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WORLD BANK RESEARCH ON POPULATION PROBLEMS

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In his first year as President of the World Bank, 1968-69, Robert McNamara called the attention of the development community to the serious problem of rapid population growth in the developing world and committed the Bank to population program lending, economic analysis, and demographic research. As the Bank began to carry out this commitment, the lack of consensus among population experts became quickly apparent. It was clear to all that current population growth rates, sustained for several more decades, would mean economic catastrophe for several of the world's poorest countries. It was also agreed that population growth rates would fall with sufficient economic and social development. But beyond this there was much controversy.

In the twelve years since the Bank entered this area, understanding of these issues has greatly increased, but a number of puzzles remain. It has proven possible to reduce fertility in some low-income countries with good family planning programs—Thailand and Indonesia are examples of success. But there have also been disappointments. Despite family planning programs, the birth rate has increased in several countries, notably Egypt and Kenya, and may well rise in other African countries. What distinguishes these cases?

We have only begun to answer these questions. What we have learned from the Bank's research on population growth will be briefly summarized in this paper.¹ While the major focus of the Bank's concern in this area has been on the determinants and consequences of high fertility, migration has also required research because of problems of rapid urban growth, disequilibrium in labor markets, and the effects of remittances on the balance of payments. This review will be organized around five topics: the determinants of fertility, mortality

and migration, the consequences of rapid population growth, and population policies and programs. Before turning to the specific topics, however, it is necessary to explain the context in which Bank population research is conducted.

The distinctive nature of the Bank's role has led to a rather different pattern of work from that of other research organizations in the field. First, because demographic data are required for country economic and project work in countries that have poorly developed data collection systems, a great deal of time and attention must be devoted to estimating levels of fertility, mortality, and migration. This may require the development of indirect measurement techniques, such as those in Zachariah's work on migration and stable population techniques.² Other studies, such as Hill's recent paper on the African demographic situation,³ demonstrate the application of a wide range of techniques. Population data have been compiled in demographic briefs for most countries and in-depth coverage has been given to population in the various human resource reports (Brazil, Egypt, Kenya, the Republic of Korea, and Pakistan), as well as less intense coverage in economic work on China, Colombia, El Salvador, India, Indonesia, Malawi, Nigeria, Thailand and Vietnam.

Second, the Bank's research in population represents less than 5 percent of the socioeconomic research in international population issues.⁴ For

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1. This review includes only in-house Bank research. We have not attempted to summarize the research financed out of population, health, or nutrition projects. At a later time such a review might be possible. Such research is country- and program-specific and in most cases the findings have not yet been completed or released.

2. K. C. Zachariah, "Measurement of Internal Migration from Census Data" in *Internal Migration: A Comparative Analysis* (London: Academic Press, 1977) and "Problems of Applying Stable Population Techniques in Estimating Demographic Measures for Arab Populations," World Bank Staff Working Paper No. 114, September 1971.

3. A. Hill, "The Demographic Situation in Sub-Saharan Africa: A Background Paper," World Bank, Population and Human Resources Division, Discussion Paper No. 81-22, May 1981.

4. B. Baron, "International Funding for Social Science Research in Population: Trends and Issues," prepared for an interagency meeting on Research for Population Policy: Directions for the Future; United Nations, New York, January 1981.

this reason, we need to keep the growing stock of knowledge continuously under review to identify research gaps and to select our research priorities. The 1974 review of policy issues was one of the first efforts of the Population and Human Resources Division and has provided a reference point for later work.⁵ The relationship between population growth and development was reviewed by Birdsall in both 1977 and 1980.⁶ Cochrane has provided reviews of the relationship between education and fertility.⁷ Migration and labor market interactions in developing countries have been surveyed by Sabot.⁸ In addition to reviews of specific topics, region-specific overviews of the human resource sector, including population, were prepared for the *World Development Report, 1980*.⁹

A third distinctive feature of the Bank's research on population has been its policy emphasis. Research on the explanations of demographic behavior is, in most instances, motivated by an attempt to understand which determinants may be manipulated by policy. The study of consequences of population growth is designed to identify which consequences can be avoided by reducing growth rates and which are inevitable, given past growth, and must thus be planned for. In addition to these policy foci, there has been considerable Bank research on the population policies and programs of various countries. Therefore, we shall look at policy issues within each topic, and also separately discuss research into specific policies themselves.

Fertility

The theory of the determinants of fertility has changed enormously in the last ten years. The causes of high fertility are now recognized as more complex than had been formulated by the simple models of the demand for children of the 1960s and early 1970s. It has been recognized that many couples in the developing world are unable to have as many children as they desire due to their own poor health and the high mortality of their offspring. In Bank-sponsored surveys in both the rural Terai in Nepal (Ref. No. 671-49)¹⁰ and rural Botswana (Ref. No. 671-61)¹¹ the vast majority of couples were in this position. Evidence from Bangladesh that fertility declined as a consequence of the 1974-75 famine also suggests that fertility levels are constrained by poor parental health.¹²

These environments differ from those found in Kerala, India (Ref. No. 671-70), Sri Lanka (Ref. No. 671-70), Thailand (Ref. No. 671-49), and Indonesia (Ref. No. 672-19), where many couples are able to achieve their desired family size and are, therefore, interested in limiting fertility. Research in these countries is giving us considerable insight into the factors involved in the adoption of family planning.

In Indonesia, differences between Bali-Java and the Outer Islands suggest that where there is a greater prevalence of family planning knowledge and practice (as in the former), socioeconomic differences between couples play a lesser role in determining contraceptive use than in areas such as the Outer Islands where family planning has only recently been introduced.¹³

In Kerala, socioeconomic differences seem to affect the type of contraceptives used rather than usage *per se*.¹⁴ Among the poorer, less educated groups,

5. T. King *et al.*, *Population Policies and Economic Development* (Baltimore and London: The Johns Hopkins University Press, 1974).

6. N. Birdsall, "Analytical Approaches to the Relationship of Population Growth and Development," *Population and Development Review*, vol. 3, no. 12 (March/June, 1977), and "Population and Poverty in the Developing World," World Bank Staff Working Paper No. 404, July 1980.

7. S. H. Cochrane, *Fertility and Education: What Do We Really Know?* (Baltimore and London: The Johns Hopkins University Press, 1979) and "Education and Fertility: An Expanded Examination of the Evidence," in *The Education of Women in the Third World*, edited by C. Elliot and G. Kelly (Buffalo: SUNY Press, forthcoming).

8. R. H. Sabot (ed.), *Migration and The Labor Market in Developing Countries* (Boulder: Westview Press, 1981).

9. W. Bussink *et al.*, "Poverty and the Development of Human Resources: Regional Perspectives," World Bank Staff Working Paper No. 406, July 1980.

10. S. H. Cochrane, N. Joshi, and K. Nandwani, "Fertility Attitudes and Behavior in the Nepal Terai," World Bank, Population and Human Resources Division, Discussion Paper No. 81-9, April 1981.

11. D. Chernichovsky, "Socio-economic Correlates of Fertility in Rural Botswana," paper presented at Botswana Rural Income Distribution Seminar, Gaborone, Botswana, June 1979.

12. R. Amin and R. Faruquee, "Fertility and its Regulation in Bangladesh," World Bank Staff Working Paper No. 383, April 1980.

13. D. Chernichovsky and O. A. Meesook, "Regional Aspects of Family Planning and Fertility Behavior in Indonesia," World Bank Staff Working Paper No. 462, May 1981.

14. K. C. Zachariah, "Anomaly of the Fertility Decline in Kerala: Social Change, Agrarian Reform, or the Family Planning Program," World Bank, Population and Human Resources Division, Discussion Paper No. 81-17, May 1981.

sterilization has been widespread, but among the more educated, reversible methods are more prevalent. The Kerala study indicates that more fertile couples are more likely to adopt fertility control. In the experiment at Narangwal, in India, it was also found that women who had had more births and fewer child deaths were more likely to adopt family planning.¹⁵

Family planning programs are only one of the policy instruments suggested for reducing fertility. Providing education, improving child survival, and raising incomes of the poor are also often suggested as measures of population policy. Both the new models and the new data, however, suggest that the relationships between fertility and socioeconomic variables are not as simple as previously believed. Cochrane has shown that in poor, rural environments fertility is higher among those with a little education than among the uneducated. This usually occurs in situations where most couples cannot achieve desired family size due to poor health. Once desired family size is achieved, however, the more educated are more likely to control their fertility.

The relationship between income distribution and fertility has been examined by several researchers in the Bank.¹⁶ In 1974, Zachariah noted that while maldistribution of income tends to be associated with higher fertility rates, as found in *Population Policies and Economic Development*, the effect of a change in income distribution on fertility rates is not in the same direction or of the same degree.¹⁷ Meesook also emphasizes the difference in the relationship between static and dynamic analysis and suggests that in dynamic analysis the relationship between fertility and income distribution is likely to be two way.¹⁸ It is possible that improved income among the poor may reduce fertility and lower fertility among the poor would improve income distribution. The effect of population growth on income distribution was illustrated in a paper by Ahluwalia, Carter, and Chenery.¹⁹ While improvements in income distribution are desirable in and of themselves, it is unclear whether they will reduce fertility in the short run.

Education and income distribution have been more fully examined in the Bank as determinants of fertility than has infant mortality. Fertility and child mortality have been shown to be positively correlated in rural Northeast Brazil (Ref. No. 671-

02),²⁰ and in the above-cited research in Bangladesh, Narangwal, and Nepal as well as in research done outside the Bank, but the cause and effect are difficult to separate. There is, however, some evidence suggesting that high child mortality causes high fertility rather than the converse, in some environments. In populations using contraceptives, this is shown by the tendency for couples with high child mortality to be less likely to adopt contraception. In populations not using contraceptives, such as that of the Terai in Nepal, it appears that the death of infants, and associated premature termination of breastfeeding, results in more closely spaced, and hence more numerous, pregnancies.²¹ Neither child spacing nor numbers *per se* appears to affect child survival in the Nepal sample, but it is a small sample and the results are not definitive. Nevertheless, in environments such as Nepal, reducing child mortality may be necessary before other policies can affect fertility. Exploring this relationship should be of high priority for future work, especially in Africa.

The knowledge gained from micro data sets has been supplemented by aggregate data. National data sets have been used by King *et al.* and Faruquee²² to determine the relative importance of

15. C. E. Taylor *et al.*, "Integration of Family Planning and Health Services: The Narangwal Experience," World Bank, March 1980 (mimeo).

16. In addition to in-house research, the Bank partially financed an extension of Repetto's work which was begun at the Bank: R. Repetto, *Economic Equity and Fertility in Developing Countries*, Resources for the Future (Baltimore and London: The Johns Hopkins University Press, 1979).

17. K. C. Zachariah, "Income Distribution and Fertility Rates," World Bank, Population and Human Resources Division, November 1974 (mimeo).

18. O. A. Meesook, "The Interrelationship Between Demographic Factors and Income Distribution: Problems of Measurement, Description and Interpretation," World Bank, Population and Human Resources Division, Discussion Paper No. 81-8, April 1981.

19. M. S. Ahluwalia, N. G. Carter, and H. B. Chenery, "Growth and Poverty in Developing Countries," *Journal of Development Economics* 6 (1979).

20. D. Chernichovsky, "Some Socioeconomic Aspects of Fertility in the Brazilian Northeast: A Note," World Bank, Population and Human Resources Division, September 1978 (mimeo).

21. S. H. Cochrane, "The Determinants of Fertility and Child Survival in the Nepal Terai," World Bank, Population and Human Resources Division, Discussion Paper No. 81-34, July 1981.

22. R. Faruquee, "Sources of Fertility Decline: Factor Analyses of Intercountry Data," World Bank Staff Working Paper No. 318, February 1979.

family planning programs versus socioeconomic development (increased education, income, and so on) in influencing contraceptive acceptance, continuous use, and birth rate levels and declines. King *et al.* found that program inputs were relatively more important in explaining contraceptive acceptance, but that socioeconomic variables were more important in explaining birth rates and the proportions of women using contraception. Faruqee used data from 55 developing countries to explain declines in birth rates between 1970 and 1975 and found that while the effects of both programs and the level of economic development were significant, the latter was relatively more important.

