|---|---|---|---|---|---|
| *Primary sector* | | | | | |
| $Y_A$ | Output (value added in million 1950 pesos) | 1052 | 2102 | 3437 | 5916 |
| $N_A$ | Labor force (PEA x $10^3$) | 448 | 614 | 629 | 642 |
| $Y_A/N_A = A$ | Output per worker (1950 pesos) | 2348 | 3423 | 5464 | 9215 |
| $\Delta(T_A/N_A)$ | Change in output per worker over past decade (1950 pesos) | | 1075 | 2041 | 3751 |
| $N_A/N_T = a$ | Labor share in sector | 0.574 | 0.501 | 0.386 | 0.303 |
| *Secondary sector* | | | | | |
| $Y_B$ | Output | 1501 | 2935 | 5208 | 12521 |
| $N_B$ | Labor force | 143 | 265 | 409 | 594 |
| $Y_B/N_B = B$ | Output per worker | 10497 | 11075 | 12733 | 21079 |
| $\Delta(Y_B/N_B)$ | Change in output per worker | | 578 | 1658 | 8346 |
| $N_B/N_T = b$ | Labor share | 0.183 | 0.216 | 0.251 | 0.280 |
| *Tertiary sector* | | | | | |
| $Y_C$ | Output | 2204 | 4089 | 8195 | 19045 |
| $N_C$ | Labor force | 189 | 346 | 592 | 884 |
| $Y_C/N_C = C$ | Output per worker | 11661 | 11818 | 13843 | 21544 |
| $\Delta(Y_C/N_C)$ | Change in output per worker | | 157 | 2025 | 7701 |
| $N_C/N_T = c$ | Labor share | 0.242 | 0.282 | 0.363 | 0.417 |
| *Total region* | | | | | |
| $Y_T$ | Output | 4757 | 9126 | 16840 | 37482 |
| $N_T$ | Labor force | 780 | 1225 | 1630 | 2119 |
| $Y_T/N_T$ | Output per worker | 6098 | 7450 | 10331 | 17689 |
| $\Delta(Y_T/N_T)$ | Change in output per worker | | 1352 | 2881 | 7358 |

Note: Definitions of sectors are given in Table 6. Definition of the Border region is given in Table 15.

than did industry in the Border region (Tables 18 and 19). Earlier, in the 1950s, Metropolitan Mexico City's import substituting manufacturing had taken a temporary lead in productivity growth after having shown a net *decline* in the 1940s (Tables 18 and 19).[15]

The Border region's primary sector labor share steadily declined, most importantly in the 1950s, so that its rural employment share in 1970 was only 30 percent compared to 57 percent for the Rest of Mexico (Tables 18 and 20). Hence it is not surprising that the primary sector contribution to productivity growth in the Border region fell from 27 percent in the 1940s to 9 percent in the 1960s. However, output per worker in the primary sector of the Border region grew by twice that of the Rest of Mexico in the 1940s, three times more in the

TABLE 19 Output, employment, and total productivity growth in the Metropolitan Mexico City region, 1940–70.

| | | 1940 | 1950 | 1960 | 1970 |
|---|---|---|---|---|---|
| *Primary sector* | | | | | |
| $Y_A$ | Output (value added in million 1950 pesos) | 385 | 486 | 590 | 673 |
| $N_A$ | Labor force (PEA x $10^3$) | 302 | 372 | 331 | 369 |
| $Y_A/N_A = A$ | Output per worker (1950 pesos) | 1 275 | 1 306 | 1 782 | 1 824 |
| $\Delta(T_A/N_A)$ | Change in output per worker over past decade (1950 pesos) | | 31 | 476 | 42 |
| $N_A/N_T = a$ | Labor share in sector | 0.319 | 0.241 | 0.157 | 0.115 |
| *Secondary sector* | | | | | |
| $Y_B$ | Output | 2 680 | 4 005 | 11 952 | 23 298 |
| $N_B$ | Labor force | 226 | 470 | 810 | 1 206 |
| $Y_B/N_B = B$ | Output per worker | 10 858 | 8 521 | 14 756 | 19 318 |
| $\Delta(Y_B/N_B)$ | Change in output per worker | | −2 337 | 6 235 | 4 562 |
| $N_B/N_T = b$ | Labor share | 0.239 | 0.304 | 0.384 | 0.374 |
| *Tertiary sector* | | | | | |
| $Y_C$ | Output | 5 204 | 9 468 | 17 996 | 41 520 |
| $N_C$ | Labor force | 418 | 703 | 970 | 1 647 |
| $Y_C/N_C = C$ | Output per worker | 12 593 | 13 468 | 18 553 | 25 209 |
| $\Delta(Y_C/N_C)$ | Change in output per worker | | 875 | 5 085 | 6 656 |
| $N_C/N_T = c$ | Labor share | 0.442 | 0.455 | 0.459 | 0.511 |
| *Total region* | | | | | |
| $Y_T$ | Output | 8 329 | 13 959 | 30 538 | 65 491 |
| $N_T$ | Labor force | 946 | 1 545 | 2 111 | 3 222 |
| $Y_T/N_T$ | Output per worker | 8 804 | 9 035 | 14 466 | 20 326 |
| $\Delta(Y_T/N_T)$ | Change in output per worker | | 231 | 5 431 | 5 860 |

