

17489

THE WORLD BANK

RESEARCH  
OBSERVER

**The Impact of Agricultural Extension:  
The Training and Visit System in India**

*Gershon Feder and Roger Slade*

**Issues in Medium-Term Macroeconomic Adjustment**

*Stanley Fischer*

**Shelter Strategies for the Urban Poor in Developing Countries**

*Stephen K. Mayo, Stephen Malpezzi, and David J. Gross*

**The Costs and Benefits of Being a Small, Remote,  
Island, Landlocked, or Ministate Economy**

*T. N. Srinivasan*

**A Benefit-Cost Analysis of Nutritional Programs  
for Anemia Reduction**

*Henry M. Levin*

---

---

THE WORLD BANK

---

# RESEARCH OBSERVER

---

EDITORIAL BOARD

EDITOR George Psacharopoulos  
MANAGING EDITOR Oey Astra Meesook  
ASSISTANT EDITOR Francesca Jessup  
MEMBERS Vittorio Corbo, Enzo Grilli, Peter Muncie,  
Demetrios Papageorgiou, David Turnham, William Tyler  
PRODUCTION EDITOR Carol C. Rosen  
DESIGNER Joyce C. Eisen

*The World Bank Research Observer* is published twice a year by the International Bank for Reconstruction and Development. The *Observer*, which is managed in the Office of the Vice President, Economics and Research, and vetted by a board drawn from various departments throughout the World Bank, seeks to keep nonspecialist readers informed about economic research currently being undertaken within the Bank and about developments in special areas of economics relevant for development policy. Each issue of the *Observer* will contain an article surveying an area of recent Bank research. In addition, it will contain reviews of special topics written by World Bank staff or outside experts in the field in a style readily comprehensible to the lay reader.

The World Bank does not accept responsibility for the views expressed herein, which are those of the authors and should not be attributed to the World Bank or its affiliated organizations. Some of the findings, interpretations, and conclusions are the results of research supported by the Bank; they do not necessarily represent official policy of the Bank. *The designations employed are solely for the convenience of the reader and do not imply the expression of any opinion whatsoever on the part of the World Bank or its affiliates concerning the legal status of any country, territory, city, area, or of its authorities, or concerning the delimitation of its boundaries or national affiliation.*

*The World Bank Research Observer* welcomes inquiries, comments, and editorial responses. Please direct all correspondence to:

*The World Bank Research Observer*  
Editorial Office, Room S-9123  
The World Bank  
1818 H Street, N.W.  
Washington, D.C. 20433, U.S.A.

Informal Bank documents cited in the articles stemming from or referring to World Bank research projects are generally available through the Bank Research Documentation Center in the Office of the Vice President, Economics and Research Staff, Room S-9035.

World Bank Staff Working Papers, Country Reports, and other official series that may be cited are published by the Bank. The most recent World Bank publications are described in the annual spring and fall catalogs, which are available free of charge from the Publications Sales Unit, The World Bank, 1818 H Street, N.W., Washington, D.C. 20433, U.S.A., or from the World Bank European Office, 66, avenue d'Iéna, 75116 Paris, France.

To be placed on the mailing list for *The World Bank Research Observer*, please fill in the order form at the back of this volume and mail it to:

World Bank Publications  
1818 H Street, N.W.  
Washington, D.C. 20433, U.S.A.

© 1986 by the International Bank  
for Reconstruction and Development/ The World Bank

All rights reserved  
Manufactured in the United States of America  
ISSN 0257-3032

---

---

THE WORLD BANK

---

RESEARCH  
OBSERVER

---

VOLUME 1

NUMBER 2

JULY 1986

---

- The Impact of Agricultural Extension: The Training and Visit System in India**  
*Gershon Feder and Roger Slade* 139
- Issues in Medium-Term Macroeconomic Adjustment**  
*Stanley Fischer* 163
- Shelter Strategies for the Urban Poor in Developing Countries**  
*Stephen K. Mayo, Stephen Malpezzi, and David J. Gross* 183
- The Costs and Benefits of Being a Small, Remote, Island, Landlocked, or Ministate Economy**  
*T. N. Srinivasan* 205
- A Benefit-Cost Analysis of Nutritional Programs for Anemia Reduction**  
*Henry M. Levin* 219
- Recent Publications** 247



---

---

# THE IMPACT OF AGRICULTURAL EXTENSION: THE TRAINING AND VISIT SYSTEM IN INDIA

*Gershon Feder and Roger Slade*

**T**wo centuries ago, Malthus predicted a grim future for mankind, with population growth outstripping the rise in food production. His projections have proved false because agricultural output has grown faster than he expected. It has done so not only because more land has been cultivated, with more irrigation and drainage; technology has also improved.

In technical terms, each farmer has a production function that dictates how much output will come from the inputs he uses. While these inputs are subject to his discretion, the production function is affected by many other factors beyond his control. Some are environmental. But others can be affected by public investment, even though an individual farmer considers them as given: public irrigation and drainage, for example, and agricultural research organizations. These factors can increase output without requiring extra inputs from the farmer. Of course, such investments are not cheap. In many developing countries, public investment in irrigation is a large part of the government's agricultural budget. As for research, worldwide spending has been estimated at \$7.4 billion in 1980. Between 1974 and 1984, the World Bank financed some 300 projects dealing partly or wholly with agricultural research, spending almost \$1.5 billion.

---

This paper summarizes the results of a study sponsored by the World Bank, "The Impact of Agricultural Extension: A Case Study of the Training and Visit System in Haryana, India" (RPO 672-29). More detailed discussions of these results can be found in other papers by the authors cited in the text. This paper has benefited from the editorial assistance of Joan S. Hazell.

However, better technology alone may not increase farm productivity. There is often a gap between available knowledge and what farmers actually do. They need to know about the costs and benefits of new technology before they adopt it. The public sector is often involved in spreading the knowledge. What is the rationale for its doing so? Information on new farming technology is often a public good, since the provider of information to one user cannot stop other users from getting it without charge, and the value of the information is not affected by the number of users. Information that is more specialized and specific is less of a public good, so could be provided by private entrepreneurs. Indeed, commercial agents dealing with certain types of information such as pest control may operate alongside a public agency providing more general information (Hall 1977). And they may have an incentive to tell farmers about new technology that is embodied in the supplies they are selling. In general, however, farming information has enough public-good qualities to justify public sector involvement in its dissemination.

Farmers obtain most of their information from each other. The time and resources they devote to acquiring it vary considerably. Also, a farmer does not consider the potential benefits to others when he decides how much information to obtain. It follows that, from a social point of view, farmers tend to underinvest in information acquisition. The availability of public sources of information tends to lower the cost of acquiring it for all farmers, and thereby increases social welfare if the cost of the public program is not too high (Feder and Slade 1984a).

The main public channel for spreading agricultural knowledge is usually the extension service. Public spending on agricultural extension is large. Judd, Boyce, and Evenson (1983) estimate that it totaled \$3.5 billion worldwide in 1980. In 1974-84, investment in agricultural extension in projects financed by the World Bank was \$2.3 billion. However, many analysts doubt that extension services can bring the big increases in agricultural productivity promised by the growing quantity of new or modified technology emerging from agricultural research institutions.

Extension services in developing countries are often criticized for: (a) lack of staff training and incentives and channels for updating agents' knowledge; (b) inefficient organizational structures that prevent adequate supervision of field workers; (c) requirements for staff to perform tasks other than spreading information, such as collecting data; (d) staff shortages; (e) absence of organized feedback about farmer problems from fieldworkers to researchers.

Accordingly, agencies have been paying more attention to improving the management and efficiency of extension systems. One result has been the Training and Visit (T&V) extension system (described in

Benor and Baxter 1984). T&V was originally tested in Turkey in the late 1960s. It has been introduced during the past ten years in more than forty developing countries, in many cases as nationwide systems, and often with the assistance of the World Bank. It has been most widely adopted since 1977 in India, replacing the system of multipurpose village-level workers.

With T&V, staff deal exclusively with extension work. They are organized in a single line of command, so at each rank an officer has few enough staff under him to allow effective and personal guidance, supervision, and training. At the bottom of the hierarchy are the village extension workers (VEWs). They usually cover areas containing 700–800 farming families, divided into about eight groups. In each group, about 10 percent are chosen as “contact farmers.” The VEW visits each of the eight farmers’ groups once every two weeks, on a specified day. These visits mostly take place in the fields of contact farmers, but other farmers are expected to participate. Occasionally, the VEW may organize a large group meeting, but most of his contacts are with small groups or individuals. The fixed schedule of visits helps the VEW’s superiors to supervise his work and also encourages interest and confidence among farmers.

To be effective, the T&V system aims to focus advice on the main crops grown and the most important farming methods. Simple methods that do not need money are promoted first, so that all farmers can benefit. Contact farmers are expected to adopt (or at least try) recommended practices and transmit them to other farmers. Because T&V involves a high ratio of extension workers to farmers, it is relatively expensive. Much research has already been done on T&V (see, for example, Cernea 1981; Howell 1982a, 1982b, 1983, 1984; von Blanckenburg 1982; Jaiswal 1983; Singh 1983; Moore 1984). Their opinions vary. Some observers argue that intensive personal contact between farmers and extension agents is unnecessarily expensive and that good results could be obtained by using written materials and the media. In many countries the mass media supplement direct contacts between farmers and extension workers (Perraton 1983). In some areas, they are the main form of diffusing public information. However, advocates of personal contact argue that the media do not give a fast feedback from farmers, nor can they adequately tailor their advice to local circumstances. Other skeptics of T&V argue that it is undesirable to separate advisory work from the supply of inputs. The counterargument is that the provision of inputs will tend to dominate the agents’ activities; fieldworkers should, however, coordinate their advice with the suppliers of inputs.

Other criticisms of T&V are (a) that it is hard to implement in areas of extensive agriculture, because it requires well-organized farmers’ groups and frequent personal contact; and (b) that T&V is biased

toward wealthier farmers. These arguments are seldom informed by suitable empirical evidence. Few authors, therefore, fail to mention the need for objective empirical information with which the effects of T&V can be assessed.

This paper assesses those effects by using farm survey data from India. First, it reviews the sources of data, then goes on to compare the importance of different channels for informing farmers about new or improved farming methods. The next section examines the characteristics of contact farmers, and the biases inherent in their selection. The following section analyzes the frequency with which contact and noncontact farmers are reached by extension and some of the factors that determine these frequencies. The paper then looks at the effect of T&V on farmers' knowledge. Subsequently, an econometric estimation of the impact of T&V on farm productivity is undertaken. Conclusions follow a cost-benefit analysis of T&V.

---

### *Empirical Sources*

This paper draws on two main sources of data. The first is a series of sample surveys from India, spanning four consecutive crop seasons in two districts in the state of Haryana (Jind and Karnal) served by a T&V extension system, and two crop seasons for Kairana Tehsil (part of Muzaffarnagar district) in the neighboring state of Uttar Pradesh. In Jind and Karnal districts, two random samples, consisting of roughly the same numbers of contact and noncontact farmers, were chosen. The sample from Kairana comprised only noncontact farmers as the T&V system had not yet been introduced there. Respondents were interviewed twice in each season and repeatedly assured that the surveys were unconnected with the extension system or any other government department. Because Jind is much drier than Karnal and Kairana, comparative analysis is mainly confined to the latter two areas. It covers both the rainy and dry growing seasons of 1982-83, for which comparable data are available.

The second source of data is monitoring and evaluation (M&E) reports from seven states in India over a number of years. The data are comparable across states because all M&E units use the same sampling design, definitions, and questionnaire (Slade and Feder 1985). The data in this study do not allow conclusive assessment of the relative merits of T&V extension and those methods based on the mass media. Neither can they illustrate the potential of T&V in areas of extensive agriculture, because Indian conditions are different.

---

### *T&V Operations*

To assess the various channels of spreading information, it is useful to review how farmers rank them. Table 1 shows that contact farmers consider extension to be their primary source of information. A signi-

**Table 1. Sources of Information for Farmers in Northwest India, by Ranked Preference, 1983**

(percent)

Source	Ranked preference	Karnal District, Haryana <sup>a</sup>		Kairana Tehsil
		Contact farmers	Noncontact farmers	Uttar Pradesh <sup>a</sup> (all farmers)
Individual advice from VEW	First	87	19	2
	Second	1	9	1
	Third	1	4	1
Advice from contact farmer	First	1	16	1
	Second	3	4	0
	Third	1	3	0
Advice from other farmers <sup>b</sup>	First	9	47	82
	Second	36	33	9
	Third	21	10	3
Demonstration/field days	First	0	0	1
	Second	10	2	28
	Third	3	1	8
Agricultural radio programs	First	1	10	9
	Second	28	27	38
	Third	39	34	32
Salesmen and agency officials	First	0	8	3
	Second	15	17	17
	Third	18	21	17
Research personnel	First	1	0	0
	Second	1	2	0
	Third	9	7	0
Journals	First	1	0	0
	Second	1	3	7
	Third	5	7	13
Other	First	0	1	1
	Second	4	3	1
	Third	5	13	26

Note: For each source of information, farmers were asked to say whether they regarded it as a primary, secondary, or tertiary source.

a. Karnal District is serviced by T&V extension, Kairana Tehsil by a different and older extension system.

b. Other farmers could be contact farmers. Not all contact farmers are known as such to noncontact farmers.

Source: Feder and Slade 1985.

ficant proportion of other farmers, 19 percent in Karnal, shares that view. However, about three-quarters of the farmers in Karnal, and rather more in Kairana, say that other farmers are their main source of advice. Radio programs tend to be a secondary or tertiary source, probably because farmers prefer to rely on direct and personal contacts, who can clarify points and answer additional questions. The minor role played by written materials is compatible with the area's

**Table 2. Relative Importance of Extension Workers and Other Farmers as Sources of Information for Wheat Farmers in Kairana and Karnal, Rabi 1982**

Type of farmer and practice	Small farms	Large farms	Total
<i>Non-T&amp;V farmer</i>			
Less expensive practices	0.00	0.07	0.04
More expensive practices	0.00	0.16	0.09
<i>T&amp;V noncontact farmer</i>			
Less expensive practices	0.20	0.36	0.27
More expensive practices	0.28	0.68	0.47
<i>T&amp;V contact farmer</i>			
Less expensive practices	3.51	4.27	3.98
More expensive practices	4.43	7.50	5.14

*Note:* Data are ratios of the number of times a VEW is cited as the main source of information to the number of times that "other farmers" is cited. Less expensive practices include choice of seed variety, seeding rate, and spacing; more expensive practices include use of phosphate, potash, and zinc, seed treatment against termites and disease, and timing of nitrogen fertilizer application.

*Source:* Feder, Slade, and Sundaram 1986.

low rate of literacy (35 percent). However, even in an area of high literacy (and very thin extension services) in Thailand, farmers used the radio much more than written sources (Hutanuwatr and others 1982).

These findings highlight the importance of communication among farmers. They also explain why several extension systems concentrate on a relatively small number of farmers, who are expected to transmit information to the rest. The choice of information source tends to be affected by the complexity or cost of the farming methods being learned. Many farmers regard firsthand or specialized information sources as more accurate and reliable (Feder and Slade 1986, Howell 1984). Table 2 compares the ratio of farmers who have learned complex or expensive practices from extension agents (firsthand source) to that of farmers who have learned from other farmers (secondhand source). The message is clear: the easier it is to consult extension agents, the more likely they are to be the source of information. And irrespective of extension availability, the more complex or risky practices tend to be learned more often from extension. When spreading the more complex methods of farming, therefore, agents should try to maximize their direct contact with farmers.

### ***Characteristics of Contact Farmers***

Contact farmers receive a direct and regular flow of information from extension agents, so their selection is a matter of considerable importance. Although their potential for leadership is the main criterion, other considerations should be kept in mind. For instance:

Contact farmers must be willing to try out practices recommended by the extension workers and be prepared to have other farmers visit their fields. But they should not be the community's more progressive farmers who are usually regarded as exceptional and their neighbors tend not to follow them. On the other hand, very weak farmers tend to be slow in adopting new methods. Furthermore, the contact farmers must be of good standing in their community so that their views on new practices will be respected by other farmers (Benor and Harrison 1977, pp. 13, 14).

Evidence suggests that there is a large overlap between the qualities of "opinion leaders" and those of "innovators," or fast adopters (Kilvin and others 1971). Traditionally, extension workers have tended to concentrate on the well-to-do farmers, because their efforts were more likely to produce an immediate and visible impact and because wealthier farmers could offer them personal benefits (meals, accommodation, produce). This bias has often been noted in the literature (Chambers 1976, Cernea 1981, and von Blanckenburg 1982). Some studies have argued that, on efficiency grounds, scarce extension re-

**Table 3. Factors Affecting the Selection of Contact Farmers**

Factor	Coefficient <sup>a</sup>		
	Jind District	Karnal District	Pooled sample
Farm size	.0275* (3.471)	.0339* (3.410)	.0317 (5.154)
Education (years)	.0397** (1.637)	.0573* (2.227)	.0453* (2.593)
<i>Dummy variables</i>			
Ownership of tubewell	.0570* (3.016)	.8987* (1.949)	.3956* (2.250)
Membership in village institutions	.3416 (1.443)	.4374** (1.524)	.4090* (2.260)
Previous participation in agriculture training	1.042* (2.180)	.8262* (2.213)	.8172* (2.851)
Likelihood ratio statistic	60.55	44.96	99.23
Number of observations	599	361	960

\* Significant at 5 percent (one-tailed) level of significance.

\*\* Significant at 7 percent (one-tailed) level of significance.

*Note:* The results in this table were obtained from a logit analysis in which the probability of a farmer's being selected as a contact farmer is related to socioeconomic explanatory variables. Numbers in parentheses are asymptotic *t* values.

a. No estimate of the constant is presented; the sample is not random with respect to the proportions of contact and noncontact farmers, and the estimated constant is therefore biased. The other coefficients are not affected, however (McFadden, personal communication).

*Source:* Feder and Slade 1984b.

sources should be used to greatest effect—implying a focus on larger, and usually richer, farmers (Welch 1979). However, this bias has disadvantages as well. Smaller and poorer farmers may not be convinced that the new practices are better: to them, a better performance by contact farmers could simply reflect the latter's greater wealth.

There are other complications as well. Extension workers are responsible for choosing contact farmers in their area, and personal preferences cannot be eliminated. As in many extension systems, agents tend to favor the wealthy and influential, even if they are not suitable as communicators of innovations. It is sometimes necessary to avoid antagonizing such powerful individuals, who may otherwise make extension work difficult to carry out. Furthermore, the choice of contact farmers will vary according to how far agents understand the extension system and how well they have been trained. Hoepfer (1983) has shown that the selection of contact farmers varies considerably. In a study on India, Feder and Slade (1984b) found that the caste composition of two groups of contact and noncontact farmers was almost identical, but that the farmers chosen as contacts tended to be wealthier, more educated, with better irrigation facilities, and of higher social status (see Table 3). However, although farmers owning less than two acres were underrepresented in the contact group their share was not negligible—12 percent—compared with 30 percent in the general population.

---

### *Relations with Farmers*

The links between extension workers and contact farmers can be regarded as the “supply” of extension services, because the T&V system requires these services to be provided regularly to contact farmers. Contact farmers, in turn, are expected to pass on this information to noncontact farmers. Moreover, it is not imperative that noncontact farmers have regular visits from extension workers; thus, the interaction between noncontact farmers and extension agents is likely to be determined by “demand” from noncontact farmers. However, the extension agents are expected to accommodate requests for information from all farmers. It is also expected that noncontact farmers will attend some meetings between extension agents and contact farmers.

Some idea of the frequency of agents' visits to contact and noncontact farmers can be gleaned from Table 4, drawn from the reports of monitoring and evaluation surveys from seven states in India over several seasons. The reference period for visit frequencies is one month. But it is possible that noncontact farmers, since they do not receive regular visits, had a longer time horizon in mind, so the data may overstate the frequency of visits.

The critical indicator is the percentage of farmers who report not seeing an extension agent. For contact farmers, this ranges from 1.2 to

34.7 percent; for noncontact farmers, from 21.4 to 59.2 percent. Across all seven states, the average percentage of “no-visits” reported by contact farmers is 15.4 percent (that is, about 85 percent of contact farmers were visited at least once in the reference month); 34.5 percent of the noncontact farmers reported no visits. Considering that some share of no-visits must be due to “normal friction” (Feder and Slade 1984a)—illness of extension workers, vacant posts, and unavailability of contact farmers—the actual supply of T&V services seems adequate relative to the potential supply.

The demand for extension services (measured by noncontact farmers’ interaction with agents) is significantly lower than the supply (measured by agents’ visits to contact farmers). However, there is not necessarily much unused capacity, since the actual supply available to noncontact farmers must be less than that to contact farmers. Furthermore, the demand for extension services is far higher in a T&V area: data for the Kairana area, which is not covered by T&V, show that between 89 and 97 percent of the farmers were not visited by (or did not seek out) the extension worker during the reference period (Feder and Slade 1986). In non-T&V areas, no distinction can be drawn between contact and noncontact farmers, so the Kairana figures could be the result of either low demand or low supply. It is known, however, that the ratio of extension workers to farmers is lower in non-T&V areas and that agents there have many duties other than extension. The small supply of extension in non-T&V areas could therefore increase the cost to the farmer of acquiring information from extension, thus reducing the contact between farmers and extension workers.

Table 5 summarizes data on visits and no-visits by farm size. Among both contact and noncontact farmers, there is a remarkable similarity between large and small farms. Among contact farmers, 15.9 percent of the small farms and 14.5 percent of the large farms were not visited, a difference of 1.4 percentage points. For noncontact farmers, the difference was only 3.2 points. While these differences are statistically significant at the 99 percent level (see Table 5), their size indicates that the bias toward large farmers is not enough to warrant serious concern. Further evidence comes from Feder and Slade (1984b), showing that “area of land owned” has a positive but not significant effect on the probability that a contact farmer would be visited. Since the links between noncontact farmers and extension workers are probably demand-driven, the difference between large and small farmers may merely indicate—as predicted by theory (Feder and Slade 1984a)—the tendency of larger farmers to invest more in gathering information.

Extension workers may visit farmers more often in the dry season. Data for both contact and noncontact farmers show that the inci-

**Table 4. Frequency of VEW Visits to Contact and Noncontact Farmers in India, by State and Farm Size**

State and farm size	Monitoring or monitoring and evaluation survey	Contact farmers				Noncontact farmers			
		Sample size	Percentage with visits in the past four weeks			Sample size	Percentage with visits in the past four weeks		
			0	1	2 or more		0	1	2 or more
<i>Haryana</i>									
Rabi 1981-82	M								
Small farms <sup>a</sup>		251	17.1	14.0	68.9	333	48.6	27.9	23.3
Large farms		202	15.9	12.8	71.3	138	45.7	29.7	24.6
Kharif 1982-83	M								
Small farms		232	16.4*	17.2	66.4	309	40.4	35.9	23.7
Large farms		219	10.0	20.1	69.9	138	45.6	21.0	33.3*
Kharif 1982-83	M&E								
Small farms		64	7.8	21.9	70.3	658	52.3	24.5	23.2
Large farms		64	6.2	17.2	76.6	267	49.8	21.3	28.9
<i>Karnataka</i>									
Rabi 1981-82	M								
Small farms		2,024	15.4*	17.3	67.3	1,482	30.2	21.8	48.0*
Large farms		1,143	12.3	20.6	67.1	530	32.6	26.4	41.0
Rabi 1981-82	M&E								
Small farms		86	17.4	16.3	66.3	395	40.3	21.8	37.9
Large farms		159	11.4	17.6	71.0	493	40.2	25.8	34.0
Kharif 1982-83	M								
Small farms		1,499	10.1	10.8	79.1*	1,869	28.0	16.2	55.8*
Large farms		1,133	10.9	14.7	74.4	760	25.8	25.8	48.4
Kharif 1982-83	M&E								
Small farms		307	13.0	24.1	62.9	2,065	50.7	19.7	29.6
Large farms		235	8.9	27.2	63.8	712	50.6	20.5	28.9
Rabi 1982-83	M								
Small farms		1,280	13.0	21.6	65.4	1,621	28.2	24.6	47.2
Large farms		988	14.0	15.0	71.0*	698	27.8	22.7	49.5
Rabi 1982-83	M&E								
Small farms		69	18.8	23.2	58.0	606	57.9*	18.0	24.1
Large farms		168	11.3	17.3	71.4*	544	48.7	20.8	30.5*
Kharif 1983-84	M								
Small farms		1,157	20.4*	13.9	65.7	1,593	36.4*	18.8	44.8
Large farms		944	15.4	18.6	66.0	648	31.3	19.4	49.3
<i>Gujarat</i>									
Kharif 1981-82	M								
Small farms		503	33.2	19.9	46.9	..	..	..	..
Large farms		328	28.6	21.6	49.7	..	..	..	..
Kharif 1981-82	M&E								
Small farms		298	8.0	19.5	72.5	..	..	..	..
Large farms		237	8.0	20.7	71.3	..	..	..	..
Rabi 1981-82	M								
Small farms		527	23.9	17.5	58.6	..	..	..	..
Large farms		308	20.1	14.0	65.9*	..	..	..	..
Rabi 1981-82	M&E								
Small farms		208	8.6	14.9	76.5	..	..	..	..
Large farms		184	12.0	20.1	67.9	..	..	..	..
Kharif 1982-83	M								
Small farms		498	24.3	14.3	61.4	..	..	..	..
Large farms		337	19.3	14.2	66.5	..	..	..	..

**Table 4** (continued)

State and farm size	Monitoring or monitoring and evaluation survey	Contact farmers				Noncontact farmers			
		Sample size	Percentage with visits in the past four weeks			Sample size	Percentage with visits in the past four weeks		
			0	1	2 or more		0	1	2 or more
<i>Gujarat (continued)</i>									
Kharif 1982-83	M&E								
Small farms		394	12.4	15.0	72.6	..	..	..	..
Large farms		375	13.1	20.3	66.6	..	..	..	..
Rabi 1982-83	M								
Small farms		481	21.9	18.8	59.3	..	..	..	..
Large farms		354	20.2	22.1	57.7	..	..	..	..
<i>Assam</i>									
Kharif 1982-83	M&E								
Small farms		394	27.3*	9.6	63.0	423	48.0*	22.7	29.3
Large farms		332	11.2	18.0	70.8*	308	21.4	9.1	69.5*
<i>Maharashtra</i>									
Rabi 1983-84	M								
Small farms		1,200	14.0*	12.2	73.8	..	..	..	..
Large farms		735	10.2	11.4	78.4*	..	..	..	..
<i>Bihar</i>									
Kharif 1983-84	M								
Small farms		734	32.2	17.5	50.3	854	59.2	15.2	25.6
Large farms		352	34.7	16.8	48.5	249	55.0	16.1	28.9
<i>Tamil Nadu</i>									
Summer 1982	M								
Small farms		347	2.0	4.6	93.1	..	..	..	..
Large farms		83	1.2	8.4	90.4	..	..	..	..
Kharif 1982-83	M								
Small farms		1,317	3.4	2.8	93.8	..	..	..	..
Large farms		248	2.8	3.6	93.6	..	..	..	..

.. = not available

\* Significant at 5 percent level of significance.

*Note:* Small farms were defined as less than 5.1 hectares in Haryana and Gujarat; 4.1 hectares in Tamil Nadu and Karnataka; 3.1 hectares in Madhya Pradesh and Bihar; and 2.1 hectares in Assam.

*Source:* Feder, Slade, and Sundaram 1986.

dence of no-visits during the dry season is significantly lower than in the rainy season, although the absolute difference is small. This result is consistent with Feder and Slade (1986), who show that the rate at which knowledge spreads tends to be higher for dry-season crops. These findings support the proposition that extension workers play a greater role in the dry season, although the cause may have more to do with the available technology and the riskiness of rainfed agriculture than with the efficiency of the extension system.

As experience with the T&V system increases, so the pattern of extension visits changes. The proportion of contact farmers not visit-

**Table 5. Summary of VEW Visits to Contact and Noncontact Farmers in India, by Farm Size**

(percent)

Farm size	Contact farmers		Noncontact farmers	
	No visits	One or more visits	No visits	One or more visits
Small	15.9	84.1	35.4	64.6
Large	14.5	85.5	32.2	67.8

Note: Data are based on evidence from large sample surveys conducted by monitoring and evaluation units; states, years, and seasons as in Table 4.

Source: Feder, Slade, and Sundaram 1986.

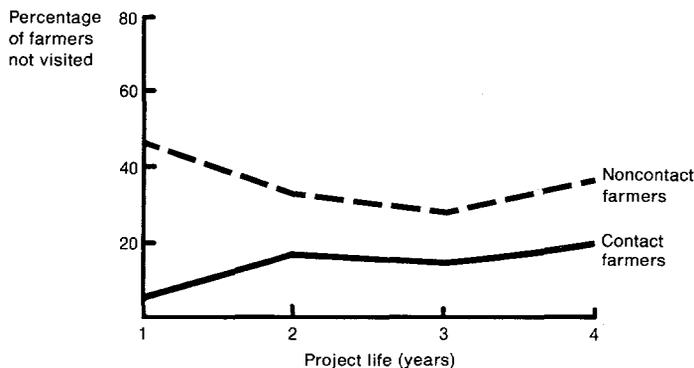
ed goes up significantly: among projects that are four or more years old, nearly one in five contact farmers was not visited (see Table 6 and Figure 1). This may be partly due to extension workers' replacing some contact farmers with others but not telling the former of the change. Conversely, the proportion of noncontact farmers not visited

declines, from about 48 to 36 percent. This may be due to the fact that, over time, more noncontact farmers come to hear of T&V and take advantage of the service; T&V workers are expected to respond to queries from all farmers (Benor and Baxter 1984). Because contact farmers form only about 10 percent of the farming community, the most important finding is that the proportion of all farmers visited increases as projects mature.

In short, although the T&V system is not without flaws, it does reach the majority of contact farmers regularly and, less regularly, a substantial proportion of noncontact farmers as well. Furthermore, the data do not support the contention that T&V has atrophied, leaving an empty structure and no change in extension operations (Jaiswal 1983). In the state of Haryana, even in unsettled times,<sup>1</sup> T&V still seemed to work better than the traditional system in neighboring Uttar Pradesh.

Moore (1984), Jaiswal (1983) and other commentators have claimed that, in many parts of India covered by T&V, farmers see little benefit in the reformed system; that workers are not known to their clients; and that contact farmers fail to pass on information to others (and

**Figure 1**



**Table 6. Frequency of VEW Visits in India, by Project Life and Farm Size**

(percent)

Project life and farm size	Contact farmers		Noncontact farmers	
	No visits	One or more visits	No visits	One or more visits
<i>One year or less</i>				
Small farms	5.0	95.0	48.7	51.3
Large farms	7.5	92.5	45.7	54.3
All farms	5.7	94.3	47.8	52.2
<i>Two years</i>				
Small farms	17.1	82.9	32.3	67.7
Large farms	13.9	86.1	36.3	63.7
All farms	16.0	84.0	33.8	66.2
<i>Three years</i>				
Small farms	14.3	85.7	28.1	71.9
Large farms	14.1	86.0	26.7	73.3
All farms	14.2	85.8	27.7	72.3
<i>Four years or more</i>				
Small farms	22.2	77.8	38.8	61.2
Large farms	14.3	85.7	28.1	71.9
All farms	19.4	80.6	36.1	63.9

*Note:* Data are based on monitoring and evaluation reports of state governments in India; states, years, and seasons as in Table 4.