The interaction between family planning efforts and development is not well understood and is difficult to model. King *et al.* found those interactions to be more important in explaining regional differences within India than in explaining differences between countries, but not much progress has been made since then in studying these interactions at a national level. This has been a difficult issue to research for a number of reasons. First, governments do not randomly adopt programs: the same factors that contribute to development also contribute to the ability of governments to adopt and implement family planning programs. Second, countries differ in their cultural receptivity to programs. Third, individual adoption of contraception is related to the factors of development in a complex, nonlinear way and, as noted earlier, development may in fact be associated with an increase in fertility prior to a decline. The study of individual fertility decisions appears more promising and, therefore, research at the household level has received increasing attention (see, for example, the household surveys mentioned above in Botswana, Brazil, Egypt, India, Indonesia, Nepal, Sri Lanka and Thailand).

Mortality

Mortality is the least researched demographic topic, both within the Bank and in the field.²³ In part this is because it has been more difficult to measure mortality than fertility. New techniques, however, have been developed and research on infant and child mortality has expanded rapidly in the last few years. The evidence on its determinants has been reviewed by Cochrane, O'Hara, and Leslie—a study that shows female education to be the most consistent factor affecting child survival.²⁴

Unfortunately, most of the empirical work reviewed does not permit more specific conclusions regarding the effects on mortality of policy variables such as the accessibility of health services.

Several ongoing or recently completed Bank studies have examined infant and child mortality. Boulter and Paqueo²⁵ and Cochrane²⁶ have studied the determinants of offspring survival in Sri Lanka, the Republic of Korea, and Nepal. These studies did not allow analysis of health policy variables, however, since the data used were originally collected for other purposes. The studies show education to be positively related to child survival, but this effect is not significant at all levels of education.²⁷

In contrast to analysis of these socioeconomic surveys, the Narangwal survey examined the effects of specific policy interventions on mortality in a follow-up survey.²⁸ The effectiveness of health programs varied depending on the age of the child. The study also found that parental initiative in seeking care was important and differed significantly across socioeconomic groups and for male and female children.

Research on the interaction of family socioeconomic characteristics, child-specific factors, and health-care availability in determining child mortality is essential for designing programs which equalize the life chances of children in different socioeconomic groups. Work on this and other factors affecting child survival is part of current research projects on Brazil (Ref. No. 672-21),

23. Baron has estimated that only 2 percent of international social science research in the period 1978-79 has been in the area of mortality. B. Baron, *op. cit.*

24. S. H. Cochrane, D. O'Hara and J. Leslie, "Education and Health," World Bank Staff Working Paper No. 405, July 1980.

25. B. L. Boulter and V. B. Paqueo, "On the Theory and Measurement of the Determinants of Mortality," World Bank, Population and Human Resources Division, Discussion Paper No. 81-31, June 1981.

26. Cochrane (July 1981), *op. cit.*

27. A number of cross-national studies of the determinants of mortality have shown the importance of education. See N.L. Hicks, "Sector Priorities in Meeting Basic Needs: Some Statistical Evidence," World Bank, Policy Planning and Program Review Department, April 1979 (mimeo).

28. C. E. Taylor *et al.*, "Malnutrition, Infection, Growth and Development: The Narangwal Experience," World Bank, Population and Human Resources Division and The Johns Hopkins University (mimeo).

Indonesia (Ref. No. 672-19), Kerala in India (Ref. No. 671-70), and Egypt (Ref. Nos. 671-81 and 672-42). It seems clear that, particularly in countries with high mortality such as those of Sub-Saharan Africa, further work of this kind should be a first-order priority for research. Research on socioeconomic differences in mortality is also needed to provide an accurate evaluation of differences in measures of lifetime income.²⁹

Migration

The Bank is uniquely positioned to study international migration and needs to do so to understand its implications for labor markets and for the balance of payments. Therefore, the Bank devotes a larger proportion of its research to migration, particularly to international migration, than does the international community as a whole.³⁰ Three large research projects have been executed in recent years. There have also been some smaller-scale research projects on internal migration.

The international migration that has attracted most attention in the Bank is labor migration within and into the Middle East. Work on this subject has attempted to document the level of migration, the characteristics of the migrants, and the economic consequences of the flows. Relatively little attention has been paid to the study of determinants because job opportunities seem so clearly the motivating force.

Middle Eastern labor migration has affected a large number of countries. In 1975, seven Middle Eastern oil-importing countries had 17 percent of their labor force composed of nonnationals, mostly from other Arab countries, primarily Egypt, the Yemen Arab Republic, and Jordan. As the demand for labor has increased, however, workers began to be imported from South and Southeast Asia. These trends are predicted to increase between now and 1985.³¹ The economic benefits to the labor-importing countries are clear. The social and potential political costs are giving rise to increasing concern as dependent families migrate to join workers and as nonnationals come to outnumber nationals in the labor markets of some countries. The costs and benefits to sending countries have been reviewed in the Middle East migration project and research project Ref. No. 671-83 is addressing these issues for Pakistan and Bangladesh. For Bangladesh, the social benefits appear to

outweigh the costs even for professionals (except in the health and power sector).³² Therefore, that project has recommended ways for increasing migration.

Another major area of migration in the developing world is West Africa. Migration in this area, both internal and international, has been documented in a series of papers produced under research project Ref. No. 670-26.³³ West African migration is more informal and has a longer history than that in the Middle East. In this part of the world, both internal and international migration are part of the same long-term migratory flow from the interior to the coast.³⁴ Not many other broad generalizations can be made, however, because there are wide differences in the importance and characteristics of the migration streams. These are carefully documented in separate reports on nine West African countries.³⁵

Internal migration has received attention in the West Africa study, in country economic work on Kenya, the Philippines, and Tanzania, and in research work on these countries as well as India, the Republic of Korea, Malaysia, and Thailand.

29. O. A. Meesook, "Demographic Characteristics of Individuals and the Measurement of Lifetime Income," World Bank, Population and Human Resources Division, Discussion Paper No. 81-1, January 1981.

30. Baron, *op. cit.*, estimates that only 9.1 percent of the social science research funds in population were spent on migration and of this less than one-eighteenth was for international migration. In contrast, particularly in the past few years, large proportions of the Bank's external research expenditures in the area of population were for international migration (30 percent in 1979 and 35 percent in 1980).

31. I. Serageldin, J. Socknat, and S. Birks, "International Labor Migration in the Middle East and North Africa, Summary of the Research Project," World Bank, Technical Assistance and Special Studies Division, EMENA Projects Department, March 1981.

32. S. A. Ali *et al.*, "Labor Migration from Bangladesh to the Middle East," World Bank Staff Working Paper No. 454, April 1981.

33. In 1975 there were 1.6 million migrant workers and 1.5 million dependents in the nine oil-exporting Middle Eastern countries. In the same year there were 2.8 million foreign nationals in the nine countries included in the West African migration study. This constitutes 7 percent of the area's population and over 10 percent of the labor force.

34. K. C. Zachariah and J. Condé, *Migration in West Africa: Demographic Aspects* (New York: Oxford University Press, 1981).

35. K. C. Zachariah *et al.*, "Demographic Aspects of Migration in West Africa, Volumes 1 and 2," World Bank Staff Working Papers No. 414 and 415, September 1980.

Attention has focused on rural to urban migration, even though in a number of countries such as Tanzania and Thailand rural to rural migration is larger and in many countries urban to urban migration is also significant.³⁶

Economic factors are overwhelmingly important in explaining internal migration.³⁷ Work in Thailand³⁸ suggests that migrant flows between areas can be well explained by such factors as the ratio of incomes, unemployment, or available farmland in the origin and destination.³⁹ It appears, however, that people from richer areas can better afford to move, particularly over long distances, and are therefore more, and not less, likely to move.

The work on Tanzania has provided a test of the interaction of income and unemployment in determining rural-urban migration.⁴⁰ As hypothesized, the very large urban-rural wage differentials, particularly for the more educated, make migration economically appealing despite very high rates of urban unemployment. It was estimated that a 40 percent reduction in urban wages would be needed to bring the labor market into equilibrium. The difficulties of redirecting the flow of migration have been discussed in recent work on urbanization policy.⁴¹

Migration from rural to urban areas has often been found to have negative effects on the sending area, since more educated individuals are more likely to migrate (Zachariah and Conde, *op. cit.*, and Sabot, 1981, *op. cit.*). Evidence from Kenya, however, suggests that this negative impact is at least partially offset by remittances which are invested in agricultural innovations.⁴²

Consequences of Population Growth

Consequences of population growth are perhaps the most difficult topic to research. Data are usually insufficient to establish past relationships and the identification of future consequences is either highly speculative or mechanical. Nonetheless, careful work on specific effects of population growth on food security, education, other public expenditures, and growth of the labor force is very useful for informing governments about the importance of the problem and for planning needed adjustments in relevant sectors. Existing macro models of the interactions of population and development have been reviewed by Faruquee.⁴³

These models have come to be considered with some skepticism given the lack of knowledge of the underlying interactions.⁴⁴ One reason that generalizations in this area are treated with skepticism is that the consequences of population growth differ substantially among developing countries with different resource endowments, standards of living, and rates of growth.⁴⁵

The consequences of population growth in specific countries have been best addressed in special reports on population growth and in background papers for country economic work. These have shown that in Kenya, for example, the most serious problems of rapid growth are the difficulties this creates for achieving improvements in basic ser-

36. This flow was found to be significant in Malaysia. D. Mazumdar, *The Urban Labor Market and Income Distribution: A Study of Malaysia* (New York: Oxford University Press, 1981).

37. Lorene Y.L. Yap, "Internal Migration in Less Developed Countries: A Survey of the Literature." World Bank Staff Working Paper No. 215, September 1975.

38. F. Arnold and S. H. Cochrane, "Economic Motivation Versus City Lights. Testing Hypotheses about Inter-Changwat Migration in Thailand." World Bank Staff Working Paper No. 416, September 1980.

39. The effects of characteristics of destination and origin as motivating factors are altered by distance and intervening opportunities. See G. Feder, "Alternative Opportunities and Migration: An Exposition and Evidence from Korea," *The Annals of Regional Science*, vol. 13, no. 3 (November 1979) and vol. 14, no. 4 (March 1980).

40. See H. N. Barnum and R. H. Sabot, "Education, Employment Probabilities and Rural-Urban Migration in Tanzania," *Oxford Bulletin of Economics and Statistics* 39 (2), (May 1977), and R. H. Sabot, *Economic Development and Urban Migration in Tanzania, 1960-1971* (Oxford: Clarendon Press, 1979).

41. Bertrand Renaud, *National Urbanization Policy in Developing Countries* (New York: Oxford University Press, 1981).

42. P. Collier and D. Lal, "Poverty and Growth in Kenya," World Bank Staff Working Paper No. 389, May 1980.

43. R. Faruquee, "Macro-Models of Population-Development Relationships," paper presented at the ESCAP meeting on "Comparative Study on Economic-Demographic Model Building," Bangkok, 26-30 November, 1979.

44. See C. A. Miro and J. E. Potter, *Population Policy: Research Priorities in the Developing World*, Report of the International Review Group of Social Science Research on Population and Development. (London: Frances Pinter, 1980.) This review project was funded in part by the Population and Human Resources Division of the World Bank.

45. These issues are analyzed in T. King, "How Do the Consequences of Population Growth Differ Among Developing Countries?" Background Paper for the *World Development Report*, 1978.

vices.⁴⁶ For Egypt, the most difficult problem, given its scarcity of arable land and its commitment to a well-fed population, is the growth of the food deficit. For Brazil, structural adjustment problems arising from oil price increases have been made politically more difficult because of the rapid rate of growth of the labor force.⁴⁷ For Thailand, increasing regional differentials in welfare seem the most unacceptable consequence.⁴⁸ In Colombia, employment and income distribution problems seem the most serious consequences of rapid population growth.⁴⁹ In Nepal, land and food availability will be even more problematic than for Egypt because present levels of food consumption are lower.⁵⁰

The consequences of high fertility at the household level are also significant. A major unresolved question is the effect of population growth and alternative family sizes on savings behavior. While the effects of population growth on public savings appear straightforward, the effects on private and corporate savings are very unclear.⁵¹

Policies and Programs

World Bank research on population policy for years concentrated on fertility reduction and the design of family planning programs. Recent expansion of Bank lending for health sector programs, however, has stimulated increased research on health policy issues as well.

Early policy work attempted to measure the economic benefits of family planning programs by evaluating the consequences of population growth and assessing the extent to which it could be slowed by population programs. An early paper suggested a methodology for measuring benefits and applied it in a case study of Jamaica.⁵² A paper expanding on the methodological problems of such analysis was prepared a few years later.⁵³ Little work has been done on this topic subsequently because the Bank decided not to use cost-benefit analysis in population projects. But with a recent resurgence of interest in the economic analysis of population, health, and nutrition projects, an overview paper is currently being prepared by the new Population, Health, and Nutrition Policy Unit.⁵⁴

Other research on fertility policies and programs has been largely descriptive, drawing either on individual country experiences—for example, In-

dia⁵⁵—or comparing programs in a broad range of countries. *Population Policies and Economic Development*,⁵⁶ prepared for the 1974 Bucharest Conference, provided both a description of existing programs and a set of policy recommendations for program design. The volume offers a useful benchmark for measuring progress in the development of population policies.