Note: Definitions of sectors are given in Table 6. Definition of the Metropolitan Mexico City region is given in Table 15.

1950s and 20 times as much in the 1960s (Tables 18 and 20). Clearly, the Northern states have retained the lead in rural output per worker by pursuing capital- and land-intensive techniques or irrigated farming. As such they could be regarded as southerly extensions of "Sunbelt" agriculture in the USA, using much the same technology and cropping patterns and exporting a considerable share of their output to the USA. Hence, this pattern of Border productivity growth in the primary sector, as in the secondary sector, is closely linked to the US economy.

In the tertiary sector, the Border region has also shown major productivity growth rising from 38 percent in the 1940s, to 59 percent in the 1950s, and to 54 percent in the 1960s of the region's growth in output per

TABLE 20 Output, employment, and total factor productivity growth in the Rest of Mexico region, 1940–70.

| | | 1940 | 1950 | 1960 | 1970 |
|---|---|---|---|---|---|
| *Primary sector* | | | | | |
| $Y_A$ | Output (value added in million 1950 pesos) | 3 734 | 6 654 | 4 890 | 11 123 |
| $N_A$ | Labor force (PEA x $10^3$) | 3 082 | 3 881 | 4 089 | 4 318 |
| $Y_A/N_A = A$ | Output per worker (1950 pesos) | 1 212 | 1 715 | 2 419 | 2 576 |
| $\Delta(T_A/N_A)$ | Change in output per worker over past decade (1950 pesos) | | 503 | 704 | 157 |
| $N_A/N_T = a$ | Labor share in sector | 0.746 | 0.696 | 0.632 | 0.567 |
| *Secondary sector* | | | | | |
| $Y_B$ | Output | 2 608 | 5 526 | 7 443 | 16 379 |
| $N_B$ | Labor force | 457 | 755 | 956 | 1 398 |
| $Y_B/N_B = B$ | Output per worker | 5 706 | 7 319 | 7 786 | 11 716 |
| $\Delta(Y_B/N_B)$ | Change in output per worker | | 1 613 | 467 | 3 930 |
| $N_B/N_T = b$ | Labor share | 0.111 | 0.135 | 0.148 | 0.184 |
| *Tertiary sector* | | | | | |
| $Y_C$ | Output | 3 462 | 5 795 | 9 505 | 21 866 |
| $N_C$ | Labor force | 593 | 939 | 1 428 | 1 897 |
| $Y_C/N_C = C$ | Output per worker | 5 838 | 6 171 | 6 656 | 11 527 |
| $\Delta(Y_C/N_C)$ | Change in output per worker | | 333 | 485 | 4 871 |
| $N_C/N_T = c$ | Labor share | 0.144 | 0.168 | 0.221 | 0.249 |
| *Total region* | | | | | |
| $Y_T$ | Output | 9 804 | 17 975 | 26 838 | 49 368 |
| $N_T$ | Labor force | 4 132 | 5 575 | 6 473 | 7 613 |
| $Y_T/N_T$ | Output per worker | 2 373 | 3 224 | 4 146 | 6 485 |
| $\Delta(Y_T/N_T)$ | Change in output per worker | | 851 | 922 | 2 339 |

Note: Definitions of sectors are given in Table 6. Definition of the Rest of Mexico region is given in Table 15. For Total Mexico see Table 6, which is the sum of Tables 18, 19, and 20.

worker (Table 21). Its employment share has also risen from 24 percent in 1940 to 42 percent in 1970. This is strong evidence that the sector has exerted a demand pull on employment sufficient to prevent steady increases in employment from swamping productivity growth. The most interesting contrast is with tertiary sector productivity in the other main receiving region (Metropolitan Mexico City) which grew more rapidly than that of the Border in the 1940s and 1950s but which lagged behind the Border region in the 1960s (Tables 18 and 19). Here again, the Border region, which is heavily engaged in service-related trade (tourism) with the USA, now leads the whole nation in its growth of output per worker. Over half of that leadership stems from productivity growth in the tertiary sector. (See Table 18 and Chapter 4).