*Source:* Feder, Slade, and Sundaram 1986.

may not even know that they are contact farmers). The data for the study area in Haryana do not support these contentions. From an original sample of 192 contact farmers selected at random from the extension lists in Karnal district, 175 turned out, on their own admission, to be contact farmers. Most of the others said they had been contact farmers in the recent past.

All farmers in the sample surveys in Karnal and Kairana were asked in 1983 if they had seen changes in the style of the extension system during the previous few seasons. Predictably, farmers in the Kairana area of Uttar Pradesh saw no change, as none had taken place.<sup>2</sup> In Karnal (where T&V was introduced in 1979) almost all contact farmers were aware of a change in extension operations, and they thought the change beneficial. Among noncontact farmers, less than half had noticed a change, but most of those who did were favorably impressed. This relative lack of awareness of the change among noncontact farmers, particularly on small farms, suggests that earlier efforts to publicize the availability of extension advice had been inadequate.

Almost all contact farmers and about half of the others knew the extension worker who visited their group. The comparable proportion

for the non-T&V area (Kairana) was little more than one-tenth. Similarly, 60 percent of noncontact farmers reported knowing at least one contact farmer in their area. More than half of all contact farmers claimed to have discussed extension advice with other farmers, while more than 30 percent of those noncontact farmers who had talked to extension workers also claimed to have passed on information obtained from them.

---

### *T&V Effects on Farmers' Knowledge*

Extension aims to increase farmers' knowledge about crops and cropping practices, obviously in the hope that additional knowledge will lead to improved husbandry and thence to increased agricultural productivity. However, many other factors affect the adoption of technology and output, and they cannot easily be disentangled from extension (as will be discussed in the next section). This section compares the levels of knowledge (thus largely avoiding such complications) among different groups of farmers, drawing on data from the sample surveys in Karnal (T&V area) and Kairana (non-T&V) during the rainy and dry seasons of 1982-83.

The data show that for most practices not involving specialized technical knowledge or major expense, contact farmers under the T&V system learned mostly from the extension service. Noncontact farmers learned mostly from other farmers, including contact farmers. Where specialized technical knowledge was involved, all farmers tended to learn from knowledgeable primary sources, such as extension agents. This pattern suggests that the spread of knowledge about the more demanding practices is likely to be much faster in an area such as Karnal, which has ample extension staff, than in a less well-endowed area such as Kairana.

During the sample surveys, farmers were also questioned about their knowledge of specific practices and when they first learned them. Knowledge is difficult to measure without a thorough examination of a respondent's understanding. For some practices this was possible; for others, detailed testing was beyond the time and resources available. In such cases, however, it was possible to establish the farmers' awareness of a particular practice; a farmer who is unaware of a practice cannot, by definition, be familiar with its detail. The resulting data show the growth in the number of farmers who were aware of different technologies in 1978, the year before T&V extension was introduced in Haryana, and four years later. To increase the validity of comparisons between Karnal and Kairana, contact farmers in Karnal have been excluded from the analysis because they receive a disproportionate amount of extension advice and may also be different in other ways (as discussed earlier).

The analysis employed two alternative standard specifications (lo-

gistic and negative exponential) of the time path of growth in the spread of knowledge.<sup>3</sup> The results showed that among ten practices for high yielding varieties (HYV) of paddy,<sup>4</sup> the rate of growth in farmer knowledge was clearly faster in Karnal for only three of them. For two paddy practices, knowledge spread faster in Kairana. It is noteworthy, however, that two of the three practices that spread faster in Karnal involved considerable technical content and needed cash inputs. These results are consistent with the argument that such practices are most commonly learned directly from extension agents. Where HYV wheat was concerned, knowledge spread faster in Karnal for nine out of the ten practices examined.

These are interesting results, but they must be qualified. First, they are based on sample surveys, and all such surveys have a margin of error. Second, even when knowledge about a practice has increased, it may not be useful or profitable to farmers. Consequently, these results do not prove whether gains in yields result from the observed increases in knowledge or whether such gains outweigh the increased costs of T&V extension. These issues are discussed later.

Nevertheless, the results suggest that T&V extension in Karnal speeded up the spread of knowledge for almost all recommended practices for HYV wheat and several important practices for HYV rice. Such results are consistent with Karnal's significantly greater extension activity. They are also consistent with other survey findings that knowledge spreads faster among contact than noncontact farmers. As this article has already shown, contact farmers have more direct links with extension workers and should therefore (other things being equal) be more knowledgeable. However, as the contact group is not necessarily representative of all farmers, its superior knowledge may be the result of other factors.

---

The process by which extension affects crop yields involves many variables. If extension efforts are successful, however, this success must eventually result in increased output per unit of input, reduced costs per unit of output, or both.

Since the contact point between the extension system and the farmer is the village extension worker, it is essential that the VEW is "better" than other sources of information. A testable hypothesis is therefore implied: other things being equal, farmers whose main information source is the extension worker will have higher productivity or yields than those who rely on other sources. Of course, there may be some systematic relationship between farmers who use extension as a main source of information and their other inherent attributes (such as intelligence) which make them better farmers who obtain higher yields.

Drawing again on the state M&E reports in India, we use data on

---

*Information  
Sources and  
Farm  
Productivity*

crop yields in the rainy and dry seasons classified by information source. For the rainy season, we use paddy yields; for the dry season, wheat (under both irrigated and unirrigated conditions).

State average yields were calculated by applying weights based on the sample sizes for irrigated and unirrigated farms and for contact and noncontact farmers. The resulting overall average for each state was set equal to 100. Each subset of yields was then expressed as an index number relative to the state average. This conversion permits paddy and wheat yields to be compared (since they differ in absolute magnitudes) and minimizes differences in agroclimatic and socio-economic factors between states. The net result is a series of index numbers that are comparable across states, crops, and cropping seasons. Table 7 summarizes the data for irrigated, unirrigated, and all farms, classified by main source of farmer information.

Farmers whose main source of information is the VEW have the highest yield index of 114.5. This is followed by those whose source is other farmers; their yield index is close to the average. Other sources (such as radio, demonstration days, sales personnel) have a lower yield index of 95.77. Farmers who receive "no advice" had an index of only 86.11. Those using extension workers as the main source of information seem to have yields that differ substantially from all other sources, but the difference between those using other farmers and other sources is much smaller. All three, however, have higher yields

**Table 7. Yield Indexes, by Type of Farm and Main Source of Information**

Type of farm	VEW	Other farmers	Other sources	No advice
Irrigated farms	116.25 (13)	89.52 (13)	92.64 (13)	93.22 (13)
Unirrigated farms	114.75 (13)	101.90 (13)	103.29 <sup>a</sup> (13)	79.88 (13)
All farms	114.50 (15)	99.08 (15)	95.77 (15)	86.11 (15)

*Note:* Data are based on monitoring and evaluation reports from seven state governments in India; states, years, and seasons as in Table 4. Figures in parentheses indicate sample size. Sample sizes differ because, for two states, data classified by irrigated and unirrigated farms were not available. The actual number of farmers in the sample is more than 1,500; the sample sizes in the table refer to the number of average yield index figures and hence represent a mean of means.

a. One state, in one cropping season, had an unduly high yield figure, and the sample base was extremely low in relation to the rest and hence was significant in the computation of weighted average yields for all farms. However, in computing the average across unirrigated farms in all states, this number receives equal weighting. Hence, this particular figure should be considered an overestimate.

*Source:* Feder, Slade, and Sundaram 1986.

than those receiving no advice. The figures shown in Table 7 were rigorously tested with econometric techniques, and the conclusions confirmed these results (Feder, Slade, and Sundaram, 1986).

One difficulty with yield comparisons is that no allowance is made for differences in, for example, soil types, farmer attributes, or extent of irrigation, which may also contribute to the variability of yields. We therefore made a deeper analysis, using the farm-level data from the Karnal and Kairana sample surveys.

Although this analysis takes into account certain differences between the two areas, Karnal and Kairana are similar in many respects. They lie on opposite banks of the Jamuna river, are flat, and have light alluvial soils. Average annual rainfall in Karnal is 803 millimeters, and in Kairana 794 millimeters. Both districts are heavily irrigated: in Karnal 74 percent of the net cropped area, in Kairana 84 percent. Linguistically and ethnically, the two are similar. In the dry season, wheat is the dominant crop in both areas. In the rainy season, however, paddy is the main crop in Karnal, sugarcane being less important; in Kairana, it is the other way round.

In the state of Uttar Pradesh, of which Kairana is one of the most western parts, the extension system at the time of the study consisted of the traditional network of village-level workers (VLWs) administered by the Community Development Department. These workers are responsible not only for providing extension advice but also for regulating the supply of inputs and credit and the administration of other subsidy and incentive schemes. They are also the link between the rural population and several other government agencies. In 1981, there were some 140 VLWs in Kairana: one worker for every 6.1 villages. In Karnal the ratio was 4.7. In terms of numbers of people, there was one village worker for every 11,500 rural dwellers in Kairana, and one for every 7,400 in Karnal. In Kairana VLWs are supplemented by staff from the Department of Agriculture, working mainly under the aegis of special crop programs.

Karnal's extension system was reformed in late 1979. The reorganization reduced the ratio of villages to VEWS from an initial 6.05 (similar to the ratio in Kairana at the time of the study) to 4.7. It created new senior positions—for example, supervisors and specialists. VEWS were relieved of nonextension duties. By March 1983, 99 percent of VEW positions and 88 percent of specialist positions (technical specialists of intermediate rank) were filled. However, in May 1982, 25 percent of the positions for agricultural extension officers (supervisors of VEWS) were still vacant.<sup>5</sup>

The study included only high yielding varieties of wheat and paddy; traditional varieties are rarely grown in Karnal. Initially, yield differences between the two regions for the two main crops, wheat and paddy, were estimated. These estimates took account of differences in

the quantities of variable and fixed inputs, the types of soils, human capital, and irrigation (both quantity and quality).<sup>6</sup> It is thus tempting to assume that any yield differences between Karnal and Kairana in 1983 were wholly attributable to differences in the extension system. However, this need not be true if other systematic (but unobserved) factors differentiated the two areas, or if yield differences had been significant in 1979. To minimize the possibility of misinterpreting the results, the control sample (the non-T&V case) was from that part of Muzaffarnagar district (Kairana Tehsil) next door to Karnal district. Thus, the villages in Kairana's sample were no more than 30 miles from the center of Karnal. Spillover effects were minimal because farmers from the two regions were not regularly in touch with each other.

These precautions could nonetheless fail to account for some fixed and systematic differences between the areas, or possibly for the fact that knowledge spread more rapidly in one of the areas before T&V began. In such cases, even the adjusted yields in 1979 would not be equal, so further adjustments would have to be made. Ideally, what would be needed would be a complete sample for 1979, so that it and the 1982-83 sample could have been subject to detailed econometric analysis. It would then have been possible to test the hypothesis that the 1982-83 residual yield difference was larger than the 1979 difference. Any difference between these two levels would then have been due to T&V extension.

Unfortunately, no such detailed sample from Karnal and Kairana was available for 1979. However, there were some data derived from the seasonal crop-cutting estimates. These data have several deficiencies: (a) the sample sizes for subdistricts are small; (b) they do not differentiate between irrigated and unirrigated conditions or between high yielding and traditional varieties, whereas the 1982-83 data focus only on high yielding varieties under irrigated conditions; (c) they provide no information on inputs or other similar variables that might explain the differences in output; (d) in any one year they include random elements that fluctuate over time, such as disease or bad weather.

To overcome these deficiencies, the data were adjusted to derive mean yields for 1979 that were comparable to the sample used in the detailed analysis of the 1982-83 data. Econometrically estimated relations were used to calculate the residual yield difference between Karnal and Kairana in 1979. This difference was subtracted from the one estimated from the 1982-83 sample, and the increased yield (if any) attributable to T&V extension was calculated on several different assumptions.

The results suggest that in 1982-83, after three years of T&V extension and holding all inputs constant, HYV wheat yields in Karnal were 8.9 percent higher than in Kairana. However, this estimate excludes any difference that existed before the more intensive T&V extension system was introduced.<sup>7</sup> The productivity difference between Karnal

and Kairana in 1979 (before the T&V system) was between 1.6 and 3.0 percent; it must be subtracted from the yield difference in 1982–83. The difference in yields, about 7 percent over the first three years of implementation, is attributable to T&V extension.

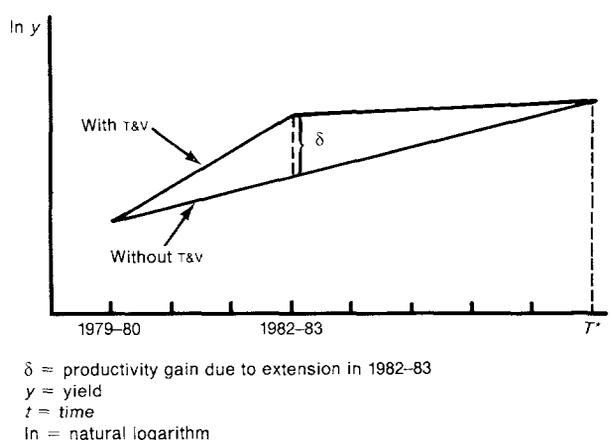
Since Karnal and Kairana were both quite advanced even before T&V—almost all farmers used HYVs and nitrogenous fertilizers—what was the source of this gain in productivity? The study suggests that the gains came partly from the spread of improved production methods, such as the timing of various farm operations. However, farmers and extension agents in the study areas also laid stress on the ability of extension workers to spot local problems, seek help from specialists, and then give farmers the right advice on what to do to minimize yield losses. In areas without a link to expert advice, unforeseen and localized production problems cause bigger losses.

The value of any increase in farm output attributable to T&V extension must be set against the additional costs incurred to make the extra output possible. Although the cost-benefit analysis of T&V in Karnal was made after the fact, a complete series of either costs or benefits for the whole of the project was not available. We were therefore obliged to make several assumptions. To estimate costs, we used data on actual costs incurred during the first four years of the T&V system, as well as projections made at the time of project appraisal. These were adjusted to constant 1979 prices. Where the project's life was assumed to be shorter than that of physical structures and equipment, appropriate residual values were calculated and deducted from cost. To estimate benefits, we drew on the figures (presented earlier) on the extra yield attributable to T&V extension in the third year of the project. However, it is reasonable to expect gains to continue beyond the third year. As there were no data with which to estimate such additional gains, we constructed a dynamic model to simulate later changes in productivity, both with and without T&V (see Figure 2).

In the absence of T&V extension, the average yield is assumed to grow at a constant rate, while the introduction of T&V initially accelerates that growth by informing farmers of better farming methods and how to use them. Once that phase is over, however, productivity

## Cost-Benefit Analysis

Figure 2



growth will slow down. After a certain number of years ( $T^*$ ), the average yield will be the same whether or not T&V was implemented. If a T&V project can be stopped as soon as marginal benefits are equal to marginal costs, that would maximize its efficiency.

The model was used to estimate the project's benefits for varying periods. The results show, with a high degree of statistical confidence, that the internal rate of return on a project lasting for  $T^*$  years exceeds 15 percent; on a project lasting for the most efficient period, it would exceed 20 percent. These calculations, it should be emphasized, refer to *incremental* costs and benefits. Thus, they reflect the returns to intensifying and improving the extension system, but not its overall return. Theoretically, the overall return could be low while that on incremental investment was high. The data, however, cannot be used to infer the overall return; that would need information on productivity without any extension, which was not available. Knowledge of the overall return would be essential if there was an option to disband the extension system altogether, including those parts that existed before the introduction of T&V. In practice such an option rarely exists, because of bureaucratic rigidities.

---

## **Conclusions**

This paper has analyzed some key hypotheses about the effects of T&V extension. The results, based on data from India, show that T&V greatly increases the number of contacts between farmers and extension workers, and the proportion of farmers reached increases the longer the T&V system operates. Extension agents were found to be an important source of knowledge about new farming practices, particularly when these practices are complex and expensive. The paper shows that T&V led to significant increases in yields of a major crop in one area covered by a detailed study. Even after allowing for many other factors that help explain differences between farmers' performance, yield differences of about 7 percent over three years remain. When the costs of T&V are set against the value of the increased production, the project produced internal rates of return of at least 15 percent. These benefits seem to be due to improvements in overall farm management rather than to the induced use of more (or new) inputs. More specifically, the results suggest that the greater availability of extension workers and, through them, the advice of specialists substantially improved the ability of farmers to respond to local problems. Moreover, these results pertain to an area where most farmers were already using high yielding varieties and fertilizers before the extension system was reformed. In less advanced areas several studies cited by Herdt and Capule (1983) show that the quality of extension affects farmers' adoption of modern varieties and inputs.

As the results concerning productivity gains come from one of

India's more advanced agricultural regions, it might be argued that they do not apply to less advanced areas. Moreover, it has been observed, for example, that profitable innovations spread fast during the green revolution in northwest India without intensive extension work. Nonetheless, the results of this study show that if extension produces even a small gain in one major crop, the extra cost is justified. The review by Herdt and Capule (1983) also cites several studies showing that extension can accelerate the spread of innovations such as high yielding varieties. Thus it seems that the basic elements of new and profitable technology may spread fast naturally, but the spread of more complicated methods and the adaptation of technology to local circumstances will be significantly improved if farmers have access to specific and up-to-date advice. Where there are not enough good and well-organized advisers, extension is likely to be much less effective. Moreover, in areas where appropriate technology is not yet available, it may be inadvisable to invest in expanding extension services.

---

This article reviews the rationale for public sector involvement in the dissemination of technological information to farmers, concluding that free markets do not fully satisfy farmers' information needs, and that government support is justified. Agricultural extension is a principal way that governments can disseminate information, and the World Bank is financing many extension projects throughout the developing world. One specific approach to extension adopted in many Bank extension projects is the Training and Visit (T&V) system. Data from a Bank-sponsored survey in northwest India and from monitoring and evaluation reports issued by several Indian states are used in this article to evaluate T&V extension operations and their impact. Extension agents' interaction with farmers is found to be more intensive and more significant as a source of information in areas covered by T&V extension than in areas with a different extension system. The yield levels of farmers whose main source of information was the T&V extension agent are also shown to be higher. In one case study, the incremental investment in T&V extension is shown to be likely to generate at least a 15 to 20 percent rate of return.

## **Abstract**

---

1. During 1982 and 1983 when the surveys in Karnal and Jind districts of Haryana were conducted, there were widespread and disruptive transfers of field staff and a high rate of turnover among senior management.

2. The extension system in Uttar Pradesh is expected to be reformed along T&V lines starting in 1986.

3. Details are to be found in Feder and Slade (1986).

4. The term "paddy" is used to describe rice, whether growing or harvested, before the milling process. (Farmers grow paddy; millers produce rice.)

5. There were also other significant difficulties during 1982 and 1983. For example, state and regional committees charged with defining and programming technical recommendations were either not convened or worked only erratically.

6. A more extensive discussion of the analysis and results reported in the rest of this paper can be found in Feder, Lau, and Slade (1985).

7. The results for HYV paddy were not statistically significant.

## **Notes**

---

## References

- Benor, Daniel, and James Q. Harrison. 1977. *Agricultural Extension: The Training and Visit System*. Washington, D.C.: World Bank.
- Benor, Daniel, and Michael Baxter. 1984. *Training and Visit Extension*. Washington, D.C.: World Bank.
- Cernea, Michael. 1981. "Sociological Dimensions of Extension Organization: The Introduction of the T&V System in India." In Bruce R. Crouch and Shankarian Chamala, eds. *Extension Education and Rural Development*, vol. 2: *International Experience in Strategies for Planned Change*. Chichester: Wiley.
- Chambers, Robert. 1976. *Two Frontiers in Rural Management: Agricultural Extension and Managing the Exploitation of Communal Natural Resources*. Institute of Development Studies Communications Series 113. Brighton, England: Institute of Development Studies, University of Sussex.
- Feder, Gershon, and Roger H. Slade. 1984a. "The Acquisition of Information and the Adoption of New Technology." *American Journal of Agricultural Economics* 66, no. 3 (August): 312-20.
- \_\_\_\_\_. 1984b. "Contact Farmer Selection and Extension Visits: The Training and Visit Extension System in Haryana, India." *Quarterly Journal of International Agriculture* 23, no. 1 (January/March): 6-21.
- \_\_\_\_\_. 1985. "The Role of Public Policy in the Diffusion of New Agricultural Technology." *American Journal of Agricultural Economics* 67, no. 2 (May): 423-28.
- \_\_\_\_\_. 1986. "A Comparative Analysis of Some Aspects of the Training and Visit System of Agricultural Extension in India." *Journal of Development Studies* 22, no. 2 (April): 407-28.
- Feder, Gershon, Lawrence J. Lau, and Roger H. Slade. 1985. *The Impact of Agricultural Extension: A Case Study of the Training and Visit System in Haryana, India*. World Bank Staff Working Paper 756. Washington, D.C.
- Feder, Gershon, Roger H. Slade, and A.K. Sundaram. 1986. "The Training and Visit Extension System: An Analysis of Operations and Effects." *Agricultural Administration* 22, no. 2: 407-28.
- Hall, D. C. 1977. *An Economic and Institutional Evaluation of Integrated Pest Management*. Environmental Protection Agency Report 68-01-2982. Washington, D.C.: U.S. Government Printing Office.
- Herdt, R. W., and C. Capule. 1983. *Adoption, Spread and Production Impact of Modern Rice Varieties in Asia*. Los Banos, Philippines: International Rice Research Institute.
- Hoeper, Bernhard. 1983. "Selected Results of the Agriculture Development Officers and Village Extension Workers Survey in Jind, Karnal and Mahendragarh Districts, Haryana, India." Organizational and Methodological Variables of the Training and Visit System of Extension, Working and Discussion Note 1. Berlin: Institute of Socio-Economics of Agricultural Development.
- Howell, John. 1982a. *Managing Agricultural Extension: The T&V System in Practice*. Discussion Paper 8. London: Overseas Development Institute, Agricultural Administration Network.
- \_\_\_\_\_. 1982b. *Responses to Discussion Paper No. 8, Managing Agricultural Extension: The T&V System in Practice*. Newsletter 9. London: Overseas Development Institute, Agricultural Administration Network.
- \_\_\_\_\_. 1983. *Strategy and Practice in the T&V System of Agricultural Extension*. Discussion Paper 10. London: Overseas Development Institute, Agricultural Administration Network.
- \_\_\_\_\_. 1984. *Small Farmer Services in India*. Working Paper 13. London: Overseas Development Institute, Agricultural Administration Network.

- Hutanuwatt, Narong, and others. 1982. "Socio-economic Constraints in Rain-fed Agricultural Production in the Lower North-East Thailand." Bangkok: Kohn Kaen University, Faculty of Agriculture.
- Jaiswal, N. K. 1983. "Transfer of Technology under T&V - Problem Identification." In *Background Papers: Workshop on Management of Transfer of Farm Technology under the Training and Visit System*. Hyderabad: National Institute for Rural Development.
- Judd, M. A., J. K. Boyce, and R. E. Evenson. 1983. *Investing in Agricultural Supply*. Economic Growth Center Discussion Paper 442. New Haven, Conn.: Yale University.
- Kilvin, Joseph, and others. 1971. *Innovation in Rural India*. Bowling Green, Ohio: Bowling Green State University Press.
- Moore, Michael. 1984. "Institutional Development, The World Bank, and India's New Agricultural Extension Program." *Journal of Development Studies* 20, no. 4 (July): 303-17.
- Orivel, F. 1983. "The Impact of Agricultural Extension: A Review of the Literature." In H. Perraton and others, eds. *Basic Education and Agricultural Extension*. World Bank Staff Working Paper 564. Washington, D.C.
- Perraton, H. 1983. "Mass Media, Basic Education and Agricultural Extension." In H. Perraton and others, eds. *Basic Education and Agriculture Extension*. World Bank Staff Working Paper 564. Washington, D.C.
- Singh, R. N. 1983. "T&V in Chambal Command Area (Kota District): Some Observations." In *Background Papers: Workshop on Management of Transfer of Farm Technology under the Training and Visit System*. Hyderabad: National Institute for Rural Development.
- Slade, Roger H., and Gershon Feder. 1985. "The Monitoring and Evaluation of Training and Visit Extension in India: A Manual of Instruction." Washington, D.C.: World Bank. Processed.
- von Blanckenburg, Peter. 1982. "The Training and Visit System in Agricultural Extension: A Review of First Experiences." *Quarterly Journal of International Agriculture* 21, no. 1 (January/March): 6-25.
- Welch, Finis. 1979. "The Role of Investments in Human Capital in Agriculture." In Theodore W. Schultz, ed. *Distortion of Agricultural Incentives*. Bloomington: Indiana University Press.



---

---

# ISSUES IN MEDIUM-TERM MACROECONOMIC ADJUSTMENT

*Stanley Fischer*

**T**he strategy adopted in 1982 to deal with the world debt crisis has averted financial collapse at the cost of a sharp slowdown in growth and investment in the heavily indebted countries. The debtors' trade accounts have improved almost entirely through restriction of imports and barely at all through growth of exports. After three years, this austerity strategy has to change. The critical question is how the affected countries can restore growth while continuing to meet their debt servicing burdens.

That is the central question confronting the World Bank as it contemplates its new role as the driver of growth in the developing countries. It is best to start by distinguishing the return to capacity production, during which growth can be fast, from the determinants of longer-run capacity growth. There are no magic formulas for ensuring long-term per capita growth at Japan's rate in the 1960s of 10 percent or more or Brazil's rate in the 1970s of more than 5.5 percent. The correct perspective on growth includes a proper respect for compound interest. A growth rate of 3 percent per capita is 50 percent higher than a growth rate of 2 percent per capita. Small increases in growth rates make a big cumulative difference to the level of gross national product (GNP). With that said, there is much that can be done to foster long-term growth.

---

This article is based on a paper prepared for the World Bank's Conference on Macroeconomic Adjustment and Growth, Fredericksburg, Virginia, June 19–21, 1985. The author is grateful to Rudiger Dornbusch and to participants in the conference for their comments.

Table 1 presents data on the economic performance of the indebted developing countries for 1980–84. The countries are divided into two groups, one designated NP consisting of countries that did not suffer any debt servicing problems, the other designated P consisting of countries that did suffer debt servicing problems during this period. Each group accounts for about 43 percent of the total GNP of the developing countries.<sup>1</sup>

Three facts stand out. First, the success of the problem countries in reducing their current account deficits was achieved mostly through a reduction in imports, accompanied by a severe slowdown in growth caused by the world recession and tight domestic fiscal and monetary policy.<sup>2</sup> Second, the growth slowdown was accompanied by a reduction in the share of investment in GNP. Third, the inflation rate and

**Table 1. *Economic Indicators for Indebted Developing Countries, 1980–84***

<i>Indicator and group</i>	1980	1981	1982	1983	1984
Growth of GDP (percent)					
NP	4.9	5.1	4.0	5.4	5.7
P	3.9	1.1	-0.1	-1.9	2.0
Current account balance (billions of dollars)					
NP	-29.3	-45.9	-41.2	-33.8	-23.2
P	-47.7	-66.7	-61.7	-25.6	-14.7
Growth of export volume (percent)					
NP	7.2	4.8	0.4	6.6	12.4
P	2.2	1.8	-2.3	3.7	8.1
Growth of import volume (percent)					
NP	9.7	5.9	-1.9	3.3	7.0
P	4.3	2.8	-12.8	-15.5	0.4
Debt service/exports (percent)					
NP	11.0	12.7	14.6	14.4	14.9
P	26.9	33.8	41.6	36.2	36.6
Investment (percent of income)					
NP	29.3	28.2	27.0	26.7	26.2
P	25.8	25.2	23.0	20.5	18.6
Inflation (percent) <sup>a</sup>					
NP	15.3	12.7	9.7	9.9	10.7
P	45.7	46.4	48.2	73.0	89.0
Fiscal balance (percent of GNP)					
NP	-3.8	-4.3	-5.5	-5.4	-5.1
P	-1.9	-3.8	-4.4	-4.0	-2.4
Growth of money supply (percent)					
NP	27.8	22.3	21.0	20.8	21.2
P	45.5	55.0	55.4	72.0	84.7

*Note:* NP countries did not have problems servicing their debt; P countries did have problems.

a. Based on consumer price indexes.

*Source:* International Monetary Fund, *World Economic Outlook* (Washington, D.C., 1985), various appendix tables.

monetary growth rose rather than fell in the problem countries during the stabilization period.<sup>3</sup>

Even in 1984 the problem economies were growing at a rate that allowed for barely any increase in per capita GNP. Debt service payments remained high, with the ratio of debt service to exports still well above the 1980 level. The question of how to return to growth rates of GNP closer to the 5.5 percent of the 1967–76 period is especially pressing for these countries. It is also an urgent concern of other countries that were not primarily market borrowers and did not make the same current account adjustments, but that nevertheless must likewise contemplate no increases in capital flows in the years ahead, coupled with an end to the extraordinary 1983–84 growth of the U.S. economy and the slowdown in world trade in 1985.

The World Bank and the International Monetary Fund (IMF) call for structural adjustment to help restore growth.<sup>4</sup> The term is used in two senses, macro and micro. First, at the macro level adjustments to the structure of aggregate demand and supply have to be made in the heavily indebted countries to restore growth while generating current account positions consistent with reduced external resource flows. A heavily indebted country may have an external debt of 50 percent of its GNP, with an implied real interest burden of about 3 percent of GNP, half as large as the impact of the first oil shock.<sup>5</sup> If foreign capital flows are sufficient just to maintain the real value of the external debt, the country will have to maintain a trade surplus of 3 percent of GNP, with the debt-GNP ratio falling over time as a result of real growth.<sup>6</sup> The restoration of growth will require an increase in the share of investment in GNP, and other supply side measures to increase the efficiency with which existing capacity is used.

Policies to bring about structural adjustment in this macro sense are readily described. The first priority is to move resources into the net export sector, meaning primarily a sustained effective real devaluation. Given the need in most problem countries for extensive use of imported inputs, the emphasis will likely be on export expansion.

If the economy is at full employment, then either consumption or government spending has to be cut to make room for investment, for growth, and for net exports. Tight fiscal policy, in the form of reduced government budget deficits, is needed. The adverse distributional effects that come from such policies have to be weighted into the decision on how to make room for exports. Lower borrowing costs, and perhaps investment incentives, will contribute to the growth of capacity. Supply side fiscal policy may increase not only investment, but also labor supply and the propensity to save.

The volume of capital flows affects the extent of adjustment that has to be made and the prospects for growth. But going further into debt is not a useful strategy for many of the heavily indebted coun-

tries, whose primary need is rather to get out from under their current heavy debt and real interest burdens. Reductions in real interest rates that have taken place in 1985, and that would also follow further U.S. fiscal restraint, would do more to improve growth prospects in the debtor countries than would increased bank lending. The goal for the heavily indebted countries must be to reduce the burden of real transfers by reducing indebtedness over time. Developments of equity markets and other forms of nondebt capital flows will help in this direction, but the quantities involved cannot be expected to provide major relief over the next few years.