A 1977 book on experiments in family planning⁵⁷ provided an excellent follow-up to the program suggestions in the 1974 book. It explored 96 family planning programs that were experimenting with different types of personnel, the use of mass media, the integration of family planning programs with other health programs, intensive campaigns, in-education campaigns, and the use of economic incentives. Results suggested that relatively untrained personnel could be used effectively to provide information, stimulate motivation and deliver contraceptive supplies. Mass media were found to be successful, particularly in conjunction

46. R. Faruqee et al., *Kenya Population and Development: A World Bank Country Study*, July 1980.

47. P. Knight and R. Moran, *Brazil: Human Resources Special Report*, A World Bank Country Study, October 1979.

48. S. H. Cochrane, "The Population of Thailand: Its Growth and Welfare," World Bank Staff Working Paper No. 337, June 1979.

49. N. Birdsall, "Fertility Decline in a Developing Economy: The Case of Colombia," World Bank, Population and Human Resources Division, November 1979 (mimeo).

50. D. T. Jamison, "Notes on Human Resources and Development in Nepal," World Bank, Population and Human Resources Division, June 1980.

51. D. Chernichovsky, "Personal Savings and Family Size and Composition: The Unresolved Issue," *Proceedings of the U/SSP Conference on Economic and Demographic Changes: Issues for the 1980s*, Helsinki, 1978.

52. T. King, "The Measurement of the Economic Benefits from Family Planning Projects and Programs," Economics Department Working Paper No. 71, March 1970.

53. T. King, "Budgetary Aspects of Population Policy: The Role of Cost-Benefit Analysis," *Proceedings of the U/SSP International Population Conference*, Liege, 1973.

54. D. de Ferranti and N. Prescott, "Review of Economic Analysis of World Bank Population, Health, and Nutrition Projects," World Bank, Population and Human Resources Division, July 1981 (mimeo).

55. R. Gulhati, "India's Population Policy: History and Future," World Bank Staff Working Paper No. 265, August 1977.

56. King et al., *op. cit.*

57. R. Cuca and C. S. Pierce, *Experiments in Family Planning: Lessons from the Developing World* (Baltimore and London: The Johns Hopkins University Press, 1977).

with fieldwork. Results of the other types of experiments were less clear.

A 1979 World Bank Staff Working Paper offered a number of generalizations about the evolution of program design and the factors contributing to success.⁵⁸ Among these were the importance of private and voluntary agencies in initiating family planning activity in a country and desensitizing the population to the discussion of contraceptives. This suggests that, particularly in Africa, governments should be encouraged to welcome such groups. A wide mix of methods is also recognized as an important factor in maximizing the use of contraceptives. One of the paper's most interesting recommendations was that ministries other than the Ministry of Health collaborate in family planning. Involvement of Ministries of Agriculture and Education was identified as especially important in successful programs. These observations were elaborated by Kanagaratnam and Pierce in a working paper for the *World Development Report, 1980*.⁵⁹

Given both the aggregate evidence on the relationship between mortality and fertility decline⁶⁰ and the micro studies described above on the relationship between child mortality experience and contraceptive usage, experiments which link maternal and child health and family planning are of clear importance for areas with extremely high mortality, such as West Africa. A review of 14 experimental and special health projects in India found that the integration of health, nutrition, and family planning services to be cost effective.⁶¹

To evaluate programs, whether in health or family planning, several methodological issues need to be resolved. A major controversy exists over whether measures such as vaccinations given, patients seen, and contraceptives distributed⁶² are sufficient for monitoring the effect of a program, or whether more costly data on changes in fertility, mortality, or morbidity are necessary.⁶³ These methodological problems relate directly to the difficulties in analyzing determinants of mortality and fertility discussed earlier. Only very careful modeling of the dependent and intermediate variables such as utilization can establish the effectiveness of health or family planning programs.

Future Directions

Studies of the consequences of population growth seem, for the most part, to be best handled in the context of the World Bank's country economic work. One issue that perhaps deserves more general attention is the effect of family size and population growth on household and business savings, a topic that has not yielded easily to previous research.⁶⁴ More household level data are needed on fertility and income and savings; the Living Standards Measurement Study (Ref. No. 600-07) may provide a means of collecting such data.

For future study of the determinants of fertility and mortality, the Bank's unique position of funding population and health projects should allow the collection of longitudinal data sets as part of project evaluation. For maximum effectiveness, research staff should be involved early in project preparation. Research advances from such projects, however, will have long gestation periods. State-of-the-art papers, analyses of existing data sets and collection and analysis of cross-sectional data sets will have a quicker payoff, but cannot be expected to provide definitive answers on some issues—such as the relationship between fertility and mortality.

Migration is more amenable to economic analysis than are fertility and mortality. The consequences of migration for developing countries can vary

58. R. Cuca, "Family Planning Programs: An Evaluation of Experience," World Bank Staff Working Paper No. 345, July 1979.

59. K. Kanagaratnam and C. S. Pierce, "Population Policy and Family Planning Programs: Trends in Policy and Administration," World Bank Staff Working Paper No. 411, August 1980.

60. K. C. Zachariah, "Fertility, Mortality and Population Growth: Interrelation and Policy Implications," World Bank Staff Working Paper No. 163, September 1973.

61. R. Faruquee and E. Johnson, "Health, Nutrition and Family Planning. A Survey of Experiments and Special Projects in India," World Bank, Population and Human Resources Division, Discussion Paper 81-14, May 1981.

62. P. S. Mohapatra, "Measuring the Performance of Family Planning Programs," World Bank Staff Working Paper No. 257, June 1977.

63. See R. Faruquee, "Analyzing the Impact of Health Services: Narangwal and Other Experiences," World Bank, Population and Human Resources Division, Discussion Paper 81-6, March 1981.

64. See T. King, "Overview: Consumption, Saving and Investment" in *Proceedings of the IUSSP Conference on Economic and Demographic Change. Issues for the 1980s*. Helsinki, 1978.

considerably: it can alter rates of return to education, affect labor market equilibrium, and relieve or increase local population pressures. For these reasons, migration studies are important for the Bank's economic work. However, the institution's broader commitment to solving long-term global population problems will continue to hinge on fertility and mortality research.

Perhaps the major lesson from previous population research is the importance of linking demographic with economic analysis and using cross-sectoral approaches that relate demographic behavior to education, income, agricultural productivity and employment. Models of household decision making that incorporate realistic assumptions about the constraints faced by families in developing countries enable us to relate school participation, the utilization of family planning and health services, fertility, mortality, and migration. This implicit model provides the underlying cohesion for the work of the Population and Human Resources Division and others doing research on population within the Bank. It is this framework, combined with the opportunities for country economic, sector, and project support, that gives the Bank a unique advantage in population research.

COMPLETED RESEARCH

Development Strategies in Semi-industrial Countries

Ref. No. 670-01

This study, whose final report is shortly to be published, traces the effects of alternative incentive policies on resource allocation, trade, and economic growth in economies that have already established an industrial base. Begun a decade ago, it extends the approach and analytical methods developed by the same principal investigator in a project on the *Structure of Protection in Developing Countries*, the findings of which were published in 1971.¹

Whereas the earlier study only considered instruments of trade protection and their effects, the

Development Strategies project considers all government policy instruments that importantly affect the profitability of individual productive activities, exports and import substitution, and/or domestic and foreign investment. Such instruments in the area of trade include import tariffs, quantitative restrictions or licensing for imports, export taxes and subsidies, and the maintenance of multiple exchange rates. Other instruments bear on investment activity without being tied to exports or import substitution: they encompass credit, tax, and expenditure measures that will affect net profits, through preferential tax treatment or by altering the costs of inputs. The concept of the effective rate of protection, outlined in the 1971 volume, is extended to derive the effective rate of subsidy. The latter is the ratio of the combined value of credit, tax, expenditure, and protective instruments to the value added in processing. It thus indicates the contribution of the incentive system to the combined remuneration of the factors of production.

Detailed studies of incentives using a common methodology were undertaken in Argentina, Colombia, Israel, the Republic of Korea, Singapore, and Taiwan. Though levels of industrialization in these economies are similar (manufacturing contributes between 20 and 40 percent of gross domestic product), other characteristics—market size, resource endowment, the types of products exported, and policies toward industrialization, trade, and foreign investment—offer a variety of contrasts. Each of the case studies in the final report describes the historical development of the incentive system, and then, for a particular year, uses input-output data to quantify the incentives received by particular activities. These calculations are used to compare the preferences granted toward individual industries, to manufacturing as against primary production, and to production for export as against import substitution. Econometric techniques are used to analyze the relationship between the incentive structure and economic growth.

Comparative analysis supplements the findings of the six case studies with experience from Brazil,

1 Bela Balassa and others, *The Structure of Protection in Developing Countries* (Baltimore and London: The Johns Hopkins University Press, 1971).

Chile, India, Mexico, and Yugoslavia. It assesses the economic effects of alternative policies with regard to international specialization, the extent of government intervention in the economy, the role of public enterprise, and the treatment accorded foreign investment.

For this analysis the economies considered are classified into four groups, depending on the strategies followed since World War I. The first group, of Far Eastern economies that avoided a bias against exports and against primary activities, provided roughly equal incentives to most exports, ensured the stability of their incentive systems, and achieved the best export performance during the period 1960-73. Reducing the bias against exports by adopting export incentives helped to improve the export performance of the second group, of Latin American economies, to a considerable extent. Israel and Yugoslavia slackened their export promotion efforts during the 1960s with an associated decline in the growth of their exports and incomes, relative to economies in the first two groups. The fourth group, India and Chile, continued to espouse policies of import substitution; their export performance was poor in absolute as well as in relative terms.

In developing economies, the first stage of import substitution may be accomplished without substantial economic costs. The nondurable consumer goods industries being established employ chiefly unskilled and semiskilled workers, who are available in abundance in most developing countries. They do not require sophisticated technology and large investments per unit of output, and they need few inputs from ancillary industries. Finally, they are not severely handicapped by the limited size of national markets since the efficient scale of their operations is relatively small and costs are not substantially higher in smaller plants. Once the first stage of import substitution is passed, replacing imports with domestic production will entail rising costs. This is because the products to be replaced at the next stage, including various intermediate products, durable consumer goods, and capital goods, are more demanding of technology and skills, are relatively capital intensive, and rely on materials, parts, and components from other industries. Further, production in these industries generally needs to be organized on a large scale if it is to be efficient, since unit costs are substantially higher at lower levels of output.

Balassa adduces evidence that second-stage import substitution may be very costly and that, rather than narrowing it, protection is likely to have widened the economic distance between developed countries and developing countries that followed an inward-looking strategy. Calculations of the domestic cost of foreign exchange, a measure in which the value added in a given activity and its domestically produced inputs is related to the saving (or earning) of foreign exchange through import substitution (or exporting), show that savings from a given income appear to be lower under import-substitution policies than under export promotion.

Saving foreign exchange through continued import substitution behind high protection involves "traveling up the staircase," by undertaking the production of commodities at higher and higher costs as measured in world market values, so that the foreign exchange saved becomes progressively more expensive in terms of domestic resources. By contrast, earning foreign exchange through expanding exports involves "extending a lower step on the staircase," by increasing the production of commodities in which the country has a comparative advantage, and which thus can be produced at lower domestic costs per unit of foreign exchange earned. Exporting may even permit unit costs to be reduced, by exploiting economies of scale, and so benefit domestic consumers as well.

Exports may also lead to increases in output and incomes elsewhere in the economy. Manufacturing activities use raw materials as inputs while primary producers purchase manufactured inputs and machinery, and the higher incomes that result from the expansion of exports increase the demand for consumer goods.

As well as the benefits derived from resource allocation according to comparative advantage, from increased use of productive capacity, and the exploitation of economies of scale, the adoption of an outward-looking strategy may also promote gains in employment, as exports increase the demand for labor. Income distribution may be improved as a result of increases in employment, and also, in some instances, by gains in real wages and lessened discrimination against agriculture. Export expansion may also ease the shortage of foreign exchange that has often impeded economic growth in developing countries. Such beneficial

effects may be obtained under policies that provide similar incentives to exports and to import substitution and entail little discrimination among industries. Apart from the once-for-all gains described above, such policies may provide a continuing stimulus to economic growth through the technological change that is undertaken in response to competition abroad, increased savings, and the more efficient use of increments in factor supplies.