TABLE 21 Sectoral and shift elements underlying growth in output per worker in the Border region, 1940–70. (All nonpercentage figures represent 1950 pesos per worker.)

| | 1940–50 | % | 1950–60 | % | 1960–70 | % |
|---|---|---|---|---|---|---|
| *Primary sector* | | | | | | |
| $\Delta Aa$ (Sectoral) | 617 | | 1023 | | 1448 | |
| $\Delta aA$ (Shift) | −171 | | −394 | | −454 | |
| $\Delta a\Delta A$ (Combined) | − 78 | | −235 | | −311 | |
| Total growth of output per worker (1950 pesos) | 368 | 27 | 394 | 14 | 683 | 9 |
| *Secondary sector* | | | | | | |
| $\Delta Bb$ | 106 | | 358 | | 2095 | |
| $\Delta bB$ | 346 | | 388 | | 369 | |
| $\Delta b\Delta B$ | 19 | | 58 | | 242 | |
| Total growth of output per worker (1950 pesos) | 471 | 35 | 804 | 28 | 2706 | 37 |
| *Tertiary sector* | | | | | | |
| $\Delta Cc$ | 38 | | 571 | | 2795 | |
| $\Delta cC$ | 466 | | 957 | | 748 | |
| $\Delta c\Delta C$ | 6 | | 104 | | 416 | |
| Total growth of output per worker (1950 pesos) | 510 | 38 | 1632 | 59 | 3959 | 54 |
| *Total region* | | | | | | |
| $\Sigma\Delta Yn$ | 761 | | 1952 | | 6338 | |
| $\Sigma\Delta nY$ | 641 | | 951 | | 663 | |
| $\Sigma\Delta n\Delta Y$ | − 53 | | − 13 | | 347 | |
| Total regional growth of output per worker (1950 pesos) | 1349 | 100 | 2890 | 100 | 7348 | 100 |
| Share of regional productivity growth attributable to shift factor | 0.48 | | 0.33 | | 0.09 | |

Note: Definitions of sectors are given in Table 6. Figures are calculated from data in Table 18. Methods are discussed in Chapter 3 and in Table 7.

The second region in productivity growth and the leader in labor absorption is Metropolitan Mexico City (Tables 19 and 22). This region is by definition almost 90 percent urban, and its service sector has accounted for most of its productivity growth in the 1940s (over 100 percent) and 1960s (75 percent). In the 1950s the growth of import-substituting industries led the way with 57 percent as mentioned above. The pattern of growth in this region provides support for the hypothesis that "push" factors are beginning to have a retarding effect on Mexico's productivity growth as labor is forced

TABLE 22 Sectoral and shift elements underlying growth in output per worker in the Metropolitan Mexico City region, 1940–70. (All nonpercentage figures represent 1950 pesos per worker.)

| | 1940–50 | % | 1950–60 | % | 1960–70 | % |
|---|---|---|---|---|---|---|
| *Primary sector* | | | | | | |
| $\Delta Aa$ (Sectoral) | 10 | | 115 | | 7 | |
| $\Delta$ (Shift) | − 99 | | − 110 | | − 75 | |
| $\Delta a \Delta A$ (Combined) | − 2 | | − 40 | | − 2 | |
| Total growth of output per worker (1950) | − 91 | − 40 | − 35 | − 1 | − 70 | − 1 |
| *Secondary sector* | | | | | | |
| $\Delta Bb$ | − 798 | | 1895 | | 1752 | |
| $\Delta bB$ | 771 | | 682 | | − 148 | |
| $\Delta b \Delta B$ | − 217 | | 499 | | − 46 | |
| Total growth of output per worker (1950) | − 244 | − 107 | 3076 | 57 | 1558 | 27 |
| *Tertiary sector* | | | | | | |
| $\Delta Cc$ | 387 | | 2314 | | 3055 | |
| $\Delta cC$ | 164 | | 54 | | 965 | |
| $\Delta c \Delta C$ | 11 | | 20 | | 346 | |
| Total growth of output per worker (1950 pesos) | 562 | 247 | 2388 | 44 | 4366 | 75 |
| *Total region* | | | | | | |
| $\Sigma \Delta Yn$ | − 401 | | 4324 | | 4814 | |
| $\Sigma \Delta nY$ | 836 | | 626 | | 742 | |
| $\Sigma \Delta n \Delta Y$ | − 208 | | 479 | | 298 | |
| Total regional growth of output per worker | 227 | 100 | 5429 | 100 | 5854 | 100 |
| Share of regional productivity growth attributable to shift factor | 3.68 | | 0.12 | | 0.13 | |