Structural adjustment is used in a second, micro, sense, corresponding to policy measures that increase the efficiency of the price system. It is argued that most of the developing economies need to undertake structural reforms in the liberalization of trade, in domestic pricing, in the financial sectors, in public enterprises, and in the fiscal system. This view is based in part on the Shaw-McKinnon thesis that financial liberalization played a key role in successful Korean economic development, in part on substantial research on trade liberalization, and also on general economic principles and the weight of experience in developing countries.<sup>7</sup> No doubt the U.S. political climate and the contrast between a dynamic U.S. economy in which deregulation has been a catchword, and a slow-growing regulation-encrusted Europe have contributed to this view.

Nonetheless, some experience with liberalization programs has been unfavorable (the Southern Cone), and micro adjustment can certainly impose short-run costs. The case for micro adjustment will have to be made for each country based on the details of its own particular distortions and on an analysis of the likely consequences of change. The general argument for liberalization will not, and should not, be sufficient to persuade responsible policymakers to move in that direction without judging the consequences. Macro structural adjustment can take place or may be essential in any economy, socialist or free market. If micro adjustment is interpreted very generally as providing incentives, through prices or otherwise, that match true economic costs and benefits, it too could take place in any economy. But there is no question that micro adjustment in principle implies a move to greater reliance on markets and *laissez faire*.

Governments that have been heavily intervening in the economy will find micro adjustment programs especially difficult to implement, because the government, after the initial changes, will have to do less, not more. The slogan for governments will eventually be, "Don't just do something, stand there." Because micro adjustment requires more of a change in approach than does macro adjustment, the case for particular reforms will have to be made by careful analysis rather than assertion.

The discussion that follows develops the argument outlined above. Because it is about growth and adjustment in general rather than in a particular country, it suffers from a lack of specificity. The adjustments that have to be made in particular countries in the next five years will depend on their structures and their past mistakes. There is no common model, and there is no single prescription that will apply to all of them. Certain problems, such as the need to maintain real exchange rates at appropriate levels, and principles, such as the need for greater efficiency through more reliance on markets, no doubt apply to all countries, but that does not reduce the need to focus on the specifics in each country.

---

Short-run adjustment to the debt crisis took place largely through restrictive aggregate demand policies and real devaluation that reduced the real wage. The real devaluation and fall in the real wage were secured in the short run by restrictive demand policy. A major medium-term question is whether the change in the real exchange rate can be maintained as output returns to its full-employment level. That in turn depends on whether the real wage, measured by domestic consumption, can be maintained.

### *Medium-Term Macroeconomic Adjustment*

#### *Real Adjustments*

Analysis of medium-term macroeconomic adjustment in principle requires a fully articulated model of the economy. Some large-scale econometric models of the industrial countries could be used to analyze both macro and micro adjustments in those countries. Computable general equilibrium models of developing countries can in principle provide similar information. Econometric models provide useful consistency tests of policy packages and continue to be used in central banks and treasuries. Prediction results are usually better than simple autoregressions, but not much.

It would be useful to work toward the creation of structural models of this type for developing countries. The difficulties are easy to state. But the models are useful precisely because they force the analyst to set out the structure of the economy and to focus on the relationships that determine the outcome of policy changes.<sup>8</sup> The development of such models—the sophistication of which will differ among countries—will take time. But even small-scale models focus the discussion of policy measures and the analysis of different approaches.

The failure of large-scale econometric models and computable general equilibrium models to match up to naively optimistic hopes has led to a reaction against modeling in general and large-scale modeling in particular. The lessons to draw are twofold. First, sophisticated use

of models requires not taking them too seriously. All models, large or small, at best provide a possible scenario of policy changes. That scenario should itself be the subject of critical analysis before it is used in policymaking—and this point is surely well known. Second, until consistent models incorporating both real and financial sides of the economy at an appropriately disaggregated level are available, smaller-scale models focusing on particular aspects of development and stabilization should be used. The alternative of forsaking models altogether and relying on general principles to guide advice giving and policy evaluation is not feasible: policy cannot be evaluated without counterfactuals, and counterfactuals require the use of either an explicit or an implicit model.

To analyze macro adjustment, it will be useful to work at two levels: a medium-term real model that produces paths of real activity consistent with the paths of the trade account and budget that are needed over the next two years, and a shorter-term model incorporating both the real and financial sectors.

### *The Real Model*

The purpose of the real model is to focus on medium-term real resource adjustments. Depending on the economy, the level of aggregation would involve four or five producing and consuming sectors, such as agriculture, services, natural resources, and a slightly disaggregated industrial sector.<sup>9</sup> The model would embody production functions, adjustment lags in moving resources between sectors, net export constraints, factor supply constraints, and (optionally) a utility function.

Target paths for the composition of supply and demand can be chosen either exogenously or by maximization of the utility function. These target paths would imply policy measures needed to achieve the desired adjustments. This section discusses the likely outcome of such an analysis, applied to a country whose primary problems are external balance and low domestic output relative to capacity.

To the extent that substitution is possible—and over a period of years substitution is possible—efficient structural adjustment to reduce the current account deficit will require a rise in the relative price of tradables. The process has to start with a real devaluation. With short-run substitution limited, domestic production costs will rise following a devaluation. Differential exchange rates for imported consumption goods and inputs can ease the effects of devaluation on domestic production costs, but such subsidies have to be temporary if they are not to inhibit substitution.

Generally, the adjustments will imply an initial cut in real wages, followed by later increases as productivity rises. The acceptance of

real wage cuts will usually be an important part of the adjustment program. If there is indexing of wages, it will be necessary to adjust the base wage downward. Incomes policy may be a means of reducing adjustment costs to the new structure of supply and demand.<sup>10</sup> Real wages appear to have been remarkably flexible in the early stages of adjustment in the large debtor countries. Whether such flexibility will remain as the economies move closer to full employment remains to be seen. But without such flexibility, a situation of permanent unemployment or underemployment becomes likely, as it has in Europe.<sup>11</sup>

Over a longer period, the resumption of real growth will depend on increasing the capital stock. The restoration of investment thus becomes an important goal of policy in both the short and long runs. In the short run renewed investment, particularly for export and import substitution, reverses the austerity that has hitherto accompanied balance of payments adjustment. Investment is just as important on the supply side for longer-term growth.

An initial target path of investment would be determined in the real optimizing analysis described above. Such a path could be modified in the light of knowledge of the investment process in the country. The target path of investment would be achieved in part through direct government investment, and in part through private investment responding to market incentives. Private investment is determined by the cost of capital and by the prospects of future profits and sales. The cost of capital will be determined in the first instance by the world interest rate. The cost of investing domestically will differ from the world interest rate to the extent that domestic capital markets are insulated from world markets and that domestic investment is subsidized. Profit and sales prospects depend on the real wage and, for exports and import-competing sectors, on the real exchange rate that firms expect over the life of their projects. Realistic real exchange rates are thus crucial for both investment and the balance of payments.

Two important issues arise in connection with investment. The first is the extent to which foreign direct investment is to be encouraged. This is a potentially important means of securing foreign capital inflows without incurring formal debt obligations; it may also be an efficient means of acquiring technology and thus increasing productivity. Of course, the encouragement of foreign investment carries an implicit obligation to permit future profit remittances. This obligation has the advantage of being closer to equity than to debt financing.

Second, as is by now well known, investment does not make a spectacular direct contribution to growth. Assuming a marginal product of capital as high as 15 percent, an increase of one percentage point in the share of GNP invested will raise output in the next year by 0.15 percent, implying an increase in the one year growth rate of 0.15

percent.<sup>12</sup> A major investment effort that raised the share of investment in GNP by five percentage points would raise the growth rate by 0.75 percent, given a 15 percent rate of return to capital. But recall that an increase in the growth rate of per capita output from 2 percent to 2.75 percent is large.

An important issue on the supply side is how rapidly to attempt to phase in the new structure of supply. The faster the new capacity is in place, the better from the viewpoint of employment. Since a real devaluation will have taken place at the beginning of the program, the main incentive to move resources into the tradables sector is in place immediately. The second necessary incentive for investment—the expectation of future sales and profits—depends both on export conditions and on expectations of the domestic market. With a sufficiently devalued exchange rate, and for a small country that does not produce primary goods, foreign demand can be assumed. But to the extent that investment is for the domestic market, sales expectations will not be high during a recession at the beginning of the adjustment process. A decisive real devaluation combined with investment incentives will contribute to aggregate demand. The supply side effects of the investment will take several years to manifest themselves.

In the meantime, so long as the operation of existing capacity provides positive rents, that capacity should be kept in operation by its existing owners without any subsidy. Rather than being unemployed, some labor can be kept at work using existing capital. There are two dangers in this approach. The first is that the owners of the capital will be receiving very low rates of return and will likely claim it is essential they be given relief—otherwise they will go out of business. Of course, they should go out of this business over the course of the next few years, but it remains likely that relief will be given, perhaps in the form of subsidies. Ending such arrangements is notoriously difficult.

Second, it is likely, if full employment is maintained, that real wages will not fall, thus hampering adjustment in the structure of production. Prodding from external critics may help prevent inefficient subsidies. Nonetheless, the likelihood that an adjustment program can begin without unemployment is sufficiently small that the possibility of operating existing capacity until it goes out of use should not be wasted. Further, given the sensitivity of investment to demand, a smaller recession at the beginning of the adjustment program may result in a more rapid rate of investment.

Given the expected level of output, policy has to produce the required composition of demand. Target net export levels are implied by the availability of capital inflows and by the stock of debt that determines interest payments. Given the level of output and the real product wage, net exports are determined by disposable income, the

real exchange rate, and foreign demand. Given combinations of the real exchange rate and disposable income will thus be consistent with the balance of payments constraint.<sup>13</sup> Desired rates of investment have already been calculated from the optimizing analysis. The target rates of investment may require investment subsidies. Fiscal policy has to ensure that government spending on goods and services and government revenues will be in balance.

### *The Speed of Adjustment*

This basic analysis of medium-term adjustment focuses on the allocation of real resources. It also produces dynamic time paths for the major macroeconomic variables. As argued by Killick and others (1984), an economic optimizing analysis is likely to produce smooth adjustment paths. Economic logic typically points in the direction of gradualism. Political logic may not. For instance, if there are costs of adjusting consumption, an optimizing analysis might imply a declining level of consumption over several years. It would likely be easier politically to apply shock treatment that sharply reduces consumption immediately, followed by a gradual rise.<sup>14</sup>

Speed is an issue particularly at the beginning of an adjustment program. Suppose that instead of having adjustment forced on them, countries had realized in 1980 that they had to improve their current accounts. Should they then have devalued sharply, or should they have moved gradually toward the new equilibrium real exchange rate? An economic optimizing analysis would imply that resources should move gradually into exports. But to provide the right incentives for them to do so, the real exchange rate might have to move quickly to its new devalued level. Furthermore, the typical optimizing analysis does not include the difficulty of securing a reduction in the real wage. It is entirely possible that substantial real wage flexibility can be obtained only in a crisis atmosphere, thus making a case for shock treatment. With shock treatment growth turns rapidly negative, and then becomes positive, perhaps even quite fast, as the recession turns into recovery. With gradualism the government is required to maintain restrictive policies that may reduce GNP for year after year over several years. To the extent that the growth rate rather than the level of output or the level of consumption affects public sentiment or voting, shock treatment may be more effective despite its adverse short-term effects on income distribution.<sup>15</sup>

In brief, if a real devaluation is needed for long-run balance of payments equilibrium, it is almost certainly better done immediately at the beginning of an adjustment program rather than gradually. The trouble with gradualist policy is that the very feature that makes it attractive to policymakers—painful measures can be put off until

later—makes it likely that the painful measures will not in fact be implemented when the time comes.

### *Sectoral Details*

The time paths resulting from a dynamic optimization serve only as a general guide to policy. The overall description of the adjustment process implied by an aggregative optimizing model would have to be supplemented by detailed partial equilibrium descriptions of the components of supply and demand. On the supply side, labor supply and demand and investment projections should be presented over a four- to five-year horizon, in greater sectoral detail than is possible in a tractable optimizing model. The implied uses of imported inputs should also be described in detail, since these frequently account for the major share in imports.

Detailed external sector accounts should also be presented, taking into account imports not only of raw materials and machinery, but also consumption goods. Export projections are particularly difficult, but they have to be made.

Government budgets should be prepared for the four or five years of the adjustment program, consistent with the overall magnitudes of government spending and revenues implied by the preceding analysis. The four- and five-year projections are unlikely to be fulfilled. But that does not mean they should not be made: current decisions depend on the direction in which the economy should move. The plans have to be adjusted frequently as new conditions develop.

This real side planning projects quantities and key price variables: the real exchange rate, the real wage, and the cost of capital. The real exchange rate plays the central role in ensuring that the balance of payments constraint is met; the responsiveness of the trade account to the real exchange rate over time is well established. The real exchange rate should be high on any list of variables to be monitored in evaluating the progress of a structural adjustment program.

### *Inflation and Finance*

With the target paths for real variables in hand, the analysis can turn to the shorter-run, more aggregated dynamic macro model to study the macroeconomic effects of policy decisions at the start of the program. Essential in any such model is the balance of payments debt constraint, the government budget constraint, a description of the assets markets, and wage and price formation.<sup>16</sup> Many models of this type exist. An example, combining detail on both the real and financial sides, is Khan and Zahler (1983), in which, however, the financial sector is mainly described by the supply and demand for money.

Such a model can be used to assess the relation between structural adjustment and inflation stabilization. This is mainly a Latin American issue. Whether inflation stabilization should be part of the structural adjustment program is a complicated issue.<sup>17</sup> Structural adjustment can take place in a high and reasonably stable inflation environment, as Brazilian experience in the early eighties suggests. But high and stable inflations are relatively rare.

The record of IMF stabilization programs is that they succeed in improving the balance of payments relatively quickly but have no success in controlling inflation because corrective fiscal action typically raises prices as subsidies are reduced (Donovan 1981). Because high and unstable inflation rates are economically disruptive, there may in particular countries be a case for attempting to disinflate in the early stages of a comprehensive economic reform and restructuring package. Coordinating the inflation reduction with structural adjustment complicates the analysis of a program and particularly complicates monitoring. The fixing of the nominal exchange rate may be part of such a package, significantly increasing the danger of real appreciation incurred in an attempt to control inflation—ending instead with failure to meet either the balance of payments or the inflation targets. Nonetheless, the Israeli and Argentinian experiences of 1985 raise the possibility that stabilization and structural adjustment can be carried out simultaneously and may even be mutually reinforcing.

Given the division of labor between the World Bank and the IMF, any structural adjustment program that included an inflation target would have to be a joint venture. An alternative to a joint program would be two successive programs, one lasting a year or two, to correct the existing balance of payments and inflation problems,<sup>18</sup> one lasting longer to achieve structural adjustment.

However, two would be worse than one in this case. Structural adjustment measures should be taken early rather than put off until the inflation problem is solved—and in any event reducing the budget deficit for structural reasons is also anti-inflationary. It will sometimes be necessary to combine structural readjustment with inflation stabilization. This would mean modifying the target paths of output, employment, and budget for consistency with a sharp reduction in the inflation rate; the case for shock treatment is never as strong as when the inflation rate is in the three-digit range.

Monetary policy analysis is in any event needed in all adjustment programs, whether or not a major anti-inflationary program is to be part of the initial effort. Monetary analysis can start from the government budget. With both taxes and government spending determined in the real analysis, and with the external deficit given, total real domestic credit creation is known. The corresponding rate of growth

of nominal credit or money depends on the target inflation rate. An independent monetary policy may be possible in countries with reasonably developed securities markets. Monetary policy may then have some—probably limited—ability to affect the real interest rate. The extent to which domestic rates can differ from world rates will depend on the mobility of financial capital.

In all likelihood, the policies needed to stabilize on the real side will imply a budget surplus or only a small deficit, which would remove the budgetary need for inflationary finance. This provides room for a monetary policy that is directed to inflation stabilization. A choice will have to be made about the nominal anchor to be used in determining the price level. Nominal credit, nominal money, or the nominal exchange rate are all potential targets; the actual choice would depend on the financial structure of the country. The behavior of nominal wages is the key to early success. Incomes policy or wage agreements, which are backed up with restrictive aggregate demand policies, are the most promising strategy for avoiding unnecessary unemployment.

A significant issue is whether the country permits domestic firms to borrow freely in international capital markets. If domestic firms borrow abroad, the government generally becomes the implicit guarantor of the loans. There is accordingly reason to control such borrowing. A second reason to control foreign borrowing is that capital account transactions may significantly affect the real exchange rate, the level of which is key to the success of the adjustment program. For example, the capital inflow problem commonly suffered in the late seventies by countries that attempted to stabilize the inflation rate was in part responsible for their real exchange rate appreciations. Liberalization of the capital account early in an adjustment program seriously complicates economic management.

The preceding analysis produces a broad description of the allocation of resources and policies needed to bring about structural adjustment in the economy. There is also a more detailed partial equilibrium description of both policies and the allocation of resources on a sectoral basis, attending also to monetary and exchange rate policies. All these programs or plans would be expected to extend over a period of four to five years.

The likelihood that any such plan will come close to being fulfilled beyond the first year is extremely slight. Policy mistakes or other shocks will ensure that the plans soon become irrelevant.<sup>19</sup> But the plans are nonetheless essential in undertaking structural adjustment, to ensure the consistency of policy measures, and to ensure that there is a serious prospect of meeting balance of payments and growth targets. Such a plan provides a baseline from which to judge events and to justify deviations that will inevitably be needed.

Micro structural adjustment aims to improve the efficiency of the price system and the allocation of resources by reducing tariffs and import quotas; by moving to unify exchange rates; by eliminating the differential taxation and subsidization of particular sectors or industries, such as agriculture; by restoring efficiency to public investment; by dealing with the inefficiencies in public sector corporations, perhaps by selling them; by liberalizing financial markets; and by improving the efficiency of the fiscal system. This approach prompts four preliminary comments.

First, detailed calculations typically imply that the welfare costs of such inefficiencies amount to a small percentage of GNP. Removing them seems hardly worth the bother. But if all the inefficiencies together amount, say, to 5 percent of GNP, then removing them permanently brings a gain equal to the present discounted value of 5 percent of GNP in perpetuity, or about a year's GNP. That is worth bothering about and should be weighed against temporary transition costs.

Second, part of the gain from implementing such reforms will take the form of greater flexibility of the economy in responding to shocks and to incentives. The notion is that an economy with a well-functioning price system is one that permits rapid change. The finding that export-oriented economies adjusted more easily to external shocks is consistent with this view (Balassa 1983). The view has been strengthened by the stylized representation of the economic success of the United States in the last few years and by textbook indoctrination. Although the hard evidence for this view is difficult to bring to court, flexibility is a likely gain from liberalization.

Third, many of these inefficiencies may be very difficult to dislodge. Tariffs, subsidies, and quotas are not the sole preserve of the developing countries. Public sector corporations operate inefficiently in many countries. Financial systems are strictly regulated, and for good reason, in many countries. This is not to justify most restrictions, but rather to suggest they have deep political roots and that they will therefore not yield easily in a structural adjustment plan.

Fourth, such programs have to be sold to developing countries: because the payoff is delayed and there are immediate costs of undertaking structural reform, a reasoned argument has to be made for the likely benefits. Partial equilibrium analysis takes the argument a long way. Larger-scale models may be useful here, too.<sup>20</sup> Without such analyses, governments are being asked to impose possibly substantial short-run costs for unknown long-run benefits.<sup>21</sup>

Rather than discuss the full range of micro structural adjustments, I will focus on financial and trade liberalization. Financial liberalization in developing countries can take the form of deregulating the domes-

tic financial sector and may go further by allowing free international capital movements. Domestic financial systems are likely to be oligopolistic, in which case the key regulatory reform will be permitting entry into the industry. But total deregulation of financial systems will not and should not happen. The failure of private financial institutions always ends with government intervention. Private institutions rely on this intervention and for that reason alone have to be regulated.

Suppose that deregulation succeeds in raising the return earned by lenders (depositors) and reducing the cost of borrowing. How would growth and the allocation of resources be affected? The optimistic view is that the higher lending rate increases saving and the lower borrowing rate increases investment. The less optimistic view is that financial deregulation moves financial intermediation into banks from curb markets (van Wijnbergen 1982). There is little evidence in industrial countries that savings rates are positively related to the rate of return. If saving does not respond to the rate of return, then any increase in investment resulting from a lower cost of capital will in the short run imply an increase in the trade deficit. Increasing investment is probably desirable, but there is a tradeoff with the external balance.

Calculation of the effects of financial deregulation on the economy would start by estimating the change in the deposit rates paid by banks and in the rates charged for loans. The effects of such changes on the demand for money and other assets, and on the demand for investment goods, could be estimated from existing demand functions, and their general equilibrium implications derived from an econometric model. But deregulation might have more far-reaching effects, such as innovation in the form of deposit, in the geographical extension of the banking system, and perhaps in the kinds of borrowers reached. These effects simply cannot be estimated until there has been considerable experience with this type of deregulation. Even then, there will be no simple way of feeding the effects into a structural model and deriving the implications. One potentially serious consequence that has to be considered is the loss of seigniorage.

In the case of financial deregulation, as with most micro structural adjustments, there is a large incalculable element in predicting the results of change. Financial and airline deregulation in the United States provide good examples. Economists believed the system would work better with less regulation, and events have borne out that belief. But economists did not predict the details of airline development, particularly the hub-and-spoke pattern of operation. One important feature of better operation of the system was increased innovation—and what and how much innovation there will be is almost by definition incalculable.

The freeing of international capital movements is a more advanced stage of financial deregulation. The freedom may extend to allowing foreign banks to operate in the domestic market. Freeing of the capital account can complicate domestic policymaking. It is not advisable in an economy that is trying to stabilize the inflation rate, since small changes in confidence can have big effects on the exchange rate.<sup>22</sup>

The issue of capital controls over domestic residents is an extremely serious one, closely connected with the problem of capital flight. Optimal portfolios are widely diversified internationally. It would not be surprising (from the viewpoint of individual optimization), if 20–40 percent of the portfolios of residents of developing countries consisted of foreign assets. As a counterpart, residents of the industrial countries will hold larger parts of their portfolio than they do now in assets of developing countries. Until a new equilibrium is reached, large capital outflows (which would be classified as capital flight) can be expected in response to changes in exchange controls in developing countries. They could be on a scale that would dominate exchange rate movements. For that reason, free capital movements should be permitted only late in a liberalization program.

The effects of trade liberalization should in principle be easier to calculate than those of financial liberalization, particularly if the liberalization takes the form of reducing tariffs. Across-the-board tariffs and export subsidy changes can be translated into implied changes in the effective exchange rate. The effects of specific tariff cuts on the domestic prices of imports can also be calculated and, given demand elasticities, so can their effects on import demand. The effects of changes in quota restrictions on the trade balance may be more difficult to calculate unless estimates of demand elasticities for the affected goods can be derived on the basis of experience outside the quota restriction period.

Beyond the direct effects of trade liberalization on imports and exports, there is the possibility that the opening of the economy to competition will increase the productivity and creativity of local producers to new heights. Much experience is needed, however, before such effects can be quantified.

Micro structural adjustment effects can be calculated for the lifting of subsidies and for changes in the tax system. The effects of selling off public enterprises or improving the efficiency of public investment, however, will be difficult indeed to estimate quantitatively. Nonetheless, there is a strong case for selling off many enterprises that are in the public sector purely as a result of historical accidents or past failure. In principle, such enterprises could be operated efficiently in the public sector. But, in fact, political pressures to maintain or create jobs will exist and are in themselves a good reason to move public enterprises into the private sector, even giving them away if necessary.

Enterprises that need to be regulated because of economies of scale, such as public utilities, present more difficult issues. The primary need is to reduce the drain on the budget typically associated with such companies. At a later stage, plans for selling and regulating such companies can be considered. Also tied up in discussion of large-scale public enterprises is the issue of foreign ownership when domestic capital markets are not sufficiently large or competitive to make sale of the enterprise possible.

---

**Action  
Points**

The World Bank in the next few years will be moving into new territory in dealing with long-term growth. There will be a need for research to address serious gaps in knowledge about the subject. There is also a need to consider the form of agreements on structural adjustment between the international institutions and the participating countries.

The modeling of macro structural adjustment programs poses no particularly difficult conceptual issues. The lack of data and the possibility that a large variety of models will be needed will make the job long and difficult in practice. Key parameters, such as the supply and demand elasticities of imports, adjustment lags in investment, and the nature of wage behavior, may be difficult to pin down with existing data. The best available may in the end not be very good. But models can be estimated and will be useful in medium-term policy evaluations.

The monitoring strategy for macro structural adjustment programs will have to be contingent, because there is no prospect that a four- or five-year program will or should be carried out as originally intended. The several-year horizon of the program is needed to ensure that actions taken at the beginning are consistent with longer-term adjustment, not because it is advisable to set a long-term plan in concrete.<sup>23</sup>

The agreement under which a government enters a structural adjustment program should specify the goals and the actions expected of the government in the first two years of the plan. It should also describe the expected path of the government's actions over the remaining three years. The required actions would be both fiscal and monetary. The behavior of the real exchange rate will be a centerpiece of any adjustment plan and a key variable in determining its success.

For its part, the World Bank should spell out its assumptions about the international economy and its expectations about the paths of target variables that the required policy changes will produce. These stipulations will make it easier for the Bank and countries to agree on adjustments to policy in the later years of the programs. The Bank should view performance that falls short of the agreed target because of unexpected developments in the international economy differently

from shortfalls caused by the failure of the government to meet its fiscal targets for domestic political reasons.

Monitoring would in the first instance examine the execution of monetary and fiscal policy actions. But the behavior of target variables—such as the real exchange rate, the current account, and investment—should also be monitored. Policy variables will have to be adjusted if target variables are off course.

As far as macro structural adjustment is concerned, monitoring and conditionality could essentially follow IMF practice, except that a larger range of variables should be monitored and the program is for a longer term. The latter feature makes contingent planning and recontracting essential.

A basic issue is whether the Bank should commit itself (subject to the good behavior of the recipient country) to a multiyear macro structural program or whether it should instead make a series of one-year loans renewable on good behavior. Because the recipient country is probably undertaking a substantial adjustment program with very little initial payoff, the Bank should be willing to commit, conditionally, for several years.

Micro structural adjustments can in some cases be fit into the same framework as macro adjustments. For instance, the removal of subsidies, tariffs, or quotas can be specified as agreed upon actions to be taken at particular times. Execution of these actions can be monitored. Their quantitative effects can be estimated and incorporated in the basic econometric model.

Even in these cases, though, agreement on policy actions may be difficult to reach. In many countries, for instance, agricultural subsidies are a key political issue. Tough negotiations can be expected over any adjustment program that attempts to remove these subsidies, economically expensive and inefficient as they may be. The Bank would then be in the position of bargaining over acceptable levels of these distortionary policies. Similar remarks apply to tariffs. In these cases the economic rationale for the change is clear, and the Bank can push for change almost uninhibitedly—the only inhibitions arise from possible adverse income distribution effects.

But, at some point, the main aim of the structural adjustment program begins to get lost. The aim is to restore growth while meeting balance of payments constraints. A complete program to maximize growth includes many elements, and the Bank will have to decide where to focus its efforts. The fundamentals are included in the macro program. Some elements of micro programs—for example, the removal of wasteful subsidies—will be very productive, and the Bank will want to push for them. The benefits of others, such as the divestiture of government corporations, may be small and difficult to establish. If the Bank is to be effective, it will have to establish

priorities among these micro policies, for by insisting on too many of them it may get none.<sup>24</sup>

Among the research projects suggested by this review, two are key: (a) the building of medium-term models of individual countries, first small real models and then models with developed financial sectors and nominal price determination features, and (b) research to establish the magnitude of welfare gains to be expected from the range of micro structural adjustment programs currently being discussed in the Bank.

---

### **Abstract**

Four years after the onset of the world debt crisis, the issue is how to restore growth. The answer is structural adjustment, both macro and micro. At the macro level, adjustments have to be made to the structure of aggregate demand and supply to restore growth while generating the needed trade surpluses. This means primarily real exchange rates that are maintained at appropriate levels and an emphasis on investment. At the micro level, it is argued that most developing countries need to liberalize trade, allow the price system to operate, develop financial systems, reform taxes, and improve the efficiency of public enterprises, perhaps by selling them. The article discusses the nature of these two types of reforms and the policy and research issues relevant to World Bank analysis of growth programs.

---

### **Notes**

1. The following countries are included in the P group: Argentina, Bolivia, Brazil, Central African Republic, Chile, Costa Rica, Dominican Republic, Ecuador, Guyana, Honduras, Jamaica, Liberia, Madagascar, Malawi, Mexico, Morocco, Nicaragua, Niger, Nigeria, Pakistan, Peru, Romania, Senegal, Sudan, Togo, Turkey, Uganda, Uruguay, Yugoslavia, Zaire, and Zambia.

2. Here it is the comparison between the P and NP countries that points to fiscal tightness in the former. The extent of the fiscal contraction in the problem countries is understated by the data in Table 1, which are for the actual and not the full-employment budget deficit.

3. The data on inflation and money growth are affected by the high levels of both variables in a few, particularly Latin American, countries. Median inflation and money growth rates tended to fall over the period 1980-84.

4. Structural adjustment loans (SALs) have been made by the World Bank since 1980. For a stimulating analysis of the issues raised by such loans and programs, see Yagci, Kamin, and Rosenbaum (1985). Killick and others (1984) provide a preliminary evaluation and defense of structural adjustment programs. The IMF's *World Economic Outlook* (1985), pp. 181-87, discusses structural policy measures for the developing countries.

5. Balassa (1983) calculates that external shocks were about 6 percent of GNP for developing countries between 1974 and 1978.

6. The more decisive the structural adjustments made by a particular country, the greater the share of capital flows to developing countries that it will attract. Whether there will be an overall increase in flows to developing countries, and at what interest rates, depends to a considerable extent on fiscal policy in the industrial countries. If European governments succumb to the lure of fiscal stimulus, while (given uncertainties about Gramm-Rudman) the United States makes no decisive attack on its deficit, total flows to developing countries at existing interest rates would be reduced rather than expanded.

7. For a review of models of financial repression, see Fry (1982).
8. The famous Lucas econometric policy evaluation critique has been associated with a falloff in academic interest in large-scale econometric models. The Lucas critique describes a theoretical possibility rather than a documented cause of model failure. It further does not imply that appropriately specified econometric models cannot be used for policy analysis.
9. The structure of production in Hwa and Cherif (1985) is along these lines, but more disaggregated.
10. Reductions in payroll taxes or temporary wage subsidies can ease the burden on the wage earner. To the extent that such tax cuts are possible without violating budget targets, they are of course desirable. But it is not possible always both to reduce budget deficits and compensate all losers from the necessary structural adjustments.
11. Whether there will be recorded unemployment or underemployment or a return of workers to the rural sector depends on the details of the labor market in the particular country.
12. It would, however, be rare for an investment project to yield 15 percent in the first year after it is initiated.
13. I will take up below the relationship between the exchange rate and capital flows, and will suggest that an effort be made to insulate the real exchange rate from temporary capital account influences.
14. Two points here. First, it would take a genuine cost of changing consumption to produce the adjustment pattern described in the text. If consumption smoothing came purely from a concave utility function, then consumption would optimally adjust completely and immediately to any permanent shock. Second, economists may be wrong in their assumptions about desirable adjustment paths if the political process indeed more readily accommodates sharp cuts in consumption than gradual ones.
15. Voting in U.S. presidential elections seems to be affected primarily by the growth rate of real output in the year before the election, rather than the level of output. The outcome of the 1984 election supports this view.
16. Corbo (1986) emphasizes wages and the Phillips curve as determining prices. This explicit approach is generally preferable to the monetary approach in which price dynamics are implicit in the specification of adjustment lags in real money demand.
17. Krueger (1981) examines aspects of the relationship between inflation and real adjustment.
18. This still leaves the IMF with responsibility for an inflation stabilization program.
19. Systematic research on past plans' successes and failures, dismal as such backward-looking work may be, will have high payoffs in teaching how to avoid similar mistakes in future.
20. For example, Feltenstein (1980) and Khan and Zahler (1983).
21. Several conference participants claimed that since the benefits are mainly dynamic, it is difficult to evaluate them. That may be so, but then a positive argument has to be made for believing the benefits exist.
22. This problem is analyzed in the Israeli context in Bruno and Fischer (1986).
23. It would be useful to conduct a review of the various five-year plans that have been adopted by developing countries to study the successful and unsuccessful strategies followed in those cases.
24. The more ambitious and detailed the structural adjustment plan, the greater the strain on economic analysis and decisionmaking capacities in the affected country. Economic expertise and political will are also scarce resources to be allocated efficiently in the execution of economic policy.