The empirical analysis reported appears to confirm that export expansion has stimulated economic growth. For one thing, intercountry comparisons show a high correlation between the growth of exports and of gross national product. Within countries, an acceleration of exports tends to be accompanied by an acceleration of the growth of GNP. Further, looking at the period 1966-73, the increase in the Republic of Korea's GNP would have been 37 percent smaller if its exports had grown at the average rate of the semi-industrialized economies as a group. The corresponding proportion is 25 percent for Taiwan. At the other extreme, in Chile and India, the increase in GNP would have been 14 and 12 percent greater, respectively, if these countries' exports had grown as rapidly as the average. Expressed in per capita terms, increases in incomes in the Republic of Korea would have been 43 percent smaller, and in Taiwan 33 percent smaller, had the exports of these economies grown at the average rate for the sample as a whole; the corresponding increases in Chile and India would have been 21 and 22 percent larger.

The study also makes recommendations for establishing appropriate incentive schemes in developing countries and for reforming the system of incentives in countries that have already established an industrial base behind protection. In addition to trade policy measures, it considers measures affecting capital and labor markets and the pricing of public utilities. The recommendations aim at improving resource allocation and accelerating economic growth by remedying distortions in factor and product markets (resulting from government actions or from market imperfections) that create a wedge between social and private profitability.

The study proposes a scheme of "ideal" trade incentives: applying optimal export taxes on

commodities that face less than infinitely elastic demand abroad and, with temporary exceptions, providing equal effective protection to all manufacturing activities at relatively low rates, as well as equal incentives to exports and import substitution within industries.

The first step recommended for reforming the existing structure of incentives is a partially compensated devaluation. This involves imposing optimal export taxes and reducing differences in incentives between manufacturing and primary activities and between sales in domestic and in foreign markets. This would be followed by the replacement of quantitative restrictions by import tariffs, reductions in tariffs and in the variation among them, and the equalization of tariff and subsidy rates.

Both the allocation of resources and the rate of economic growth would benefit from these measures, while employment opportunities would be increased through a shift in the structure of production from relatively capital-intensive import substitution to labor-intensive exports. At the same time, a partially compensated devaluation would allow subsidies to be provided to nontraditional exports indirectly, through a more favorable exchange rate—an expedient that is not subject to retaliation from importing countries.

The threat of retaliation would be reduced further if, in cases where explicit export subsidies could not be forgone, use was made of duty and tax rebates, export credits and guarantees, and various export services that are internationally acceptable. At the same time, international limitations on the use of export subsidies provide an additional argument for lowering tariffs.

The author stresses that a system of incentives cannot be reformed overnight. Apart from opposition from vested interests, the possibilities of industrial dislocation make a gradual approach advisable, with advance publication of the targets to be reached, as well as the steps by which they are to be approached. Political and social factors can of course affect the outcome of any chosen development strategy in unforeseen ways. But it is stressed in the study that changes in development strategies have greatly affected the economic performance of individual countries without major changes in the political and social environment.

Both the results of this study, with their implications for the choice of industrialization strategy, and the analytical methods it developed have gained increasing currency both in the Bank's operational work and in member countries. The findings of some of the case studies have had direct effects on government policies. Within the Bank, the demand for detailed studies of countries' incentive systems has burgeoned. A later note in this issue of *Research News* describes the unit that is now being set up to coordinate incentive studies undertaken for the World Bank's operations. Related research projects still in progress include one on Industrial Policies and Economic Integration in Western Africa (Ref. No. 670-87), which applies similar methods to countries at an earlier stage of industrialization, a study of trade and incentive policies in Bangladesh (Ref. No. 671-75), research on the efficiency of the manufacturing sector in Indonesia (Ref. No. 672-12), and a study of the industrial incentive system in Morocco (Ref. No. 671-85). Balassa and associates are also engaged in a project on Export Incentives in Developing Countries (Ref. No. 671-35). This evaluates, looking at individual products rather than at industries, the experience with policies for export promotion in Greece, the Republic of Korea, and Pakistan. The results will be used to formulate recommendations on the scope and methods of export promotion in developing countries.

The research on Development Strategies was managed by Professor Bela Balassa of the Bank's Development Research Center and The Johns Hopkins University. The country studies were carried out with the support of the governments concerned, which also defrayed some of the expenses of the research and provided other assistance.

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A Model of Zambian Agriculture

Ref. No. 671-29

This project constructed a model of Zambia's agricultural sector to help provide a basis for policy analysis. In most respects the approach followed that of CHAC, a linear programming model of Mexican agriculture developed by the Development Research Center in the early 1970s;² the

2. Louis M. Goreux and Alan S. Manne, *Multi-level Planning: Case Studies in Mexico* (Amsterdam and London: North Holland, 1973).

Zambia model differs from CHAC in that prices are specified exogenously, since Zambia's policy has been to fix both producer and consumer prices for the major agricultural commodities. The model clarifies the degree of disequilibrium that results from given price policies, the costs of this disequilibrium in terms of the level of government subsidies, and the effects on the balance of payments.

The main methodological innovation of this project was its almost complete reliance on secondary sources of data, and one of the main findings is that this was too ambitious an undertaking for a model of this type. Much more confidence could have been placed in the model's numerical results had it been based on reliable and consistent survey data.

Nevertheless, the results demonstrate the usefulness of considering taxes, foreign exchange costs, rural incomes, and commodity price levels together in a consistent framework. They suggest that Zambia's high subsidies on the consumer price of maize may have diverted maize out of low-cost official marketing channels into the high-cost channels managed by parastatal bodies. Small farmers could raise their incomes substantially if they received higher prices for maize, if fertilizer were easier to obtain, and the extension service were rejuvenated.

The project established good cooperation with the Planning Unit of the Zambian Ministry of Agriculture, resulting in the Ministry staff constructing and calibrating their own model using the same methodology, but using a small farm survey and extensive review within the Ministry. The project contributed to obtaining Ford Foundation support for this latter study. Final runs of the Ministry model were made in the Bank's Development Research Center.

Work on this project contributed to the ideas in a paper on "Food Security: Some East African Considerations," by Uma Lele and Wilfred Candler, the project's principal researcher. This paper concludes that official food trade is only the visible portion of a much larger total food trade and that, although governments are responsible for food security, they are powerless to control major components of the food distribution system. The authors' view of production and marketing systems implies that the basis for estimating food security requirements should be very different from that

now in use. They also conclude that in most East African countries a food security scheme based on public distribution will not reach rural consumers adequately. Rural food security will be achieved through increased research and extension on the production of drought-resistant crops, improvements in the supply of inputs and the marketing of produce, a better communication network, and an effective storage program for farm households, using local and inexpensive materials. The paper also argues that an important cause of instability in urban food supply is the behavior of food producers, who maintain their subsistence consumption and have less to market when harvests are bad.

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Occupational Structures of Industries

Ref. No. 671-52

Forecasts of manpower demand—the number of people in different occupations needed to produce a given output—are an important element in the planning of education and training systems and in the formulation of policies toward investment in productive capacity. In developed countries, manpower forecasting has generally been based on the extrapolation of past trends in the relationship between output and the employment of people in the various occupational categories. Among the major drawbacks of this approach for developing countries are the common lack of reliable and detailed historical data and, equally if not more important, the fact that planning in these countries entails a deliberate effort to break with the past, so that past trends should not be taken as the main guidelines for future development. The latter is especially true where the introduction of new industries is contemplated.

This research project has made available data on productivity and the distribution of occupations

among industries that make possible the use of new forecasting methods. The study, managed by the Bank's Education Department, reviewed censuses, manpower surveys, and other sources to collect data on the skill structures of economic sectors and activities; developed criteria by which such occupations and industries may be grouped to make the data on them comparable across countries; and built matrices of occupations by industry.

The project produced a *Guide for the Classification of Occupations by Skill Level*, updating the work done by Professor Herrnstadt in the 1960s as part of a broader project financed by USAID. It also produced a volume of tables on the *Occupational Structures of Industries*. The first part of this volume comprises tables that show, for 26 individual countries (developing and industrialized), the occupational composition of industries per 1,000 persons engaged. One hundred-twenty occupations or occupation groups are cross-classified with 58 industries or industry groups. This set also shows the structure of employment, by sectors and industries, for each country. The second set of tables, arranged by industries, shows the occupational composition of each industry and sector, by countries ranked by per capita income. These industry tables also give data on productivity (value added per person engaged), energy consumed in production per person engaged, and employment (total numbers of persons engaged). Published data were available for only five of the 26 countries covered. The project could not have been completed without the generous cooperation of governments, some of whom also helped by running computer tapes and cross-classifying data.

The data in *Occupational Structures* provide a basis for testing economic hypotheses about manpower and production. *Forecasting Manpower Demand*, the third publication from the project, suggests new methods for forecasting manpower demand that make use of such information. It first examines different kinds of forecasts—from simple extrapolations of past trends to the use of elasticity coefficients that relate changes in the occupational structure to changes in productivity. Practical steps are suggested for forecasting the growth of occupations, including those occupations for whose growth indicators such as production, productivity, or income per capita are statistically insignificant. The second chapter explains why it is fallacious to infer the requirements for education directly from

the requirements for occupations, without analyzing the historical development of the labor market and the trends of education attainment in the population. Appendices to the volume present equations useful in manpower forecasting.

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Capital Market Imperfections and Economic Development

Ref. No. 671-69

This study examined whether imperfections in capital markets affect the rate and composition of savings and investment, particularly in the small enterprise sector, as well as the overall distribution of income and wealth. It developed an analytical framework for assessing the effects of policies designed to make capital markets work better, particularly in their dealings with small enterprises in agriculture, industry, and trade. Related studies are *Small Enterprise Financing: the Role of Informal Credit Markets* (Ref. No. 671-65), which has also just been completed (see below), and *Small-Scale Enterprise Development* (Ref. No. 671-59).

Imperfect capital markets may be of two types: multiple and isolated, or fragmented but interrelated. These market structures discriminate against the traditional sectors and the small-scale sector generally, and favor the modern medium-scale and large-scale sectors. Such discrimination results in (1) lower than potential savings, investment, and output; (2) a misallocation of given resources; and (3) distributional consequences unfavorable to the traditional and small-scale sectors. One basic cause of these phenomena is the difference in the transaction costs of borrowing and lending in different markets. These costs comprise the real resource costs of borrowing and lending, plus an element of risk, caused by imperfect information and inevitable uncertainty. (These two elements are interrelated; real resource costs, for example,

would rise if, in order to reduce risk, the lender sought more information.) Transaction costs can be reduced only by technical change in financial institutions, instruments, and market forms, either undertaken spontaneously by the financial institutions or induced by government policy changes.

Policy interventions to improve the functioning of capital markets can be of two types: one that directly affects the cause of imperfections and the other that tries to tackle the symptoms. An example of the former type is the institutional innovation of credit guarantees, to reduce the risk perceived by lenders directly and, thus, increase the supply of credit. The latter type tries to affect the cost and allocation of credit by administrative regulations or new institutions, without reducing transaction costs. However, interventions of this type may, in fact, cause further fragmentation of markets, thereby accentuating market imperfections and the intensity of their effects on saving, investment, output, and distribution. Financial markets are fragile and their functioning depends on trust and confidence; that they require overall regulation is not disputed. The study has emphasized, however, that the regulatory framework must be appropriately designed if it is not to increase transaction costs or create disincentives for financial innovations.

Two case studies were undertaken, in India and the Philippines, using data specially collected from banks and as well as a special survey, on the financing pattern for specific economic activities and the related pattern of transaction costs. Such data are not easily available, and this lack handicaps further research work in this area. However, the analytical framework developed by the project is expected to be useful in the analysis and planning of country policies toward financial institutions dealing with small enterprises.

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Financing Small Enterprises: The Role of Informal Credit Markets

Ref. No. 671-65

In many developing countries, the majority of small businesses obtain credit from so-called informal (that is, unregulated) credit markets, which have links with both formal financial institutions and the corporate sector. Despite their obvious importance, relatively little is documented about how these markets work and what they offer small producers that cannot be obtained from the formal financial market. Bhatt and Roe in "Capital Market Imperfections and Economic Development," produced under the project referred to above, suggest that informal markets have several characteristics that enable them to distribute credit to parts of the economy unreached by commercial

banks, and hence to increase the total volume of intermediation in the economy:

- their transaction costs are lower, because the lenders personally know the borrowers, and do not have to seek information on which to assess risks;
- they avoid statutory controls on interest rates; and
- they avoid taxes.