Note: Definitions of sectors are given in Table 6. Figures are calculated from data in Table 19. Methods are described in Chapter 3 and in Table 7.

into the tertiary sector which, after remaining at a fairly constant 45 percent of employment in the first two decades, rose to 51 percent in the 1960s (Table 19). Still output per worker in the tertiary sector continued to grow in the 1960s, though evidence from Chapter 1 would suggest that if the decade could have been divided into 5-year intervals, that trend might well have been declining. The probable slowdown is likely to have continued into the 1970s as a flood of immigrants failed to find adequate employment opportunities in the overcrowded Valley of Mexico. The drastic deceleration in productivity

TABLE 23 Sectoral and shift elements underlying growth in output per worker in the Rest of Mexico region, 1940–70. (All nonpercentage figures represent 1950 pesos per worker.)

| | 1940–50 | % | 1950–60 | % | 1960–70 | % |
|---|---|---|---|---|---|---|
| *Primary sector* | | | | | | |
| $\Delta Aa$ (Sectoral) | 375 | | 490 | | 99 | |
| $\Delta aA$ (Shift) | − 60 | | − 110 | | − 156 | |
| $\Delta a\Delta A$ (Combined) | − 25 | | − 45 | | − 10 | |
| Total growth of output per worker (1950 pesos) | 290 | 34 | 335 | 36 | − 67 | − 3 |
| *Secondary sector* | | | | | | |
| $\Delta Bb$ | 179 | | 63 | | 580 | |
| $\Delta bB$ | 139 | | 90 | | 280 | |
| $\Delta b\Delta B$ | 39 | | 6 | | 141 | |
| Total growth of output per worker (1950 pesos) | 357 | 42 | 159 | 17 | 1001 | 43 |
| *Tertiary sector* | | | | | | |
| $\Delta Cc$ | 48 | | 82 | | 1075 | |
| $\Delta cC$ | 142 | | 322 | | 190 | |
| $\Delta c\Delta C$ | 8 | | 25 | | 139 | |
| Total growth of output per worker (1950 pesos) | 198 | 23 | 429 | 46 | 1404 | 60 |
| *Total region* | | | | | | |
| $\Sigma\Delta Yn$ | 602 | | 635 | | 1754 | |
| $\Sigma\Delta nY$ | 221 | | 305 | | 314 | |
| $\Sigma\Delta n\Delta Y$ | 22 | | − 14 | | 270 | |
| Total regional growth of output per worker | 845 | 100 | 926 | 100 | 2338 | 100 |
| Share of regional productivity growth attributable to shift factor | 0.26 | | 0.33 | | 0.13 | |

Note: Definitions of sectors are given in Table 6. Figures are calculated from data in Table 20. Methods are described in Chapter 2 and in Table 7.

growth in manufacturing and agriculture almost certainly will have repercussions on income and job multipliers in the service sector of this region, exacerbating relative pressures for migration to the Border and other growth centers. Hence if policies were adjusted to favor decentralized growth, they might well find a favorable labor response, though as shown in Chapter 5 absolute gaps in output per worker still favor Metropolitan Mexico City.

Finally, the Rest of Mexico (Tables 20 and 23) deserves attention since the 23 states that make up this region account for almost two-thirds of the

TABLE 24 Regional and sectoral shifts as a share of Mexican productivity growth (%). (Based on the division of Mexico into 3 regions.)

| Shift | 1940–50 | 1950–60 | 1960–70 |
|---|---|---|---|
| 1. Regional shift as a share of productivity growth in Mexico | 20 | 8 | 10 |
| 2. Sectoral shift as a share of productivity growth | 51 | 28 | 16 |
| 3. Internal migration among the 3 regions as a share of growth in the economically active population | 13 | 19 | 22 |

SOURCE: Tables 18–23 and Chapters 5 and 6.