---

## References

- Balassa, Bela. 1983. "The Adjustment Experience of Developing Economies after 1973." In John Williamson, ed. *IMF Conditionality*. Cambridge, Mass.: MIT Press.
- Bruno, Michael, and Stanley Fischer. 1986. "The Inflationary Process in Israel: Shocks and Accommodation." In Yoram Ben Porath, ed. *The Economy of Israel: Maturing Through Crisis*. Cambridge, Mass.: Harvard University Press. Forthcoming.
- Corbo, Vittorio. 1985. "International Prices, Wages and Inflation in an Open Economy: A Chilean Model." *Review of Economics and Statistics* 67, no. 4 (November): 564-73.
- Donovan, Donald J. 1982. "Macroeconomic Performance and Adjustment under Fund-Supported Programs: The Experience of the Seventies." *IMF Staff Papers* (June): 171-203.
- Fel'denstein, Andrew. 1980. "A General Equilibrium Approach to the Analysis of Trade Restrictions with an Application to Argentina." *IMF Staff Papers* (December): 749-84.
- Fry, Maxwell J. 1982. "Models of Financially Repressed Developing Economies." *World Development* (September): 731-50.
- Hwa, Erh-Cheng, and M'Hamed Cherif. 1985. "A Proposed Medium-Term Model of Structural Adjustment for Colombia." Washington, D.C.: World Bank, Economic Analysis and Projections Department. Processed.
- Khan, Mohsin, and Roberto Zahler. 1983. "The Macroeconomic Effects of Changes in Barriers to Trade and Capital Flows: A Simulation Analysis." *IMF Staff Papers* (June): 223-82.
- Killick, Tony, and others. 1984. "Towards a Real Economy Approach." In Tony Killick, ed. *The Quest for Economic Stabilisation*. London: Heinemann Educational Books.
- Krueger, Anne O. 1981. "Interactions between Inflation and Trade Regime Objectives in Stabilization Programs." In William R. Cline and Sidney Weintraub, eds. *Economic Stabilization in Developing Countries*. Washington, D.C.: Brookings Institution.
- van Wijnbergen, Sweder. 1982. "Stagflationary Effects of Monetary Stabilization Policies." *Journal of Development Economics* 10 (April): 133-69.
- Yagci, Fahrettin, Steven Kamin, and Victoria Rosenbaum. 1985. *Structural Adjustment Lending: An Evaluation of Program Design*. World Bank Staff Working Paper 661. Washington, D.C.

---

# SHELTER STRATEGIES FOR THE URBAN POOR IN DEVELOPING COUNTRIES

*Stephen K. Mayo*  
*Stephen Malpezzi*  
*David J. Gross*

Cities in developing countries are growing at rates that are extremely fast by historical standards: from 2 to 10 percent a year. At such rates, by the year 2000, more than 2 billion people will be living in cities and towns in developing countries, three times the number in 1970. The United Nations projects that twenty of the world's twenty-five largest cities in 2000 will be in developing countries (United Nations 1984). The people in these cities are poor. In 1980, over 200 million city dwellers in developing countries were estimated to be living below an absolute poverty threshold; by 2000, this number is expected to double (World Bank 1980, p. 30).<sup>1</sup>

Coping with rapid urban growth and widespread poverty strains the resources and imagination of even the most accomplished governments. Yet governments often hinder their ability to deal with such problems because they misunderstand how the urban economy works and thus do not employ the right policies and programs. This is especially true of housing. Even the most casual empiricism can confirm that housing policies in many developing countries are inefficient and inequitable.

This article examines ways to improve strategic planning and project design in housing in developing countries. It starts by discussing some common perceptions of housing problems and the common, yet

---

This paper was prepared for the annual meetings of the American Real Estate and Urban Economics Association, New York, New York, 1985. The authors are grateful for helpful comments on an earlier draft of this paper which were received from Alain Bertaud, Jim Follain, and Bertrand Renaud.

often facile, solutions. The article reviews recent evidence on how housing markets in developing countries actually work and evaluates current public policies in urban land and housing markets. The final section suggests ways in which policy could be improved.

---

***Common  
Problems,  
Common  
Solutions***

Many housing problems can be stated simply, and their solutions may therefore appear simple; unfortunately, facile solutions often compound the problems.

*Problem:* There is a perceived shortage of housing.

*Common solution:* Government should build housing. This is usually the wrong solution. Housing shortages, when they exist, are the results of fast growth in demand and of impediments to the supply of housing. Governments do not, in general, respond to demand faster or more efficiently than private markets. But they can do much to mitigate or remove market imperfections.

*Problem:* The quality of housing is poor.

*Common solution:* Raise standards through stricter building codes and better enforcement. This, too, is often the wrong solution. Standards, where they are enforced, usually have little to do with basic structural soundness or hygiene. Even those standards that are related to safety and hygiene are relevant only if they are attainable by the bulk of the population. Most standards, derived from Western codes, are not. Standards and codes should focus on basic requirements for safety and health. Further improvements will come as development proceeds and incomes rise, provided regulations do not actually prevent upgrading.

*Problem:* There are too many squatters. Many poor people live on public or private land, contravening land use controls and similar laws.

*Common solution:* Clear the squatter areas. For many reasons this can be the wrong solution. When people are moved off land, they go somewhere else. Slum housing represents a large part of the poor's capital stock; destroying capital is not a good prescription for development. And informal housing is sometimes of surprisingly high quality. Policies can be adopted that improve conditions more cheaply and for more people than clearance programs, even when such programs include new public construction.

*Problem:* The price of housing is too high for many families.

*Common solution:* Control rents and the price of land and building materials. This is usually the wrong solution. When housing prices rise faster than prices in general, that is a signal to the market to produce more housing relative to other goods and services. Such price increases are transitory unless the market is prevented from adjusting because of shortages of inputs, excessive government regulation, and

similar restrictions. It is far better to deal directly with the causes of rising costs, rather than try to shift the burden of adjustment to landlords, who will then reduce the quantity of housing and land for rent, thereby exacerbating the very problem controls were supposed to solve.

---

In developing countries, those who make housing policy are often planners by training. Planners tend to see housing in terms of “housing needs,” defined as minimum acceptable physical standards of housing and infrastructure. “Needs assessments,” based on such standards, are used to establish the basic requirements of a country’s housing strategy—amount, quality, location, and cost.<sup>2</sup> In practice, such assessments are often inadequate guides to policy, because they do not include a realistic assessment of the resources available, nor consider people’s ability and willingness to pay for housing.<sup>3</sup>

An alternative to planning on the basis of housing needs is to consider the effective demand for housing—essentially a needs assessment backed up by an analysis of people’s willingness and ability to pay. In contrast to normative definitions of housing needs, the definition of effective demand is positively based on the behavior of individuals, as shown by surveys of how much they actually spend on housing and other goods and services. These are related to measurable influences on spending, such as income and family size, the price of housing compared with other goods and services, and the state of the housing market (including, for example, the general level of economic development, inflationary expectations, and the existence of government policies such as rent control, which might influence spending on housing). Policies derived in this way have an inherently greater chance of success than do those based on rather arbitrary normative standards.

Less than a decade ago, there was only a handful of empirical analyses of housing demand in developing countries, and even fewer that tried to compare patterns of behavior across countries. As recently as 1977, for example, Burns and Grebler called their seminal cross-country study of housing consumption “a first effort to chart new territory” (p. 47). Since that time the pace of research has grown. Studies by Follain, Lim, and Renaud (1980), Ingram (1984), and Jimenez and Keare (1984) are notable for the care with which they were conducted and the conclusions they reached. Together with Burns and Grebler’s work, these studies suggested certain patterns of housing demand which might be used to develop general explanations of housing demand and then to devise appropriate policies.

Two main speculative conclusions emerged from these studies, each of which has large implications for the design of housing projects and

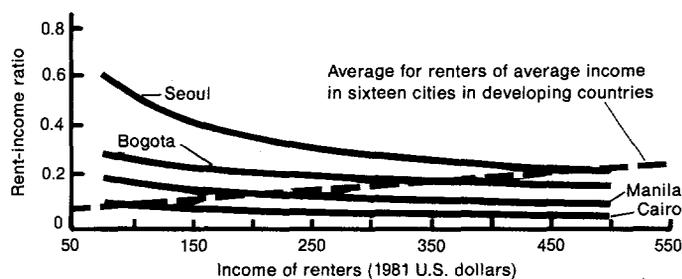
### *How Housing Markets Work in Developing Countries*

policies. First, as Jimenez and Keare noted, the sensitivity of spending on housing to household income (the income elasticity of demand) appeared to be quite similar in several developing countries; within a given housing market, as income increases, housing expenditures generally increase less than proportionately—that is, the income elasticity of demand is less than one. As indicated by Burns and Grebler, however, when gross national product (GNP) per capita rises, the average fraction of income spent on housing also seems to rise: across cities, in other words, demand is income elastic. Were such observations to be confirmed in other cross-country studies, they would suggest that (a) there is no single rule of thumb for the fraction of income that can be earmarked for housing, and (b) despite this, regularities exist that can be used in devising housing strategies.

To increase the empirical analysis of housing demand in developing countries, a major comparative study was initiated in 1981 at the World Bank. It collected high-quality data for sixteen cities in eight countries (Colombia, Egypt, El Salvador, Ghana, India, Jamaica, Korea, and the Philippines) and used them to estimate housing demand

relationships on a comparable basis. For comparative purposes identical econometric models were estimated for two U.S. cities. The results of this study are discussed extensively in Malpezzi and Mayo (1985, 1986a, and 1986b); some of the main findings are summarized in Figure 1. It shows the estimated relationship between the

Figure 1



rent-income ratio and monthly household income in four developing-country cities (Bogota, Cairo, Manila, and Seoul). In each city, as household income increases, the observed ratio of rent to income declines—confirming that income elasticities of housing demand within cities consistently tend to be less than one. In fact, they clustered within a range of 0.4 to 0.6, indicating that spending on housing rises only 40 to 60 percent as fast as income. Results for the other twelve cities in the analysis present a similar picture, and are generally similar for owners and renters.<sup>4</sup>

When one compares results across cities, however, they show an entirely different picture of housing demand. Specifically, as the general level of development rises (as measured by average household income), the average fraction of income spent on housing also increases. This is shown by the upward shift in the curves relating the rent-income ratio to income (with average incomes in Seoul, for example, being higher than those in Cairo). While there is some evi-

dence that the upward sloping relationship eventually turns down at higher levels of development (see Malpezzi and Mayo 1985, p. 58 ff.), the relationship is a good approximation among countries with incomes of less than \$2,000 per person, which are the focus of most international assistance.

The two overall tendencies shown here are indicative of medium-run (within city) and long-run (across city) demand relationships. In the medium run, housing is treated as a necessity, so poor households are willing to spend a bigger fraction of their income on housing than are richer households. As economic development proceeds, however, the share of household budgets allocated to housing increases among households at all income levels.

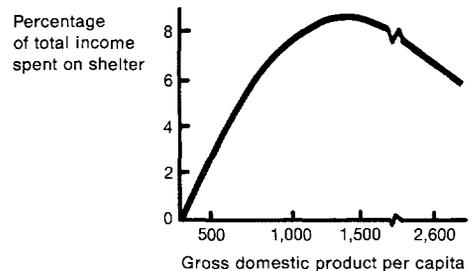
### *The Supply of Housing Services*

If in the long run the supply of housing is elastic in developing countries, the pattern of housing investment will mirror the long-run demand. Overall levels of housing investment relative to GNP are strongly related to the pattern of demand portrayed in Figure 1. Thus knowledge of underlying demand is also the key to understanding supply and can add some realism to countries' policy analysis and investment planning.

When countries plan their investment in housing, they often do so in terms of target fractions of GNP. Indeed, since Burns and Grebler's work, planners in many countries have set investment targets on the basis of that study's observed relationship between GNP per capita and the ratio of housing investment to GNP. This relationship (see Figure 2) indicates that the share of housing investment in GNP first rises with GNP per capita but then falls as countries pass about \$1,600 per capita in 1970 dollars (or about \$3,400 in 1981 dollars, the benchmark units used in Figure 1.)<sup>5</sup> To put this in perspective, upper-middle-income countries such as Argentina, Uruguay, South Africa, and Yugoslavia were approaching this estimated turning point in 1981; Venezuela, Greece, Israel, and Hong Kong had recently passed it.

It is important to note the microeconomic foundations of the Burns and Grebler finding in order to bolster its value as a planning tool. Its microeconomic basis treats housing investment as a derived demand—the result of a mismatch between effective demand and available supply. Three sources of housing demand stimulate housing investment: demand for housing by new households; replacement demand (for housing removed from the stock); and demand for better housing by existing households. Each source depends on prevailing housing

**Figure 2**



Source: Burns and Grebler 1977.

standards in a country and hence—since standards (implied by ratios of housing expenditure to income) are systematically related to the level of development—on a country's per capita income.

The simplest measure of housing investment is the average value of a new housing unit multiplied by the number of units built. Recent research (Annez and Wheaton 1984) has shown that the number of new units built in a country (relative to population) is largely insensitive to a country's income level, but varies proportionately with the rate of population increase. Housing value, in contrast, is very sensitive to a country's level of development; indeed, it follows directly from the sorts of demand relationships shown in Figure 1. The value of housing is simply equal to the capitalized value of rent; thus the relationship between value and income will follow from the relationship between rent and income. Just as the average ratio of rent to income rises with economic development, so too will the ratio of housing investment to GNP.<sup>6</sup> Planners who base their housing investment targets on the Burns and Grebler approach can be confident that the relationship is rooted in strong microeconomic patterns among countries.

Another implication of the Burns and Grebler relationship is that it represents as much a constraint on effective government intervention in housing as it does an opportunity. The powerful regularity between housing investment and GNP reflects pervasive behavioral differences among households in different markets. It cannot be easily transcended by governments that want to use housing investment to serve other goals, such as stimulating economic growth.

A shortcoming of the analysis so far is that statistics on housing investment are not broken down between new construction and spending on existing buildings. Most countries lack data on net investment in the existing stock, even though it is probably the great bulk of spending on housing. As a result, policymakers tend to neglect the largest part of the market. Little research has been done on the role of the existing stock. For example, to evaluate the impact of current housing strategies on the poor, it is important to know whether new construction for the middle-income market increases the supply of housing for the poor through filtering. The few studies that have been done suggest that filtering does *not* have much effect on low-income groups in developing countries (Ferchiou 1981).

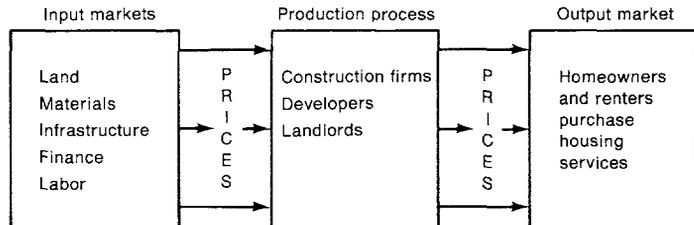
### *How Governments View Housing Markets*

Figure 3 shows a schematic diagram of how the housing market works. Inputs such as land, labor, finance, materials, and infrastructure are combined by supply-side agents such as landlords and developers to produce housing services. Homeowners, and to a lesser

extent renters, are also producers, if they maintain and upgrade their houses. Relative prices inform producers of housing services about whether to provide more or less housing, and the input suppliers about providing more or fewer inputs.

It is not a bad approximation to treat the market for housing services as a competitive market. For the activities in the middle box, there are few barriers to entry or large economies of scale in most countries. This does not mean, of course, that anybody in a poor country can become a landlord or developer. But there are seldom so few landlords or developers that they exert significant market power, except insofar as they also control inputs that are not competitive.

**Figure 3**



The market for many inputs is not competitive, however: (a) their ownership may be so concentrated that owners can fix prices, as in some land markets; (b) large economies of scale may make the production of some inputs a natural monopoly, as with some types of infrastructure; and (c) government regulations may restrict the competitive allocation of inputs, notably finance.

The implications of this analysis are clear. Problems in housing markets are often caused by problems in the input markets. Government actions that attack these problems directly are the right ones. Rather than adopt this approach, however, many governments intervene in production (the middle box). Governments that try to fix prices—for example, by rent controls—only distort the signals being sent to the market and may exacerbate the original problem.

Among the main ways that governments intervene in housing markets are direct measures to increase the number of houses (such as conventional public housing, sites and services, and squatter upgrading); actions to affect the supply of housing finance, land, infrastructure, materials, and other inputs; and regulations such as rent controls and building codes and standards. This section discusses these approaches in developing countries and suggests some of the problems and opportunities in their application.

## ***Public Sector Interventions***

### ***Public Housing, Sites and Services, and Upgrading***

Until the early 1970s housing policies in developing countries often followed the model of many industrial nations: relying on heavily

subsidized blocks of public housing with high standards of construction and infrastructure; zoning and building standards that discouraged housing with lower standards; and, in many cases, destruction of slum areas and squatter settlements in the name of either "law and order" or "urban renewal."

By and large, those policies did not work. Public housing did not reach most of the rapidly growing urban populations, because the programs were too expensive. Despite large subsidies, however, public housing often went unoccupied for long periods—a result of poor location, inadequate infrastructure, or rents that, even with subsidies, were higher than people could afford. At the same time, zoning and building standards were widely flouted, and squatter settlements proliferated. Informal, illegal, or unregistered housing became the main source of new housing in many cities (see Grimes 1976). Such is the vitality of this informal housing that in many cities the number of new houses has outstripped population increases in recent years (see Mayo and others 1982).

By the late 1960s and early 1970s many governments started to build on the success of informal housing. They introduced sites and services projects and slum upgrading, encouraged by the World Bank and other international organizations. These projects tried to set design standards on the basis of what people (particularly poor people) could and would pay, rather than on some arbitrary and inflated notion of "housing need." The new approach involved two important principles: "affordability" and full recovery of costs. This latter point was seen as necessary to ensure that projects could be replicated on a large scale, as the modest initial surpluses were used to finance new schemes. Governments also tried to encourage self-help, in building houses and community facilities and also in producing cheap building materials.<sup>7</sup>

These principles sometimes forced project planners to use rules of thumb for standards of affordability and design. It was common, for example, to assume that low- to moderate-income households could spend 20 to 25 percent of their incomes on housing and related services (see Mayo and Gross 1985, p. 37). Nearly three-quarters of World Bank sites and services projects financed between 1972 and 1984 were planned on that assumption. It was used regardless of a country's income level and of the incomes of the target population within a country.

A major point of this paper is that, despite the general validity of the sites and services concept, such rules of thumb are inconsistent with what people actually spend on housing and can have consequences that frustrate some of the most fundamental goals of low-cost housing projects. In particular, the intended beneficiaries may be excluded, or subsidies needed on such a scale that projects are not fully

replicable. If planners are to meet the housing needs of the poor, they must pay more attention to identifying the effective demand for housing and then planning in a way consistent with that demand. To some extent this is now happening, as the World Bank and other agencies' lending gradually shifts in relative terms from sites and services projects toward slum upgrading. As noted by Ayres (1983):

Partly because some of the earlier sites and services projects proved too costly for the urban poor, partly because the number of beneficiaries in sites and services projects tended to be small, partly because it fit better with the Bank's emphasis on realism and lower standards, there was a tendency in later urban projects to include more components for slum renovation (p. 158).

### *Housing Finance*

As housing is such a large item in household spending and wealth, access to mortgage finance can provide a strong incentive for people to save and invest. Savings in housing finance institutions, while generally used to provide mortgages, can become a large part of a country's total savings, available for financing infrastructure and other nonhousing projects. The housing finance system can also help to ensure that housing projects are repeated, as repaid loans provide money for new mortgages.

Despite these potential benefits, few developing countries have widespread and successful systems of housing finance. Development planners often seem to treat housing more as a consumption good than an investment and fail to recognize either its potential for encouraging savings or the macroeconomic links between it and other sectors of the economy. It is also clear that the development of housing finance institutions is strongly related to the general sophistication of a country's financial system, which in turn is closely related to overall economic development (Renaud 1984). In addition, recent economic circumstances in many developing countries—rapid inflation, shifting terms of trade, and slow growth—have not been conducive to the development of housing finance institutions. Many have also had inappropriate lending and borrowing policies (often under the direction of governments) and have thus been seriously weakened within the past decade.

The viability of housing finance institutions has often been jeopardized by governments which, in wanting to make housing more "affordable," have sought to keep down interest rates. Particularly during the 1970s, when inflation was rapid in most developing countries, many housing finance institutions lent at negative real rates of interest, which often led to considerable decapitalization by the early

1980s. A recent survey of World Bank housing projects initiated between 1973 and 1983 found that more than 60 percent involved mortgage lending at rates of interest below the prevailing rate of inflation (and even then, lending rates were higher than they had been before the World Bank projects).

The inevitable consequence of keeping mortgage rates below market rates is that loans are rationed. Usually, the rationing benefits those who are perceived to have the lowest risk of default—often, wealthier people or those favored by government policy such as civil servants, many of whom are also relatively well off. Subsidies to better-off households are not only unfair; they are also an inefficient way of achieving whatever housing goals they are believed to serve. Lump-sum subsidies—in the form of writing down the cost of land or materials—could achieve the same production goals with far less distortions in resource allocation and far less harm to the viability of housing finance institutions.

Institutional viability is not the only issue facing mortgage agencies in developing countries. They must also consider their menu of mortgage instruments; how to change the mix of mortgage instruments, terms, and conditions as economic circumstances change; and how to evaluate the impact of alternative instruments on profitability, demand for credit, repayment, or default. Other issues include the role of contractual savings schemes; who should get housing finance—lower- versus higher-income groups, construction versus long-term financing, first-time owners versus others, upgrading and renovation versus new construction; and the place of housing finance in the development of the financial system as a whole. These and other issues have seldom been considered in such a way as to yield prescriptions for rationalizing and developing viable housing finance institutions.

### *Land Markets and Tenure Security*

An estimated 20 to 40 percent of all urban households in developing countries are living on land to which neither they nor their landlords have legal title. In many cities the figure is much higher. Squatter settlements are the most conspicuous sign of how land markets work in developing countries, but they do not define what is wrong with those markets.

The market for land in developing countries is often highly unorganized. Information about who owns what is poor; squatter settlements increase uncertainty about property rights; the legal and administrative systems for establishing, recording, and transferring title are inadequate. These failures have serious ramifications, many of which disproportionately affect the poor. Property transactions are slow or

stalled; incentives for new construction and upgrading are depressed; lenders are unwilling to extend credit to property holders without clear title; and property taxation is impeded, often with the result that infrastructure investments can neither be made nor maintained because costs are not recovered.

When cities in developing countries began to grow rapidly—and with them their slums, bustees, and bidonvilles—land policy often had a simplicity that was generally misguided: if squatter settlements are growing, evict the squatters. Such policies have rarely been effective. Usually they displaced rather than eradicated settlements, they were politically and economically costly, and, more fundamentally, they failed to deal with the root causes of squatting—low squatter incomes and insecure tenure.

Given the ineffectual and costly nature of squatter removal, governments have increasingly taken a more direct approach to dealing with squatter settlements and to improving the efficiency of urban land markets. They have tried to upgrade rather than remove squatter settlements and slums. Upgrading schemes have generally involved physical improvement of slum areas and increasing security of tenure by mapping, by cadastral registration, and by government's selling land to squatters (often at subsidized prices). The impact of such efforts has often been dramatic, prompting large additional spending by the residents (Keare 1983; Jimenez 1982).

Security of tenure has clearly had a major effect on behavior. It has been observed repeatedly (Jimenez 1984; Friedman, Jimenez, and Mayo 1985) that people are willing to pay a large premium for secure tenure. In the Philippines, for example, studies have shown that housing prices are systematically higher for otherwise similar dwellings with secure tenure. The premium averages 10 to 15 percent for renters and between 25 percent and almost 60 percent for owners (Jimenez 1984; Friedman, Jimenez, and Mayo 1985). Those figures demonstrate the benefits of urban land reform. They also explain why residents spend so much on their houses once their tenure is established: in response to higher land prices, households increase the ratio of capital to land, so as to equalize returns to each factor.

Tenure reform also has potential distributional consequences. The fact that premiums are greater for owners than renters is attributable to the relatively smaller effect of secure tenure on the contemporaneous flow of housing services than on the present value of that flow. By implication, owners tend to benefit more from tenure reform than do renters. Nonetheless, the increased investment incentives for owners appear often to produce more houses to rent. Closer examination indicates that benefits are proportionately greater for poor households, for larger families, and for households living in newer squatter areas, where *de facto* occupancy rights are small (Jimenez 1984).

### *Infrastructure*

The provision of infrastructure and related services—transport, water, sanitation, and so forth—is a traditional public sector activity, and one of particular importance to low-income groups. Directly, households benefit from several types of infrastructure through saving time and money (for example, publicly supplied water rates versus user charges) and through improved living conditions. Often infrastructure investments encourage new construction and upgrading of existing housing, including the provision of more houses to rent (Strassman 1980). Households also benefit indirectly from infrastructure investments, if these are seen as legitimizing previously illegal or informal settlements (discussed in the previous section).

Government policies on the supply and pricing of urban infrastructure are characterized by various conflicting tendencies. For example, governments have taken the view that (a) water and sanitation (and sometimes other types of infrastructure) are merit goods; (b) infrastructure has significant externalities; (c) low-income households may, out of ignorance, seriously underestimate the benefits of improved water and sanitation; and (d) some of these services involve large economies of scale—that is, they are “natural monopolies” or at least require investments too large for the private sector. These views have led to governments’ taking the leading role in providing urban infrastructure, but often with underinvestment, and prices that are too low to recover costs. The result has been severe rationing and chronic problems in maintaining and expanding the stock of urban infrastructure. Cities are therefore both less efficient and more inequitable than they could be with alternative policies.

Of the possible alternative policies, cost recovery must be of high priority. In some cases, better information about people’s willingness to pay for improved water and sanitation could help. Poor households are widely assumed to be unable or unwilling to pay for improved services; often this is not so. For example, many urban households spend significant amounts of time collecting water from standpipes or wells; in cities with water vendors, people often pay high unit prices for water. Understanding the demand for water, sanitation, and other urban services also helps to indicate the correct type of technology. For example, the choice between a communal standpipe system and individual house connections depends on the demand for water and the value people place on the time spent in water collection.

### *Rent Controls*

One of the most common of governmental controls on housing is rent control. The consensus among economists is that rent controls

reduce the quantity and quality of housing available. This consensus rests on the analysis of a simple price control imposed on a good with elastic supply. However, remarkably little research has been done on the size of these effects; the lags involved; the second-order effects on mobility, property taxes, and the like; or on how tenants and landlords adjust, for example, by paying key money or by accelerating the deterioration of housing.<sup>8</sup>

While the standard analytical model is simple, rent control is in practice a complicated phenomenon. In some cities, rent control has been accompanied by little or no new construction and deterioration of the existing stock (for example, Santa Monica, California; Kumasi, Ghana); in others, new construction has continued (Los Angeles, California; Cairo, Egypt). Research has shown that the net effect depends on the type of law, its enforcement, and market conditions.<sup>9</sup> Rent controls differ in the types of units covered; the extent to which rents can be changed over time or to cover maintenance costs; the treatment of new construction; the stringency of enforcement of the law; the legal provisions for tenant protection and the grounds for eviction; the characteristics of related laws such as land market regulations; and the requirements for maintenance of the property by tenants.

Tenants as well as landlords can lose from rent controls. First, rental housing usually becomes a rationed good. Some tenants will live in houses with bargain rents; others will have to pay *higher* rents than they would in an uncontrolled market (because controls can drive up rents in the uncontrolled part of the market, and not everyone lives in the controlled market). Other households will have to double up. Second, even tenants who manage to get controlled units usually sacrifice their mobility, staying in a house of a different size, quality, and location from what they would choose in an unconstrained market. Recent research on rent control in Cairo estimated that the net welfare cost to tenants in controlled units from this “disequilibrium in housing consumption” largely offsets the benefit of lower rents and that when other welfare losses connected with job mobility and commuting are considered, the costs of rent control to tenants may exceed its benefits.

While rent control is often a pressing issue, its mere existence should not be construed as a case for its removal. In some markets it is overshadowed by other housing problems. The present state of knowledge about the effects of different rent control regimes under varying market conditions, and of the effects of various methods of decontrol, is unsatisfactory. A forthcoming research project at the World Bank will involve a survey of rent controls in developing countries, an estimate of the size of their impact, and a framework for evaluating different types of decontrol.

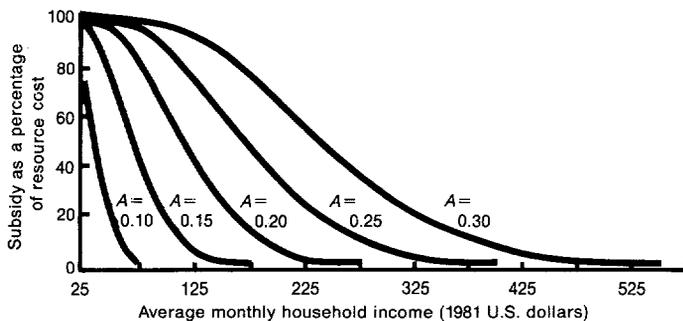
## Building Codes and Standards

The potential problems created by choosing inappropriate design standards are illustrated in Figures 4 and 5. Respectively, they show estimates of the minimum subsidy needed to induce moderate-income households (defined as those in the thirty-fifth income percentile) to participate in sites and services projects with specific design standards; and of the income percentile of households that would be most likely to participate in a project in the absence of subsidies.<sup>10</sup> While the arguments in this section apply to the choice of design standards in sites and services projects, they could also apply to the setting of building codes and standards in urban areas.

Each figure has a family of curves showing how subsidies or participant incomes are related to the average incomes in a city (the horizontal axis) and the assumption of design affordability.<sup>11</sup> The latter is represented by  $A$ , which is the assumed proportion of income that target households will allocate to housing. Each figure is derived from the empirical evidence taken from our demand estimates cited above, so each represents a “best guess” about the actual behavior of people who might be the intended beneficiaries of sites and services projects.