This research project studied the workings of urban credit markets in India. Several hundred informal market participants were interviewed in Bombay, Calcutta, Madras, Amritsar, Kanpur, and Benares, and in the various commercial centers of Gujerat and South India. The systems covered are those operated by the Shikarpuri or Multani, Gujerati, Rastogi, and Chettiar indigenous bankers, and the more modern ones run by finance "companies" and market finance brokers in the cloth and other wholesale markets in various cities.

The study found that legal informal financial markets provide perhaps up to 30 percent of all working capital in Indian urban markets (50 percent if such items as interest-bearing corporate deposits by private investors are included). They finance half the wholesale trade in certain commodities and 10 to 30 percent of the capital needs of such small-scale producers as powerloom owners and pharmaceutical manufacturers. Though bank credit is rapidly becoming more accessible for small-scale industrial units, most of these units find it necessary to borrow in the informal market, at least during their busy season. The rates in this informal market are generally 2-4 percent higher than the bank lending rates—but there is enormous variance in rates and forms of lending. Very small enterprises when served by these markets directly may pay nominal rates up to 10 percent higher than normal bank rates—but they normally are financed through trade credit refinanced with the informal market and, increasingly, by discount facilities. In southern Gujerat, a parallel system of indigenous-style bankers successfully serves much of the urban economy. Elsewhere, informal markets are conducted by commercial financiers like the Shikarpuris, brokers, and discounters of commercial paper.

Informal markets are used because they provide funds for purposes that the banks do not finance,

such as trade; they provide them more rapidly than the banks for those who require speed, such as exporters; and they provide them without security for those, including restaurateurs and contractors, for whom security is a big stumbling block.

The operating margins—the transaction costs and bad debt experience—of these markets are, by and large, superior to those of the banks, and, as was indicated, their normal lending rates are higher.

The evidence from India, together with conclusions from earlier work on the Republic of Korea,³ suggests that the relationship between formal and informal credit markets is competitive and complementary and that legally restricting informal markets is counterproductive, since this raises the transaction costs of both borrowers and lenders.

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Adoption of Farm Technology in Northern Nigeria

Ref. No. 671-88

The final report will soon be available on a two-year study of farmers' adoption of new practices in the World Bank's first three agricultural development projects in northern Nigeria. The study sought insights to help in the design and management of the statewide agricultural development projects that are now in the early stages of implementation.

The three agricultural development projects, at Funtua, Gusau, and Gombe, each cover an area farmed by about 80,000 farm families; socioeco-

3. Yung Chul Park, "The Unorganized Financial Sector in Korea, 1945-75" Domestic Finance Studies No. 28. World Bank, Development Economics Department (November 1976).

conomic and agroclimatic conditions vary within the project areas. Under the projects, farm service centers were set up to provide access to inputs and credit, feeder roads were constructed, seed farms established, water supplies improved, and extension services reorganized. Monitoring and evaluation have been an integral part of the projects.

When the present research was started, in the fourth year of the projects, monitoring and evaluation data showed that farmers' responses had been mixed: fertilizer use was rising rapidly, but demand for insecticides and certain types of equipment was limited. Farmers had not responded much to advice from project extension staff to adopt pure stand cropping; they preferred their traditional mixed cropping systems.

The research started from the premise that a detailed understanding of production processes and decision behavior in traditional agriculture, in each socioeconomic region, was a key to the relevance, practicality, and potential success of farm innovations. The study sought an improved understanding of traditional farming systems as a reflection of the goals and preferences of farmers.

Data were available from six detailed farm management surveys that had been conducted by the Agricultural Projects Monitoring, Evaluation, and Planning Unit (APMEPU). These provide full profiles of consumption and production over the period 1976-79 for about 800 households.⁴ Supplementing these data with information from project recommendations, the results of trials, and testimony from extension staff, farm budgets and production functions under alternative technologies were constructed. The study also sought information on farmers' perceptions and attitudes—for example, what they knew about the techniques promoted by the projects, why they decided to adopt them or reject them, and so forth. Repeated visits were made to about 35 farmers, covering different parts of the crop cycle. Taking account of farmers' objectives and preferences and the constraints they faced, models of individual farms were constructed, describing traditional techniques and those recommended by the project.⁵

A micro-computer was used in the field to compare and discuss with farmers the outcomes of alternative potential production strategies, as modeled;

farmers explained their perceptions of the advantages and disadvantages of these strategies.

The study is not the first to note the persistence of multiple cropping in Sub-Saharan Africa, though it does contribute to a better understanding of the reasons for this. Early in the study it became clear that only in the case of maize were the gross returns to single cropping, as practiced on the project's demonstration plots, appreciably higher than those from multiple cropping as traditionally practiced. Apart from the maximization of profits, multiple cropping has the other advantage of reducing the risk of total crop failure where weather conditions are different to predict.

The original hypothesis underlying the farm models was that farmers maximized income, while trying to minimize risk and to produce enough food for subsistence consumption. In the course of the study three broad types of farmers were distinguished: the "almost landless," whose farms only supplement labor income; subsistence farmers, who are in the majority, and can usually both feed themselves and produce some cash surplus; and "large farmers," who run no risk of going hungry in the next season. The research concentrated on subsistence farmers. It was found that for this group, the dominant objective is to ensure a harvest of the main crop large enough to meet subsistence needs. Only once this aim seems assured will their attention turn to generating cash income. For these farmers, risk aversion expresses itself through a series of adaptive choices. The aim of self-sufficiency in food dominates decisions between the start of the rains and the germination of the first food crops. If the rains are good, the farmer gradually changes his objective from "safety first" to income maximization and the reduction of risks, as the season progresses and as he gains additional information on the state of nature.

4. Roger H. Slade, "The Monitoring and Evaluation of the Funtua, Gusau and Gombe Agricultural Development Projects." Volume I: Main Report, and 17 volumes of statistics. World Bank, West Africa Projects Department, 1980. (Use of these data is subject to clearance by the Government of Nigeria.)

5. These models have the same basic structure as that used in the Nigeria component of current research on the structure of Rural Employment, Income, and Labor Markets (Ref. No. 671-30).

The study identified some general hypotheses about the adoption of new technologies by subsistence farmers:

- farmers are more receptive to innovations that, other things being equal, make it more likely that their subsistence requirements will be met;
- innovations that are divisible, and continuous both as regards the intensity of application and the intensity of use, are more readily acceptable because they can be adjusted as the season unfolds;
- innovations that give results at the time of germination, when the farmer is especially attentive to signals that would mark the end of his "safety first" period, are more readily acceptable;
- new technologies that demand a rearrangement of farm activities early in the growing season are less likely to be adopted, because in this period the farmer is most averse to risk; rearrangements of activities later in the growing cycle are more likely to be accommodated.

The findings have emphasized farmers' ability to discriminate keenly among inputs and recommendations, no matter how persuasively or coercively these are offered; indeed, they adjust the recommended practices to their own circumstances and themselves evolve new ones. Though experience has varied among zones within the project areas, there has generally been little adoption of innovations that would increase farm incomes, apart from the planting of maize (a cash crop increasingly accepted as a food crop), *gicci* groundnuts (groundnuts intercropped with widely spaced cereals), fertilizer and seed dressing to improve germination rates, the profitability of all of which have been demonstrated to farmers. The study also noted that since few farmers can read or are accustomed to estimating area in the abstract, quotations of yields per hectare convey little to them. Once their interest has been aroused by a good crop on a demonstration plot or a neighbor's plot, however, they learn the husbandry techniques to reproduce it.

Looking at the entire spectrum of technologies (recommended and evolved), the study identified two broad categories of innovators: the *improved sole croppers*, typically land-rich and labor-poor with a holding above 7 hectares, and the *improved mixed croppers*, typically land-poor and labor-rich

with a holding below 7 hectares. Each of these two categories represented a third of the total number of respondents (only 10 percent of all respondents had completely adopted the sole-crop packages. The non-adopters represented 35 percent and were a very heterogeneous group. The adopters had followed four typical routes or parts of routes to adoption: (1) from traditional sole cropping to improved sole cropping for the larger farmers (above 7 hectares); (2) from traditional mixed cropping to improved mixed cropping for the smaller farmers (below 3 hectares); (3) from traditional sole cropping to improved mixed cropping for medium-size farmers (3 to 7 hectares); and (4) from a full range of crop varieties to a lesser number of more productive varieties of crops, for all categories of innovators.

The report notes several implications of the findings for the implementation of further projects:

- *Farmer behavior*: small farmers are receptive to properly demonstrated new husbandry practices. They are likely to be most receptive to those techniques which promise to increase the reliability of their subsistence food supply (for example new crops or varieties that are quicker to mature and thus more likely to succeed if the growing season is short, or crop mixtures that allow a flexible response to seasonal conditions, or higher yields). But they are also receptive to innovations that improve productivity generally, or reduce the labor required during the period when labor is fully occupied (the survey data show that labor bottlenecks, particularly for weeding, are the main constraint on production). A crop such as maize, which is both a food and a cash crop and responds to improved input regimes, has proven highly successful and less risky than other crops.
- *Extension*: effective demonstration should be the keystone of the extension program, both to increase farmers' awareness and to establish the credibility of field agents. A strong hierarchy of supervision, say one supervisor to five extension workers, is needed, even at the expense of some reduction in the ratio of field agents to farmers. In particular, some sort of incentive system for effective demonstration plots may well be advisable. The more innovative larger farmer plays an important role in demonstrating technological changes.

- *Adaptive research*: successful demonstration needs to be based upon sound adaptive whole-farm research that develops packages in the context within which they are to be used. Maize-based mixtures, short-season maize, and methods to save labor in weeding, including use of herbicides, would appear to be promising directions for research.
- *Agro-climatic zones*: agricultural development projects need to pay detailed attention to the definition of agroclimatic zones within the project area, tailoring demonstrations, adaptive research, and the extension program to the different characteristics of these zones.

The research was commissioned by the Country Programs Department I (WA1) in the Western Africa Regional Office and largely undertaken by the Development Research Center. For further information, contact R.G. Grimshaw in WA1.

Reports

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NEW RESEARCH AND APPLICATIONS

Development Paths for Oil Exporters: Long-run Macro Analysis

Ref. No. 672-49

This research project addresses the longer-run development options and problems facing the "capital-deficit" oil-exporting economies. Included in such a group are Algeria, Ecuador, Egypt, Indonesia, Iran, Mexico, Nigeria, Trinidad and Tobago, and Venezuela. Notwithstanding their different structural and institutional features, it is easy to discern a strong central theme of common concern: how to use oil revenues, which may be available only for a limited period, to promote sustained growth with acceptable distributional characteristics.

The recent experience of industrial, as well as developing, oil-exporting countries suggests that to use mineral rents productively is not easy, despite the central role played by natural resources in the development of a number of economies. With limited linkages between a key, rent-producing export sector and the domestic economy, the problem faced by mineral exporters is not unlike that of absorbing large, and possibly volatile, capital inflows. Short-run market signals, affected by a rapid increase in absorption out of oil windfalls, may stimulate investment patterns that are inappropriate to longer-run developmental objectives. Real exchange-rate appreciation, stagnant agriculture, slow growth of manufacturing, the crowding out of the private by the public sector, and a trend to dualism are all classic symptoms of the oil economy syndrome, although such effects are not inevitable.

The rate at which oil revenues are spent, as well as the spending pattern decided on by government, will influence the extent to which alternative productive sectors are developed and experience is accumulated to help raise productivity. Efficient nonoil tradeable activities are needed to supplement and eventually replace oil as a source of

foreign exchange and public revenue. The initial spending decisions, which are essentially political rather than determined by market forces, will also have a substantial impact on income distribution and the extent of dualism.

Theoretical and empirical analysis of these issues for oil exporters is of relatively recent vintage, although a considerable literature exists on the "export-enclave" economy. Most research in the field of natural resources focuses on exhaustibility, rather than on how varying resource rents affect the rest of a producing economy. In addition, little cross-country comparative analysis has been done.