Mexican labor force (1970). Here too the pattern is disturbing. Although 57 percent of the labor force remained in the primary sector in 1970, that sector's share of regional productivity growth, which had been one-third in the 1940s and 1950s, became negative in the 1960s (Table 23). Manufacturing on the other hand showed signs of regional dispersion, as its share of employment rose from 11 percent in 1940 to 18 percent in 1970. Here again, however, the tertiary sector took the lead with a 60 percent contribution to overall productivity growth in the 1960s. It is likely that without significant labor emigration from the Rest of Mexico to the Metropolitan Mexico City and the Border regions, the productivity growth in the Rest of Mexico would have lagged still more. The output per worker in agriculture in that region was only about one-fourth that of the Border region, though its service sector productivity was one-half that of the Border. Clearly, it is the tertiary sector in which productivity "leveling" is occurring, and it is this sector that deserves much more research than it has received, given its patterns of employment, distribution of output, and income trends.

In conclusion, the shift factor is declining as a contributor to productivity growth, both regionally and sectorally. Meanwhile, the share of migration among regions, as a proportion of growth in the labor force, is on the increase (Table 24). This indicates that while workers are increasingly moving to higher productivity regions in search of employment, those regions are less capable of sustaining their role as transmitters of growth through shifts in the labor force. A squeeze is coming between migratory pressures for higher income and the potential of leading regions to provide jobs. Indeed, it is likely that rather than passing on productivity gains, migration is now dampening such growth in the leading sectors and regions. Mexico is in danger of becoming a low income and low productivity "service economy" in contrast to the USA which is attempting to maintain its position as a high income "service economy". The consequences are a sharpening of the disparities in the standards of living and

quality of life between the two countries, disparities that exacerbate pressures for migration northward to bridge the gap that has not yet been narrowed through trade and investment flows or technology transfers. The emerging pattern is different from the 1940s, when according to our data, there was more hope. During the 1940s the internal shift factor accounted for one-half of productivity growth. Migration within Mexico offered promise of a better life, and the regional shift accounted for up to one-fifth of national productivity growth (Table 24). But by the 1960s sectoral shifts were at most responsible for only one-sixth and regional shifts for one-tenth of national productivity growth. The new petroleum windfall may provide an economic surplus that could be allocated to favor basic regional and sectoral productivity growth. This might reverse historical trends. But to do so, every effort must be made to assure that the new oil rents are not simply redistributed as consumption subsidies, artificially causing service sector employment to rise still further, nonpetroleum exports to decline, and imports of consumer goods to expand disproportionately. Fundamental changes are needed in the incentive structure of the economy. These changes should favor true productivity growth in the nonpetroleum primary sector, in manufacturing, and in agriculture, together with expansion of wage good production to serve the mass of the Mexican population.

## NOTES

1. The Human Settlements and Services Area's research in urbanization and development is concerned with simulation modeling and counterfactual analysis of alternative patterns of demographic and economic growth, urbanization, and regional migration under conditions of alternative rural technologies, income distribution, and demand patterns, and implications of the foregoing for the provision of social services (Rogers 1978). This research is inspired by the importance of issues underlying current debates between those criticizing alleged "over-urbanization" of developing countries and those supporting present patterns of urbanization and migration as means of improving social welfare. Demographic influences on migration are of course of considerable importance to economic growth, and the outcome will, in an iterative fashion, affect the future growth of population, welfare, and migration. By breaking into this sequence of behavior to look at the structure of output and employment and its changes over time at the national level and by sector and region, for a single important case, the Mexican Case Study seeks to provide empirical evidence on both costs and benefits of rapid demoeconomic changes. The resettlement of important segments of the work force has been an essential element in this study.
2. A more explicit statement of the theoretical framework used follows. The foundation of the section is taken from production theory and uses the implicit production function

$$Y = A_{(t)}f(K, L, R) \tag{1}$$

where $Y$ is the total value added or GDP; $f$ is a function having the neoclassical properties of being homogeneous of degree one and twice differentiable; and $A_{(t)}$ is the so-called efficiency term which is a function of time and independent of the factors of production. Changes of this term are considered to reflect the effects of technological change, and they serve to shift the production function without altering its basic structure. Therefore the term is considered as neutral technological change. The term can adopt the form