Figure 4 demonstrates the effect that project standards have on the incentive of target groups to participate, and the need to provide subsidies to induce participation when standards are set too high. For example, suppose it were assumed that households in an African country with 1981 household income of roughly \$100 per month would be willing to pay for a house designed to cost 20 percent of their income. According to Figure 4, a subsidy of roughly 60 percent of the market value of the house would have to be paid to induce

Figure 4



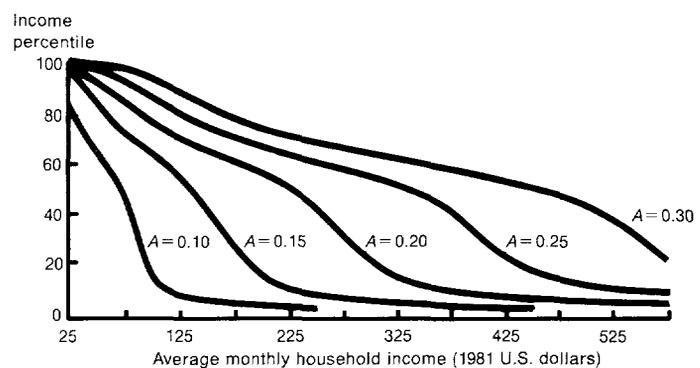
households in the thirty-fifth percentile of the income distribution to participate, even if such households were willing to increase housing expenditures to 20 percent of income from a lower “typical” level. In Burundi, with monthly household income of only about \$70 in 1981, a subsidy of over 90 percent would be needed to induce households in the thirty-fifth income percentile to participate if the design standard is based on an affordability assumption of 20 percent of income. Subsidies of this size are, of course, a reflection of the low average propensities to spend income on housing, which were derived from the cross-country expenditure functions described earlier.

In higher-income developing countries by contrast, a 20 percent affordability standard may be entirely appropriate. For example, when average household monthly incomes are above about \$175, subsidies of less than 20 percent would be enough to induce target groups to participate. Required subsidies, it should be stressed, are extremely sensitive to the choice of design standards. While the difference between 20 percent and 25 percent of income may not sound much to a project planner, it represents a difference of 25 percent in monthly shelter costs—and thus can easily mean the difference between required subsidies in the 60 to 70 percent range rather than the 20 to 35 percent range. Depending on whether big enough subsidies are forthcoming or not, target income groups may not even participate; or, if they do, they may have strong incentives to sell out to higher income groups.

While Figure 4 portrays the estimated subsidies needed to induce low-income households to take part in projects with different design standards, it is also useful to estimate how the incomes of households that would participate without subsidies would vary in response to varying design standards. To do so, the information on housing demand in Figure 1 can be used to infer the income level that would typically be associated with the spending on housing implied by a given design standard; this is the estimated income of project participants in the absence of any subsidy.

Figure 5 illustrates the effect of alternative design standards of unsubsidized projects on the income of probable participants. Not only does a higher design affordability ratio raise the income level of likely participants, but it does so with dramatic effect at various thresholds. For example, for households in low-income countries (that is, countries in which average household income is less than \$100 per month), setting the design standards on the assumption that households are willing to spend 20 percent of their income on housing implies that households in approximately the eightieth percentile of the income distribution could afford to participate without subsidies. Dropping the standard to one based on 15 percent of income has only a modest effect, inducing participation down to the sixty-fifth percentile in the absence of subsidies. By dropping the standard to just 10 percent of income, however, groups all the way down to the fifteenth percentile would be reached. Similar

**Figure 5**



thresholds exist at each income level, which suggests that dramatic improvements can be made in the ability to reach the poor through sites and services projects by finding the “correct” design standard—the one that reflects the true willingness-to-pay of poor people.

---

### *Improving Housing Strategies in Developing Countries*

An integrated housing strategy requires a clear statement of objectives, an understanding of local conditions, a sense of how policy and program features are linked to outcomes, and a plan for generating and applying the resources needed to implement the strategy. Even though local political and other conditions will have a strong influence on the content of a strategy in any given place, enough is known about developing-country housing markets to suggest some general strategic guidelines. Two points in particular are worth emphasizing:

- Economic development is the most effective way of improving housing conditions in developing countries.
- To ensure the maximum benefits, governments should promote the efficiency of the housing sector and should avoid policies that cause significant market distortions and produce counterproductive results.

### *Economic Development*

Research suggests that, as development proceeds, housing conditions improve more rapidly than incomes. Housing investment as a share of GNP increases rapidly, as does the fraction of income that people spend on housing. In low-income countries, housing investment relative to GNP is only 2 percent; in middle-income developing countries, the fraction is from 6 to 8 percent. Households in low-income countries spend only 5 to 10 percent of their income on housing; in middle-income developing countries the fraction may be 25 to 30 percent. To a considerable degree, what is good for the economy is better for housing.

While this is an encouraging long-run prescription, it does little to solve immediate housing problems. Nor does it show how the gains from economic development are most effectively channeled into improving housing conditions. These questions require a careful choice of policies and programs by governments.

### *Government Policies*

The governmental activities that deserve emphasis include:

- *The provision of infrastructure with appropriate and affordable*

*standards.* The benefits of infrastructure investments are considerable: rates of return to investment are high (often higher than in housing alone), household spending on housing is often spurred, and de facto security of tenure is established for many informal households.

- *The recovery of the costs of providing and maintaining infrastructure through efficient systems of taxes and user charges.* Otherwise, enormous social and private economic costs result, as with the private provision of water and electricity in Lagos, for example.
- *The development of systems of land information and a legal and administrative framework that promotes efficiency in land markets.* The costs of developing land are unnecessarily high in most developing countries, largely because of poor land information, backward systems of titling and property rights, and a cumbersome legal and administrative structure.
- *The reform of land tenure systems in order to promote private spending on housing.* Most cities in developing countries are being built by the informal sector, with houses that are often illegal and with insecure tenure. Research shows that even very poor households place significant monetary premiums on security of tenure and that incentives to improve property are often dramatically increased when tenure in illegal or squatter settlements is legalized.
- *The development of financial markets and institutions.* Development or reform of housing finance institutions should be part of the overall process of financial reform and thus of promoting savings, financial intermediation, and the free movement of capital throughout the economy. Housing finance institutions should not be excessively concerned with providing housing subsidies, but should instead be seen as facilitating capital to move into a sector that is growing rapidly as development proceeds.
- *The critical review of housing subsidies, with the goals of increasing their effectiveness, avoiding unintended side effects, minimizing costs to the public and private sectors, and distributing benefits fairly in relation to need.* In most developing countries, subsidy policies suffer from an almost total lack of strategic planning. The scale, distribution, and impact of subsidies are not known.
- *The pursuit of sites and services and slum upgrading projects as solutions for the housing problems of low- to moderate-income households.* The best of such projects provide appropriate and affordable housing and services to low- and moderate-income groups, recover costs and minimize subsidies, target such subsidies as there are to those in greatest need, have high economic rates of return, and improve the ability to replicate projects on a broad scale. Many such projects, however, often fall short of these potential benefits in practice. Research indicates that planning

assumptions are frequently incorrect, which leads to problems as the projects develop.

- *The promotion of private housing, especially rental housing.* The rental sector in most developing-country cities is large and growing, usually comprising at least 50 percent and sometimes as much as 90 percent of the housing stock. The sector is often hampered, however, by favorable treatment for owner-occupied housing.

Of the policies that governments should avoid, these deserve special mention:

- *The creation of unrealistic and costly building codes and zoning regulations.* These increase costs, often without corresponding benefits, and may encourage development of illegal, informal areas.
- *The destruction of squatter settlements.* Slum removal and urban renewal programs that simply displace the slums to other areas may encourage the development of larger and more militant squatter settlements.
- *The displacement of private investment by public activities.* One study in the United States recently found that each 100 new units of publicly subsidized housing caused a drop of almost 85 units in private construction; other studies indicate that public housing actually has a negative economic rate of return (it is worth less than what it cost to build it) (Murray 1983, Mayo and others 1980). Similar displacement effects and inefficiencies undoubtedly exist in many developing countries and are to be avoided at all cost.

These general guidelines are the basis for development and improvement of housing strategies in most developing countries. Detailed formulation of housing strategies must, of course, be informed by data collection, research, planning, and monitoring and evaluation of the program involved.

---

### **Abstract**

Rapid growth in many developing-country cities is straining the capacity of their shelter delivery systems. Governments have chosen a variety of implicit and explicit policies to ameliorate these strains. However, these policies are not always consistent with their objectives, often because of a lack of knowledge of how housing markets actually work and how policies affect and are constrained by market behavior. This paper reviews recent research on housing market behavior in developing countries, including the demand for housing and the pattern of housing investment across countries, the financing of housing by low-income households, and the willingness to pay for secure tenure. Common housing policies are then examined, including public housing, sites and services projects, and slum clearance versus upgrading. Rent controls, measures to improve the supply of finance and infrastructure, and building codes and standards are also discussed.

---

### **Notes**

1. World Bank (1980). Without doubt, absolute poverty is difficult to define opera-

tionally and to measure, but for the purposes of this paper orders of magnitude are sufficient.

2. For a review of two recently developed housing needs assessment methodologies see Gray and Richardson (1985).

3. One recently developed approach to housing needs assessment, Rourk, Fay, and Struyk (1984) pays more attention to willingness to pay.

4. Median-income elasticities estimated for renters (0.49) moderately exceeded those for owners (0.46), but average propensities to consume were almost invariably higher among owners than renters in the same city, at similar income levels.

5. At the peak, housing investment is about 8 percent of GNP; at very low GNP levels, the ratio is between 2 and 3 percent.

6. This assumes that population growth rates are relatively constant over the relevant range; if they decline rapidly with development, then the tendency toward the inverted-U type of relationship indicated by Burns and Grebler will be enhanced. This is discussed at greater length in Mayo and Malpezzi (1985).

7. It should be emphasized that while sites and services projects produce housing, and thus constitute interventions in the production process, they constitute a package of interventions in input markets (land, finance, infrastructure, etc.) at the same time. In most such projects it is hoped that reforms in input market features initiated as part of sites and services projects will be extended more broadly.

8. See Malpezzi (1984a, 1984b, 1986). A research project focusing on comparative rent control in developing countries is now being designed at the World Bank.

9. Malpezzi (1984b), and the references cited therein.

10. For an extended discussion of how these are derived see Mayo and Gross (1985).

11. For reference, estimated monthly household incomes in 1981 U.S. dollars in most African countries and countries on the Indian subcontinent were below \$100; some of the countries with incomes between \$100 and \$200 were Botswana, Cameroon, Egypt, El Salvador, Indonesia, the Philippines, and Thailand; countries between \$200 and \$400 included a number of Latin and Central American countries, Nigeria, and Zambia; and countries above \$400 included Caribbean, Latin American, and East Asian countries such as Jamaica, Bahamas, Brazil, Mexico, Panama, and Korea.

The basis for each figure is the estimated demand functions for renters rather than for owners. The main reasons for this are (a) that often it is "homeless" or renter households that represent the designated sites and services project target group; (b) owners' current consumption relative to current income reflects an average greater longevity and hence more chance to have upgraded housing relative to renters; and (c) in some markets, owners' current housing consumption reflects both windfall price appreciation and possibly overconsumption because of high transactions costs of moving. While it is probably the case that renter and owner demand functions may be thought of as bounds for the "true" affordability ratio in sites and services projects or other housing schemes, the costs of overestimating willingness to pay are far higher than the costs of underestimating. In the former case problems may occur such as not reaching the target population (or only being able to reach them with large subsidies) or high rates of arrearage default; in the latter case, "progressive development" of projects from initial design standards to those more closely reflecting effective demand would be expected to occur.

---

Annez, Philippe, and William Wheaton. 1984. "Economic Development and the Housing Sector: A Cross-National Model." *Economic Development and Cultural Change* 32, no. 4 (July): 749-66.

Ayres, Robert L. 1983. *Banking on the Poor*. Cambridge, Mass.: MIT Press.

## References

- Burns, Leland S., and Leo Grebler. 1977. *The Housing of Nations: Analysis and Policy in a Comparative Framework*. London: MacMillan.
- Ferchiou, Ridha. 1982. "The Indirect Effects of New Housing Construction in Developing Countries." *Urban Studies*, 19: 167-76.
- Follain, James, and E. Jimenez. 1986a. "Estimating the Demand from Housing Characteristics: A Survey and Critique." *Regional Science and Urban Economics*, forthcoming.
- \_\_\_\_\_. 1986b. "The Demand for Housing Characteristics in Developing Countries." *Urban Studies*, forthcoming.
- Follain, James, Gill-Chin Lim, and Bertrand Renaud. 1980. "The Demand for Housing in Developing Countries: The Case of Korea." *Journal of Urban Economics* 7, no. 3 (May): 315-36.
- Friedman, Joseph, E. Jimenez, and S. Mayo. 1985. "The Demand for Secure Tenure in Developing Countries." Washington, D.C.: World Bank, Water Supply and Urban Development Department. Processed.
- Gray, Gary, and Eric Richardson. 1985. "Users and Their Needs: A Review of Two Housing Needs Assessment Methodologies." *Third World Planning Review* 7, no. 3 (July): 193-202.
- Grimes, Orville F., Jr. 1976. *Housing for Low-Income Urban Families: Economics and Policy in the Developing World*. Washington, D.C.: World Bank.
- Gross, David J. 1984. "Designing a Suitable Housing Project: Integration of a Demand Module into a Supply Side Planning Model." Washington, D.C.: World Bank, Water Supply and Urban Development Department. Processed.
- Ha, Seong-Kyu, and Stephen Merret. 1984. "Assessing Housing Consumption Requirements: The Case of Seoul." *Third World Planning Review* 6, no. 4 (November): 331-37.
- Ingram, Gregory. 1984. *Housing Demand in the Developing Metropolis: Estimates from Bogota and Cali, Colombia*. World Bank Staff Working Paper 663. Washington, D.C.
- Jimenez, Emmanuel. 1982. "The Economics of Self-Help Housing: Theory and Some Evidence from a Developing Country." *Journal of Urban Economics* 11: 205-28.
- \_\_\_\_\_. 1984. "Tenure Security and Urban Squatting." *Review of Economics and Statistics* 66, no. 4 (November): 556-67.
- Jimenez, Emmanuel, and Douglas Keare. 1984. "Housing Consumption and Permanent Income in Developing Countries: Estimates from Panel Data in El Salvador." *Journal of Urban Economics* 15: 172-94.
- Keare, Douglas. 1983. "Affordable Shelter and Urban Development: 1972-82." *Research News* 4, no. 2 (Summer): 3-14.
- Keare, Douglas, and Emmanuel Jimenez. 1983. *Progressive Development and Affordability in the Design of Urban Shelter Projects*. World Bank Staff Working Paper 560. Washington, D.C.
- Malpezzi, Stephen. 1984a. *Analyzing an Urban Housing Survey: Economic Models and Statistical Techniques*. Urban Development Department Discussion Paper 52. Washington, D.C.: World Bank.
- \_\_\_\_\_. 1984b. "Economic Analysis of Alternative Rent Control Policies, with an Application to Cairo, Egypt." Paper presented to the Regional Science Association, Denver, Colorado, November 1984.
- \_\_\_\_\_. 1984c. "Rent Controls: An International Comparison." Paper presented to the American Real Estate and Urban Economics Association, Dallas, Texas, December 1984.

- \_\_\_\_\_. 1986. "Rent Control and Housing Market Equilibrium: Theory and Evidence from Cairo, Egypt." Ph.D. dissertation, George Washington University, Washington, D.C.
- Malpezzi, Stephen, Michael Bamberger, and Stephen Mayo. 1982. *Planning an Urban Housing Survey: Key Issues for Researchers and Program Managers in Developing Countries*. Water Supply and Urban Development Discussion Paper 44. Washington, D.C.: World Bank.
- Malpezzi, Stephen, and Stephen K. Mayo. 1986a. "User Cost and Housing Tenure in Developing Countries." *Journal of Development Economics*, forthcoming.
- \_\_\_\_\_. 1986b. "The Demand for Housing in Developing Countries: Empirical Estimates from Household Data." *Economic Development and Cultural Change*, forthcoming.
- Malpezzi, Stephen, and Stephen Mayo, with David J. Gross. 1985. *Housing Demand in Developing Countries*. World Bank Staff Working Paper 733. Washington, D.C.
- Mayo, Stephen K. 1986. "Effective Demand and Effective Housing Policy." In Lloyd Rodwin, ed. *Shelter, Settlements, and Development*. New York: United Nations Commission on Human Settlements, forthcoming.
- Mayo, Stephen K., and others. 1980. *Housing Allowances and Other Rental Housing Assistance Programs—A Comparison Based on the Housing Allowance Demand Experiment, Part 2: Costs and Efficiency*. Cambridge, Mass.: Abt Associates, Inc.
- \_\_\_\_\_. 1982. *Informal Housing in Egypt*. Cambridge, Mass.: Abt Associates, Inc.
- Mayo, Stephen K., and Stephen Malpezzi. 1985. "Cross-Country Models of Housing Demand." Washington, D.C.: World Bank, Water Supply and Urban Development Department.
- Mayo, Stephen K., with David J. Gross. 1985. "Sites and Services—and Subsidies: The Economics of Low-Cost Housing in Developing Countries." Washington, D.C.: World Bank, Water Supply and Urban Development Department.
- Merrett, Stephen. 1984. "The Assessment of Housing Consumption Requirements in Developing Countries." *Third World Planning Review* 6, no. 4 (October): 319–29.
- Murray, Michael. 1983. "Subsidized and Unsubsidized Housing Starts." *Review of Economics and Statistics* 65 (November): 590–97.
- Renaud, Bertrand. 1984. *Housing and Financial Institutions in Developing Countries*. World Bank Staff Working Paper 658. Washington, D.C.
- Rourk, Phillip W., James W. Fay, and Raymond J. Struyk. 1984. *Preparing a National Housing Needs Assessment*. Washington, D.C.: U.S. Agency for International Development.
- Strassman, W. Paul. 1980. "Housing Improvement in an Opportune Setting: Cartagena, Colombia." *Land Economics* 6, no. 2 (May): 155–68.
- United Nations. 1984. *Urbanization and Components of Urban and City Population Growth*. New York: United Nations Secretariat, Population Division of the Department of International Economic and Social Affairs.
- Weicher, John C., Lorene Yap, and Mary Streitweiser Jones. 1982. *Metropolitan Housing Needs for the 1980s*. Washington, D.C.: Urban Institute Press.
- World Bank. 1980. *Shelter*. Washington, D.C.



---

---

# THE COSTS AND BENEFITS OF BEING A SMALL, REMOTE, ISLAND, LANDLOCKED, OR MINISTATE ECONOMY

*T. N. Srinivasan*

**T**o classify economies into two categories, “small” and “not small,” two things are needed: some measure of size and a cutoff point below which economies are classed as small. Various definitions of size suggest themselves. The theory of international trade uses market power—the ability of an economy to affect its terms of trade by changing its volume of exports and imports, and the cutoff point is zero. Operationally, this is not useful: apart from the empirical problems of determining whether a country has market power, the fact that it may have positive power in some commodities but not in others makes the concept difficult to apply to a whole economy.

Another possible measure of size is a country’s real gross national product (GNP) or, better still, gross domestic expenditure (GDE). Of course, a poor country with low per capita income could still have a large GNP (because of its large population). But it would still be only a small potential market, because the bulk of its population is too poor to be potential demanders of anything but basic commodities. This has been taken to imply that an index of market size for manufactures has to be related to the total consumption of them, which in turn has to be based on population, per capita income, and income distribution. And any measure of the market for basic services such as transport, health, and education would need to take account of the geographical area of a country, the density and distribution of its popula-

---

The author thanks Bela Balassa, John Duloy, Gregory Ingram, Deepak Lal, and Sarath Rajapatirana for their valuable comments.

tion, and even the age and sex pattern of population. The definition of smallness may also have to change as technologies do. For instance, the "optimal" size of a plant for producing ammonia increased when high pressure compressors were developed.

Given these difficulties in defining size, the literature on small economies has settled on a country's population as the primary measure of its size, with GNP as a secondary measure. The cutoff point for smallness has been anywhere between 1.5 million and 5 million people. For example, Chenery and Syrquin (1975) classify countries with fewer than 5 million people as small.

Classifying countries with fewer than 1.5 million people as very small and those with between 1.5 million and 5 million people as small, the data for 189 countries and their dependent territories show that:

- Forty-two independent countries and twenty-five dependent territories are very small, and thirty-three independent countries are small.
- Thirty-eight countries and twenty-four dependent territories are islands, of which twenty-four countries and twenty-two dependent territories are very small and four countries and two dependent territories are small.
- Twenty-six countries are landlocked, of which five are very small and six are small. The remaining fifteen landlocked countries have populations of more than 5 million.

Available GNP figures show that:

- Of the sixty-seven very small economies, four are classified as low-income with per capita GNP below \$410; but twenty-one are upper-middle-income, with per capita GNP exceeding \$1,670.
- For the thirty-three small economies, six are low-income and seven are upper-middle-income.
- For those forty-six economies that are both very small and islands, three are low-income and eighteen are upper-middle-income.
- Of the six small island economies, none is low-income and two are upper-middle-income.
- Of the six small landlocked economies, only three are low-income. None of the five very small landlocked economies falls into this category, and no very small or small landlocked economies are in the upper-middle-income group.

Data on the growth of real GNP per capita in 1970–80 are available for 158 economies. They show that:

- Thirty-four countries had declining GNP per capita. Of these, sixteen (of which fourteen are islands) were very small, and eight (one island, two landlocked) were small. Among the remaining ten countries, six were landlocked, and one was an island.

- In eighty-three economies, real GNP per capita grew by more than 2 percent a year. Of these, thirty (of which nineteen are islands and four are landlocked) were very small; and ten (of which two are islands) were small.

The details are in Tables 1–3.

The United Nations characterizes thirty-six countries as least developed. Of them, twelve are very small, nine are small, and the other fifteen have a population of more than 5 million. A total of fifteen least developed countries (three very small, four small, and eight others) are landlocked, and five are very small islands. The rest, sixteen, are neither landlocked nor islands. Thus if population signifies size, the majority of least developed countries are very small or small, and are islands or landlocked countries. And in eight least developed countries real GNP per capita declined in 1970–80. Against these facts, however, many small economies (a third of them including islands like Singapore and Trinidad and Tobago) are not poor. Many have had significant growth in per capita incomes. Several have grown very rapidly. Smallness is neither a necessary nor sufficient condition for slow economic development.

---

Several international organizations have devoted time and effort to the special difficulties believed to affect small economies (UNCTAD 1983a, 1983b, 1984). In 1982 the Development Committee of the World Bank and the International Monetary Fund “noted the problems of small island and landlocked states, and recognized the urgent need to review mechanisms and adjustment prescriptions appropriate to the particular circumstances of such states...” (World Bank 1982). At the same time, the ministers of the Group of Twenty-four “urged that the international community pay particular attention to small island and landlocked developing states, having regard to their limited size, their openness, their vulnerability to the vagaries of the international economic environment...” They agreed with the Development Committee on the urgent need for “immediate action to review the mechanism and format of conditionality and the nature and content of adjustment prescriptions requested by multilateral financing institutions in small island and landlocked economies...” (Group of Twenty-four 1982). Both the World Bank and the International Monetary Fund (IMF) have discussed the same theme internally.

These concerns raise two related questions. First, do small economies have special problems not faced by developing economies that are larger or that border other countries or oceans, and do these problems call for special attention? If so, the second question is whether such problems are already being addressed by multilateral

*Problems of  
Small  
Economies*

**Table 1. Distribution of Countries by Region and Population, 1983**

Population group	Africa	Asia	Europe	Oceania and Indonesia	North and Central America <sup>a</sup>	South America	Independent countries	All regions, dependent territories	Total
<i>All economies</i>									
Less than 1.5 million	15 (2)	8 (1)	9 (5)	16 (7)	16 (9)	3 (1)	42	25	67
1.5 million to 5.0 million	11	8	4	2	6	2	33	..	33
More than 5.0 million	27	22 (1)	22	2	8	8	88	1	89
Total	53	38	35	20	30	13	163	26	189
<i>Island economies</i>									
Less than 1.5 million	6 (1)	2	7 (4)	16 (9)	15 (8)	..	24	22	46
1.5 million to 5.0 million	..	1	1	2 (1)	2 (1)	..	4	2	6
More than 5.0 million	1	4	..	2	20	..	10	..	10
Total	7	7	8	20	..	..	38	24	62
<i>Landlocked economies</i>									
Less than 1.5 million	3	1	1	..	..	..	5	..	5
1.5 million to 5.0 million	3	2	..	..	..	1	6	..	6
More than 5.0 million	8	2	4	..	..	1	15	..	15
Total	14	5	5	..	..	2	26	..	26

Note: Data are for mid-1983. Figures in parentheses indicate number of dependent territories.

a. Includes Caribbean nations.

Source: *The World Bank Atlas 1985* (Washington, D.C.: World Bank, 1985)

Table 2. *Distribution of Countries by Region, Population, and Per Capita Income, 1982*

Income group <sup>a</sup>	Africa			Asia			Europe			Oceania and Indonesia			North and Central America			South America			All regions			Total
	VS	S	O	VS	S	O	VS	S	O	VS	S	O	VS	S	O	VS	S	O	VS	S	O	
<i>Very small and small economies</i>																						
Low-income	4	6	n.a.	..	..	n.a.	..	..	n.a.	..	..	n.a.	..	..	n.a.	..	..	n.a.	4	6	n.a.	10
Lower-middle-income	4	3	n.a.	..	..	n.a.	..	..	n.a.	4	1	n.a.	7	4	n.a.	1	1	n.a.	16	9	n.a.	25
Upper-middle-income	3	..	n.a.	1	4	n.a.	2	..	n.a.	5	..	n.a.	8	2	n.a.	2	1	n.a.	21	7	n.a.	28
High-income oil exporters	..	..	n.a.	5	1	n.a.	..	..	n.a.	..	..	n.a.	..	..	n.a.	..	..	n.a.	5	2	n.a.	7
Industrial	..	..	n.a.	..	..	n.a.	7	3	n.a.	..	1	n.a.	1	..	n.a.	..	..	n.a.	8	4	n.a.	12
Data not available	4	1	n.a.	2	3	n.a.	..	1	n.a.	7	..	n.a.	..	..	n.a.	..	..	n.a.	13	5	n.a.	18
Total	15	11	n.a.	8	8	n.a.	9	4	n.a.	16	2	n.a.	16	6	n.a.	3	2	n.a.	67	33	n.a.	100
<i>Island economies</i>																						
Low-income	3	..	1	..	..	1	..	..	..	..	..	..	..	..	1	..	..	..	3	..	3	6
Lower-middle-income	1	..	..	..	..	1	..	..	..	9	1	1	5	1	1	..	..	..	15	2	3	20
Upper-middle-income	2	..	..	..	1	1	2	..	..	5	..	..	9	1	..	..	..	..	18	2	1	21
High-income oil exporters	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	..	..	1
Industrial	..	..	..	..	..	1	5	1	..	..	1	1	1	..	..	..	..	..	6	2	2	10
Data not available	..	..	..	1	..	..	..	..	..	2	..	..	..	..	1	..	..	..	3	..	1	4
Total	6	..	1	2	1	4	7	1	..	16	2	2	15	2	3	..	..	..	46	6	10	62
<i>Landlocked economies</i>																						
Low-income	..	3	6	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	3	7	10
Lower-middle-income	3	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	1	1	3	1	3	7
Upper-middle-income	..	..	..	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	1	1
High-income oil exporters	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Industrial	..	..	..	..	..	..	1	..	2	..	..	..	..	..	..	..	..	..	1	..	2	3
Data not available	..	..	..	1	2	1	..	..	1	..	..	..	..	..	..	..	..	..	1	2	2	5
Total	3	3	8	1	2	2	1	..	4	..	..	..	..	..	..	..	1	1	5	6	15	26

n.a. = not applicable

Note: Data include dependent territories. Countries are divided by size according to population: VS—very small: population less than 1.5 million; S—small: population between 1.5 million and 5 million; O—other: population greater than 5 million.

a. Income categories are compatible with classifications used in the *World Development Report 1984*: Low-income: \$0–\$410; Lower-middle-income: \$410–\$1,670; upper-middle-income: \$1,670–\$6,900; high-income oil exporters: \$6,240–\$21,340; industrial countries: \$4,810–\$16,390.

Source: *World Bank Atlas 1983 and 1985*; World Bank, *World Development Report 1984* (New York: Oxford University Press, 1984).

**Table 3. Growth of Real GNP Per Capita, 1970–80**

GNP growth group	Africa	Asia	Europe	Oceania and Indonesia	North and Central America	South America	Total
<i>All economies</i>							
Negative growth	17	2	1	4	8	2	34
Zero to +2% growth	14	6	5	5	7	4	41
Greater than +2% growth	17	20	22	4	13	7	83
Data not available	5	10	7	7	2	..	31
Total	53	38	35	20	30	13	189
<i>Very small economies</i>							
Negative growth	3	1	1	4	6	1	16
Zero to +2% growth	1	2	..	2	2	1	8
Greater than +2% growth	8	4	7	3	7	1	30
Data not available	3	1	1	7	1	..	13
Total	15	8	9	16	16	3	67
<i>Small economies</i>							
Negative growth	6	..	..	..	2	..	8
Zero to +2% growth	5	1	..	2	3	..	11
Greater than +2% growth	..	4	3	..	1	2	10
Data not available	..	3	1	..	..	..	4
Total	11	8	4	2	6	2	33
<i>Other economies</i>							
Negative growth	8	1	..	..	..	1	10
Zero to +2% growth	8	3	5	1	1	3	21
Greater than +2% growth	9	12	12	1	5	4	43
Data not available	2	6	5	..	1	..	14
Total	27	22	22	2	7	8	88

Note: Data include dependent territories.

Source: World Bank Atlas 1983.

agencies and bilateral donors. These two questions will be considered by discussing the special problems that small economies are often said to face (see also de Vries 1973):

- Their inability to exploit economies of scale in the production of goods and services
- Their vulnerability to, for example, external economic shocks and natural disasters
- Their remoteness from markets of a reasonable size
- Their difficulties in obtaining private foreign capital
- Their limited independence in setting macroeconomic policies
- The tendency of often used exchange-rate conversions to overstate the real incomes of small economies.

### ***Economies of Scale***

Having only a small local market need not stop a country from exploiting economies of scale in the goods it sells to world markets.

However, to the extent that success in exporting depends on the experience gained in the domestic market, small economies may be at a disadvantage. Even that deduction needs to be qualified, however, since market size for this purpose is not measured just by a country's population and is not directly related to it being an island or land-locked. Similar problems arise for any country, large or small, with a limited domestic market. The issue is ultimately one for empirical research. The analysis of Chenery and Syrquin (1975) suggests that, even among small countries, there are substantial differences in their sources and patterns of industrialization. The exports of some industrial small economies are similar in composition to those of large countries, even though the small countries are more dependent on trade. However, small countries that are mainly primary producers tend to industrialize later than their larger counterparts. This is probably due to the latter's greater emphasis on import substitution, and perhaps to inappropriate policies as well. Another study found that there was no "significant correlation (positive or negative) of scale with growth for small and large countries" (Jalan 1982, p. 91). Separate problems could arise for small countries in producing those goods and services that are not traded internationally. In infrastructure particularly, unit costs could be higher where countries are too small to enjoy economies of scale. In building additional thermal capacity for power generation, for instance, it has been estimated that small countries face a cost disadvantage averaging 65 percent. However, for small countries with a high population density (such as Barbados), this disadvantage is only 20 percent, according to a recent IMF study (Legarda 1983). To the extent that many nontraded goods or services are inputs for tradables,<sup>4</sup> the international competitiveness of small economies may be harmed. This depends partly on the share of capital costs in the unit cost of production of infrastructure, and on the share of infrastructural costs in the cost of producing other goods and services. The lower these shares, the smaller is the disadvantage of being small. It should also be remembered that some neighboring countries can share certain infrastructural activities, such as electric power generation, education, communications, and health facilities.

