THE WORLD BANK

Research Observer

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on Globalization and Inequality

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on The Uses of Multitopic
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on Reconsidering
Agricultural Extension

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Research Observer

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Globalization and Inequality, Past and Present

Jeffrey G. Williamson

The late nineteenth and late twentieth centuries shared more than globalization and economic convergence. The trend toward globalization in both centuries was accompanied by changes in the distribution of income as inequality rose in rich countries and fell in poor ones. Between one-third and one-half of the rise in inequality since the 1970s in the United States and other member countries of the Organization of Economic Cooperation and Development (OECD) has been attributed to global economic forces, about the same as a century earlier. It appears that the inequality produced by global economic forces before World War I was responsible in part for the retreat from globalization after the war. What does this retreat imply for the future? Will the world economy once again retreat from globalization as the rich OECD countries come under political pressure to cushion the side effects of rising inequality?

Economic growth after 1850 in the countries that now belong to the Organization for Economic Cooperation and Development (OECD) can be divided into three periods: the late nineteenth century belle epoque, the dark middle years between 1914 and 1950, and the late twentieth century renaissance. The first and last epochs were characterized by rapid growth; economic convergence as poor countries caught up with rich ones; and globalization, marked by trade booms, mass migrations, and huge capital flows. The years from 1914 to 1950 are associated with slow growth, a retreat from globalization, and economic divergence. Thus history offers an unambiguous positive correlation between globalization and convergence. When the pre–World War I years are examined in detail, the correlation turns out to be causal: globalization was *the* critical factor promoting economic convergence (Williamson 1996a).

Because contemporary economists are now debating the impact of the forces of globalization on wage inequality in the OECD countries, the newly liberalized Latin American regimes, and the East Asian "tigers," it is time to

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ask whether the same distributional forces were at work during the late nineteenth century. A body of literature almost a century old argues that immigration hurt American labor and accounted for much of the rise in income inequality from the 1890s to World War I. The decision by a labor-sympathetic Congress to enact immigration quotas shows how important the issue was to the electorate. An even older literature argues that cheap grain exported from the New World eroded land rents in Europe so sharply that landowner-dominated continental parliaments raised tariffs to protect domestic growers from the impact of globalization. But nowhere in this historical literature had anyone constructed data to test three contentious hypotheses with important policy implications:

> *Hypothesis 1:* Inequality rose in resource-rich, labor-scarce countries such as Argentina, Australia, Canada, and the United States. Inequality fell in resource-poor, labor-abundant agrarian economies such as Ireland, Italy, Portugal, Scandinavia, and Spain. Inequality was more stable among the European industrial leaders, including Britain, France, Germany, and the Lowland countries, all of whom fell in between the rich New World and poor Old World.
> *Hypothesis 2:* If the first hypothesis is true, a second follows: these inequality patterns can be explained largely by globalization.
> *Hypothesis 3:* If this second hypothesis holds, then these globalization-induced inequality trends help explain the retreat from globalization between 1913 and 1950.

This article reviews the historical debate about the first globalization boom in the late nineteenth century and attempts to tie it to the current debate about the globalization boom in the late twentieth century. The two debates are strikingly similar. They also share a shortcoming in the empirical analysis: nobody has yet explored this issue with late nineteenth century panel data across poor and rich countries, and, with the important exception of Wood (1994), few have done so for the late twentieth century debate either (Burtless 1995, p. 813). Indeed, until very recently, most economists had focused solely on the American experience. The central contribution of this paper is to explore a database for the late nineteenth century that includes both rich and poor countries or, in the modern vernacular, North and South.

It appears that globalization did contribute to the implosion, deglobalization, and autarkic policies that dominated between 1913 and 1950. Indeed, during these years of trade suppression and binding migration quotas, the connection between globalization and inequality completely disappeared. It took the globalization renaissance of the early 1970s to renew this old debate.

Globalization and Inequality in the Late Twentieth Century

From 1973 through the 1980s, real wages of unskilled workers in the United States fell as a result of declining productivity growth and an increasing disparity in wages paid to workers with different skills (Kosters 1994; Freeman 1996). This difference was manifested primarily by higher wages for workers with advanced schooling and age-related skills. The same trends were apparent elsewhere in the OECD in the 1980s, but the increase in wage gaps was typically far smaller. The widening of wage inequalities coincided with the forces of globalization, both in the form of rising trade and increased immigration, the latter characterized by a decline in the skill levels of migrants (Borjas 1994). Trade as a share of gross national product in the United States increased from 12 percent in 1970 to 25 percent in 1990 (Lawrence and Slaughter 1993), while exports from low-income countries rose from 8 percent of total output in 1965 to 18 percent in 1990 (Richardson 1995, p. 34). These developments coincided with a shift in spending patterns that resulted in large trade deficits in the United States.

The standard Heckscher-Ohlin trade model makes unambiguous predictions: every country exports those products that use abundant and cheap factors of production. Thus a trade boom induced by a drop in tariffs or in transport costs will cause exports and the demand for the cheap factor to boom as well. Globalization in poor countries should favor unskilled labor; globalization in rich countries should favor skilled labor. Lawrence and Slaughter (1993) explored this wage inequality and concluded that there was little evidence to support the standard trade model explanation. Instead, the authors concluded that technological change was an important source of rising wage inequality. Hot debate ensued, with no resolution in sight.

This strand of the debate stressed the evolution of labor demand by skill, ignoring the potential influence of supply. Borjas (1994) and Borjas, Freeman, and Katz (1992) took a different approach, emphasizing instead how trade and immigration augmented the supply of labor in the United States. They first estimated the implicit labor supply embodied in trade flows, since imported goods increase the effective labor supply in the importing country. Similarly, exports imply a decrease in the effective labor supply in the exporting country. In this way, the huge U.S. trade deficit of the 1980s implied a 1.5 percent increase in the labor force, and because most of the imported goods used unskilled labor, it also implied a work force characterized by an increasing ratio of unskilled to skilled labor. Between the 1960s and the 1980s, an increasing proportion of immigrants to the United States were from developing nations, which meant that a far higher fraction were relatively unskilled just when there were more immigrants.