$$A_{(t)} = A_{(0)}e^{\lambda t}$$

where $\lambda$ is a parameter. Explicitly what we have in the paper is

$$Y = e^{T}L^{a}K^{b}R^{c} \tag{2}$$

Therefore, the following observations are in order

(a) $A_{(0)} = 1$
(b) $\lambda T = t$
(c) $f$ adopts the form of a Cobb–Douglas production function. The purpose of this section is to determine by means of equation (2) the percentage of change in output attributed to variation in the quantity and quality of inputs. To illustrate, we can differentiate equation (1) totally with respect to time and obtain

$$\frac{\partial Y}{\partial t} = \frac{\partial A}{\partial t} f + A_{(t)} \frac{\partial f}{\partial K}\frac{\partial K}{\partial t} + \frac{\partial f}{\partial L}\frac{\partial L}{\partial t} + \frac{\partial f}{\partial R}\frac{\partial R}{\partial t} \tag{3}$$

or

$$\frac{\dot{Y}}{Y} = \frac{\dot{A}}{A} + A_{(t)} \frac{\partial f}{\partial K}\frac{\dot{K}}{Y} + A_{(t)} \frac{\partial f}{\partial L}\frac{\dot{L}}{Y} + A_{(t)} \frac{\partial f}{\partial R}\frac{\dot{R}}{Y} \tag{4}$$

We know that under competitive conditions (one of the implicit assumptions in the analysis)

$$\frac{\partial f}{\partial K}\frac{K}{Y} = b; \quad \frac{\partial f}{\partial L}\frac{L}{Y} = a; \quad \frac{\partial f}{\partial R}\frac{R}{Y} = c$$

Therefore

$$\frac{\dot{Y}}{L} = \frac{\dot{A}}{A} + a\frac{\dot{L}}{L} + b\frac{\dot{K}}{K} + c\frac{\dot{R}}{R} \tag{5}$$

or in discrete terms

$$\frac{\Delta Y}{Y} = \frac{\Delta A}{A} + a\frac{\Delta L}{L} + b\frac{\Delta K}{K} + c\frac{\Delta R}{R} \tag{6}$$

Since $A$ is not observable, it is found as a residual

$$\frac{\Delta A}{A} = \frac{\Delta Y}{Y} - a\frac{\Delta L}{L} - b\frac{\Delta K}{K} - c\frac{\Delta R}{R} \tag{7}$$

3. These factor shares are based on estimates for the period 1940–65 taken from the author's earlier study (Reynolds 1970) in which the labor share includes mixed income ("ingresos mixtos") of small business and farm households. There is some likelihood that in the years since 1965 the labor share has declined serving to lower this coefficient.
4. It should be noted that the post-1960 GDP series was somewhat revised since the Reynolds (1970) volume was published, and the present study incorporates these changes, causing the results for earlier years to be slightly different from earlier estimates.
5. The 1960 census PEA (economically active population over 12 years of age) was reported to be $11\,235 \times 10^3$. Altimir adjusted this figure to $10\,213 \times 10^3$. The agricultural population was most affected by this downward adjustment: the census PEA in agriculture for 1960 of $6086 \times 10^3$ being reduced by Altimir to $5048 \times 10^3$. If the census figures for 1960 ($6086 \times 10^3$) and 1970 ($5329 \times 10^3$) are compared, it appears that the rural PEA declined sharply in absolute terms. Yet as Altimir shows, this is not consistent with sample surveys taken in 1963, 1964, and 1965 that showed rural labor participation rates to be close to the 1970 levels and much below those of 1960. Clearly, Altimir's adjustments for 1960 when disaggregated are crucial, regionally, to the analysis of migration and sectoral and regional labor absorption in Mexico between 1950 and 1970. On the basis of the uncorrected 1960 census data, the degree of labor flow from rural to urban areas is seriously understated for the