Some authors have emphasized another cost-raising aspect of smallness—the need to have some political and administrative structures, regardless of a country's size. For example, a very small country and a very large one will each have one president or prime minister, and a range of government departments that is not proportional to their size. Nonetheless, it has been argued that smallness brings social and political advantages, such as greater cohesion and fewer vested interests (Jalan 1982, pp. 85–86).

In the extreme, a very small economy could face the choice of running its own government or becoming part of a larger community.

As a study by the United Nations Conference on Trade and Development (UNCTAD) points out, however, small islands may choose to retain their separate status because “islanders are never happier with insularity than when asserting that they are completely different from their neighbors, particularly in regard to language, customs and laws, legal and administrative regulations, currency, system of government and all other symbols which demonstrate the small self-contained universe. Consequently, small islands tend to band together only under the influence of external forces...” (Doumenge 1983).

---

### ***Vulnerability***

Since many small islands are located in the “ring of fire,” they are susceptible to volcanic eruptions and earthquakes. Some of them are also in the tropical latitudes in which cyclones and hurricanes develop. Since any country, large or small, in these areas faces such threats, the particular vulnerability of small (island) economies is attributed to the disproportionate effect that natural disasters could have on them. For instance, a strong earthquake could destroy a large proportion of housing and public buildings on a small island. Similarly, an epidemic could affect much of its population, although epidemics are less likely in isolated islands. Even the smallest economies can take steps to protect themselves against natural disasters. For example, a buffer stock of food built up after good harvests can help cushion the impact of a severe drought. Countries can also build up foreign exchange reserves, so as to buy imports if their domestic production is hit by a natural disaster. Although these forms of insurance are valuable, they are a cost to the economy—and a cost that increases if the probability of a disaster is high.

Natural disasters aside, small economies are allegedly more vulnerable than large ones on a second count: being necessarily more open and reliant on fewer exports, they are more affected by international economic conditions. This argument needs qualifying, however. Small economies with relatively few and modest distortions in their foreign trade can and do exploit their comparative advantage much more than large economies. Furthermore, not all small countries are affected to the same extent by external shocks, partly because of differences in the composition and size of their exports. In the fifteen years 1967–81, some had more stable export earnings than other larger but comparable countries.

Qualifications also apply to the argument that small economies have their exports heavily concentrated in a few commodities and services. Some small economies—Singapore and Hong Kong, for example—have developed the entrepreneurship and skills to diversify widely. And some large economies have at least as high a concentration of exports, if not of total production, as most small countries do.

Being small is therefore not synonymous with having production concentrated in only a few commodities. In any case, a heavy concentration of exports need not mean that a country's spending on imports has to be as volatile as its export earnings. Prudent holdings of foreign reserves would allow it to minimize the fluctuations in its imports. The same applies to domestic inventories, which can be used to even out consumption despite erratic production. Finally, countries may have the option of allowing some of their workers to emigrate, and then remit part of their earnings to their families at home. Several island economies have a significant proportion of their labor force working abroad, providing a stable source of foreign exchange.

Of course, the management of foreign reserves and domestic inventories involves some costs. Small economies may lack the necessary skills, in which case they will be at a disadvantage from the international facilities available to finance temporary and reversible shocks: examples include the IMF's compensatory financing and food facilities, and the European Communities' STABEX scheme. These can reduce the unfavorable effects of external shocks. Given their existence, it is not clear that new facilities aimed specifically at small countries are needed.

---

Some studies argue that many islands are considerably handicapped by being far from major ports. In a similar vein, it is claimed that the development of wide-bodied passenger jets and containerized cargo ships has resulted in some islands having fewer transport links, because they are too small to warrant scheduled services. As for small landlocked economies, they have to bear the relatively higher costs of land transport. And their dependence on neighbors for access to the sea is a drawback because other countries' transport systems do not necessarily serve their requirements and may charge them monopolistic prices.

High transport costs can undoubtedly reduce a country's foreign trade, just as tariff barriers can: in a simple Ricardian model, the introduction of sufficiently high transport costs will eliminate trade altogether. In consequence, the real income of an unfavorably located country will be lower than that of an otherwise identical economy. However, focusing on high transport costs alone is a mistake, since it ignores the way that countries adapt to these costs by the choice of their exports. A classic example is Switzerland, which has exported products with high value but low weight, such as watches and instruments. Two other drawbacks of remoteness have been identified in the literature. First, countries that are both small and remote are prone to internal market imperfections, because producers are not subject to effective competition. Second, many small economies (dependent terri-

## *Remoteness*

ories in particular) are far removed from the centers of power where decisions affecting them are made. However, this argument can be inverted: if remoteness means less interference from the center, it can have positive benefits. In any case, remoteness in this sense is not unique to small islands. In a large country, many areas can be just as detached from the centers of decisionmaking.

**Table 4. Per Capita Net Resource Flows by Region and Population, 1982**

(millions of U.S. dollars)

Region and group	Official		Private	
	Total	IDA	Total	Financial markets
<i>Africa, south of the Sahara</i>				
Very small countries	42.1	1.9	-10.6	-14.4
Small countries	26.0	2.9	16.1	12.4
Other countries	12.0	2.2	4.1	4.1
Regional average	23.5	2.3	3.1	-0.7
<i>North Africa and the Middle East</i>				
Very small countries	2.7	0.0	138.7	143.8
Small countries	77.0	5.1	-4.6	-4.4
Other countries	21.7	0.4	-2.3	-2.2
Regional average	30.9	1.3	11.3	12.0
<i>Mediterranean countries</i>				
Very small countries	79.0	0.0	132.6	129.7
Small countries	215.5	0.0	30.4	32.5
Other countries	21.9	0.0	43.8	41.0
Regional average	53.2	0.0	53.2	51.1
<i>South Asia</i>				
Very small countries	57.7	0.6	-2.5	-1.2
Small countries	n.a.	n.a.	n.a.	n.a.
Other countries	6.5	2.0	1.6	1.3
Regional average	13.8	1.8	1.0	0.9
<i>East Asia and the Pacific</i>				
Very small countries	26.3	1.5	12.5	11.3
Small countries	11.2	2.8	33.4	33.6
Other countries	11.0	0.2	13.5	38.9
Regional average	16.1	1.3	9.7	17.4
<i>Latin America and the Caribbean</i>				
Very small countries	36.5	0.1	70.0	69.6
Small countries	46.7	0.2	51.1	52.6
Other countries	14.1	0.3	22.7	19.7
Regional average	27.7	0.2	40.0	38.9

n.a. = not applicable

Note: Very small countries are those with population less than 1.5 million; small countries are those with population between 1.5 million and 5 million; other countries are those with population greater than 5 million. Data are based on a sample of 103 economies.

Source: World Bank, *World Debt Tables, 1983-84* (Washington, D.C., 1984); and World Bank, *World Tables, 3d ed., vol. 1: Economic Data* (Washington, D.C., 1983).

Small economies are alleged to have only limited access to private foreign capital. The evidence for this view is thin and hard to interpret. Flows of foreign capital are influenced by many factors other than a recipient's size: its economic policies and political stability are obviously of prime importance. Some small economies have succeeded not only in borrowing abroad but also in attracting investment from multinationals. A few islands have become significant financial centers, benefiting perhaps from the restrictions and tax systems of rich and large countries. Whether or not small economies find it difficult to obtain private capital from abroad, they do not suffer at all when it comes to official development assistance. Their per capita receipts of ODA are much larger than those of many large economies. An analysis of this bias in aid allocations is contained in Isenman (1976). In almost every region, very small and small countries have benefited disproportionately, both from all net official transfers and, more narrowly, from lending by the International Development Association (IDA) (see Table 4).

Some common arguments about small economies are that they have little choice except to be open; that they have little room for independent exchange rate and monetary policies; and that their scope for taxation and public spending is limited, thus restricting the flexibility of fiscal policy. The first of these claims is self-evident: autarkic policies are likely to be costlier for small economies, so they tend to be more open purely out of self-interest. But it does not necessarily follow that openness denies a country some policy independence. Since the major currencies started floating in the early 1970s, even the large industrial countries have had little room for independent (that is, internationally uncoordinated) macroeconomic policies. In most respects, the argument about policy independence boils down to the assertion that small open economies find it harder to adjust their economic policies in the face of external shocks. This issue has been addressed in the section above on vulnerability, where it was concluded that small economies are not inherently more vulnerable than large ones to external shocks. Furthermore, the dictum "finance shocks that are temporary and reversible, but adjust to permanent shifts" applies equally to large and small countries. And the task of deciding whether a shock is "temporary" or "permanent" is no easier for a large than a small economy.

Consider, for simplicity, two economies identical in every respect except transport costs. They face the same prices in world markets. Neither has any domestic distortions. However, one of them is so close to its markets and suppliers that its transport costs can be

**Table 5. Measures of Per Capita Gross Domestic Product by Country, 1975**

Country	Per capita GDP		Exchange-rate deviation index (2)/(1)
	In U.S. dollars <sup>a</sup> (1)	In international dollars <sup>b</sup> (2)	
<i>Africa</i>			
Kenya (shillings)	241	470	1.95
Malawi (kwacha)	138	352	2.55
Zambia (kwacha)	495	738	1.49
<i>Asia</i>			
India (rupees) <sup>c</sup>	146	470	3.23
Iran (rials) <sup>d</sup>	1,587	2,705	1.70
Japan (yen)	4,474	4,907	1.10
Korea (won)	583	1,484	2.54
Malaysia (ringgit)	780	1,541	1.98
Pakistan (rupees)	189	590	3.12
Philippines (pesos)	376	946	2.51
Sri Lanka (rupees)	183	668	3.65
Syria (pounds)	718	1,794	2.50
Thailand (baht)	359	936	2.61
<i>Europe</i>			
Austria (schillings)	5,010	4,995	1.00
Belgium (francs)	6,298	5,574	0.88
Denmark (kroner)	7,498	5,911	0.79
France (francs)	6,428	5,877	0.91
Germany (DM)	6,797	5,953	0.88
Hungary (forint)	2,125	3,559	1.68
Ireland (pounds)	2,673	3,049	1.14
Italy (lire)	3,440	3,861	1.12
Luxembourg (francs)	6,472	5,883	0.91
Netherlands (guilders)	6,061	5,397	0.89
Poland (złote)	2,586	3,598	1.39
Romania (lei)	1,742	2,387	1.37
Spain (pesetas)	2,946	4,010	1.36
United Kingdom (pounds)	4,134	4,588	1.11
Yugoslavia (dinars)	1,664	2,591	1.56
<i>Latin America and the Caribbean</i>			
Brazil (cruzeiros)	1,149	1,811	1.58
Colombia (pesos)	568	1,609	2.83
Jamaica (dollars)	1,406	1,723	1.23
Mexico (pesos)	1,465	2,487	1.70
Uruguay (N. pesos)	1,308	2,844	2.17
<i>North America</i>			
United States (dollars)	7,176	7,176	1.00

a. Converted at the official exchange rate.

b. The 1975 international dollar has the same purchasing power as a 1975 U.S. dollar.

c. Reference year beginning April 1.

d. Reference year beginning March 21.

Source: Irving B. Kravis, A. Heston, and R. Summers, *World Product and Income: International Comparisons of Real Gross Product* (Baltimore, Md.: Johns Hopkins University Press, 1982), table 1.2.

neglected; the second is so far away that transport costs prevent it participating in world trade. If the income (value added) of each of these economies is measured by valuing its net output at the common set of world prices, then the second will have a lower real income than the first. The difference between the two is that transport costs distort the prices facing producers and consumers in the second economy, thereby reducing the real value of its income. This argument implies that both countries produce only commodities that have a world price—that are traded internationally. However, it remains valid even when nontraded goods are included as long as they are valued at prices that equal the value of the inputs used in their production, the input prices being those prevailing in the first economy.

In practice, real incomes in a common currency such as the U.S. dollar are often computed by converting the real income in national currency into dollars at the official exchange rate. This procedure, it is generally agreed, has many flaws that make income comparisons between countries a misleading guide to their true differences in welfare and purchasing power. Beyond this general drawback, however, some studies have argued that income measures are particularly misleading when applied to small economies.

Some writers say that many small and poor countries have a rich expatriate community which may distort the figures by pulling the country's per capita income well above that of its resident citizens. However, with adequate data, statisticians can work out the per capita incomes of resident citizens. A more serious argument is that using the official exchange rate to convert incomes into a common currency understates the cost disadvantages (notably transport) of small islands. This amounts to saying that an exchange rate that properly reflects these costs will be higher than the official one. The results from the International Comparisons Project, however, show that the "exchange rate deviation index"—the ratio of the official exchange rate to the purchasing-power-corrected exchange rate—is greater for small economies than for all developing countries (see Table 5). Their real incomes are actually higher than those measured by standard exchange-rate conversions. To that, some researchers reply that the incomes of small developing economies are nonetheless being overstated compared to those of larger ones. The data to justify this claim, however, are not available.

---

Many of the problems allegedly faced by small economies are either not peculiar to them or can be addressed through suitable policy measures. The main operational significance of this conclusion is the need to use several indexes of development and welfare in determining whether a country should have aid and trade concessions. Deci-

## *Conclusions*

sions made on the basis of any single criterion—such as a country's per capita real income in U.S. dollars at the official exchange rate—are bound to be unfair to any economy, but perhaps especially to small islands or landlocked economies. Even if a flexible approach ensures that small economies are fairly treated, this does not mean that all is well with them. Several have suffered a fall in real per capita incomes in recent years, and the external environment for all developing countries is not favorable. But it would be wrong to suppose that the economic and social stagnation in some small economies is due to their smallness.

---

### **Abstract**

Any index of smallness is somewhat arbitrary, but common practice has been to use population and income criteria. Experience suggests that smallness is neither a necessary nor sufficient condition for poor development performance. This paper considers the problems that small economies are most often alleged to face, including absence of economies of scale, vulnerability, remoteness, reduced access to capital markets, problems of macroeconomic policy dependence, and overstatement of real income. The paper concludes that many of the alleged problems of small economies are either not peculiar to small economies or can be addressed through suitable policy measures.

---

### **References**

- Chenery, Hollis B., and M. Syrquin. 1975. *Patterns of Development 1950–1970*. London: Oxford University Press.
- de Vries, B.A. 1973. "The Plight of Small Countries." *Finance and Development* 10, no. 3 (September): 6–8.
- Doumenge, F. 1983. "Viability of Small Island States." Geneva: United Nations Conference on Trade and Development.
- Group of Twenty-four. 1982. "Communique of the Group of Twenty-four, September 3, 1982."
- Isenman, Paul. 1976. "Biases in and Allocations Against Poorer and Larger Countries." *World Development* 4, no. 8: 631–41.
- Jalan, B.M., ed. 1982. *Problems and Policies in Small Economies*. New York: St. Martin's Press.
- Legarda, Benito. 1983. "Small Tropical Island Countries: An Overview." Washington, D.C.: International Monetary Fund. Processed.
- United Nations Conference on Trade and Development. 1983a. "The Incidence of Natural Disasters in Island Developing Economies." Study by the UNCTAD Secretariat in collaboration with the Office of the United Nations Disaster Relief Coordinator (TD/B/961). Geneva.
- . 1983b. "Specific Action Related to the Particular Needs and Problems of Landlocked and Island Developing Countries: Issues for Consideration." Report by the UNCTAD Secretariat. UNCTAD Conference, sixth session, policy paper (TD/279), parts 1–2. Belgrade, June 6, 1983.
- . 1984. "Islands in the Sun—Have Problems Too." *UNCTAD Bulletin* 198 (December–January).
- World Bank. 1982. "Press Communique of the World Bank Development Committee, September 5, 1982." Washington, D.C.

---

---

# A BENEFIT-COST ANALYSIS OF NUTRITIONAL PROGRAMS FOR ANEMIA REDUCTION

*Henry M. Levin*

One of the most common nutritional problems in both industrial and developing countries is iron deficiency anemia. In many developing countries, between one- and two-thirds of the population are affected. Anemia refers to a condition in which the concentration of hemoglobin (Hb) in the blood is below some norm for a given population. Although anemia may be due to factors such as disease or blood loss, its most common cause is a deficiency of iron (Charlton and Bothwell 1982). Such deficiency is typically caused by not consuming enough absorbable iron, relative to what the body needs for forming hemoglobin and other purposes.

The Hb level provides the mechanism for carrying oxygen to muscles and other tissues of the body. At low hemoglobin levels, the body's ability to produce energy and meet other functional needs is limited. The anemic person feels weak and listless and may be more susceptible to infection. Work capacity is also impaired, and anemic children perform less well in school. Many of the consequences of anemia have been summarized (Pollitt and others 1982; Pollitt and Leibel 1976; Read 1975; Scrimshaw 1984).

The purpose of this study is to review the available literature from the perspective of those concerned with investment in human resources. All investments have a cost—the value of the resources employed (Levin 1983)—and may also produce benefits. To reduce anemia, the costs stem from the iron supplements and the system for delivering them. The potential benefits are improved fetal and child growth, lower morbidity and mortality, higher productivity, more enjoyment of leisure, and more effective learning by students.

Ideally, this review would be based on case studies of benefits and costs of programs to counter anemia. Unfortunately, no such systematic data exist. But a large variety of studies can be used to construct a picture of the benefits and costs of anemia programs, and they form the basis of this article. The next section will discuss the treatment of anemia. The third and fourth sections will develop the types of benefits and costs associated with reducing anemia. The fifth section will discuss methods of calculating benefits. The sixth section develops specific calculations for costs and benefits in three countries—Indonesia, Mexico, and Kenya. The final section will draw policy implications from these results.

---

### ***Treatment of Anemia***

The World Health Organization (WHO) has defined the following levels of Hb concentration in grams a deciliter below which anemia is likely to be present: children 6 months to 6 years, 11; children 6 to 14 years, 12; men, 13; women who are not pregnant, 12; and women who are pregnant, 11 (WHO 1968). However, these are general indicators of anemia rather than precise criteria. Iron requirements also vary among individuals and groups. The daily intake of iron needed to maintain homeostasis is estimated to range from 0.7 mg for infants and 0.9 mg for men to about 3.0 mg for women in the second half of pregnancy (Baker and DeMaeyer 1979).

Anemia is a serious nutritional problem around the world, but especially in the tropics (Fleming 1977 and 1982; Masawe 1981; Woodruff 1972 and 1982). Pregnant, lactating, and premenopausal women are most at risk, but there are high incidences of anemia among other populations as well (Royston 1982). A summary of studies of the incidence of anemia around the world shows that as much as 80–90 percent of the population is affected in some regions (see Annex Table 1).

Although anemia can be caused by nutritional deficiencies, disease, and excessive blood loss, this article concentrates on its leading cause, inadequate intake of usable iron. Both the amount and the form of iron eaten are important. Heme sources of iron (meat, fish, and poultry) are not only high in iron content, they are also easily absorbed and they assist the absorption of iron from nonheme sources such as the cereals that compose the staple diet for most of the world (INACG 1982). Ascorbic acid is also a valuable source for increasing the absorption of iron (Hallberg 1981).

Antianemia programs take two forms: supplementation and fortification (Baker and DeMaeyer 1979). Supplementation involves providing extra iron in medicinal form, either orally or by injection. Fortification involves adding nutrients to foods to maintain or improve the quality of a diet. A standard supplementation for adults is 120–200

mg a day of ferrous sulphate or ferrous fumarate, and rather less for infants and children (Callender 1982). Ferrous sulphate is one of the cheapest of all nutritional supplements, costing only 68 cents a kilogram in 1977. Other iron compounds are from two to seventeen times more expensive, after adjusting for bioavailability (INACG 1977; Bothwell and Charlton 1981). Although costs are still relatively low, they have risen by about 30 percent since 1977. Adding ascorbic acid to increase iron absorption from meals is expensive: in 1982 both stabilized and unstabilized ascorbic acid cost between \$10 and \$11 a kilogram (INACG 1982). According to Bothwell and Charlton (1982), the addition of 200 mg or more of ascorbic acid increases iron absorption by at least 30 percent.

In some cases, particularly for pregnant women, folate deficiency is also a cause of anemia, often in conjunction with iron deficiency. WHO has recommended that pregnant women with folate deficiencies should receive 2.5 to 4.0 mg of folic acid a day as a supplement (INACG 1977). The cost to UNICEF of tablets containing 60 mg of elemental iron in the form of iron sulphate and 0.5 mg of folate was about \$1.00 a thousand in 1981; the folate added only about 2 percent to total cost (DeMaeyer 1981).

With dietary supplementation, the main difficulty is to persuade people to take iron regularly for the full period. Dietary fortification is simpler, because it does not require people to change their behavior. However, the real issue is what is the right type of food to fortify. WHO has set out the following criteria for fortified food (Baker and DeMaeyer 1979; WHO 1975):

- It is consumed by the vast majority of the target population and in adequate amounts.
- It can be fortified on a large scale and at relatively few centers, so the fortification can be adequately supervised.
- It is stable under the extreme conditions likely to be encountered in storage and distribution.
- It remains palatable, even when it is mixed with other food.

The ideal food for fortification may vary from country to country, and perhaps even from region to region. In industrial countries such as the United States and Sweden, wheat flour is commonly fortified: in the United States such enrichment has taken place since 1941. In developing countries, the more common vehicles are salt, sugar, infant foods, and skimmed milk (WHO 1975). Fortification can be done with iron compounds or ascorbic acid. Salt fortified with ascorbic acid doubles or even quadruples the absorption of the intrinsic iron in maize porridge or rice (WHO 1975). Even small amounts of ascorbic acid—such as adding 25 mg to a simple maize meal—tripled the absorption of iron, and 200 mg increased iron absorption sixfold

(Hallberg 1981). Derman and others (1977) found that fortifying sugar with an extra 50 mg of ascorbic acid increased ninefold the absorption of iron from maize-meal porridge. When initial levels of hemoglobin are low, iron supplementation is associated with big rises in hemoglobin, of the order of 60–100 percent. Even relatively short periods of iron supplementation—two to three months—can be effective. However, some dietary fortification would probably be needed to sustain these gains.

Among studies of fortification, an Indian study added iron to salt, and one for Mauritius used wheat flour baked into bread. The Indian study covered three sites and several population groups. The largest rises in Hb occurred among people with the worst anemia. For example, the Calcutta women with mean initial Hb of 8.5 showed a 35 percent increase to 11.5, while the men in the Calcutta sample boosted their Hb levels from 9.7 to 12.8 after a year. Changes were considerably smaller at the two other sites where the prevalence of anemia—and especially severe anemia—was smaller to begin with. A summary of iron interventions and changes in Hb is found in Annex Table 2.

---

### ***Benefits of Anemia Reduction***

Some of the benefits of reducing anemia are hard to identify—for example, a reduction in infection—and others are hard to quantify—for example, a feeling of greater well-being. This section will focus on a quantifiable benefit from the relation between anemia and productivity, although the final section of this report will try to incorporate an estimate of all the benefits.

#### *Work Capacity and Work Output*

One measure of the effect of anemia on work capacity is what it does to a person's maximum oxygen uptake (Astrand and Rodahl 1977). This is an assessment of the largest amount of oxygen that a person can take in during exercise and is a good indicator of fitness. Studies have found that increasing Hb concentrations through iron supplements is associated with an increase in oxygen uptake and lower heart rates (Davies and Van Haaren 1973; Gardner and others 1975).

A person's capacity for work and his actual output may differ for several reasons. First, work capacity sets a limit on the maximum amount of work that can be performed. The types of jobs that draw upon maximal aerobic capacities are those that are highly physical, requiring continuous exertion and stamina. These jobs include much of the work in agriculture, labor-intensive manufacturing, infrastructure industries such as construction and mining, and various services such as loading and unloading vehicles, transport by foot or foot-

driven vehicles, and cleaning. They also include many household tasks such as cutting and carrying firewood, drawing water, and hand-grinding grain. These jobs cover a high proportion of work in developing countries.

Second, work output depends not only upon work capacity, but also on a person's intelligence, skills, motivation, size, strength, and stature. Other factors include the availability of work, access to tools and equipment, incentives to work, and supervision. Finally, the weather influences the amount of outdoor work that is achievable (Popkin 1978).

Even given these differences, research has shown a close relationship between Hb-related measures of work capacity and work output. For example, Davies (1973) studied the relation of maximum oxygen uptake ( $VO_2$  max) to both productivity and absenteeism among seventy-eight cane cutters age eighteen to fifty in Tanzania. Their daily output was positively related to  $VO_2$  max, and their involuntary absences from work were negatively related, both at significant statistical levels. There have been eight studies of work output in relation to Hb levels or changes in Hb levels (Basta and Churchill 1974; Basta and others 1979; Edgerton and others 1979; Gardner and others 1977; Karyardi and Basta 1973; Ohira and others 1981; Popkin 1978; and Viteri and Torun 1974). Although they refer to different countries and measures of work output, the results are remarkably consistent. The elasticity of work output with respect to rises in Hb is between 1 and 2: that is, a rise in Hb of 10 percent is associated with a rise in work output of between 10 and 20 percent (Levin 1985).

### *Cognition and Schooling*

Several studies have established that anemia affects a person's learning ability. Work by Pollitt and others (1982) with three- to six-year-olds, as well as the findings of Lozoff and others (1982a) and Oski and Honig (1978) and Oski (1979) have led to the conclusion that iron deficiency "...has adverse effects on cognition, and that these are reversible following iron repletion. The effects are mild and most probably located at the level of information reception" (Pollitt and others 1982).

More recently, Popkin and Lim-Ybanez (1982) have published an extensive analysis of the relation between nutrition and school achievement for 182 children, age twelve to fourteen, in three rural and three urban schools in the Philippines. It found a significant positive relation between Hb and the language test score, with no statistically significant relation between Hb and science or mathematics scores. Hb levels seemed to have no relation to pupils' ability to concentrate or to participation in extracurricular activities. However,

they showed a significant, but slight, negative relation to the number of days absent. Although it appears that learning and school success are related to Hb, the evidence is not as strong as that relating Hb to work capacity and work output.

### *Other Potential Benefits*

Summaries of the effects of severe anemia during pregnancy have established a connection with increased risk of both maternal and fetal mortality and morbidity (INACG 1977). Even mild anemia has been associated with premature delivery and low birthweight (INACG 1977; Baker and DeMaeyer 1979). There is also some evidence that iron deficiency is associated with lower weight gains among infants and children (Baker and DeMaeyer 1979; Burman 1982; Oski 1979). Many researchers suspect that anemia may increase a person's susceptibility to infection, although the evidence is not straightforward (Baker and DeMaeyer 1979; INACG 1977; Nutrition Reviews 1975); indeed, there is some support for the view that iron deficiency is a defense against certain types of infections and is a factor reducing the probability of heart disease (Callender 1982). Symptoms commonly associated with anemia are fatigue, headaches, weakness, lightheadedness, and irritability. These are difficult to define and measure, however, and various studies have found no evidence between the extent of them and the severity of anemia (Leibel and others 1979).

---

### *Costs of Interventions*

A straightforward way of estimating the costs of antianemia programs is to specify the ingredients needed (Levin 1983). The costs of buying and applying these ingredients will vary from program to program. However, there has been little systematic collection and analysis of cost data in antianemia programs. Studies of other programs can be used as a guideline for evaluating costs, particularly immunization programs (Creese and others 1982) or antihelminth drug programs (Stephenson and others 1983). In the case of iron fortification programs, there seems to be some direct evidence on costs (Cook and Reusser 1983).

### *Required Ingredients*

A supplementation program would require the following basic ingredients:

- *Personnel.* The main responsibilities at the site level are the distribution of iron supplements, record keeping, and health education. In a small village these responsibilities might be undertaken by a

full-time community health worker. A larger program might involve supervisors, community health workers, and clerical and warehouse staff. However, a big program might be considerably cheaper per client served because of economies of scale.

- *Medicinal supplements.* These include iron compounds, folic acid, and absorbency enhancers such as ascorbic acid.
- *Transport.* This can vary from public transport and bicycles in urban areas, to motorbikes or motorcycles in outlying areas with reasonable roads, to four-wheel vehicles or even animal transport in remote areas. Equipment, maintenance, and fuel must be taken into account.
- *Facilities.* At the village level, facilities need be no more than a small office and storeroom. The iron compounds and other supplements do not normally require refrigeration or other special treatment, except perhaps in conditions of extreme heat and humidity. In urban areas, the program could be incorporated into a larger health center.

Cultural and dietary differences may affect people's receptiveness to different forms of supplementation, and hence the character and cost of a program. If a health or nutritional service already exists, few additional resources may be needed to mount an antianemia program. The costs of adding iron compounds to an existing fortification program may also be much lower than those of developing a special program for iron fortification.

The cost of ingredients may also vary widely between countries. And the relative scarcity of different types of labor will affect a program's costs. Creese and others (1982) found that the daily salaries of capable vaccinators in Indonesia and Thailand in 1979 differed by more than 250 percent.

The costs of servicing a given population will depend upon the efficiency of a supplementation unit or fortification program, as well as on its ability to reach the target populations. Organizational efficiency is beyond the scope of this article. However, one major determinant of productivity—the number of clients that a program can efficiently serve—is closely tied to the size and density of a geographical area as well as its transport facilities.

### *Costs of Fortification*

Iron fortification is considered the best way of reducing anemia because it requires little effort by the target group and is cheap. The only costs beyond those of the food that would normally be eaten are those of the fortifying nutrients and stabilizers; of mixing them into the food; and of any special packaging or distribution.

Sugar and salt are the best foodstuffs for fortification (Working Group on Fortification of Salt with Iron 1982; Layrisse and others 1976; Sayers and others 1974; and Derman and others 1977), so this section uses them as examples. In particular, it looks at the report of the Working Group on Fortification of Salt with Iron (1982), which dealt with field trials over twelve to eighteen months at three rural sites and an urban one in India, each covering 4,000 to 6,000 people. Fortification consisted of adding 3.5 g of ferric orthophosphate to each kilogram of common salt. This was estimated to provide an extra 10–15 mg of iron a day for adults. Statistically significant increases in Hb occurred in the three sites for which valid data were obtained (the evaluation at one site encountered operational difficulties). The strongest effects were in Calcutta, where Hb increased by about 3 g/dl compared with little or no change in control groups. Increases in Hb were smaller at other sites: roughly 0.8 g/dl in Hyderabad and about 0.5 g/dl in Madras, with important differences by sex and age. As shown in Annex Table 2, anemia was much more severe in Calcutta, which almost certainly explains the substantially greater Hb response to fortification. The fortification effort added about 20 percent to the cost of the salt (Working Group on Fortification of Salt with Iron 1982) or an estimated \$0.07 a year per person (Cook and Reusser 1983).

The use of sugar in fortification was examined in detail in field trials in Guatemala (Viteri and others 1981). Two communities in the highlands and one in the lowlands received fortified sugar over a thirty-one month period. Sugar was fortified at a ratio of 1.3 mg of iron per gram of sugar. Mean daily consumption of sugar was 40 g, so that the daily iron intake from the fortification was more than 5 mg. The incidence of anemia was reduced substantially in all of the communities receiving fortification, in contrast with the control groups. According to Cook and Reusser (1983), the extra iron added 1–2 percent to the cost of sugar—about \$0.10 a year per person.