These shifts in the supply of labor produce the desired qualitative result for the purposes of this study—wage inequality between skill types. The quantitative result, at least in George Borjas' (1994) hands, also seems to be large: he estimates that 15 to 25 percent of the relative decline in the wages of high-school graduates compared with those of college graduates is attributable to globalization forces, of which trade accounts for one-third, immigration, two-thirds. He also estimates that 30 to 50 percent of the decline in the wages of high-school dropouts relative to the wages of all other workers is attributable to these same forces. Hatton and Williamson (1995; 1997) show that a century earlier, immigration was a far more dominant influence on U.S. inequality than was trade, and furthermore, that trade and migration influenced relative wages in practically every country involved in the globalization experience.

Thus far the discussion has focused mainly on the United States, perhaps because rising inequality and immigration have been greatest there. But the question is not simply why the demand for unskilled labor in the United States and even Europe was depressed in the 1980s and 1990s (Freeman 1995, p. 19), but whether the same factors were *stimulating* the relative demand for low-skill labor in developing countries. This is where Adrian Wood (1991, 1994, ch. 6; 1995b) enters the debate. Wood was one of the first economists to systematically examine inequality trends across industrial and developing countries.

Wood distinguishes three skill types: uneducated workers, those with a basic education, and the highly educated. The poor South has an abundance of uneducated labor, but the supply of workers with basic skills is growing rapidly. The rich North, of course, is well endowed with highly educated workers; its supply of labor with basic skills is growing slowly. Wood assumes that capital is fairly mobile and that technology is freely available. As trade barriers fall and the South improves its skills through the expansion of basic education, it produces more goods that require only basic skills, while the North produces more high-skill goods. It follows that the ratio of the unskilled to the skilled wage should rise in the South and fall in the North. The tendency toward the relative convergence of factor prices raises the relative wage of workers with a basic education in the South and lowers it in the North, producing rising inequality in the North and falling inequality in the South.

Wood concludes that the decline in the relative wages of less-skilled northern workers is caused by the elimination of trade barriers and the increasing abundance of southern workers with a basic education. He also dismisses skill-using technological change as a potential explanation for rising inequality because labor and total factor productivity growth both slowed during the period. Wood also argues that the pattern of increasing wage inequality in the North favors a trade explanation because there is no cross-country association between inequality trends and technological progress.

Wood's research has met with stiff critical resistance.[1] Since his book appeared in 1994, more has been learned about the link between inequality and globalization in developing countries. Economic theory argues that poor countries should become more egalitarian in the face of globalization, unless demographic or industrial revolution forces offset it. A recent review by Davis (1996) reports the contrary, and a study of seven countries in Latin America and East Asia shows that wage inequality typically did not fall after trade liberalization but rather *rose* (Robbins 1996). This apparent anomaly has been strengthened by other studies, some of which have been rediscovered since Wood's book appeared (Michaely, Papageorgiu, and Choksi 1991). Almost twenty years ago Krueger (1978) studied ten developing countries covering the period through 1972, and her findings were not favorable to the simple predictions of standard trade theory. Her conclusions have been supported by Bourguignon and Morrisson (1991) and by recent work on the impact of Mexican liberalization on wage inequality (Feenstra and Hanson 1995; Feliciano 1996). None of these studies is very attentive to the simultaneous role of emigration from these countries, however, leaving the debate far from resolved.

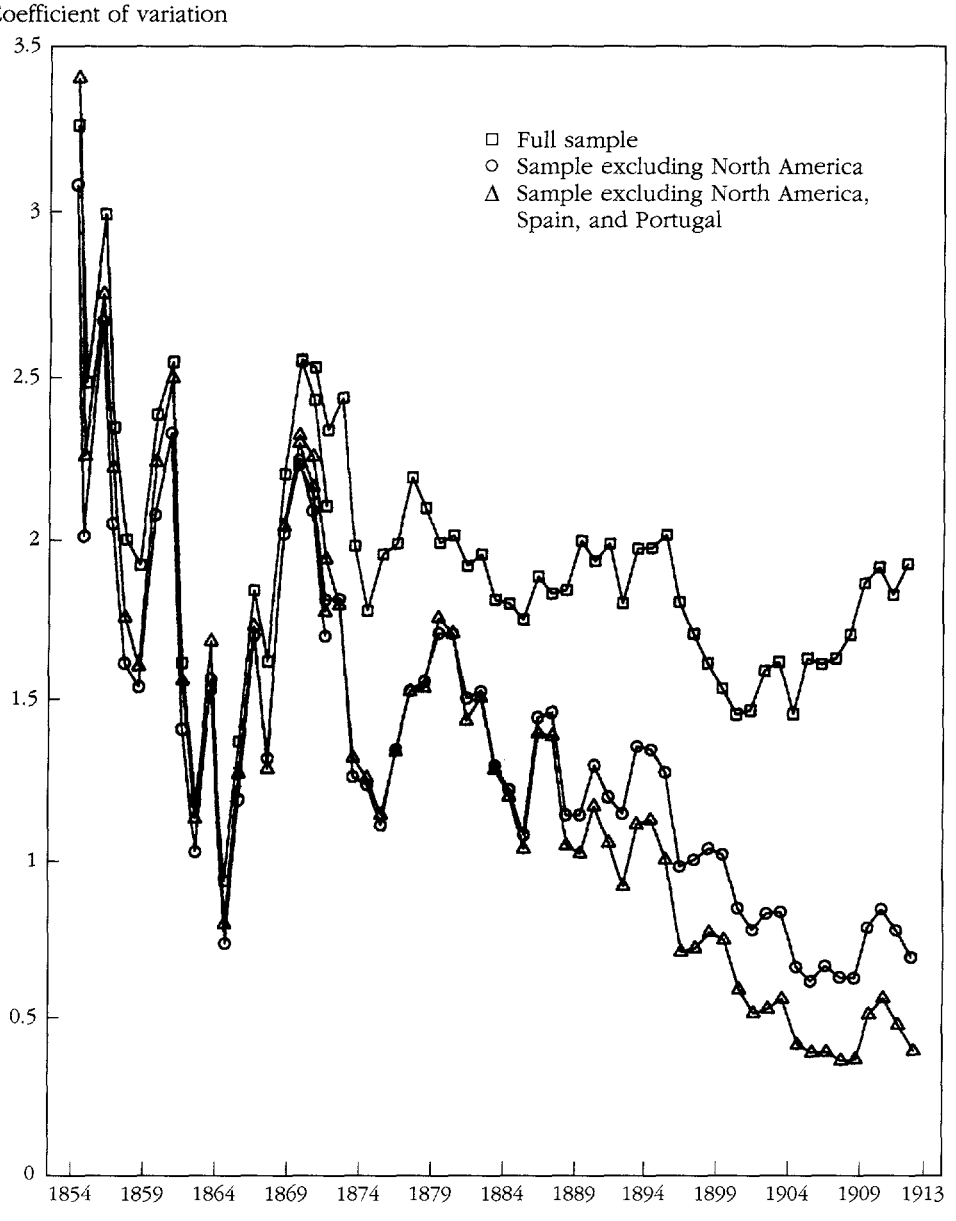
Globalization and Inequality in the Late Nineteenth Century