The present research project has two components. The objective of the first, comparative, part is to document, analyze, and compare the development paths selected by several oil-exporting countries, including Norway and the United Kingdom, and the consequences of these choices for the nonoil parts of their economies. The central difficulty—strengthening nonoil tradeable sectors in the face of strong pulls toward the construction and service sectors—is widely acknowledged, yet exporting countries have adopted quite different development strategies and sectoral priorities. This part of the study will include comparative political analysis and will also draw on the experience of the Bank's country economists. The analysis will extend a study undertaken by the principal researcher for *World Development Report 1981*.¹

The second component of the project is to model formally the impact of key policy options in a particular oil-exporting country and to assess the development paths resulting from such choices. The modeling exercise will be undertaken for Indonesia, which is one of the poorest of the oil exporters, though the comparative element of the research will prevent the project from focusing disproportionately on Indonesia's special features. The approach will be comparative-dynamic: hypothetical alternative paths will be simulated for a period of twenty to thirty years. In addition to choices of extraction rates and total expenditures, choices of sectoral emphasis will be addressed. If, for example, spending is heavily directed toward infrastructure, domestic inflation is likely, at least for a period, to lead to appreciation of the real exchange rate and to squeeze private manufacturing. An import-intensive strategy would exert less

stress on the domestic economy, but reduce the multiplier effects of oil spending.

Data collection for the model will be coordinated with that for a short-term model of Indonesia's economy, to be constructed by the Economic Analysis and Projections Department. The modeling work is expected to complement the work currently in progress in the Central Statistical Office in Indonesia on social accounting; collaboration will be sought with Indonesian researchers.

The research is expected to take two-and-a-half years. An interim report will be available in the autumn of 1982. For more information contact Alan Gelb in the Development Research Center.

Macro Modeling in Thailand

Ref. No. 672-47

Funds were recently approved for a two-year collaborative project between the National Economic and Social Development Board of Thailand (NESDB) and three departments of the Bank, to extend a model of Thailand's economy that is now being used in Bank country economic work. In Thailand, macromodels have been constructed by the Bank of Thailand for short-term projections and by the NESDB for planning purposes. One of the aims of the present project is to enhance NESDB's capacity for using macromodeling in medium-term planning. As to the research aims of the project, the Thailand model, which will be concerned with structural adjustment in an oil-importing country, is a part of the Development Research Center's macroeconomic work program that complements the planned model of Indonesia described above (Development Paths for Oil Exporters). Further, the project aims to bring together techniques of documentation from the General Algebraic Modeling System with the organizational framework of the social accounting matrix. If this is found possible, the implications for the specification, management, and communication of models could be substantial.

1. Alan H. Gelb, "Capital Importing Oil Exporters: Adjustment Issues and Policy Choices," World Bank Staff Working Paper No. 475, July 1981.

The project will extend the Siam I Model constructed by the principal researcher last year, to improve its power to analyze the structural adjustment problems the country faces as a result of increased energy prices.² The model will be one of the first to address structural adjustment in a predominantly agricultural economy. In modeling Thailand's agriculture, it will take account of the growing scarcity of arable land. Previous agricultural growth relied on bringing new land into use, but it has now become necessary to upgrade the technology for existing crops and to diversify into new ones. As the world's second largest exporter of rice, the restructuring of Thai agriculture raises important issues of investment policy, fiscal policy, employment generation, and the use of energy through fertilizers.

The research will have two phases: first, an initial version of the new model will be constructed and installed in Bangkok and Washington; second, improved data will be incorporated in it, and further research will be undertaken including, in particular, experiments with alternative closing rules.

The installation and application of the model for policy analysis will call for considerable skill in documentation. The researchers will attempt to combine techniques from the General Algebraic Modeling System (Ref. No. 671-58—see *Research News*, vol. 1, no. 2) with Social Accounting Matrices (SAMs).³ As a framework for a data base for macro work, SAMs are already well established. However, they can also be used as frameworks for algebraic statements. This feature has been recognized for at least ten years, but has only recently been shown to work well in practice, with the development of Siam I and the Cairo University-MIT model of Egypt (Ref. No. 672-25—*Research News*, vol. 2, no. 1). If this can be married to the computational disciplines provided by GAMS, it will enormously improve the ability to document, communicate, and replicate the structure of models and their results.

For further information, contact Wafik Grais in the Development Research Center, the project manager, Dusan Vujovic in the East Asia and Pacific Country Programs Department, or John Shilling in the Economic Analysis and Projections Department.

Changes in the Pattern of Comparative Advantage in Manufactured Goods

Ref. No. 672-41

The determinants of international trade in manufactured goods and the prospects of this trade are of considerable interest to policy makers in developing countries and the development community generally. A two-year research project, begun last July, addresses these questions by analyzing the pattern of, and changes in, comparative advantage in manufactured goods in response to the accumulation of physical and human capital. It will also examine the determinants of trade flows in manufactured goods and provide projections of these flows. Finally, it will provide information on the actual and prospective employment effects of this trade. Earlier empirical studies on trade have not succeeded in fully integrating international trade theory and empirical testing. In this research project, an attempt will be made to achieve this integration.

The project seeks to respond to the interest of the Bank's country economists in the place of particular countries in the process of international specialization in manufactured goods, in the reasons for deviations from the average pattern, and in projections for the future. It also responds to the interest expressed by the Bank's management in analyzing and forecasting trade in manufactures among countries at different stages of economic development. Further, the methods of analysis and projection to be developed may subsequently be useful in the Bank's operational work.

The research has two parts. The first will examine international specialization in manufactured goods traded by individual countries with the rest of the world. It will extend earlier work by one of the investigators, reported in "A 'Stages Approach' to

2. Wafik Grais, "Aggregate Demand and Macroeconomic Imbalances in Thailand: Experiments with the Siam I Model," World Bank Staff Working Paper No. 448, April 1981.

3. See Benjamin B. King, "What is a SAM? A Layman's Guide to Social Accounting Matrices," World Bank Staff Working Paper No. 463, June 1981.

Comparative Advantage.”⁴ In that paper, Balassa showed empirically that “intercountry differences in the structure of exports are in large part explained by differences in physical and human capital endowments. The results lend support to the ‘stages approach to comparative advantage’ according to which the structure of exports changes with the accumulation of physical and human capital.” The current project will generalize this model and relate it to models of commodity production and cost. The resulting model will be used to test the robustness of the original results and to extend the empirical coverage. In particular, the study will utilize data from several different years and examine changes over time in the interactions between commodity characteristics and country endowments. Different explanations or theories of trade will be combined into representations that can be tested and that will allow an evaluation of their relative importance in explaining trade flows. The project will analyze how the evolution of comparative advantage is affected by trade restrictions, industrial structure, economies of scale, and natural resource endowments. The effects of policy interventions will be examined, and projections made for the future.

The second part of the project will look at trade flows in bilateral and multilateral contexts. Here, the magnitude of trade flows will be related to commodity characteristics, on the one hand, and to the endowment structure of countries of origin and destination, on the other. This part will require considerable innovation. Early “gravitational” models, originating in the work of Tinbergen, explain total trade flows between two countries in terms of distance factors and the national incomes of the countries concerned. The model of H. Linneman (1966)⁵ is a good example. Later work by authors such as Gruber and Vernon (1970)⁶ and Leamer (1974)⁷ introduced endowment factors, again, however, in the context of trade in all commodities taken together. In the proposed study the determinants of comparative advantage will be introduced in explaining bilateral trade in a commodity breakdown. An associated simulation model will be developed.

The project will share a data base with the project on ‘The Direction of Developing Countries’ Trade (Ref. No. 672-32—see *Research News*, vol. 2, no. 2). Additional sources of data known to be held by other researchers in the Bank and elsewhere will

also be investigated. The researchers are Bela Balassa and Roger Bowden in the Development Research Center.

Support for Work on Industrial Incentives and Comparative Advantage: the INCA Unit

Ref. No. 672-44

The Bank has sponsored a considerable amount of research on incentive systems and comparative advantage. (See notes on Development Strategies in Semi-Industrial Countries, under “Completed Research” above.) As the research results have become available, both the Bank and its member countries are becoming increasingly aware of the need for quantitative studies of incentives as a basis for reforming incentive policies and for increasing the economic efficiency of new investments.

For a considerable time, members of the Development Policy Staff doing research on industrial incentives and comparative advantage (“INCA” research) have been advising and assisting operational staff, but on an *ad hoc* basis. An experimental unit has now been set up in the Industrial Development and Finance Department in the Central Projects Staff to provide more systematic support to operating units in the Bank. Since several of the methodologies and techniques used in this work have only recently emerged from the research stage and at present need specialist staff for their application, the unit will also do applied research to make these analytical tools more widely usable in operations. Specifically, the unit will:

4. Bela Balassa, “A ‘Stages Approach’ to Comparative Advantage,” in *Economic Growth and Resources, Volume 4: National and International Issues*, ed. Irma Adelman (London: Macmillan, 1979). Published in a slightly abbreviated form as “The Changing Pattern of Comparative Advantage in Manufactured Goods,” *Review of Economics and Statistics*, vol. 61 (May 1978).

5. H. Linneman, *An Econometric Study of International Trade Flows* (Amsterdam: North Holland, 1966).

6. W.H. Gruber and R. Vernon, “The Technology Factor in a World Trade Matrix,” in *The Technology Factor in International Trade*, editor, R. Vernon (New York: National Bureau of Economic Research, Columbia University Press, 1970).

7. Leamer, E.E. “The Commodity Composition of International Trade in Manufactures: An Empirical Analysis,” in *Oxford Economic Papers*, vol. 26 (1974), 350-374.

- support country-specific studies sponsored by the Regional Offices;
- support short-term studies by industry sector missions of the Bank and International Finance Corporation;
- undertake applied research, particularly to develop software and computer programs for use in operations;
- write an introductory manual on the carrying out of incentive and comparative advantage studies, mainly for use by officials in developing countries; and
- maintain information files, including information on consultants, previous and current studies, and sources of information on international prices.

One of the main aims is to assist the Bank's efforts to build up the capacity of national institutions for INCA analysis. The Bank is collaborating with national institutions in five INCA studies at present; collaborative studies in nine other countries are being planned; and seven more are being considered. Many of these studies would be financed under Bank loans for structural adjustment and would be related to reforms of industrial incentive policies. In conjunction with Bank regional staff, the INCA unit will advise the national institutions involved, on such matters as methodology, setting up and operating computer or other analytical programs, questionnaire designs and survey methods, and the interpretation and follow-up of INCA work.

The INCA unit is sponsored jointly by the Industrial Development and Finance Department and the Development Economics Department. Garry Pursell will head the unit, which has funding for two years. The work and contribution of the unit will be evaluated before the end of this period; a decision will then be taken on incorporating its work into the regular functions of the Industrial Development and Finance Department.

The Acquisition of Technological Capability

Ref. No. 672-48

Technological change is now generally recognized as essential to industrial development. However, there is little understanding of what technological

change consists of in developing countries. Despite the lack of research that might guide policy, governments in many developing countries have attempted to create local technological capability by intervening directly and indirectly. Partly as a result of these interventions, different developing countries have achieved different levels of technological capability. However, there is no systematic evidence for appraising either the success or the benefits of promoting local technological capability, or for prescribing the sequence of activities a developing country should undertake at different points in its industrial development to build up its technological capability.

This research project is intended to yield an overview of the acquisition of technological capability in industry in order to improve understanding of what technological capability consists of and how it is acquired. It will seek cross-country comparative information to obtain a broad appreciation of different country experiences and of different relations between the development of local technological capability, industrial development, and government policies.

The initial focus chosen for the cross-country comparative study is exports of technology from developing countries. Technology exports are presumptive evidence of underlying technological capability, while the fact that know-how is being exported gives a *prima facie* indication of world standards of competence. Two pilot studies, already completed, confirm that focusing on technology exports is a useful way to identify areas where local technological capability has been developed, and that technology exports reveal differences between countries in the areas of expertise and in the ways that technological capability has been established.

The study will seek information at two levels. Phase I will map out the extent and nature of technology exports from a selected group of developing countries. Its objective is to learn what these technology exports indicate about the development of technological capabilities in different countries and to identify interesting cases or sectors for further study. This phase also involves gathering general information on technological capability and on government policies. As tentatively planned, Phase II consists of studies of the acquisition of technological capability in some of

the sectors identified in Phase I. It would look at the development of local technological capability in about 24 firms in each of three countries—to learn about the sources of such capability, the relative cost of attaining it, and the role of government policy and institutional factors in developing it.

The Inter-American Development Bank participated in the initial design of the research. The two-and-a-half year project will cover India, the Republic of Korea, and Mexico.