Some costs of a fortification program—processing and distribution—have not been calculated with any precision. As a rough estimate, however, they do not increase the costs of delivering sufficient iron by more than \$0.10–0.20 a year per person. Thus the total costs, in 1980 dollars, are between \$0.20 and \$0.30 a year per person. From data provided by Derman and others (1977), Levin (1985) estimated the cost of adding ascorbic acid to cane sugar at about \$0.60 a year per person in 1980 dollars.

### *Costs of Supplementation*

Developing a delivery system exclusively for iron supplementation would be costly and wasteful, since supplementation is essentially a

short-term exercise. Its costs should therefore be calculated as the marginal costs of a program organized through an existing health care system. These costs can be estimated using two different assumptions. One, that a delivery system exists, so only the supplements are an extra cost. Two, that supplementation has to carry one-fourth of the overall costs of the delivery system, as well as all the costs of the supplements themselves.

The strict marginal cost assumption is often realistic: in both the workplace and the community, delivery mechanisms often exist. For example, meals are sometimes provided to workers in both factories and farms. A typical program would provide 100–200 mg of ferrous sulphate a day for two to three months. Such a supplement would be expected to increase Hb between 20 and 50 percent, depending upon the initial Hb, the specific populations, the existence of parasites, and so on. In 1981 the cost to UNICEF of 1,000 tablets of 60 mg of iron sulphate with 0.5 mg of folate was about \$1.00 (DeMaeyer 1981) or about \$1.10 a year for 180 mg a day. The U.S. government depot from which the U.S. Public Health Service obtains pharmaceuticals was charging \$7.80 for 1,000 tablets of 500 mg of ascorbic acid in March 1984, or a cost of less than \$3.00 a year for one tablet a day. Presumably, the cost would be somewhat lower for three tablets of 100 mg a day. Depending on what was chosen, therefore, supplementation with an existing delivery mechanism would cost about \$1.10 a year per person for iron with folate to about \$3.00 a year per person for iron with ascorbic acid.

The costs of developing a delivery system for antianemia programs and other purposes can be illustrated with the examples of Indonesia, Kenya, and Mexico. The delivery system could be built around a community or village-based health care approach (Djukanovic and Mach 1975; Hetzel 1978; PAHO 1973; WHO 1979). Such a system makes heavy use of local resources, as well as of health auxiliaries or community health workers. Health auxiliaries are people who have completed all or most of primary school and are literate in basic reading, writing, and computational skills. They typically come from the local community, so will relate well to the populations they serve. They can deliver nutritional supplements and provide information and advice on their use. They are also able to offer inoculations and other health services. They are given short training programs and then have only occasional contact with more highly trained staff or administrators.

Our basic model assumes that a health auxiliary can serve a large village of 1,000 inhabitants or several smaller ones with a combined population of 1,000. Creese and others (1982) reported that the daily wages in 1979 of midwives and sanitarians in Indonesia, the Philippines, and Thailand varied from \$2.24 for a vaccinator in Indonesia (or \$560 a year for 250 days) to \$5.90 for a midwife in Thailand

(about \$1,500 a year). We will assume that the higher figure is necessary to obtain the skills and experience required. For Indonesia, the cost of an inoculator for 250 days was less than \$600 a year according to Creese's figures; for Kenya, according to Stephenson and others (1983), community field workers were used to provide antihelminth medications to children at a cost of \$2.50 a day, about \$625 for a 250-day year. In order to provide a generous estimate of personnel costs, our calculations assume a cost of \$1,500 a year per health auxiliary. Procedures for estimating the costs of facilities, transportation, and supplies are found in Levin (1985).

Table 1 estimates the annual cost, in 1980, of delivering supplements to reduce anemia. Personnel costs and supplies are similar in all three cases, but different assumptions are made on facilities and transportation costs. The total cost per year is about \$3,200 for the low case, \$5,800 for the medium case, and \$8,300 for the high case. These costs are divided by four to obtain the average costs for the anemia program alone, and then by 1,000 to obtain the per capita costs. Clearly, the estimates would be lower if this delivery service could cover more clients—as in urban areas—and higher if the population is too dispersed to be able to serve 1,000 people by this method. Population density has been a major factor in the costs of immunization programs (Creese and others 1982).

The per capita costs of service delivery are less than \$1.00 for the low assumptions, about \$1.50 for the medium assumptions, and just over \$2.00 for the high assumptions. To these must be added the medicinal supplements, resulting in costs of almost \$2.00 a person

**Table 1. Estimated Annual Cost for Delivering Medicinal Supplements to Reduce Anemia (Based on Service for 1,000 People), 1980**  
(U.S. dollars)

<i>Ingredients</i>	<i>Low case</i>	<i>Medium case</i>	<i>High case</i>
Personnel	1,500	1,500	1,500
Facilities	294	588	1,175
Transportation	368 <sup>a</sup>	2,756 <sup>b</sup>	4,592 <sup>c</sup>
Supplies	1,000	1,000	1,000
Total	3,162	5,844	8,267
Average (total cost divided by 4)	791	1,461	2,067
Per capita (average cost divided by 1,000)	0.79	1.46	2.07
Including ferrous sulphate	1.89	2.56	3.17
Including ascorbic acid	3.79	4.46	5.07

a. Moped.

b. Automobile.

c. Four-wheel drive vehicle.

Source: Levin (1985).

with ferrous sulphate or almost \$4.00 with ascorbic acid for the low model; about \$2.50 with ferrous sulphate and \$4.50 with ascorbic acid for the medium model; and about \$3.00 with ferrous sulphate and \$5.00 with ascorbic acid for the high model.

### *Higher Energy Needs*

One additional element of cost is the higher energy needs of a less anemic workforce. People engaged in strenuous activities obviously need more energy than those with inactive lives. Any increases in work output would require an increase in energy to sustain them over the long term (Viteri and others 1971). Several studies have attempted to ascertain when the cost of a higher caloric input for workers is justified by the value of the higher agricultural output, as well as the implications for rural labor markets (Immink and Viteri 1981a, 1981b; Leibenstein 1958; Mirrales 1976; Stiglitz 1976). Although some studies do show how energy requirements vary between different kinds of work, our data refer to higher levels of output for the same amount of work. Energy needs depend also upon climate, the weight of the individual workers, and so on. Thus, it is hard to generalize about the relation between output and energy needs. However, Levin (1985) estimated that a 10 percent increase in output will add 160 calories to the daily energy requirement per worker.

To provide an approximate cost for additional energy intake, we will use a major food staple as an example. According to Watt and Merrill (1963), uncooked rice and cornmeal both have a caloric content of about 3.65 calories per gram. The unsubsidized price (reflecting the full cost) of rice in Indonesia in 1980 was about \$0.34 per kilogram (Mears 1981), a daily cost of about \$0.0093 for an amount that would be expected to provide about 100 more calories. Cornmeal was in the same price and caloric range in Mexico. For 200 days of work a year, the additional cost of 100 calories a day would be about \$1.86, and for 300 days it would be \$2.79. This means that for a daily increase of 400 calories—the amount associated with a 25 percent increase in work output—the annual cost for 200 days of work would be almost \$7.50. These, of course, are costs per worker, not per capita. They must be divided among the entire population to make them consistent with the other cost estimates. Further, some of the additional energy needed to raise the output of a particular worker may be offset by the lower requirements of workers who are displaced. Both of these adjustments will be discussed later.

---

Labor markets in developing countries consist mainly of agricultural workers. In 1979 some 71 percent of the labor force in low-income

*Calculating  
Benefits*

countries (as defined by the World Bank) was in agriculture, and 43 percent in middle-income countries (World Bank 1981). In the low-income countries, roughly equal proportions—14–15 percent—were engaged in manufacturing and services. In the middle-income countries, the proportion in manufacturing was 23 percent, and in services 34 percent. Most of these countries had high unemployment. They also had many localized labor markets, each characterized by different wages according to the region of the country, urban-rural distinctions, seasonal factors, and industry composition.

The nature of these labor markets has important implications for estimating the benefits of higher work output. For example, productivity and wages differ substantially both within and among societies, so extra output cannot be given a single value. In addition, the existence of surplus labor may mean that some of the additional output of the employed labor force will be translated into a need for fewer workers.

Keeping these factors in mind, we can identify several steps for estimating the benefits of anemia reduction. First, stipulate the probable effect of specific programs on Hb and their likely impact on output. Second, estimate the pecuniary value of the extra output. Third, adjust the value of additional output per person for the number of people who are not in the productive labor force but are benefiting from the antianemia program. Finally, estimate the value of non-labor-market benefits, such as lower morbidity, improved physical stature and learning, and reduced mortality.

### *Effects of Programs on Hb*

Based on data summarized in Levin (1985), we assume that antianemia fortification programs raise Hb levels by a minimum of 5 percent, a maximum of 20 percent, and a probable norm of 10 percent. As for iron supplementation, we will use 10 percent and 50 percent as the low and high estimates of the incremental change in Hb, and 25 percent as the most likely value.

### *Effects of Changes in Hb on Output*

On the basis of the previous analysis, we will assume that the elasticity of Hb changes on output will be between 1 and 2, with the most likely value being 1.5. That means that for every increase of 1 percent in Hb, there will be an expected increase in output of between 1 and 2 percent, with the most likely increase being 1.5 percent. Applying these assumptions, Table 2 shows the estimated increase in output for arduous physical occupations. The effects can be dramatic. An increase in an individual's Hb of 20 percent and an elasticity of 1.5 would suggest a rise in his output of more than 30 percent.

**Table 2. *Estimated Impact of Iron Interventions on Work Output***

(percent)

<i>Intervention</i>	<i>Hb/work output elasticity</i>		
	1	1.5	2
<i>Fortification</i>			
$\Delta$ Hb = 5 percent	5	7.5	10
$\Delta$ Hb = 10 percent	10	15	20
$\Delta$ Hb = 20 percent	20	30	40
<i>Supplementation</i>			
$\Delta$ Hb = 10 percent	10	15	20
$\Delta$ Hb = 25 percent	25	37.5	50
$\Delta$ Hb = 50 percent	50	75	100

*Source:* Levin (1985).

### *Pecuniary Value of Work Output*

Factors determining the value of work include the organization of work, capital intensity, technology, economic structure, and the overall level of economic development. In a perfectly competitive market economy that meets all of the textbook assumptions, the equilibrium wage is assumed to approximate the value of worker productivity at the margin.

However, labor markets in developing countries do not approach this model. In farming, for example, much of the output comes from small holdings with no hired labor. Where labor is hired—on the large plantations and estates—labor markets are dominated by a few employers, at most. Traditional attachments to villages and poor transport reduce labor mobility, and inadequate access to capital markets limits capital mobility. With a rapidly growing population and labor supply, there is a labor surplus even at subsistence wages.

Now consider the social value of additional output. For the self-contained traditional farm, extra output can increase home consumption. But if family members are underemployed, their increased productive capability may not be fully realized, especially during the seasonal lulls in agricultural activity. In that case, the extra output of less anemic workers may serve only to displace other workers who would have had more employment. Of course, during periods of high employment (such as planting and harvesting), the extra capabilities of workers—hired and family—can be put to full use. The social value of additional output of a particular worker over a year is therefore likely to be greater than zero, but less than his or her average productivity (Gittinger 1982; McDiarmid 1977).

On the basis of evidence and analysis in Levin (1985), we assume that the social benefit of additional output will be equal to half of the

increase in the annual earnings associated with greater productivity. This value is based upon two assumptions: the marginal value is 50 percent higher than the monopsony wage, and the social opportunity cost of the marginal worker is one-third of his or her productivity.

A study by Gillian Hart (cited in World Bank 1983) of a Javanese village in 1975–76 found that men had annual earnings of about \$161 and women \$58. Assuming eight-hour days, approximately 200 days of work a year, and a weighted wage, annual earnings were about \$118. Halving that to obtain the social value of output brings the figure down to \$59. Adjusting it on a per capita basis requires taking account of nonearners as well as earners. We will assume that productive work is done by people age fifteen to sixty-four, who compose about 55 percent of the population in low- and middle-income countries. Therefore, the per capita value of social output at the margin is about \$32.50 a year.

This estimate can be combined with the impact of antianemia programs on output shown in Table 2. For example, an increase in Hb of 10 percent, combined with an output elasticity of 1.5 and a social output of \$32.50 yields an increased output per capita of about \$4.88. For supplementation we can take the intermediate value of 25 percent for the change in Hb, an elasticity of 1.5, and hence an increase in output of 37.5 percent. Multiplying this by \$32.50 yields an increased output per capita of about \$12.19. These estimates, it should be noted, tend to be conservative, because they assume the relatively low agricultural wage as a benchmark and also that only people age fifteen to sixty-four are doing productive work.

### *Adjusting for Other Benefits*

Apart from immediate increases in output, antianemia programs produce several long-term benefits: lower morbidity and mortality, greater physical stature, higher productivity outside of the workplace, improved quality of leisure time, greater learning and faster school advancement, and improved feelings of well being. Especially important is the additional work output in the household and in peasant agriculture, which is not accounted for by the value of additional output in labor markets. However, the value of these other benefits is extremely difficult to estimate. The best parallel is to consider what these types of benefits might mean in the field of education. The usual approach to estimating the economic value of additional education is to work out the extra earnings associated with an extra year of schooling. In a comprehensive article, Haveman and Wolfe (1984) estimated the nonmarket effects of education on economic well being. These include improving the well-being of children through home activities, improvements in health, and some seventeen other catego-

ries of benefits not tied to market productivity and wages. They concluded that the standard estimates of the benefits of an extra year of schooling "...may capture only about one half of the total value" (p. 401).

If this finding were also true of programs that provide a major improvement in health, the overall marginal social benefit of anemia reduction would be twice the value of the additional output alone. We assume a more modest effect in which total benefits are 1.5 times the value of additional work in the labor market. This would raise the social benefits of our fortification example from \$4.88 to \$7.32 and for supplementation from \$12.19 to \$18.29.

In these three case studies, all cost data are for 1980. Benefit data for Indonesia are based on agricultural wages of \$118 a year for 1975–76. For Mexico and Kenya we use 1980 wage data from the International Labour Office (ILO 1983): the estimated wages of agricultural workers at the prevailing exchange rate was \$1,150 for Mexico and \$689 for Kenya, on the assumption of 200 days of work a year. Table 3 goes through all the calculations described earlier in this article.

The expected social benefits attributable to fortification and supplementation can be compared directly with the costs of the programs. These costs, set out in Table 4, are based on the cost data and methodologies already described in this article. To be consistent with the assumption that only one-third of the extra output of the marginal

***Benefit-Cost  
Ratios:  
Indonesia,  
Kenya, and  
Mexico***

**Table 3. *Estimated Annual Per Capita Benefits of Anemia Interventions in Indonesia, Kenya, and Mexico***

(U.S. dollars)

<i>Benefits and intervention</i>	<i>Indonesia</i>	<i>Kenya</i>	<i>Mexico</i>
Annual earnings per agricultural worker	118	689	1150
Social benefit (divide by 2)	59	345	575
Per capita benefit (multiply by 0.55)	33	190	316
<i>Fortification</i>			
Δ Hb = 5 percent	3.66	21.32	28.42
Δ Hb = 10 percent	7.32	42.64	56.84
Δ Hb = 20 percent	14.63	85.26	113.70
<i>Supplementation</i>			
Δ Hb = 10 percent	7.32	42.63	56.84
Δ Hb = 25 percent	18.29	106.59	142.12
Δ Hb = 50 percent	36.57	213.18	284.24

*Note:* Hb/work output elasticity is assumed to be 1.5. Benefits per capita adjusted upward by 55 percent to account for benefits attributable to factors other than market output.

*Source:* Levin (1985).

**Table 4. Estimated Annual Per Capita Costs of Anemia Interventions**

(U.S. dollars)

*A. Costs of supplements and delivery*

<i>Intervention</i>	<i>Low case</i>	<i>Medium case</i>	<i>High case</i>
<i>Fortification</i>			
Iron	0.10	0.20	0.30
Ascorbic acid	..	0.60	..
<i>Supplementation</i>			
Ferrous sulphate	1.89	2.56	3.17
Ascorbic acid	3.79	4.46	5.07

*B. Social costs of additional energy requirements*

<i>Intervention</i>	<i>Hb/work output elasticity</i>		
	<i>1</i>	<i>1.5</i>	<i>2</i>
<i>Fortification</i>			
Δ Hb = 5 percent	0.28	0.41	0.55
Δ Hb = 10 percent	0.55	0.82	1.10
Δ Hb = 20 percent	1.10	1.64	2.20
<i>Supplementation</i>			
Δ Hb = 10 percent	0.55	0.83	1.10
Δ Hb = 25 percent	1.38	2.06	2.75
Δ Hb = 50 percent	2.75	4.13	5.50

*Source:* Levin (1985).

agricultural worker contributes to social output (because it is assumed that the other two-thirds simply displaces the output of other capable workers, whose unemployment rises), we must also assume that two-thirds of the extra energy input of a more productive worker is offset by a decline in the energy requirements of displaced workers. Thus, the social costs of extra energy needs are based upon taking one-third of the estimated cost of the additional energy requirements associated with an increase in output. This provides an estimate of the social cost per worker of additional energy inputs. This cost must be adjusted to a per capita measure by multiplying it by 0.55, as discussed in the previous section. Thus, the annual social cost per capita of the additional energy in a fortification program that increases Hb by 10 percent with a work elasticity of 1.5 is estimated to be \$0.82. For a supplementation program that increases Hb by 25 percent with a work elasticity of 1.5, the annual social cost per capita of the additional energy requirement is \$2.06.

Table 5 brings together the benefits and costs of fortification for Indonesia, Kenya, and Mexico. Table 6 does the same for supplementation programs. For all three countries and under all assumptions,

**Table 5. Annual Per Capita Benefits and Costs of Iron Fortification in Indonesia, Kenya, and Mexico**

(U.S. dollars, except ratios)

<i>Cost and benefit</i>	<i>Indonesia</i>	<i>Kenya</i>	<i>Mexico</i>
<i>Cost (medium case)</i>			
Fortification			
Iron	0.20	0.20	0.20
Ascorbic acid	0.60	0.60	0.60
Additional energy intake			
Low case	0.28	0.28	0.28
Medium case	0.82	0.82	0.82
High case	2.20	2.20	2.20
<i>Benefit</i>			
Low case	2.45	14.21	23.70
Medium case	7.32	42.64	71.10
High case	19.50	113.70	189.60
<i>Benefit-cost ratio<sup>a</sup></i>			
Low case	5	30	49
Medium case	7	42	70
High case	8	47	79

*Note:* Low benefits and costs assume a change in Hb of 5 percent and a work output elasticity of 1; medium benefits and costs assume a change in Hb of 10 percent and a work output elasticity of 1.5; and high benefits and costs assume a change in Hb of 20 percent and a work output elasticity of 2.

a. Includes energy requirements.

*Source:* Levin (1985).

the benefits of iron fortification exceed costs by a wide margin. The medium values represent our “best” estimate of the appropriate benefit-cost ratios. These range from 7 in Indonesia to 42 in Kenya and 70 in Mexico. Even assuming a rise in Hb of only 5 percent and a work elasticity of 1 for the country with the lowest agricultural earnings, Indonesia, the benefit-cost ratio is 5. Although Table 5 does not show estimates for ascorbic acid, they can be calculated from the same information and are also high. Under no set of conditions in the table would they be less than about 3; under the medium set of conditions they would range from 5 for Indonesia to 30 for Kenya and 50 for Mexico. Benefit-cost ratios remain high even when a high annual estimate of \$0.30 per capita is used for fortification, considerably above the \$0.07–0.10 cost reported in fortification studies. The benefit-cost ratio would be higher if we assumed a 35 percent increase in Hb, as in the Calcutta sample of the Indian salt study.

As for supplementation, benefit-cost ratios are also attractively high. On all assumptions, they exceed 1 by a good margin, and range from 6 to 58 for the medium case. Including the costs of service delivery, the benefit-cost ratios in the medium range run from 4 to 38. Only in the low case for Indonesia does the ratio fall significantly, to

**Table 6. Annual Per Capita Benefits and Costs of Iron Supplementation in Indonesia, Kenya, and Mexico**

(U.S. dollars, except ratios)

<i>Cost and benefit</i>	<i>Indonesia</i>	<i>Kenya</i>	<i>Mexico</i>
<i>Cost (medium case)</i>			
Ferrous sulphate (alone)	1.10	1.10	1.10
Ascorbic acid (alone)	3.00	3.00	3.00
Delivery systems with ferrous sulphate	2.56	2.56	2.56
Delivery systems with ascorbic acid	4.46	4.46	4.46
<i>Additional energy intake</i>			
Low case	0.55	0.55	0.55
Medium case	2.06	2.06	2.06
High case	5.50	5.50	5.50
<i>Benefit</i>			
Low case	4.88	28.42	47.40
Medium case	18.29	106.59	177.75
High case	48.75	284.24	474.00
<i>Benefit-cost ratio<sup>a</sup></i>			
<i>Ferrous sulphate (alone)</i>			
Low case	3	17	29
Medium case	6	34	56
High case	7	43	72
<i>Delivery system with ferrous sulphate</i>			
Low case	1.6	9	15
Medium case	4	23	38
High case	6	13	59

*Note:* Low benefits and costs assume a change in Hb of 10 percent and a work output elasticity of 1; medium benefits and costs assume a change in Hb of 25 percent and a work output elasticity of 1.5; and high benefits and costs assume a change in Hb of 50 percent and a work output elasticity of 2.

a. Includes energy requirements.

*Source:* Levin (1985).

just 1.6 (and 1.3 when the high case for service delivery is used). However, the Indonesian ratio is probably understated because of the high value assumed for the community health worker and the fact that earnings for Indonesia are taken from a 1975-76 study. Agricultural wages were probably somewhat higher in 1980, on the basis of productivity increases over that period (World Bank 1983).

One cost that might be understated is that of health staff in the Mexican case. Accordingly, one test of the robustness of the results would be to assume that the annual cost of the community health auxiliary was \$4,500 rather than \$1,500, a rise of \$3.00 a person for the population base of 1,000. Even with this higher cost, the benefit-cost ratio would remain substantial, between 8 and 43.

### ***Policy Implications***

Under a wide variety of assumptions, most of them conservative, the benefit-cost ratios of both fortification and supplementation ex-

ceed unity by a considerable margin. Accordingly, we conclude that programs to reduce anemia represent highly productive investments in developing countries. It is important to emphasize that fortification and supplementation should be viewed more as complements than substitutes. It is also noteworthy that the benefit-cost ratios of supplementation are so high that even sub-optimal consumption of the supplements is likely to be associated with high returns to investment.

Several issues ought to be emphasized in the interpretation and use of these findings. First, there may be other alternatives for reducing anemia. This article has ignored programs for reducing anemia associated with blood loss from parasites such as hookworm and schistosomiasis. Stephenson and others (1983) have shown that, at least for children, the cost of controlling roundworms was modest in a four-year program in Kenya. To the extent that parasites are a significant cause of anemia, antihelminth projects should be evaluated for their cost-effectiveness in improving Hb.

Second, this article did not consider the fact that some people may be hypersusceptible to iron toxicity, so that some screening may be necessary (Omenn 1982). Third, the financing of antianemia programs will probably require government sponsorship. Although the benefit-cost ratios may be high for society and even for individuals, the beneficiaries may be reluctant or unable to pay for them from incomes that are at the survival level. Programs will have a solid financial base only if they are publicly financed. Finally, the estimation of benefits and costs in this report assumes that policy decisions can be based on incomplete data, as long as the data are substantial and provide strong and consistent findings. However, in any particular case it is still highly desirable either to carry out field trials to establish more precise estimates on costs and benefits (WHO 1975) or to evaluate the impact, after several years, of an operational program.

**Annex Table 1. Populations at Risk: Estimated Percentage with Hemoglobin Concentration Below the Norm for Nonanemic Subjects**

Country and study	Age	Sex	Location	Anemic subjects	
				Percent	Criteria <sup>a</sup>
<i>Bangladesh</i>					
1976 (Baker 1981)	Adult	F—pregnant	Urban	66	a
<i>Burma</i>					
1976 (Baker and DeMaeyer 1979)	Adult	F—pregnant	Urban	82	a
1972 (Baker 1981)	Adult	F—pregnant	Urban	47–41	a
1972 (Fleming 1982)	Preschool	M/F		3–27	c
<i>Fiji</i>					
Indian, 1970 (Fleming 1982)	Adult	M		80	c
<i>India</i>					
Northern, 1968 (Baker and DeMaeyer 1979)	Adult	F—pregnant	Rural	80	a
Northern, 1973 (Fleming 1982)	Children	M/F		90	b
	Adult	M/F		48	g
				84	c
Southern, 1968–73 (Baker and DeMaeyer 1979)	Adult	F—pregnant	Mainly rural	57.4	a
Southern, 1975 (Baker 1981)	Children	M/F	Rural	76	c
	Adult	M	Rural	56	c
	Adult	F	Rural	81	c
	Adult	F—pregnant	Urban/rural	88	a
1975 (Baker 1981)	Adult	F—pregnant	Urban/rural	88	a
<i>Indonesia</i>					
East Java, 1980 (Baker 1981)	Adult	F—pregnant	Rural	37	a
		F		30	c
West and Central Java, Bali, 1973 (Baker 1981)	Adult	F—pregnant	Rural	65	a
<i>Jamaica</i>					
1979 (Fleming 1982)	Preschool	M/F		76	c
<i>Kenya</i>					
1957 (Masawe 1981)	Adult	M/F	Rural	32.3	e
<i>Latin America</i>					
1971 (Baker and DeMaeyer 1979)	Adult	F—pregnant	Mixed	26.5	a
1971 (Fleming 1982)	Adult	M	Mixed	4	c
<i>Mauritius</i>					
1960 (Masawe 1981)	Preschool	M/F		50	d
<i>Malaysia</i>					
1964 (Baker 1981)	Adult	F—pregnant	Urban	75	a
<i>Mexico</i>					
1968 (Baker and DeMaeyer 1979)	Adult	F—pregnant	Rural	26.6	a
<i>Nepal</i>					
1977 (Baker 1981)	Adult	F—pregnant	Urban	35	a

**Annex Table 1** (continued)

Country and study	Age	Sex	Location	Anemic subjects	
				Percent	Criteria <sup>a</sup>
<i>Pakistan</i>					
1970 (Baker 1981)	Adult	F—pregnant	Urban	73	a
<i>Philippines</i>					
1971 (Baker 1981)	Adult	F—pregnant	Urban	63	a
1976 (Baker 1981)	Adult	F—pregnant	Urban	72	a
1976 (Fleming 1982)	Preschool	M/F		42	c
	Adult	M		7	c
	Adult	F		37	c
<i>Poland</i>					
1968 (Baker and DeMaeyer 1979)	Adult	F—pregnant	Urban	21.8	a
<i>South Africa</i>					
Natal, 1976 (Masawe 1981)	Adult	M		44.3	c
	Adult	F		38.1	c
<i>Singapore</i>					
1972 (Baker 1981)	Adult	F—pregnant	Urban Indian	20	b
			Urban Malay	21	b
			Urban Chinese	6	b
<i>Sri Lanka</i>					
1957 (Baker 1981)	Adult	F—pregnant	Rural	50	a
1974 (Baker 1981)	Adult	F		50	c
	Adult	M		48	g
<i>Tanzania</i>					
1973 (Masawe 1981)	Adult	M/F	Rural	37.3	f
<i>Thailand</i>					
Bangkok, 1980 (Baker 1981)	Adult	F—pregnant	Urban	80	a
Ubal, 1971 (Baker 1981)	Adult	F—pregnant	Rural	48	a
1979 (Fleming 1982)	Preschool	M/F		45	c
	Adult	M		35	c
	Adult	F		45	c
1980 (Baker 1981)	Preschool	M/F		15	c
	Children	M/F		33	c
	15–49	M		15	c
	15–49	F		18	c
	Over 49	M		34	c
	Over 49	F		51	c

a. Criteria are as follows: (a) Hb < 11; (b) Hb < 10.5; (c) WHO criteria, preschool < 11, school children < 12, adult males < 13, adult females < 12, pregnant females < 11; (d) Hb < 10.8; (e) Hb < 8; (f) Hb < 10; and (g) Hb < 12.

Source: Levin (1985).

Annex Table 2. *Iron Interventions and Changes in Hemoglobin Levels*

Country and study	Form of iron	Amount	Period	Hb changes	
				Amount	Percent
<i>Guatemala</i>					
Adult men (Viteri and Torun 1974)	Elemental iron as ferrous sulphate	100 mg/day iron 5 mg/day folic acid	6 months	9.5 to 14 = 4.5	47
<i>India</i>					
Pregnant females (22 weeks) (Sood and others 1975)	B <sub>12</sub> , folate and iron tablets	100 mg B <sub>12</sub> fortnight 5 mg folate daily 120 mg iron daily	3 months	9.58 to 10.84 = 1.26	13
Pregnant females (22 weeks) (Sood and others 1975)	B <sub>12</sub> , folate and iron tablets	100 mg B <sub>12</sub> fortnight 5 mg folate daily 240 mg iron daily	3 months	9.43 to 10.82 = 1.39	15
Males/ females, age 25-44 (Food and Nutrition Board and UNICEF 1981)					
Madras	Elemental iron in salt	1 mg/g salt	12 months	(M) 15.4 to 15.9 = 0.5 (F) 12.4 to 12.9 = 0.5	3 4
Calcutta	Elemental iron in salt	1 mg/g salt	12 months	(M) 9.7 to 12.8 = 3.1 (F) 8.5 to 11.5 = 3.0	32 35
Hyderabad	Elemental iron in salt	1 mg/g salt	18 months	(M) 13.7 to 14.4 = 0.7 (F) 11.1 to 11.9 = 0.8	5 7
<i>Indonesia</i>					
Adult males (Basta and Churchill 1974)	Elemental iron	100 mg/day	2 months	12 to 13.5 = 1.5	11
Adult males (Basta and others 1979)	Elemental iron	100 mg/day	2 months	12 to 13.3 = 1.3	13

<i>Ireland</i>						
Females, age 20 and over (Elwood and Hughes 1970)	Ferrous-carbonate tablets	150 mg/day	2 months	10.5 to 2.5 = 2.0	19	
<i>Mauritius</i>						
Adult males (Stott 1960)	Ferrous sulphate bread	extra 10 mg/day	4 months	14.7 to 16.0 = 1.3	9	
<i>Norway</i>						
Males/females, adolescents (Vellar and Hermanson 1971)	Bivalent iron tablets	60 mg/3Xday	9 months	(F) 11.8 to 13.4 = 1.6	14	
<i>Sri Lanka</i>						
Males/females, age 20–60 (Edgerton and others 1979)	Ferrous sulphate tablets	200 mg/day	2 months	10.8 to 12.8 = 2.0	19	
Males/females, age 39–54 (Ohira and others 1981)	Imferon, intravenous	30–50/ml	1 week	[6.4–14.1] to [7.6–14] = 0.7 <sup>a</sup>	9	
<i>Tanzania</i>						
Males, age 18–35 (Davies and Van Haaren 1973)	Oral iron	200 mg/day	3 months	7.8 to 13.4 = 5.6	71	
<i>Venezuela</i>						
Males/females, age 17–46 (Gardner and others 1975)	Iron dextron injection		80 days	(M) 7.1 to 14 = 6.9 (F) 7.1 to 12.4 = 4.7	97 61	

a. Data in brackets are average ranges for five age groups.