The spread between real wages from 1854 to 1913 in fifteen countries is shown in figure 1.[2] The downward trend confirms what new-growth theorists call convergence, that is, a narrowing in the economic distance between rich and poor countries. The convergence is more dramatic when America and Canada—which were richer—or when Portugal and Spain—who failed to play the globalization game—are excluded. Convergence of gross domestic product (GDP) per worker hour has been reported elsewhere, based on Maddison's (1991) data. Most of this convergence was the combined result of the trade boom and the prequota mass migrations (Hatton and Williamson 1995; O'Rourke and Williamson 1994, 1995, 1996, and forthcoming; Taylor and Williamson 1997; Williamson 1995, 1996a).

Trade Issues

The late nineteenth century was a period of dramatic integration of commodity markets: railways and steamships lowered transport costs, and Europe moved toward free trade in the wake of the 1860 Cobden-Chevalier treaty. These developments implied large trade-induced price shocks that affected every European participant. The drop in grain prices was the canonical case: wheat prices

Figure 1. *Real Wage Dispersion, 1854–1913*



Note: Wage data are urban, male, purchasing-power-parity adjusted.
Source: Williamson (1996a, figure 1).

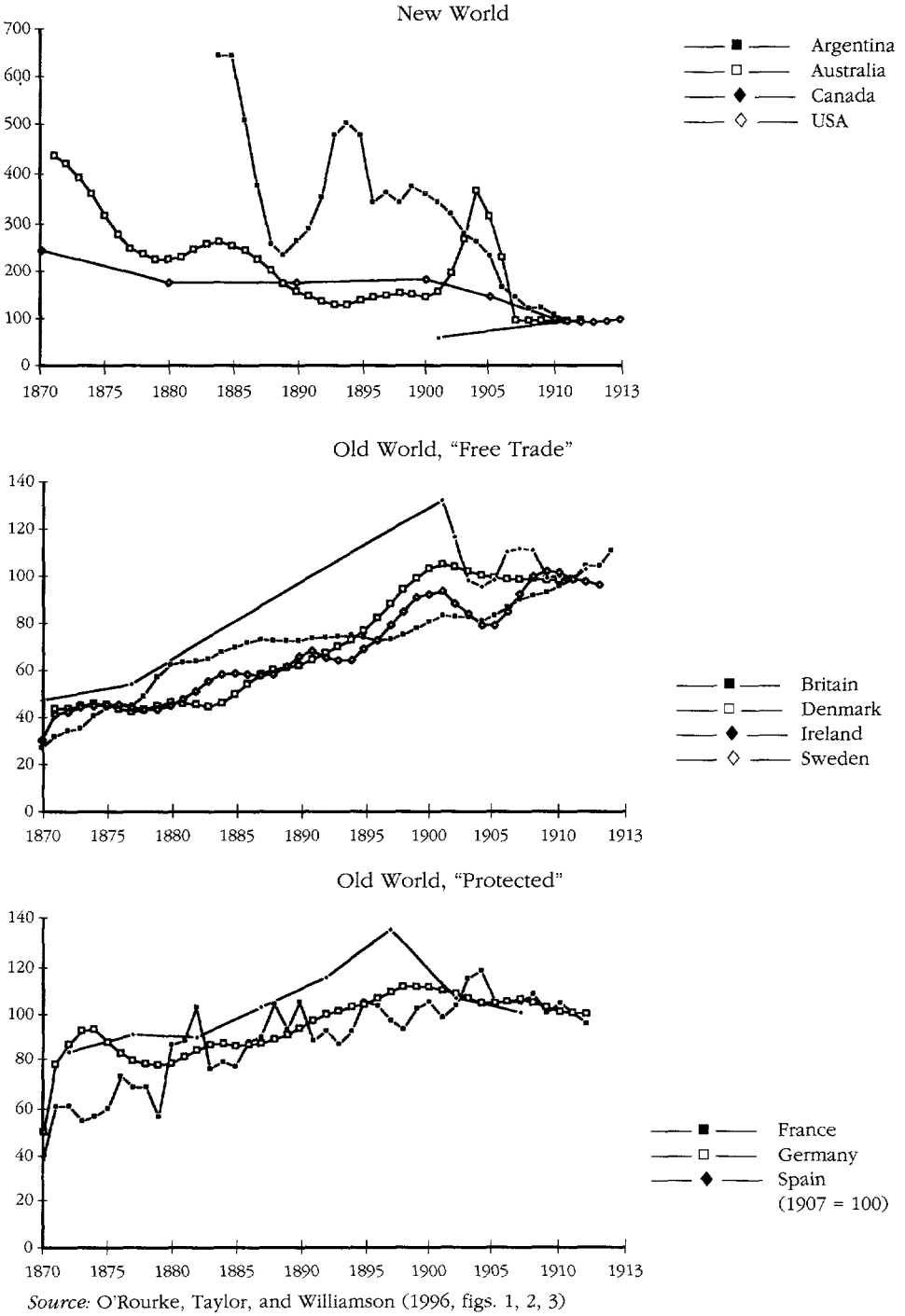
in Liverpool were 60 percent higher than those in Chicago in 1870, for example, but they were less than 15 percent higher in 1912, a decline of forty-five percentage points. The commodity price differential declined by even more when the spread is measured from wheat-growing regions outside of Chicago. Furthermore, prices of all tradables, not just grain, were affected. It should be stressed that these globalization price shocks were *far* larger than those embedded in the infamous 1930 Smoot-Hawley tariff or any other U.S. tariff in the past century.[3] They were also larger than the decline in OECD tariff barriers induced by the General Agreement on Tariffs and Trade after the 1940s, events which triggered the globalization boom of the last quarter century. World Bank studies report that tariffs on manufactures imported by industrial countries fell from 40 percent in the late 1940s to 7 percent in the late 1970s, a drop of thirty-three percentage points. Wood (1994, p. 173) uses this example to advertise just how revolutionary world commodity market integration has been in recent decades, but even this spectacular drop is smaller than the forty-five percentage-point decline in trade barriers between 1870 and 1913 caused by improvements in transport.