1950s and overstated for the 1960s. The Altimir adjustments resulted from a thoroughgoing examination of coverage, definition, measurement and other problems of the population censuses of 1950, 1960, and 1970. His research was done under the auspices of the United Nations Economic Commission for Latin America and the Regional and Urban Development Project at El Colegio de Mexico. Altimir argues convincingly that the PEA reported in the 1960 census was seriously overestimated, the upward bias being concentrated in the rural labor force through over counting of unrenumerated family workers and agricultural wage labor in 1960 relative to that of the 1950 and 1970 censuses. His conclusions are supported by a comparison of the respective population censuses of 1950 and 1960 (which also report rural employment) and by an El Colegio de Mexico reestimate of the 1960 PEA based on a 1.5 percent sample of 1960 census cards. As mentioned above, his major adjustment was to reduce the PEA in the agricultural sector (which includes cattle, forestry, and fishing) in 1960 from $6089 \times 10^3$ to $5048 \times 10^3$. Altimir does not give statewide breakdowns for these adjustments by sector, but he does report the adjusted PEA by state for 1960. Since the overall total downward adjustment was concentrated in the primary sector, I applied the difference in state PEA from the census and Altimir's estimates entirely to the primary sector of the respective state. Only in the case of the state of Mexico and the Federal District of Mexico did this method lead to spurious results (negative employment in the rural sector). In those two cases instead of using the above method, I reduced primary sector employment by the same proportion as that of the Rest of Mexico allocating the remainder as a proportioned reduction to the rest of the states.

6. The capital stock in 1959 was assumed to be 331 124 million pesos (at constant 1960 values) to which an assumed 5 percent depreciation rate was applied. To this figure were added gross investment flows in 1960 of 33 132 million pesos, producing an estimated capital stock at the end of 1960 of 347 700 million pesos (this would have meant a capital/output ratio ($K_{t-1}/Y_t$) for 1960 of 2.2.
7. Continual revisions of the national accounts make it difficult to get a secure fix on the level or trend of income and product in Mexico. For example, earlier data implied trends in GDP for the 1940s of 6.4 percent to 6.7 percent per annum (Reynolds, 1970) compared to 5.8 percent in Table 2 (Solis 1970; Unikel 1976). Official revisions that have appeared since the Unikel study lower the growth rate for the 1960s from 7.2 percent to 6.8 percent per annum. In order to keep estimates in this chapter as close as possible to those in the following chapters (which rely on Appendini (1974)–Unikel (1976) regional gross product estimates that are linked to the Solis (1970) GDP data at the national level), I have retained the Solis figures for GDP growth in the 1940s and 1950s. However, estimates for 1960–1976 provided by the Bank of Mexico in 1977 differ significantly from Solis's earlier figures. Thus, it is necessary to adopt the Bank of Mexico's data for the 1960s, despite the fact that they lower the growth rate (and residual) during that decade by 0.4 percent per annum. The turnaround in productivity growth since the mid-1960s is independent of the choice of GDP estimates for the 1960s.
8. Hewitt's 1960 figure (Hewitt 1976) is derived from CIDA (1964: Vol. 1), and the source of the 1960 figure is not clearly cited. Her figures for growth of cultivated land between 1940 and 1960 are comparable to those presented in Reynolds (1970), justifying a linking of her 1960 to 1970 figures to the earlier index.

| | 1940–50 (%) | 1950–60 (%) | 1960–70 (%) |
|---|---|---|---|
| Hewitt (1976) | 3.0 | 1.0 | 2.1 |
| Reynolds (1976) | 3.6 | 1.0 | N.A. |