Source: Levin (1985).

---

## Abstract

Using benefit-cost analysis, this article evaluates potential programs for reducing iron deficiency anemia, one of the most prevalent nutritional disorders. It discusses the origins and prevalence of anemia and reviews the literature on consequences of anemia for work capacity, output, learning, and other variables. Costs and benefits are estimated for two types of programs—medicinal supplementation and fortification of food with iron—and for three cases—Indonesia, Kenya, and Mexico. Estimates of benefits are calculated to include the value of additional work output in labor-surplus societies.

Under a wide range of assumptions, the benefit-cost ratios are found to be substantially greater than 1: for dietary fortification ratios ranged between 7 and 70 for the three illustrative countries; for dietary supplementation, the range was from 4 to 38 on the most reasonable set of assumptions. The study concludes that field trials should be carried out to see if the findings of this study are supported in particular cases.

---

## References

- Astrand, P. O., and K. Rodahl. 1977. *Textbook of Work Physiology*. New York: McGraw-Hill.
- Baker, S. J. 1981. "Nutritional Anaemias, Part 2: Tropical Asia." *Clinics in Haematology* 10 (October 1979): 843–71.
- Baker, S. H., and E. M. DeMaeyer. 1979. "Nutritional Anemia: Its Understanding and Control with Special Reference to the Work of The World Health Organization." *American Journal of Clinical Nutrition* 32 (February): 368–417.
- Basta, Samir Sanad, and A. Churchill. 1974. *Iron Deficiency Anemia and the Productivity of Adult Males in Indonesia*. World Bank Staff Working Paper 175. Washington, D.C.
- Basta, Samir Sanad, and others. 1979. "Iron Deficiency Anemia and the Productivity of Adult Males in Indonesia." *American Journal of Clinical Nutrition* 32 (April): 916–25.
- Bothwell, Thomas H., and Robert W. Charlton. 1981. *Iron Deficiency in Women*. Washington, D.C.: INACG.
- Burman, David. 1981. "Iron Deficiency in Infancy and Childhood." *Clinics in Haematology* 11, no. 2 (June): 339–51.
- Callender, Sheila T. 1982. "Treatment of Iron Deficiency." *Clinics in Haematology* 11, no. 2 (June): 309–25.
- Charlton, Robert, and Thomas H. Bothwell. 1982. "Definition, Prevalence and Prevention of Iron Deficiency." *Clinics in Haematology* 11, no. 2 (June): 327–38.
- Cook, J. D., and M. E. Reusser. 1983. "Iron Fortification: An Update." *American Journal of Clinical Nutrition* 38 (October): 648–59.
- Creese, A. L., and others. 1982. "Cost-Effectiveness Appraisal of Immunization Programmes." *Bulletin of the WHO* 60, no. 4 (November): 621–32.
- Davies, C. T. M. 1973. "Relationship of Maximum Aerobic Power Output to Productivity and Absenteeism of East African Sugar Cane Workers." *British Journal of Industrial Medicine* 30, no. 2 (April): 146–54.
- Davies, C. T. M., and J. P. M. Van Haaren. 1973. "Effect of Treatment of Physiological Responses to Exercise in East African Industrial Workers with Iron Deficiency Anaemia." *British Journal of Industrial Medicine* 30, no. 4 (December): 335–40.
- DeMaeyer, E. M. 1981. "The Role of WHO in the Control of Nutritional Anaemia." In A. E. Harper and G. K. Davis, eds. *Nutrition in Health and Disease and International Development: Symposia from the Twelfth International Congress of Nutrition. Progress in Clinical and Biological Research*, vol. 77. New York: Liss.
- Derman, D., and others. 1977. "Iron Absorption from a Cereal-Based Meal Containing Cane Sugar Fortified with Ascorbic Acid." *British Journal of Nutrition* 38 (September): 261–69.

- Djukanovic, V., and E.P. Mach, eds. 1975. *Alternative Approaches to Meeting Basic Health Needs in Developing Countries*. A joint UNICEF/WHO study. Geneva: WHO.
- Edgerton, V. R., and others. 1979. "Iron-deficiency Anaemia and its Effects on Worker Productivity and Activity Patterns." *British Medical Journal* 15, no. 2 (December): 1546-49.
- Elwood, P. C., and Dafydd Hughes. 1970. "Clinical Trial of Iron Therapy on Psychomotor Function in Anaemic Women." *British Medical Journal* 3 (August): 254-55.
- Fleming, Alan F. 1977. "Iron-Deficiency in the Tropics." *Scandinavian Journal of Haematology*, supplement 32: 315-21.
- \_\_\_\_\_. 1982. "Iron Deficiency in the Tropics." *Clinics in Haematology* 11, no. 2 (June): 365-88.
- Food and Nutrition Board (India) and UNICEF. 1981. *The Use of Common Salt Fortified with Iron: A Report on Collaborative Studies*. New Delhi.
- Gardner, Gerald W., and others. 1975. "Cardiorespiratory, Hematological and Physical Performance Responses of Anemic Subjects to Iron Treatment." *American Journal of Clinical Nutrition* 28 (September): 982-88.
- \_\_\_\_\_. 1977. "Physical Work Capacity and Metabolic Stress in Subjects with Iron Deficiency Anemia." *American Journal of Clinical Nutrition* 30 (June): 910-17.
- Gittinger, J. P. 1982. *Economic Analysis of Agricultural Projects*. Baltimore, Md.: Johns Hopkins University Press.
- Hallberg, L. 1981. "Effect of Vitamin C on the Bioavailability of Iron from Food." In J. N. Counsell and D. H. Hornig, eds. *Vitamin C*. Englewood, N.J.: Applied Science Publishers.
- Haveman, Robert H., and Barbara L. Wolfe. 1984. "Schooling and Economic Well-Being: The Role of Nonmarket Effects." *Journal of Human Resources* 19 (Summer): 377-407.
- Hetzel, Basil S., ed. 1978. *Basic Health Care in Developing Countries: An Epidemiological Perspective*. Oxford: Oxford University Press.
- Immink, M., and F. E. Viteri. 1981a. "Energy Intake and Productivity of Guatemalan Sugarcane Cutters: Part 1." *Journal of Development Economics* 9 (October): 251-71.
- \_\_\_\_\_. 1981b. "Energy Intake and Productivity of Guatemalan Sugarcane Cutters: Part 2." *Journal of Development Economics* 9 (October): 271-87.
- IL0, International Labour Office. 1983. *Yearbook of Labour Statistics*. 43rd ed. Geneva.
- INACG, International Nutritional Anemia Consultative Group. 1977. *Guidelines for the Eradication of Iron Deficiency Anemia*. Washington, D.C.
- \_\_\_\_\_. 1982. *The Effects of Cereals and Legumes on Iron Availability*. Washington, D.C.: Nutrition Foundation.
- Karyadi, Darwin, and Samir Basta. 1973. *Nutrition and Health of Indonesian Construction Workers: Endurance and Anemia*. World Bank Staff Working Paper 152. Washington, D.C.
- Layrisse, M., and others. 1976. "Sugar as a Vehicle for Iron Fortification: Further Studies." *American Journal of Clinical Nutrition* 29 (March): 274-79.
- Leibel, Rudolph L., and others. 1979. "Iron Deficiency: Behavior and Brain Biochemistry." In M. Winick, ed. *Nutrition: Pre and Postnatal Development*. New York: Plenum.
- Leibenstein, H. 1958. "Underemployment in Backward Economies: Some Additional Notes." *Journal of Political Economy* 66 (April): 256-58.
- Levin, Henry M. 1983. *Cost-Effectiveness: A Primer*. Beverly Hills, Calif.: Sage Publications.

- \_\_\_\_\_. 1985. *A Benefit-Cost Analysis of Nutritional Interventions for Anemia Reduction*. Population, Health and Nutrition Department Technical Note 85-12. Washington, D.C.: World Bank.
- Lozoff, Betsy, and others. 1982. "The Effects of Short-Term Oral Iron Therapy on Developmental Deficits in Iron-Deficient Infants." *Journal of Pediatrics* 100 (March): 351-57.
- McDiarmid, O. J. 1977. *Unskilled Labor for Development: Its Economic Cost*. Baltimore, Md.: Johns Hopkins University Press.
- Mears, Leon. 1981. *The New Rice Economy of Indonesia*. Jakarta: Gadjah Mada University Press.
- Mirralees, J. A. 1976. "A Pure Theory of Underdeveloped Economics." In L.G. Reynolds, ed. *Agriculture in Development Theory*. New York: Wiley.
- Nutrition Reviews. 1975. "The Relationship between Infection and the Iron Status of an Individual." *Nutrition Reviews* 33, no. 4 (April): 103-105.
- Ohira, Y., and others. 1981. "Work Capacity after Iron Treatment as a Function of Hemoglobin and Iron Deficiency." *Journal of Nutritional Science Vitaminology* 27, no. 2 (April): 87-96.
- Oski, Frank A. 1979. "The Nonhematologic Manifestations of Iron Deficiency." *American Journal of Disabled Children* 133 (March): 315-22.
- Oski, Frank A., and Alice S. Honig. 1978. "The Effects of Therapy on the Developmental Scores of Iron-Deficient Infants." *Journal of Pediatrics* 92, no. 1 (January): 21-25.
- PAHO, Pan American Health Organization. 1973. *Medical Auxiliaries*. Proceedings of a symposium held during the twelfth meeting of PAHO Advisory Committee on Medical Research. Scientific Publications 278. Washington, D.C.: PAHO-WHO.
- Pollitt, Ernesto, and Rudolph L. Leibel. 1976. "Iron Deficiency and Behavior." *Journal of Pediatrics* 88, no. 3 (March): 372-81.
- \_\_\_\_\_, eds. 1982. *Iron Deficiency: Brain Biochemistry and Behavior*. New York: Raven Press.
- Pollitt, Ernesto, and others. 1982. "Behavioral Effects of Iron Deficiency Anemia in Children." In E. Pollitt and R. L. Leibel, eds. *Iron Deficiency: Brain Biochemistry and Behavior*. New York: Raven Press.
- Popkin, Barry M. 1978. "Nutrition and Labor Productivity." *Social Science and Medicine* 12C (November): 117-25.
- Popkin, Barry M., and M. Lim-Ybanez. 1982. "Nutrition and School Achievement." *Social Science and Medicine* 16, no. 1: 53-61.
- Read, Merrill S. 1975. "Anemia and Behavior." In *Nutrition, Growth and Development, Modern Problems in Pediatrics*, vol. 14. Basel: Karger.
- Royston, E. 1982. "The Prevalence of Nutritional Anemia in Women in Developing Countries: A Critical Review of Available Information." *Rapport Trimestriel de Statistiques Sanitaires Mondiales* 35, no. 2: 52-91.
- Sayers, M. H., and others. 1974. "Iron Absorption from Rice Meals Cooked with Fortified Salt Containing Ferrous Sulphate and Ascorbic Acid." *British Journal of Nutrition* 31 (May): 367-75.
- Scrimshaw, Nevin. 1984. "Functional Consequences of Iron Deficiency in Human Populations." *Journal of Nutrition, Science, and Vitaminology* 30 (February): 47-63.
- Sood, S. K., and others. 1975. "WHO Sponsored Collaborative Studies on Nutritional Anaemia in India: I. The Effects of Supplemental Oral Iron Administration to Pregnant Women." *Quarterly Journal of Medicine* 44 (April): 241-58.
- Stephenson, L., and others. 1983. "Evaluation of a Four Year Project to Control Ascaris

- Infection in Children in Two Kenyan Villages." *Journal of Tropical Pediatrics* 29 (June): 175–84.
- Stott, G. 1960. "Anemia in Mauritius." *Bulletin of the WHO* 23, no. 6 (November): 781–91.
- Vellar, Odd D., and Lars Hermansen. 1971. "Physical Performance and Hematological Parameters." *Acta Medical Scan.* (supplement) 522: 1–40.
- Viteri, Fernando E., and Benjamin Torun. 1974. "Anemia and Physical Work Capacity." *Clinics in Haematology* 3, no. 3 (October): 609–26.
- Viteri, Fernando E., and others. 1971. "Determining Energy Costs of Agricultural Activities by Respirometer and Energy Balance Techniques." *American Journal of Clinical Nutrition* 24 (December): 1418–30.
- \_\_\_\_\_. 1981. "Iron Fortification in Developing Countries." In A. E. Harper and G. K. Davis, eds. *Nutrition in Health and Disease and International Development: Symposia from the Twelfth International Congress of Nutrition. Progress in Clinical and Biological Research*, vol. 77. New York: Liss.
- Watt, Bernie K., and A. L. Merrill. 1963. *Composition of Foods*. Agricultural Handbook 8. Washington, D.C.: U.S. Department of Agriculture.
- Woodruff, A. W. 1972. "Recent Work on Anaemias in the Tropics." *British Medical Bulletin* 28, no. 1 (January): 92–95.
- Working Group on Fortification of Salt with Iron. 1982. "Use of Common Salt Fortified with Iron in the Control and Prevention of Anemia—A Collaborative Study." *American Journal of Clinical Nutrition* 35 (June): 1442–51.
- World Bank. 1983. *Wages and Employment in Indonesia*. Report 3586-IND. Washington, D.C.: World Bank, Industry Department.
- WHO, World Health Organization. 1975. *Control of Nutritional Anaemia with Special Reference to Iron Deficiency*. WHO technical report series 580, report of an IAEA/USAID/WHO joint meeting. Geneva.
- \_\_\_\_\_. 1979. *Training and Utilization of Auxiliary Personnel for Rural Health Teams in Developing Countries*. Technical Report 633. Geneva.



---

---

## Recent Publications

The World Bank List of New Publications—issued in the spring and fall and available free of charge—describes the new publications distributed by the World Bank. Several formal series, notably the World Bank Staff Working Papers, Technical Papers, Commodity Working Papers, and Country Studies, are sold at the prices shown here. To ensure prompt handling of requests, including orders for books published commercially for the World Bank, include payment where applicable. Other publications, such as the World Bank Reprint Series, are available free. All publications mentioned here may be obtained from World Bank Publications, Sales Unit, 1818 H Street, N.W., Washington, D.C., U.S.A. 20433.

### New books

*China: Long-term Development Issues and Options.* This major study (with six annex volumes) looks at the main development issues that China will face in the next 20 years and examines some options for China in the perspective of international experience. 400 pages. \$14.95 (paperback).

*Putting People First: Sociological Variables in Rural Development.* Michael M. Cernea. A culturally sensitive approach to the preparation, planning, and implementation of projects, it emphasizes the need to analyze the social organization of rural populations and their modes of production. 44 pages. \$24.95 (hardcover).

*Dollar GNPs of the U.S.S.R. and Eastern Europe.* Paul Marer. Attempts to estimate the GNP and growth of centrally planned economies, which do not use the concept of GNP in their statistics. 256 pages. \$25.00 (hardcover).

*Research-Extension-Farmer: A Two-way Continuum for Agricultural Development.* Michael M. Cernea, John M. Coulter, and John F. A. Russel. A World Bank symposium on ways to ensure that research and extension help farmers. 192 pages. \$14.00 (paperback).

*Proceedings of the Fifth Agricultural Symposium: Population and Food.* Ted J. Davis. Looks at the impact of population on agriculture, food security, and nutrition. 238 pages. \$10.00 (paperback).

*Technological Innovation in Agriculture: The Political Economy of Its Role and Bias.* Alain de Janvry and Jean-Jacques Dethier. Examines the role of markets and institutions in technological change. 98 pages. \$5.00 (paperback).

*Plant Genetic Resources: The Impact of the International Agricultural Research Centers.* J. G. Hawkes. Looks at the strengths and weaknesses of the International Board of Plant Genetic Resources and International Research Centers. 123 pages. \$5.00 (paperback).

*Modern Varieties, International Agricultural Research, and the Poor.* Michael Lipton and Richard Longhurst. Examines how modern varieties of food staple affect the poor. 152 pages. \$8.00 (paperback).

*Multicountry Investment Analysis.* Loet B. M. Mennes and Ardy J. Stoutjesdik. Attempts an investment analysis that takes into account economies of scale as well as equity issues. 240 pages. \$25.00 (hardcover).

*Estimating Crop Production in Development Projects: Methods and Their Limitation.* C. D. Poate and Dennis J. Casley. Looks at measurement techniques for assessing crop yields. 40 pages. \$5.00 (paperback).

*Social Accounting Matrices: A Basis for Planning.* Graham Pyatt and Jeffrey I. Round. A World Bank symposium. 293 pages. \$16.95 (paperback).

*Sampling for Monitoring and Evaluation.* Chris Scott. Addresses issues for sample design. 48 pages. \$5.00 (paperback).

*Agricultural Research and Extension: An Evaluation of the World Bank's Experience.* Reviews the Bank's support for research and extension projects in ten countries in 1974–80. 120 pages. \$6.95 (paperback).

*Tropical Forests: A Call for Action.* Looks at the environmental damage and human suffering caused by the shrinking tropical forests. 144 pages. \$12.50 (paperback).

#### **Staff working papers**

738 Issues in the Appraisal of Energy Projects for Oil-importing Developing Countries. Sudhir Anand and Barry Nalebuff. 80 pages. \$5.00.

739 India's Financial System—An Overview of its Principal Structural Feature. Felipe Morris. 96 pages. \$5.00.

740 Imports of Developing Countries: An Empirical Model of Inter-Temporal Allocation and Financial Constraints. L. Alan Winters. 118 pages. \$5.00.

741 The External Debt of Sub-Saharan Africa: Origins, Magnitude, and Implications for Action. Kathie L. Krumm. 78 pages. \$5.00.

743 Agricultural Pricing and Marketing Policies in an African Context: A Framework for Analysis. Inderjit Singh, Lyn Squire, and James Kirchner. 122 pages. \$5.00.

744 Land Assets and Rural Poverty. Michael Lipton. 76 pages. \$5.00.

745 Oil Revenues and Economic Policy in Cameroon: Results from a Computable General Equilibrium Model. Nancy C. Benjamin and S. Devarajan. 58 pages. \$5.00.

746 School Enrollment in Indonesia. Dov Chernichovsky and Oey Astra Meesook. 38 pages. \$3.50.

747 Government Policy and the Development of Financial Markets: The Case of Korea. Arvind Virmani. 114 pages. \$5.00.

748 Institutional Considerations in Rural Road Projects. Cynthia C. Cook, Henri L. Beenhakker, and Richard E. Hartwig. 104 pages. \$5.00.

749 Labor Force Participants in a Developing Metropolis: Does Sex Matter? Rakesh Mohan. 84 pages. \$5.00.

750 Brazil: Medium-term Policy Analysis. Kenneth Myers and F. Desmond McCarthy. 122 pages. \$5.00.

751 Strategic Planning and Management: A Review of Recent Experience. Nagy Hanna. 100 pages. \$5.00.

752 Tax and Contractual Arrangements for the Exploitation of Natural Resources. Arvind Virmani. 156 pages. \$5.00.

753 Interest Rate Policies in Selected Developing Countries, 1970–82. James A. Hanson and Craig R. Neal. 188 pages. \$8.00.

754 Western Samoa: The Experience of Slow Growth and Resource Imbalance. Shahid Yusuf and R. Kyle Peters, Jr. 34 pages. \$3.50.

- 755 The Structure of China's Domestic Consumption: Analyses and Preliminary Forecasts. Li Xuezheng, Yang Shengming, and He Juhuang. 154 pages. \$8.00.
- 756 The Impact of Agricultural Extension: A Case Study of the Training and Visit System in Haryana, India. Gershon Feder, Roger Slade, and Lawrence Lau. 104 pages. \$5.00.
- 764 Scrambling for Survival: How Firms Adjusted to the Recent Reforms in Argentina, Chile and Uruguay. Vittorio Corbo and Jaime de Melo. 234 pages. \$10.00.
- 765 The Nature of Argentina's Economic Reform Policies During 1976-81. Julio Nogues. 66 pages. \$5.00.
- 766 The Shenyang Smelter: A Case Study of Problems and Reforms in China's Non-Ferrous Metals Industry. William A. Byrd. 122 pages. \$5.00.
- 770 A Study of Cuba's Material Product System, Its Conversion to the System of National Accounts, and Estimation of Gross Domestic Product per Capita and Growth Rates. Carmelo Mesa-Lago and Jorge Perez-Lopez. 120 pages. \$5.00.
- 771 National Accounts Statistics and Exchange Rates for Bulgaria. Shamsher Singh and Jong-Goo Park. 42 pages. \$3.50.
- 772 The Gross Domestic Product of Czechoslovakia, 1970-80. Peter Havlik and Friedrich Levčík. 94 pages. \$5.00.
- 773 The Estimation of Gross Domestic Product and its Growth Rate for the German Democratic Republic. Irwin L. Collier. 114 pages. \$5.00.
- 774 National Accounts and the Estimation of Gross Domestic Product and Its Growth Rates for Romania. Marvin R. Jackson. 124 pages. \$5.00.
- 775 The Gross National Product of Hungary: Important Issues for Comparative Research. Edward A. Hewett. 54 pages. \$5.00.
- 776 National Income Statistics for Poland, 1970-80. Zbigniew M. Fallenbuchl. 136 pages. \$8.00.
- 777 The Conversion of National Income Data of the U.S.S.R. to the Concepts of the System of National Accounts in Dollars and Estimation of Growth Rates. Robert W. Campbell. 62 pages. \$5.00.
- 779 Exchange Rates, Foreign Trade Accounting, and Purchasing Power Parity for Centrally Planned Economies. Thomas A. Wolf. 82 pages. \$5.00.
- 780 Issues Related to Higher Education in Sub-Saharan Africa. Keith Hinchliffe. 94 pages. \$5.00.
- 782 Reducing Input Subsidies to Livestock Producers in Cyprus: An Economic Analysis. Avishay Braverman, Jeffrey S. Hammer and Erica Jorgenson. 62 pages. \$5.00.

#### **Technical papers**

- 41 Fuel Peat in Developing Countries. Irish Peat Development Authority. 172 pages. \$8.00.
- 42 Administrative and Operational Procedures for Programs for Sites and Services and Area Upgrading. J. Ronald Campbell. 244 pages. \$10.00.
- 43 Farming Systems Research: A Review. Norman W. Simmonds, Michael M. Cernea, and Scott Guggenheim. 118 pages. \$5.00.
- 44 Animal Health Services. Cornelius de Haan and Nico J. Nissen. 92 pages. \$5.00.
- 47 Guidelines for Evaluating the Management Information Systems of Industrial Enterprises. Edilberto L. Segura. 134 pages. \$8.00.
- 48 Handpumps Testing and Development: Proceedings of a Workshop in China. G. Tschannerl and Kader Bryan. 254 pages. \$10.00.

#### **CGIAR study papers**

CGIAR is the Consultative Group on International Agricultural Research; the World Bank, the FAO, and the UNDP are its sponsors.

4 Costa Rica and the CGIAR Centers: A Study of Their Collaboration in Agricultural Research. Rigoberto Stewart. 80 pages. \$5.00.

5 Guatemala and the CGIAR Centers: A Study of Their Collaboration in Agricultural Research. \$5.00.

6 Zimbabwe and the CGIAR Centers: A Study of Their Collaboration in Agricultural Research. K. J. Billing. 176 pages. \$8.00.

7 Nepal and the CGIAR Centers: A Study of Their Collaboration in Agricultural Research. Ramesh P. Sharma and Jock R. Anderson. 74 pages. \$5.00.

8 Bangladesh and the CGIAR Centers: A Study of Their Collaboration in Agricultural Research. Carl E. Pray and Jock R. Anderson. 72 pages. \$5.00.

10 Indonesia and the CGIAR Centers: A Study of Their Collaboration in Agricultural Research. Barry Nestel. 128 pages. \$8.00.

#### **Living Standards Measurement Study working papers**

22 Household Expenditure Surveys: Some Methodological Issues. Christiaan Grootaert and K. F. Cheung. 73 pages. \$5.00.

#### **Country studies**

World Bank country studies are prepared mainly for the Bank's use, with distribution restricted to member governments and international organizations that deal with development problems. If the issues studied are of wide interest and if the authorities of the country agree, such reports are made available to the public. These are working documents, not prepared with a view to broad distribution.

Antigua and Barbuda: Economic Report. 1985. 102 pages. \$5.00.

Bolivia: Agricultural Pricing and Investment Policy. 1985. 138 pages. \$8.00.

China: Issues and Prospects in Education (Annex 1 to China: Long-term Development Issues and Options). 1985. 120 pages. \$5.00.

China: Agriculture to the Year 2000 (Annex 2 to China: Long-term Development Issues and Options). 1985. 170 pages. \$8.00.

China: The Energy Sector (Annex 3 to China: Long-term Development Issues and Options). 1985. 240 pages. \$10.00.

China: Economic Model and Projections (Annex 4 to China: Long-term Development Issues and Options). 1985. 114 pages. \$5.00.

China: Economic Structure in International Perspective (Annex 5 to China: Long-term Development Issues and Options). 1985. 120 pages. \$5.00.

China: The Transport Sector (Annex 6 to China: Long-term Development Issues and Options). 1985. 140 pages. \$8.00.

Colombia: The Investment Banking System and Related Issues in the Financial Sector. 1985. 128 pages. \$8.00.

Dominica: Priorities and Prospects for Development. 1985. 120 pages. \$5.00.

Dominican Republic: Economic Prospects and Policies to Renew Growth. 1985. 200 pages. \$10.00.

Grenada: Economic Report. 1985. 104 pages. \$5.00.

Panama: Structural Change and Growth Prospects. 1985. 384 pages. \$20.00.

St. Christopher and Nevis: Economic Report. 1985. 94 pages. \$5.00.

St. Lucia: Economic Performance and Prospects. 1985. 114 pages. \$5.00.

St. Vincent and the Grenadines: Economic Situation and Selected Development Issues. 1985. 122 pages. \$5.00.

Sudan: Pricing, Policies and Structural Balances. 1985. 254 pages. \$10.00.

Yugoslavia: Constraints and Prospects for Restructuring the Energy Sector. 1985. 388 pages. \$20.00.



**THE WORLD BANK**  
**RESEARCH OBSERVER** *Order Form*

SEND TO: **WORLD BANK PUBLICATIONS**  
1818 H Street, N.W.  
Washington, D.C. 20433, U.S.A.

Name \_\_\_\_\_

Occupation \_\_\_\_\_

Firm \_\_\_\_\_

Address \_\_\_\_\_

\_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Postal Code \_\_\_\_\_

Country \_\_\_\_\_ Telephone (\_\_\_\_) \_\_\_\_\_

Subscriptions are free of charge.  
ROF-2

-----

**THE WORLD BANK**  
**RESEARCH OBSERVER** *Order Form*

SEND TO: **WORLD BANK PUBLICATIONS**  
1818 H Street, N.W.  
Washington, D.C. 20433, U.S.A.

Name \_\_\_\_\_

Occupation \_\_\_\_\_

Firm \_\_\_\_\_

Address \_\_\_\_\_

\_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_ Postal Code \_\_\_\_\_

Country \_\_\_\_\_ Telephone (\_\_\_\_) \_\_\_\_\_

Subscriptions are free of charge.  
ROF-2



## Books of related interest from the World Bank

### Poverty and Hunger

Issues and Options for Food Security in Developing Countries

*Poverty and Hunger* shows how effective government policies can contribute to food security while promoting economic growth and increasing purchasing power among the poor.

The report provides valuable insight and tools for analyzing food security problems, finding that it is not only desirable but possible to provide enough food for people in every country to lead active, healthy lives.

- Outlines the nature and extent of food security problems in developing countries.
- Explores options available to developing countries, identifying both policies that will waste economic resources and those which can achieve desired goals in cost-effective ways.
- Indicates what international institutions can and should do to help countries solve their food security problems.

*A World Bank Policy Study*

82 pages paperback / 8 1/2 × 11 / \$7.50

Available in English, French, and Spanish

### Putting People First

Sociological Variables in Rural Development

Edited by Michael M. Cernea

This book describes a culturally sensitive approach to the preparation, planning, and implementation of rural development projects. It places a strong emphasis on analyzing the social organization of rural populations and their modes of production in livestock projects, community forestry, irrigation and water users' associations, rural roads, fisheries, and agricultural settlements.

The difficulties encountered by rural development projects during the past are considered. Examples from World Bank experience are provided and criticism of existing limitations in project preparation is combined with guidelines and practical answers on how to increase the attention paid to local people involved in rural development.

*Published for the World Bank by Oxford University Press*

444 pages hardcover / 6 1/8 × 9 1/4 / \$24.95

## **A manual and two World Bank–UNDP symposia on the training and visit system of agricultural research and development**

### **Training and Visit Extension**

Daniel Benor and Michael Baxter

Contains a comprehensive explanation of the organization and operation of the training and visit system of agricultural extension. Emphasizes simplicity and decisiveness. Defines organization and mode of operation and allows continuous feedback from farmers to extension and research workers. This method has been adopted in some 40 countries in Asia, Africa, Europe, and Central and South America. Useful to extension staff at all levels, agricultural research personnel, trainers, and staff of agricultural organizations, as well as universities and training institutions involved in agricultural and rural development and public administration.

*214 pages paperback / 8 1/2 × 11 / \$15.00*

### **Agricultural Extension by Training and Visit**

The Asian Experience

Edited by Michael M. Cernea, John K. Coulter, and John F.A. Russell

Captures nearly ten years of experience with the Training and Visit Extension System. Addresses five issues: farmer participation, the research-extension linkage, training, system management, and monitoring and evaluation. Within this framework, extension system managers and evaluators from six Asian countries and six discussants present their experience and analyses. Notes the World Bank's strong commitment to agricultural development in its member countries and to helping least advantaged farmers to improve their productivity.

*176 pages paperback / 8 1/2 × 11 / \$13.50*

### **Research-Extension-Farmer**

A Two-Way Continuum for Agricultural Development

Edited by Michael M. Cernea, John K. Coulter, and John F. A. Russell

Although agricultural research and extension have common objectives, the lack of close coordination between them often limits their ability to help farmers and to contribute to agricultural development. This volume reviews and analyzes actual experiences—successes and failures—with linking research and extension in several Asian countries.

Looks at policy and institutional dimensions of building linkages between research and extension, identifying farmers' most urgent production problems, generating improved technology (and its on-farm validation), and jointly formulating extension messages by extension and research staff. Discusses incorporating technical know-how into farming systems to achieve a communications continuum that operates in both directions.

*192 pages paperback / 8 1/2 × 11 / \$14.50*

## Contributors

*Gershon Feder* is a senior economist in the Research Unit of the Department of Agriculture and Rural Development of the World Bank.

*Stanley Fischer* is professor of economics, Massachusetts Institute of Technology.

*David J. Gross* is an economist at Abt Associates, Cambridge, Massachusetts.

*Henry M. Levin* is professor, School of Education, and affiliated professor, Department of Economics, Stanford University.

*Stephen Malpezzi* is an economist in the Operations Policy and Research Division of the Water Supply and Urban Development Department of the World Bank.

*Stephen K. Mayo* is an economist in the Operations Policy and Research Division of the Water Supply and Urban Development Department of the World Bank.

*Roger Slade* is a senior economist in the South Asia Projects Department of the World Bank.

*T. N. Srinivasan* is Samuel C. Park, Jr., Professor of Economics, Economic Growth Center, Yale University.