The standard trade model argues that, as countries everywhere expand the production and export of goods that use their abundant (and cheap) factors relatively intensively, the resultant market integration would lead to an international convergence of factor prices. Under this theory, then, the late nineteenth century trade boom accounted for 10 to 20 percent of the convergence in GDP per worker hour and in the real wage.[4] It also had distributional implications for poor countries: it meant rising wages for unskilled workers relative to land rents and skilled wages. For rich countries, it meant that unskilled wages fell relative to land rents and skilled wages.

Migration Issues

The correlation between real wages or GDP per worker hour and migration rates is positive and highly significant. The poorest Old World countries tended to have the highest emigration rates, while the richest New World countries tended to have the highest immigration rates. The correlation is not perfect since potential emigrants from poor countries often found the cost of the move too high, and some New World countries restricted inflows of such migrants. But the correlation is still very strong. Furthermore, the effect on the labor force was very important, augmenting the New World labor force by almost 37 percent and reducing the Old World labor force by 18 percent (at least among the emigrant countries around the European periphery), much larger than U.S. experience in the 1980s. One estimate suggests that mass migrations explain about 70 percent of the real wage convergence in the late nineteenth century

Figure 2. *Ratio of Unskilled Wages to Land Values, 1870–1913*
(1911 = 100)



Source: O'Rourke, Taylor, and Williamson (1996, figs. 1, 2, 3)

(Williamson 1996a; Taylor and Williamson forthcoming). This estimate, in contrast with the contemporary debate about immigration in the 1980s, which focuses only on immigration into Europe and the United States, includes the total impact on rich receiving countries *and* poor sending countries.

Because the migrants tended to be unskilled, and increasingly so toward the end of the century, they flooded the receiving countries' labor markets at the bottom of the skill ladder. Thus immigration must have lowered unskilled wages relative to those of skilled artisans and educated white-collar workers and relative to land rents. These immigration-induced trends implied increased inequality in rich countries, while emigration-induced trends must have moved in the opposite direction and reduced inequality in poor countries.

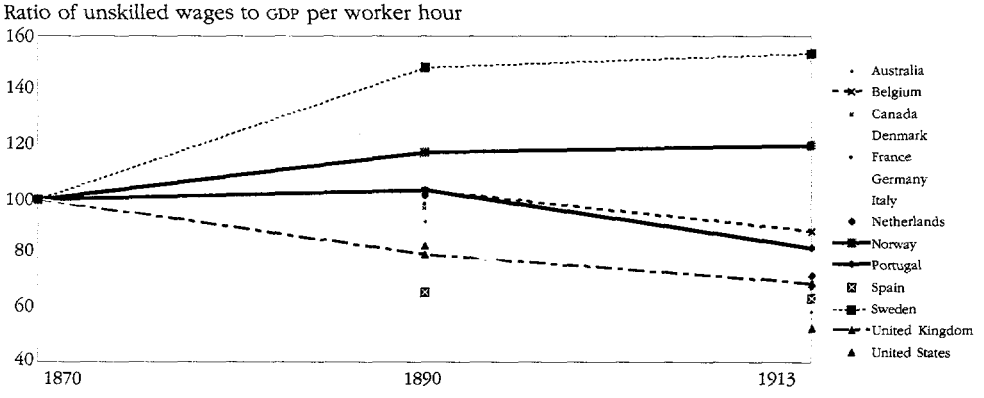
So much for plausible assertions. What were the facts?