9. In my 1970 volume, estimates of the unexplained productivity residual showed a decline between the 1940s and 1950s, from 3.3 percent per annum to 2.5 percent per annum, respectively, as compared with the reverse trend in Table 2 (from 2.5 percent to 2.7 percent). The later results are due primarily to a downward revision of output growth in the 1940s (GDP in constant 1950 pesos) based on the GDP estimates (Solis 1970) presented in Appendini (1974)–Unikel (1976). Labor force growth in the 1950s has also been sharply reduced in the present study drawing on the more recent downward revision of the 1960 census figures by Altimir (1974). The growth in PEA based on official census data between 1950 and 1960 was 3.1 percent per annum (Reynolds 1970: 50, Table 1.7).
10. The primary sector receives emphasis as a source of out-migration. Regional differences in agricultural productivity, which in Mexico reflect severe contrasts between irrigated agriculture in the North and Pacific North (or Border states) and rain-fed agriculture (principally in the Center, Gulf, and South, i.e., Rest of Mexico states), leading to different paths of employment and income among the regions of Mexico. The tertiary sector is focused on as a buffer that absorbs labor displaced from rural areas. In Mexico the tertiary sector also evidences wide differences in employment and productivity growth by region. The tertiary sectors of the Border and Metropolitan Mexico City regions absorb much labor displaced from the primary sector both in those regions and in the Rest of Mexico region.
11. This is a generalized version of the shift-share model for three sectors presented in Reynolds (1970: 64ff) designed to accommodate any number of sectors and regions. Its characteristics are discussed in detail in that study.
12. The sustained high value of output per worker in the tertiary sector, exceeding that of the secondary sector in all four years (Table 6), deserves comment. Since this sector aggregates a number of activities of very different productivity, from banking and finance to domestic services and street vendors, it disguises a large and growing dualism in Mexico as elsewhere. While productivity is growing in the modern tertiary sector, reflecting a high and growing rate of capital formation and technological progress in modern commerce, transport, and services, it is almost certainly stagnating or perhaps even declining in the traditional tertiary sector, which serves as a major buffer for workers migrating from the rural areas of Mexico. Hence, further analysis of this problem should attempt to differentiate between tertiary activities that are capital intensive and those that are labor intensive. It is likely that some of the shift factor attributable to the tertiary sector is in fact own productivity growth in the modern tertiary sector rather than increased employment as in the traditional tertiary sector. In addition the methodology used for estimation of value added in some of the tertiary sector activities, such as commerce and services, is extremely crude (application of a coefficient to value added in other production sectors) and leads to possible biases in either direction, while employment figures are taken from the decennial censuses and bear no relation to the value added estimates in the national accounts. It is quite possible that value added is overestimated for these components of the tertiary sector. Also, value added for the large and growing public sector is a simple reflection of government wages and salaries and bears no necessary relationship

to physical productivity. It has been suggested, on the other hand, that the nature of highly protected manufacturing in Mexico has led to a lower level of productivity and slower rate of productivity growth in the secondary sector than would have been obtained under a more internationally competitive system. This should be offset by the consideration that value added in manufacturing is distorted upward by the degree of effective protection of its products, while value added in the primary and tertiary sectors is subject to a proportional downward bias. In short, it is not possible to net out the effects on output per worker in the three sectors of statistical and policy-related (price) distortions. For that reason the value added estimates from the national accounts are used without adjustment.

13. In subsequent chapters regional patterns of productivity growth in the service (tertiary) sector are examined. It is shown that the regional performance of this sector is quite diverse, and that the shift element is an important contribution *within* the tertiary sector as well as between it and the primary sector. These initial findings support the need for far more detailed research on the service sector, with special attention to its role in labor absorption in Mexico (Souza and Tokman 1976; Reynolds and Leiva 1978). It is quite likely that the pattern of productivity growth within the tertiary sector is even more unbalanced than between it and other activities. Growth in output per worker in services tends to occur in the more capital- and skill-intensive subsectors, which are least likely to absorb job seekers displaced in increasing numbers from the rural areas. Unfortunately, the data used in this paper do not easily accommodate disaggregation of the tertiary sector. A more detailed study of the output and population censuses might permit such an analysis to be made at both the national and regional levels for at least some of the subsectors. This research could then be combined with a sectoral analysis of budget study data plus interviews of small businesses and other activities in the informal sector. The rarely characterized "urban informal sector" is a nontrivial consideration and may be said to include self-employed, workers and owners of small businesses, workers receiving relatively low incomes and those outside of the social security system, or other categories, depending upon the choice of criteria of the observer. There seems to be a strong overlap between conventionally defined informal sector employment and that of subsectors of the tertiary sector, but all sectors of production have been found to have important elements of informal sector employment (Souza and Tokman 1976).
14. This study draws on the statewide breakdown of GDP data in Unikel (1976), which is based on work by Appendini for the years 1940, 1950, and 1960. It also draws on estimates by the Secretaria de Hacienda y Crédito Público, Dirección de Programación y Descentralizacion Administrativa, Subdirección de Programación Fiscal, for 1970, which appear in Unikel (1976). Labor force data for 1940, 1950, and 1970 are estimated on the basis of the respective population censuses as described in Unikel and Torres (1970). The data for 1960 have been further adjusted by Altimir's agricultural labor force estimates for 1960 (Altimir 1974).
15. The figures in Table 19 show a significant decline in output per workers in the Metropolitan Mexico City region during the 1940s. If correct, they suggest that labor absorption dominated the growth of secondary production in that period, while capital-intensive growth characterized the 1950s and 1960s.

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## THE AUTHOR

Clark W. Reynolds received his Ph.D. in Economics from the University of California at Berkeley and is now a professor at the Food Research Institute at Stanford University. His main interests of research include economic development, international trade and finance, and social history.