The project is managed by Carl Dahlman and Larry E. Westphal in the Development Economics Department. The work that led to the preparation of this project yielded three papers; the last two may be obtained from the authors. Larry E. Westphal, Yung W. Rhee, and Garry Pursell, "Korean Industrial Competence: Where It Came From," World Bank Staff Working Paper no. 469, July 1981; Carl J. Dahlman and Larry E. Westphal, "Technological Effort in Industrial Development—An Interpretative Survey of Recent Research," July 1981; and Carl J. Dahlman, "Technology as a Starting Point in the Study of Technological Capability: The Findings of a Pilot Study in Brazil and Mexico," April 1981.

Long-Term Trends in the World Aluminum Industry

Ref. No. 672-43

The Bank is helping to finance several investment projects in the aluminum sector, and is considering others in West Africa and Latin America. Whenever a bauxite mine development, an alumina refinery, and an aluminum smelter are to be developed simultaneously, the investments needed are very large, not only in absolute terms but also in relation to the economies of most of the developing countries endowed with bauxite. (In one West African country, for example, the Bank is considering such a project complex, with investment requirements 4.5 times the country's gross national product.) Appraising such large aluminum projects raises some difficult issues concerning the effects of large additions to total supply and the dependence of small economies on the output of a single or a few projects.

To help in the analysis of large projects in the aluminum sector, this research will look in depth at

the structure and prospects of the world aluminum industry. As well as providing a detailed assessment of the long-term market prospects for aluminum, the research will construct an analytical framework for looking at possible changes in the location and structure of the industry worldwide, and will also identify the main industry-specific factors that should be considered in analyzing the prospects of the aluminum sector in a given producing country.

Three departments in the Development Policy Staff will participate. The project will draw upon an early linear programming model of the world aluminum industry, constructed under a research project on Natural Resources and Planning (Ref. No. 671-09), that though an advance on previous methodology, has not been adaptable for use in operational work for want of reliable data. Such data are being assembled for the present project by the Bank and the Development Centre of the Organisation for Economic Co-operation and Development. The linear programming model to be constructed will be specified using the General Algebraic Modeling System (developed under research project Ref. No. 671-58, described in *Research News*, vol. 1, no. 2); the price of aluminum will be treated endogenously. The model will be used to simulate sectoral developments under different assumptions about prices of inputs, electricity supplies, levies and tariffs, and transport costs. Although this approach does not directly incorporate such nonquantifiable factors as the risks of investing in a particular country or the diversification of markets, an attempt will be made to include some of these factors by introducing constraints in some versions of the model.

Particular attention will be paid in the study to the supply and price of energy. Aluminum is a notoriously energy-intensive commodity: to produce one ton at present requires an average of 17,500 kilowatt hours of electricity. With rising energy prices, one might expect developing countries with potential resources of hydropower, particularly if combined with bauxite deposits, to have gained a comparative advantage, but recent feasibility studies in such countries are equivocal on this. At present, 80 percent of the world's aluminum is produced in energy-importing developed countries. Producers in the traditional producing countries receive subsidized electricity. But even if power costs rise for these producers,

developing countries may not increase their shares of the aluminum market. First, Australia, a developed country and a competitor, is rapidly developing its aluminum industry, based on extensive supplies of bauxite as well as coal. Second, investment costs for hydro facilities, mines, and processing plants in developing countries have risen sharply over the last five to six years, placing new producers at a considerable disadvantage in comparison with traditional ones.

The results from this research should contribute to further work that is envisaged on the methodological issues involved in appraising large project complexes in small economies.

For further information, contact Kenji Takeuchi or Alfredo Dammert in the Economic Analysis and Projections Department, Ardy Stoutjesdijk in the Development Economics Department, or Alexander Meeraus in the Development Research Center. Staff from the Industrial Projects and Energy Departments, as well as in the Regional Offices, are also collaborating in this project.

Canal Command Model for Project Design and System Operation in the Indus Basin

Ref. No. 671-45

This project is a major research application of the project on Programming and Designing Investment: Indus Basin (Ref. No. 671-45), which has developed a large-scale model of the Indus Basin. Its objectives are (1) to assist in the design and evaluation of the Command Water Management (CWM) investment project in the Indus Basin, being planned by the Bank and (2) to help develop the analytical capability of the collaborating institution, the Water and Power Development Authority (WAPDA) of Pakistan.

The Command Water Management project is primarily intended to increase agricultural production through improved water management, backed up by the necessary agricultural supporting services and other inputs. The present research application involves modifying the Indus Basin model system to make it suitable for use in evaluating and planning components of the CWM project. Officers of WAPDA will make these modifications under the direction of the Indus

Basin Project team; they will thereby acquire a continuing ability to modify, adapt, and use the model system, including its dissemination among other concerned agencies.

The revised version, or canal command model, will be used to study aspects of surface water distribution, especially losses in flows from the diversion point (barrage) to the fields, the conjunctive use of ground and surface water, and the response of farm production to additional water and related inputs. The data base for the application is unusually good, since all that is required is the transformation of parameters already estimated under the Indus Basin Project.

The application project will produce:

- contributions to the CWM project, particularly planning the set of components within subprojects, and the evaluation of subprojects;
- a canal command model that can be used by WAPDA for system management and investment appraisal;
- an enhanced modeling capability in WAPDA; and
- a manual for practitioners on the application of modeling techniques to the design and appraisal of irrigation projects at the canal command level.

For further information contact John H. Duloy or Gerald T. O'Mara in the Development Research Center.

The Determinants of Fertility in Egypt

Ref. No. 672-42

Funds were recently approved for the analysis of a unique set of demographic and economic data from the Egyptian Fertility Survey, which was undertaken by the World Fertility Survey, the Egyptian Central Agency for Public Mobilization and Statistics (CAPMAS), and the World Bank. The data cover 8,900 women who have been married and a subsample of 2,300 husbands; for households in the subsample, the data cover economic as well as demographic features. The collection of data from the subsample was funded under Bank research project Ref. No. 671-81 under the same title.

The data will be used to test a general model of fertility determination and to examine some of the paradoxes that are specific to Egypt. The country's birth rate has been rising in recent years, despite earlier declines and a family planning program over 15 years old. Three of the main policy questions to be addressed are:

- To what extent does high fertility persist because of lack of access to family planning services or because high fertility is desired (by husbands, wives, or both)?
- Why are infant and child mortality higher in Egypt than in other countries with comparable levels of health facilities and personnel?
- Is the low female enrollment in primary school—which helps to perpetuate high fertility—caused by lack of demand for schooling for daughters or by a scarcity of school places?

The analysis will be done in two stages, both using the analytical framework developed by Easterlin.⁸ In this framework, fertility is determined by the biological supply of children, the demand for children, and the cost of regulating fertility. In turn, these variables are determined by economic and demographic variables such as education, market wage rates, and age at marriage. They also depend on the availability of public services such as education, health and family planning clinics, and water supply and sanitation facilities.

The first stage of analysis will produce a descriptive report, showing the relationships between the variables revealed by simple cross-tabulations. It will examine how far husbands and wives agree on fertility goals and correctly interpret each other's attitudes; it will also seek to trace the link between parental attitudes and preferences and fertility behavior. This stage of the analysis will also examine the effects of economic factors on fertility and describe the relationship between the characteristics of the community (e.g., level of public services, availability of adult literacy programs) and the fertility and contraceptive use of its members.

The second stage will develop and use multivariate analysis to test a model of fertility determination. The model will make it possible to study the relative importance of socioeconomic and community variables in the determination of fertility, child

mortality, and child enrollment through the demand for children, the demand for schooling, the biological supply of children, and contraceptive use. The relationships identified will also help to refine the policy conclusions to be drawn from the descriptive analysis.

The research will be done collaboratively by CAPMAS, WFS, and the Bank. One of the objectives is to train staff members of CAPMAS in the analytical techniques to be used.

The project is expected to take about two and a half years. It is managed by Susan H. Cochrane in the Development Economics Department.

Research and Development in Integrated Resource Recovery (Waste Recycling)

Ref. No. GLO/80/004

Work began in July on a three-year research and development project in waste recycling, funded by the UN Development Programme (UNDP) and executed by the World Bank. In developing countries, the management of solid waste is becoming increasingly expensive, while energy, materials, and jobs are becoming increasingly scarce. In many cities of the Third World, an estimated 1 to 2 percent of the population lives by recovering and reusing materials discarded by wealthier residents. In some of these cities, proposals are now being made for introducing capital-intensive, high-technology schemes for the indiscriminate collection and disposal of refuse. Such schemes usually rely on large numbers of compaction trucks, which improve sanitation to some extent, but have to be purchased with foreign exchange and require skilled people to maintain. These schemes also make it impossible to recover wastes efficiently for recycling and, hence, they eliminate the resource base for a variety of secondary industries in the informal sector. Such industries can be an important source of employment. They provide entry-level jobs for new arrivals in the city, and yield household incomes

8. Richard A. Easterlin, *Population and Economic Change in Developing Countries* (Chicago and London: The University of Chicago Press, 1980).

that range from bare survival to—in one city—two or three times the average urban income. In other cities, refuse disposal costs have mounted to over 20 percent of the total municipal budget. Meanwhile, the costs of waste-water disposal are also rising, as water services are extended. Urban fringes and rural areas increasingly face shortages of fuel and food and rising costs of energy; indiscriminate disposal and inefficient use of human, animal, and crop wastes further aggravates these shortages, particularly in the long term.

The ultimate objective of the present project is to design and undertake replicable resource recovery projects in developing countries that will improve health and environmental quality, increase the available supplies of energy, and add to employment and incomes. The approach will be similar to that of the completed World Bank research project on appropriate technology for low-cost water supply and waste disposal, which examined technological alternatives, the socioeconomic conditions of the users, and the potentials for recovering water, fertilizer, and energy. (See *Research News*, vol. 1, no. 1, January 1980.)

Consultants from developing countries will participate in comparing capital- and labor-intensive operations, designs, and demonstration projects for determining costs and benefits from (1) recovering energy directly through thermochemical conversion or methane production; (2) conserving materials and equivalent energy through recycling metals, glass, paper, and plastics; (3) conversion of fertilizer values to protein, carbohydrates, fiber, or fiberwood; and (4) better occupational health and municipal sanitation.

Research products will include:

- a state-of-the-art review of relevant historical and current practices in industrial countries and current practices in developing ones;
- documentation and other dissemination of research and development findings;
- design and operation of appropriately scaled integrated systems in developing countries;
- a manual of practice; and
- policy options and planning guidelines for single-purpose and integrated resource-recovery systems. Waste sources that have implications for sanitation or pollution will be

considered. These include community rubbish, street sweepings, construction debris, household garbage, market refuse, animal dung, crop residues, night soil, and sewage sludge.

The integrated projects for resource recovery are planned to include four or more of the following elements: methane (biogas) production; food, fuel, or fiber production; improvement of agricultural or forestry land; recovery of ferrous and nonferrous metals, plastics, leather, rubber and other polymers, glass, paper and other fibers, and building materials; restoration of asphalt or concrete pavements; combustion and energy recovery from organic wastes; utilization of inorganic debris; and improved occupational safety and health and community hygiene.

The project will examine different combinations of entrepreneurial and municipal services for the collection, separation, recovery, storage, marketing, and reuse of components of solid and liquid wastes. Access to markets, development of secondary (cottage) industries, social and institutional characteristics, investment priorities and schedules, revenues, technological interventions, and related factors will be evaluated. Locations for demonstration projects will be chosen by visiting sites and assessing existing and potential resource-recovery operations, considering a range of economic, environmental, and institutional factors, and levels of local and central government support. Major benefits from the research will be additional energy, materials, and employment in urban areas and additional energy, food, and fiber in urban fringe and rural areas.

For further information, contact John M. Kalbermatten, Senior Adviser, Saul Arlosoroff, UNDP Projects Manager, or Charles G. Gunnerson, Resource Recovery Projects Officer, in the Transportation, Water, and Telecommunications Department.

A District and Farm Level Analysis of Agricultural Innovations in India

Ref. No. 672-14

While similar to that of previous decades in aggregate terms, the growth of agricultural output in India over the last 10 to 15 years has been

qualitatively different in that it has resulted largely from increases in yield rather than extension of the cropped area. The increasingly intensive use of "modern" inputs such as fertilizers and high-yielding varieties (HYV) of seeds has been mainly responsible for the improvement in yields. Knowledge of the economic forces determining the adoption of these inputs will be useful in shaping policies aimed at increasing farm production.

Looking at both wheat and rice production, this study will assess the role that various factors—farmer characteristics (e.g., education), farm characteristics (e.g., soil quality, irrigation), and policy variables such as fertilizer prices, output prices and the provision of extension services—have played in the process of adoption, to provide answers to a range of policy-related questions:

- What has determined the spread of these innovations? Have farmers not adopted the new inputs because they did not know about them or because the inputs could not be used profitably under particular farm conditions?
- What role have relative prices played in the adoption process?
- What has been the contribution of extension services to farm productivity?