Establishing the Facts, 1870–1913

How did the typical unskilled worker near the bottom of the distribution do relative to the typical landowner or capitalist near the top, or even relative to the skilled blue-collar worker and educated white-collar employee near the middle? The debate over inequality in the late twentieth century has fixed on wage inequality, but a century earlier, land and landed interests were far more important sources of income, so they need to be added to the inquiry. (I believe this is true throughout the developing world, certainly its poorer parts.[5]) In any case, two kinds of evidence are available to document nineteenth century inequality trends so defined: the ratio of unskilled wages to farm rents per acre, and the ratio of the unskilled wage to GDP per worker hour.[6] Everyone knows that farm land was abundant and cheap in the New World, while scarce and expensive in the Old World. And labor was scarce and expensive in the New World, while abundant and cheap in the Old World. Thus, the ratio of wage rates to farm rents was high in the New World and low in the Old. What everyone *really* wants to know, however, is how the gap evolved over time: Are the trends consistent with the predictions of the globalization and inequality literature? Was there, in Wood's language, relative factor price convergence in the late-nineteenth century, implying rising inequality in rich countries and declining inequality in poor countries? Figure 2 supplies some affirmative answers.

In the New World the ratio of wage rates to farm rents plunged. By 1913 it had fallen in Australia to a quarter of its 1870 level; in Argentina to a fifth of its mid-1880 level; and in the United States to less than half of its 1870 level. In the Old World the reverse occurred, especially where free trade policies were pursued. In Great Britain the ratio in 1910 had increased by a factor of 2.7 over its 1870 level, while the Irish ratio had increased even more, by a factor of 5.5. The Swedish and Danish ratios had both increased by a factor

Figure 3. *Normalized Inequality Levels, 1870–1913*



Note: Inequality levels are normalized by setting the ratio of unskilled wages to GDP per worker-hour at 1870 = 100.

Source: Williamson (1996b).

of 2.3. The surge was less pronounced in protectionist countries, increasing by a factor of 1.8 in France, 1.4 in Germany, and not at all in Spain.

Because landowners tended to be near the top of the income distribution pyramid,[7] this evidence confirms Hypothesis 1: inequality rose in the rich, labor scarce New World and fell in the poor, labor-abundant Old World. There is also some evidence that globalization mattered: countries that were open to trade absorbed the biggest distributional changes; those that retreated behind tariff walls sustained the smallest distributional changes.

So much for wage-rental ratios. What about the ratio of the unskilled worker's wage (w) to the returns on *all* factors per laborer, or GDP per worker hour (y). Changes in w/y measure changes in the economic distance between the working poor near the bottom of the distribution and the average citizen in the middle of the distribution.

Figure 3 summarizes the wide variance across the fourteen countries in the sample. Powerful Danish and Swedish equality trends establish the upper bound, 1913 = 244 (the index rises above 100); powerful Australian and U.S. *in*equality trends establish the lower bound, 1913 = 53 (the index falls below 100).[8]

An alternative way to standardize these distributional trends is simply to compute the annual percentage change in the index between 1870 and 1913, which ranges from +0.97 and +0.98 for Denmark and Sweden to −1.22 and −1.45 for Australia and the United States. It is plotted against the 1870 real wage in figure 4, and it offers a stunning confirmation of the first hypothesis: Between 1870 and 1913 inequality rose dramatically in rich New World countries such as Australia and the United States; inequality fell dramatically in

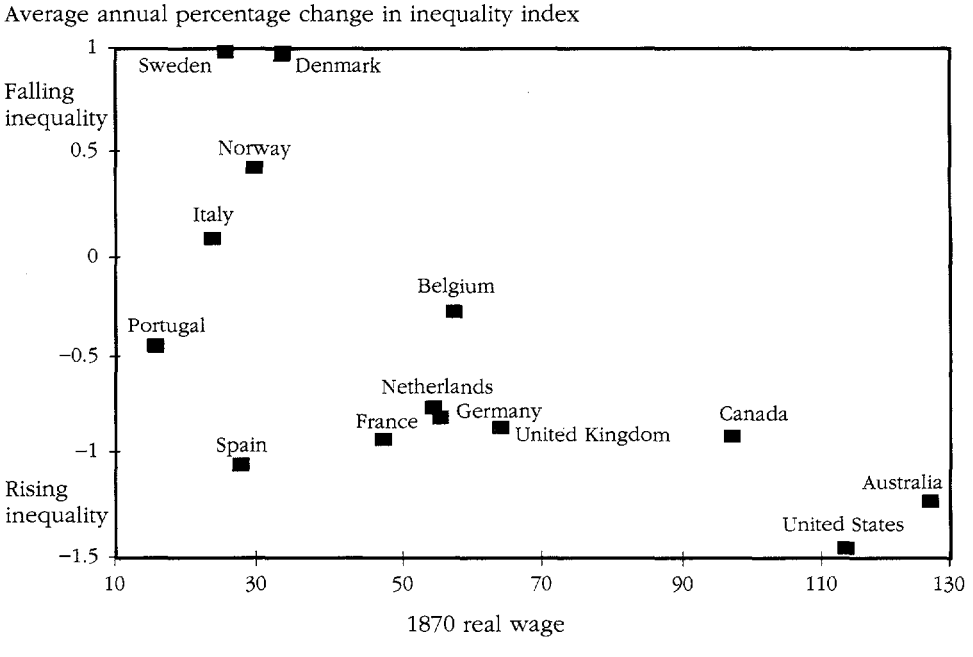
poor, newly industrializing countries such as Norway, Sweden, Denmark, and Italy; inequality fell only modestly in middle-income, industrial economies such as Belgium, France, Germany, the Netherlands, and the United Kingdom.

The Impact of Globalization on Inequality Trends, 1870–1913

Theory suggests that globalization can account for this key stylized fact: In an age of unrestricted international migration, poor countries should have the highest emigration rates and rich countries should have the highest immigration rates; in an age of liberal trade policy, poor countries should export labor-intensive products and rich countries should import labor-intensive products. Theory is one thing: fact is another. What evidence on trade and migration in the late nineteenth century supports this (apparently plausible) globalization hypothesis?

I start with trade effects. There was a retreat from trade liberalism after 1880, and the retreat included France, Germany, Italy, Portugal, and Spain. In the absence of globalization forces, poor labor-abundant countries that protect do-

Figure 4. *Initial Real Wages vs. Inequality Trends, 1870–1913*

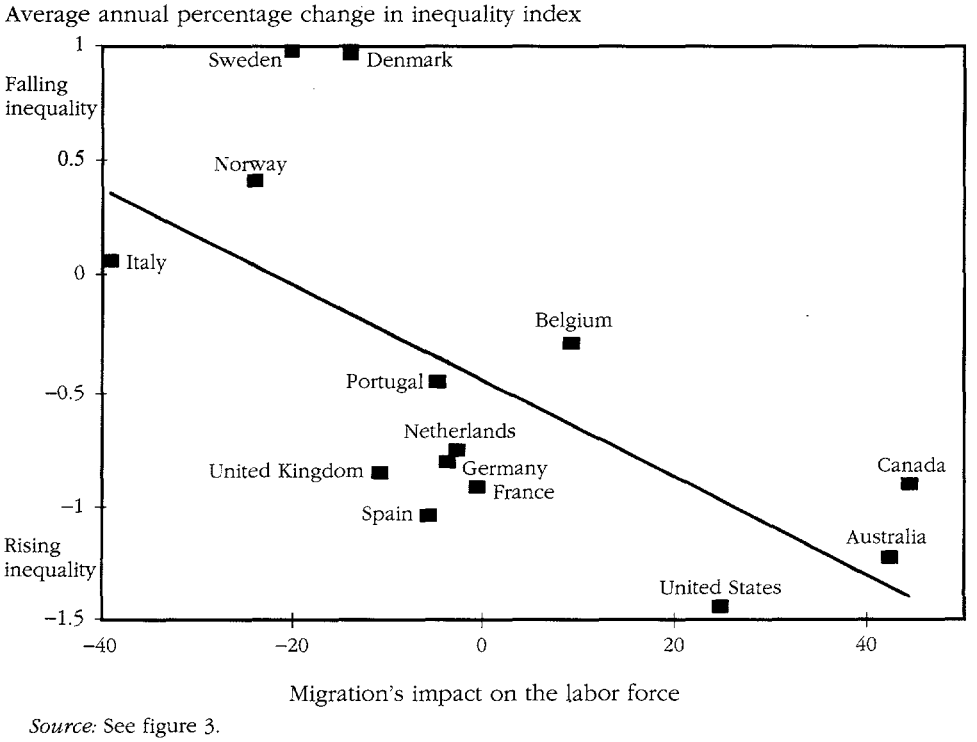


Note: Real wage in 1870 relative to an index where United Kingdom = 100 in 1905.
Source: See figure 3.

mestic industry should raise the returns to scarce factors (such as land) relative to abundant factors (such as unskilled labor). In the face of globalization forces, the same countries should at least mute the rise in the relative scarcity of unskilled labor and thus stem the fall in inequality. The evidence seems to be roughly consistent with these predictions. That is, the correlation between rising inequality and initial labor scarcity turns out to be better for 1870–90—an environment of shared liberal trade polices—than for 1890–1913—an environment of rising protection on the Continent.[9]

I turn next to the impact of mass migration. As indicated above, the impact of mass migration on labor supplies in sending and receiving countries between 1870 and 1910 ranged from 37 percent for three New World destination countries (Canada at 44 percent absorbing the largest supply of immigrant labor) to −18 percent for six poor European sending countries (Italy at −39 percent losing the largest share of its labor supply). Migration's impact on the receiving country's labor force is also known to be highly correlated with an initial scarcity of labor, although not perfectly (Hatton and Williamson 1994). Migration is therefore a prime candidate in accounting for the distribution trends. Figure 5 plots the

Figure 5. *Inequality Trends vs. Migration's Impact on Labor Force, 1870–1913*



Source: See figure 3.

result: where immigration increased the receiving country's labor supply, inequality rose sharply; where emigration reduced the sending country's labor supply, inequality declined.

Unfortunately it is impossible to decompose globalization effects into trade and migration using this information because the correlation between migration's impact and initial labor scarcity is so high. Yet an effort has been made by constructing a trade-globalization-impact variable as the interaction of initial labor scarcity and "openness." The result is that the impact of migration is still powerful, significant, and of the right sign: when immigration rates were small, inegalitarian trends were weak; when emigration rates were big, egalitarian trends were strong; when countries had to accommodate heavy immigration, inegalitarian trends were strong. In the Old World periphery, where labor was most abundant, the more open economies had more egalitarian trends, just as the Heckscher-Ohlin trade model would have predicted. It appears that the open economy tigers of that time enjoyed benign egalitarian effects, while those among them opting for autarky did not. In the Old World industrial core, this effect was far less powerful. It appears that open economy effects on income distribution were ambiguous among the land-scarce industrial leaders in Europe where the farm sector was relatively small.[10] Heckscher and Ohlin would have predicted this result too. In the labor scarce New World, however, the more open economies also had more egalitarian trends, which is certainly *not* what Heckscher and Ohlin would have predicted. The result is not significant, however.

Overall, I read this evidence as strong support for the impact of mass migration on income distribution and as weak support for the role of trade. This empirical exercise explains about two-thirds of the variance in distributional trends across the late nineteenth century. What forces could possibly account for the remaining third, forces that were also highly correlated with initial labor scarcity and GDP per worker-hour? Late twentieth century critics of the globalization thesis have argued that the answer lies with technological change. Lawrence and Slaughter (1993) contend that a skill-using bias in the United States has driven rising inequality. Wood counters that it cannot be so because inequality in the United States and the other OECD countries was on the rise just when the slowdown in productivity was in full swing. Whichever view the reader believes, it is important to remember that we are searching for an explanation that can account simultaneously for falling inequality in the South, rising inequality in the North, and some mixture among the newly industrializing countries in the middle. But is there any reason to believe that technological change should be unskilled labor-saving in rich countries and unskilled labor-using in poor countries?