Answers to these questions will be sought through examination of household and district level data for the years 1970-71, 1975-76, and 1976-77. Household-level analysis can indicate the role of factors determining adoption at a point in time. District-level data for two different time periods (1970-71 and 1976-77) can be used to evaluate factors determining the speed with which the new practices are adopted.

The project is managed by Surjit S. Bhalla in the Development Economics Department, in collaboration with Prannoy L. Roy and Pulin Nayak of the Delhi School of Economics, Delhi University, India.

Housing Demand and Housing Finance in Developing Countries

Ref. No. 672-46

Most of the Bank's considerable volume of lending for urban housing has been for sites and services and slum rehabilitation projects. In the years to

come, its urban housing operations are expected to become more diverse, with a greater emphasis on sector lending and a greater involvement with housing-finance institutions. To assist the design of such operations and to throw light on the effects of public interventions in the housing market, this new study by the Development Economics Department is investigating the ways in which housing demand is affected by the social and economic characteristics of the household and the city. In a second phase, not covered by the present project, it is intended to evaluate the ways in which the availability of different kinds of finance affects the demand for housing and the choice between renting and owning.

It is important that housing intended to benefit low-income groups should be affordable and should offer features that are highly valued by these groups. The type of housing a family demands depends to a large extent on its income level and on housing prices. The first part of the study will compare the price and income elasticities of demand for housing across cities in approximately eight countries, to determine whether general relationships exist that could be used as guidelines to judge whether the housing to be provided by a project will be considered affordable by the population it is designed to benefit. Evidence already gathered shows that demand parameters are similar in Colombia, El Salvador, and the Republic of Korea. This part of the analysis will also address such questions as:

- How do households value the trade-off between the quality of shelter and its location?
- How important is the investment motive as a determinant of the demand for housing?
- How similar are the characteristics of demand for housing across countries?

The second part of the research will use recently developed analytical techniques, such as hedonic price analysis, to examine how families value such characteristics as lot size, living space, unique rather than shared occupancy, service levels, neighborhood and location. The research methods will be refined and simplified for subsequent use in operational work.

For further information, contact Douglas H. Keare in the Development Economics Department.

Diversified Secondary Curriculum Study

Ref. No. 672-45

Education authorities in a large number of developing countries have committed themselves, to some degree, to the diversification of curricula in secondary schools. Such diversification, in which practical and/or occupational subjects are introduced into an otherwise completely academic program, has been endorsed by the education community at large and extensively supported by the Bank (it is a feature of half the education projects approved by the Bank in the last 15 years). Its broad objective is to match the skills and aspirations of the majority of secondary school graduates more closely to the job opportunities open to them. There are two models of such diversification: (1) in which practical subjects are introduced as a component of a general curriculum with no direct occupational aims and (2) in which vocationally oriented subjects, with direct occupational aims, are introduced as subjects in which students may specialize.

Experience with curricular diversification reveals several recurrent problems, notably in the training of teachers of vocational subjects, the use and maintenance of facilities, and the attitudes of staff and students. More fundamental than these problems of implementation, there is some evidence that conventional 'academic' secondary education may have been dismissed too quickly—it may, in itself, be an invaluable form of vocational training.⁹ There are also some more recent innovations in postprimary education and training that may be more cost-effective and otherwise more useful alternatives to traditional secondary education than the diversification of conventional curricula.¹⁰

A study managed by the Bank's Education Department will test some of the assumptions that underlie diversification and evaluate the outcomes of practical/vocational curricula. It will be the first to undertake comprehensive and rigorous tests of the efficacy of diversification. The study will evaluate the effects of diversification according to the two models on the internal efficiency of schools (measured through tests of school graduates' cognitive abilities and attitudes) and external efficiency (measured in terms of school graduates'

experience of unemployment and their job performance).

Case studies will be undertaken in two countries whose experience with diversified curricula is long enough to be evaluated meaningfully: Tanzania for the first model and Colombia for the second. To assess the effects of diversification on the internal and external efficiency of schools, the study will use cost-benefit analysis; data on earnings will be gathered from recent school graduates and leavers, and the analysis of costs will measure differences in the social cost between diversified and conventional schools. To supplement the quantitative analysis, existing and newly gathered data will be used to compare the broad features of diversified and conventional schooling, measured in terms of enrollments, dropout and graduation rates, and the post-secondary school choices made by school leavers.

The data to be collected will cover the costs of schooling under the two models; the socioeconomic-background of students; the characteristics of communities, schools, and teachers; and the aspirations of students and their subsequent attainments. A subset of the graduates and school leavers to be studied will be traced after they have left school, to assess how far their experiences differ according to the type of school they attended.

The conclusions to be drawn from the study as to the feasibility and effectiveness of diversification in different circumstances will, it is hoped, help to provide a policy framework for the Bank's further operations in secondary education, and aid government decision making on curricula.

The Colombian part of the study will be executed

9. See, for example, Philip Foster, "The Vocational School Fallacy in Development Planning," in C. Arnold Anderson and Mary Jean Bowman (eds.), *Education and Economic Development* (Chicago: Aldine, 1965); and Burton C. Newbry and Kenneth L. Martin, "The Educational Crisis in the Lesser Developed Countries," *Journal of Developing Areas*, vol. 6 (January 1972): 155-162.

10. See Wadi Haddad, "Diversified Secondary Curriculum Study: A Review of World Bank Experience," and Paul Hurst, "Implementing Innovative Projects: A Critical Review of the Literature" (World Bank, Education Department, 1979); and "Diversification of Secondary Education: A Review of the Literature," by the University of Sussex Center for Educational Technology, 1978.

by a joint working group of the Instituto SER de Investigacion and the Ministry of Education. The Tanzanian part will be undertaken by the Department of Education of the University of Dar es Salaam, in collaboration with a research team drawn from the Ministry of Education. For more information, contact George Psacharopoulos in the Education Department.

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NEW BOOKS

Agricultural Price Policies and the Developing Countries

George S. Tolley, Vinod Thomas, and Chung Ming Wong

The Johns Hopkins University Press, forthcoming.
272 pages.

LC 81-47614
ISBN 0-8018-2704-3 \$25.00 hardcover

This is a comprehensive examination of agricultural price policies—such as price supports, seasonal stabilization schemes, input subsidies, and export taxes—in the Republic of Korea, Bangladesh, Thailand, and Venezuela.

The authors describe the effects of such policies on government cost and revenue, farm income, and producer and consumer welfare. Other effects, including those on agricultural diversification, inflation, economic growth, and the balance of payments are also discussed.

The book demonstrates how these effects can vary with a nation's agricultural situation and level of development, and presents a methodology for estimating such effects in any country. The authors develop operational tools for measuring the impact of agricultural price policies on producers, consumers, and government, then apply them to the different interventions that can be used.

Electricity Pricing in Developing Countries

Mohan Munasinghe and Jeremy Warford

The Johns Hopkins University Press, forthcoming.
About 208 pages (including appendixes, index).

LC 81-47613
ISBN 0-8018-2703-5 \$22.50 hardcover

The large investments in, and rising costs of, power have highlighted the need for increased economic efficiency in the electricity sector. This book emphasizes the importance of adopting correct power pricing policies to maximize the net economic benefits to society of electricity consumption. The synthesis and practical application of pricing policies described are the result of the Bank's active involvement in power project and sector work in the developing countries and the continuing exchange of information on pricing issues with utility companies.

The methodology presented is based on long-run marginal costs (LRMC). Case studies are used to illustrate this system. LRMC provides an explicit framework for analyzing system costs and setting tariffs, and it allows the tariff to be revised on a

continual basis. Thus, the optimal price is reached gradually during several years without subjecting consumers to large and abrupt price changes.

Farmer Education and Farm Efficiency

Dean Jamison and Lawrence Lau

The Johns Hopkins University Press, forthcoming. About 216 pages (including bibliography, appendixes, index).

LC 81-47612
ISBN 0-8018-2575-X \$18.50 hardcover

Development strategies increasingly stress agricultural development, employment, and equity; it is, therefore, important to examine the role of education in light of these new emphases. The educational requirements of a capital-intensive, industrially focused growth strategy can be expected to differ in important ways from the requirements of a strategy placing greater emphasis on employment and agriculture; nonetheless, much of the research on education's economic benefits is limited to examination of data from the urban wage sector. This monograph complements the urban data by examining and developing new empirical evidence on farmer education and farm efficiency. The volume analyzes three new data sets—from the Republic of Korea, Malaysia, and Thailand—which confirm previous findings that education improves farm efficiency. The authors then introduce a new concept of efficiency—market efficiency—to allow examination of the extent to which farmers get “good” prices for their inputs and outputs in imperfect product and factor markets.

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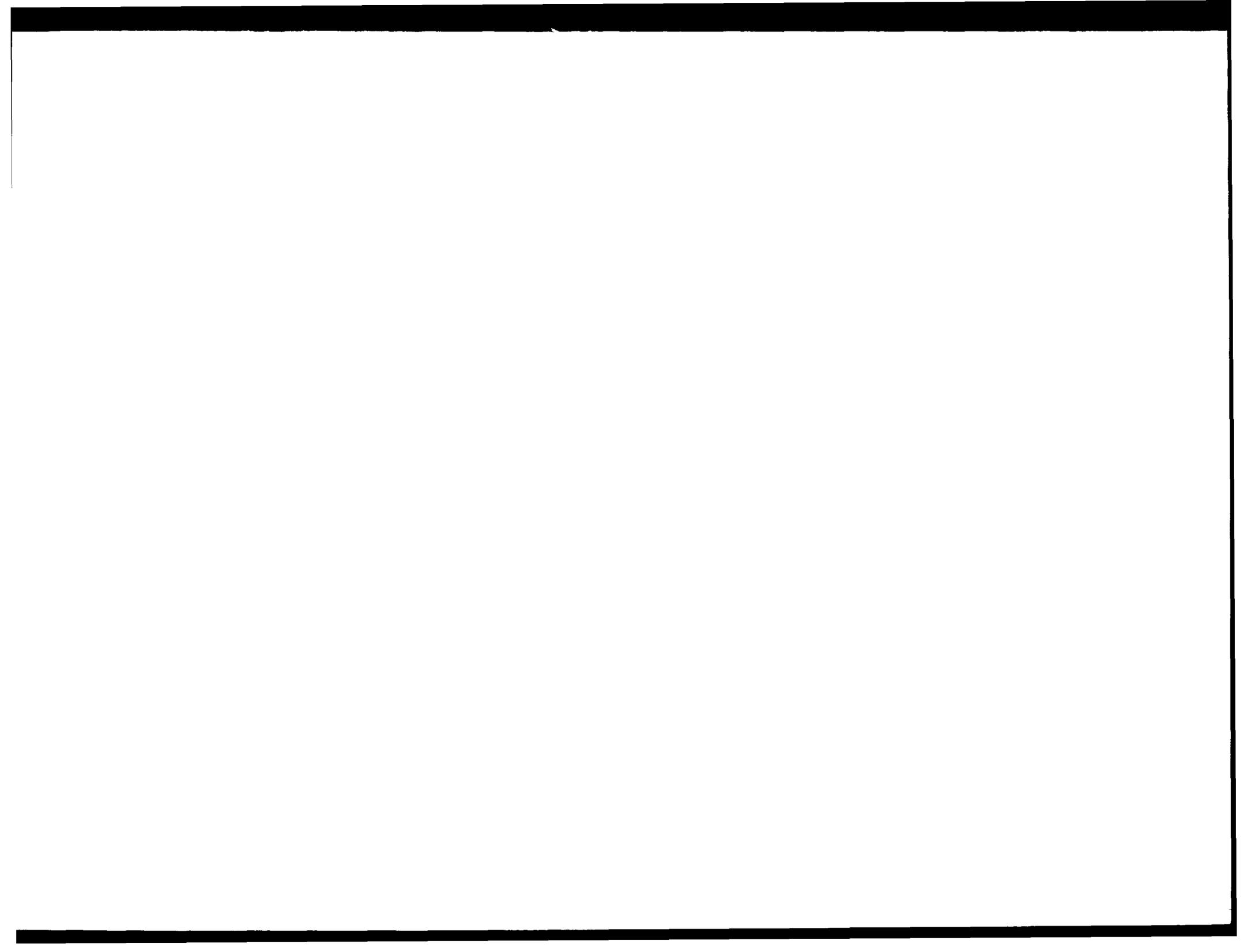
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