This issue has been explored at length (O'Rourke, Taylor, and Williamson 1996) using the data on the ratio of wages to land rent shown in figure 2.

Almost by definition, industrial revolutions embody productivity growth that favors industry. Because industrial output makes little use of farmland, industrialization instead raises the relative demands for labor and capital. Industrial revolutions tend, therefore, to raise wages relative to land rents. According to this prediction, more rapid industrialization in Europe than in the New World should also have raised the wage-rental ratio by more in Europe. Such events should have contributed to a convergence in the prices of factors of production, including a rise in real wages in Europe relative to those in the New World. This prediction would be reinforced if productivity advance in the late nineteenth century New World was labor-saving and land-using, as the above hypothesis suggests and as economic historians generally believe (Habakkuk 1962; David 1974; di Tella 1982). The prediction would be further reinforced if productivity advance in the Old World was land-saving and labor-using, as economic historians generally believe.

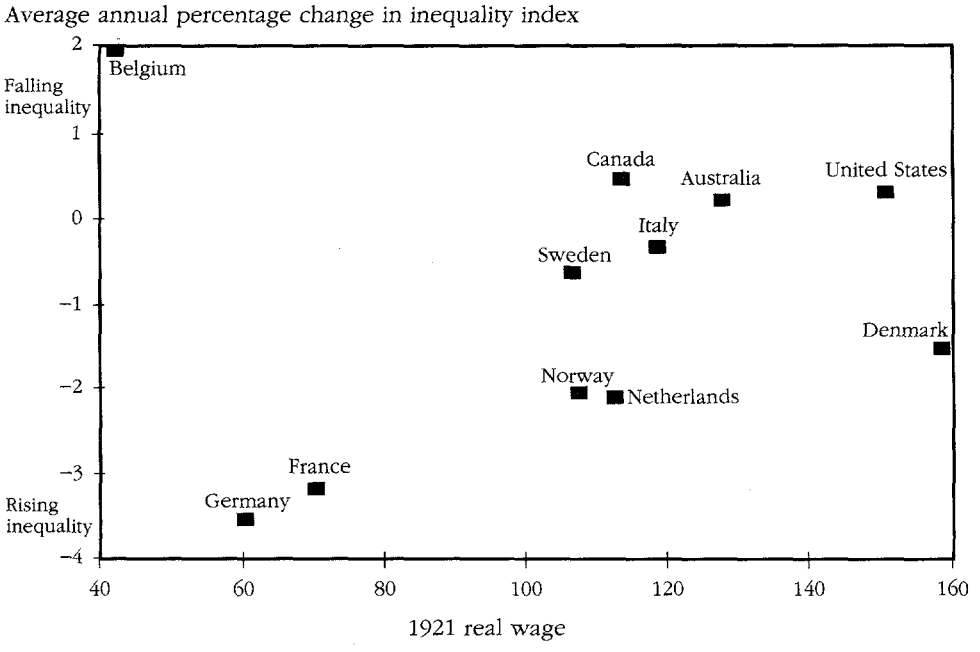
O'Rourke, Taylor, and Williamson's results (1996, table 4) are striking. The combination of changes in land-labor ratios and capital deepening accounted for about 26 percent of the fall in the wage-rental ratio in the New World, but for none of its rise in the Old World. Commodity price convergence and Heckscher-Ohlin effects accounted for about 30 percent of the fall in the New World wage-rental ratio and for about 23 percent of its rise in the Old World. Advances in productivity, as predicted, were labor-saving in the labor-scarce New World and labor-using in the labor-abundant Old World. Labor-saving technologies appear to have accounted for about 39 percent of the drop in the wage-rental ratio in the New World, while labor-intensive technologies accounted for about 51 percent of its rise in the Old World, powerful technological forces indeed.[11] Globalization accounted for more than half of the rising inequality in rich countries and for a little more than a quarter of the falling inequality in poor ones. Technology accounted for about 40 percent of the rising inequality in rich countries in the forty years before World War I, and about 50 percent of the decline in inequality in poor countries.

Establishing the Inequality Facts, 1921–38

What happened after World War I, when quotas were imposed in immigrating countries, capital markets collapsed, and trade barriers rose?

First, wage differentials between countries widened. Some of the differences were war-related, and some were due to the Depression, but even in the 1920s the trend was clear. Second, the connection between inequality and the forces of globalization was broken (see figure 6). Inequality rose more sharply in poorer countries than in richer countries, where in four cases, it actually declined.

Figure 6. *Initial Real Wage vs. Inequality Trends, 1921–1938*



Note: The real wage in 1921 relative to an index where the United Kingdom = 100 in 1927.
Source: See figure 3.

Some Things Never Change

At least two events distinguish the late nineteenth century period of globalization from that of the late twentieth century. First, a decline in inequality seems to have been significant and pervasive in the poor, industrial latecomers in the late nineteenth century sample. This move toward equality has not been universally true of the Latin American and East Asian countries recently studied by other researchers. Second, mass migration appears to have had a more important effect than trade on inequality in the late nineteenth century. Except for the United States, and perhaps West Germany, this phenomenon does not seem to have been true of the late twentieth century, although it should be noted that no economist has assessed the impact of emigration on wages and inequality in Turkey, Mexico, the Philippines, or other developing countries in which net outmigration has been significant over the past quarter century or so.

Some things never change, and that fact implies a warning. Globalization and convergence ceased between 1913 and 1950. It appears that rising inequality in rich countries induced by globalization was responsible, at least in part,

for the interwar retreat from globalization. The connection between globalization and inequality was also broken between World War I and 1950. Rising inequality in the rich countries stopped exactly when immigration was choked off by quotas, global capital markets collapsed, and the international community retreated behind high trade barriers. Are these interwar correlations spurious? The pre–WWI experience suggests not.

Is there a lesson from this history? Will the world economy soon retreat from its commitment to globalization just as it did almost a century ago?

Notes

Jeffrey G. Williamson is the Laird Bell Professor of Economics and faculty affiliate at the Harvard Institute for International Development at Harvard University. A longer and more technical version of this paper appeared as NBER Working Paper 5491 and is available on request (jwilliam@kuznets.fas.harvard.edu). The research underlying this paper was supported by the National Science Foundation. I am grateful for the excellent research assistance of Bill Collins, Asim Khwaja, and Tien Quek, as well as for useful comments from Moe Abramovitz, Don Davis, Ron Findlay, Tim Hatton, Doug Irwin, Ed Leamer, Kevin O'Rourke, Sherman Robinson, Alan Taylor, Adrian Wood, and referees of *The World Bank Research Observer.*

1. See, for example, Baldwin and Cain (1994), Bergstrand and others (1994), Bhagwati and Dehejia (1994), Bhagwati and Kosters (1994), Borjas and Ramey (1994), Freeman (1995), Freeman and Katz (1994), Krugman and Venables (1995), Leamer (1994, 1995), Richardson (1995), Wood (1995a, 1995b), and World Bank (1995).

2. Before 1870 the full sample includes Australia, Belgium, Brazil, France, Germany, Great Britain, Ireland, the Netherlands, Norway, Portugal, Spain, Sweden, and the United States. After 1870, the sample includes Argentina, Canada, Denmark, and Italy.

3. The Smoot-Hawley tariff of 1930 is infamous for its alleged contribution to the Great Depression. Yet the *ad valorem* tariff equivalent levels were 42.5 percent under Smoot-Hawley, an increase of only 8 percentage points over the levels implied by the 1922 Tariff Act (Irwin 1995, table 1). A tariff-induced 8-percentage-point increase seems tiny compared with a 45-percentage-point decrease in cost as a result of declining transport charges before World War I—one-sixth the magnitude in fact!

4. Commodity price convergence accounts for about three-tenths of real wage convergence between the United States and Britain during the twenty-five years after 1870 and about one-tenth of the convergence between the United States and Sweden over the four decades after 1870; however, Anglo-American commodity price convergence effects were swamped by other forces after 1895, and they made only a modest contribution to Anglo-Swedish real wage convergence over the four decades as a whole (O'Rourke and Williamson 1994, 1995). O'Rourke, Taylor, and Williamson (1996) turned to econometric analysis of wage-rental trends in seven countries (including Britain and Sweden) to search for the average case. They found that commodity price convergence could explain about a quarter of wage-rental convergence between the New World and the Old World. These estimates are close to the 10–15 percent reported by Richardson (1995, p. 36) for the contribution of trade to rising United States inequality from the 1970s.

5. As far as I am aware, recent studies of the globalization-inequality connection in developing countries focus almost exclusively on wage inequality, and sometimes only on *urban* wage inequality. I think this is a big mistake for countries where rural wage employment is signifi-

cant and where landed interests are powerful. Surely the economic position of landlords and rural labor matters in economies where agriculture is one-fifth, one-quarter, or even one-third of the economy.

6. O'Rourke, Taylor, and Williamson (1996) constructed a panel database documenting the convergence of the ratio of unskilled wages to farm rents per acre among late nineteenth century countries (figure 2): four New World countries—Argentina, Australia, Canada, and the United States; four free-trade Old World countries—Denmark, Great Britain, Ireland, and Sweden; and three protectionist Old World countries—France, Germany, and Spain.

7. This was certainly true of Europe, Argentina, and the American South, but less true for the American Midwest and Canada, where the family farm dominated.

8. The equality index is normalized by setting *w/y* 1870 = 100.

9. In addition, the slope on an estimated inequality–real-wage regression line is far steeper in 1890–1913 without the protected five (France, Germany, Italy, Portugal, and Spain) than with them. We saw the same contrast when comparing wage-rental ratio trends between four Old World countries with free trade and three Old World countries that are protectionist (figure 2).

10. This was *not* true in England during the 1830s when the Corn Laws can be shown to have had inegalitarian implications and thus that repeal had egalitarian implications (Irwin 1988; Williamson 1990; O'Rourke 1994). England had a very different economic structure and mix of political interest groups in the 1830s compared with the 1880s, a half century later.

11. The residual was 5.1 percent for the New World and 27.5 percent for the Old.

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The Policymaking Uses of Multitopic Household Survey Data: A Primer

Margaret E. Grosh

Household surveys are a valuable tool for policymakers deciding among policy options. This article illustrates the kinds of issues typically addressed in these surveys and shows how detailed analyses of the data can feed into the decisionmaking process. It outlines the general virtues and limitations of household survey data and provides a brief sample of the kind of data analysis that is relevant to policymaking. It also discusses the benefit-cost ratios that are likely to apply to survey-based policy analysis.

This article is designed to help policymakers and their technical staff understand how household survey data can be useful in their work. Such data may be underused for several other reasons (see box 1), but an appreciation of how useful the analysis of survey data can be in informing the policymaking process increases the likelihood that these other issues will be addressed.

Examples of the Use of Survey Data in Policymaking

Governments can use survey data to inform their policymaking in several different ways, as the following examples illustrate.

Jamaican Food Stamp Reform

In January 1990 the Jamaican cabinet approved major changes in the government food stamp program based, in part, on recommendations arising from an analysis of the Jamaican Survey of Living Conditions (JSLC), the Jamaican version of the World Bank's Living Standards Measurement Study (LSMS). The survey was used at five different stages of the reform process.

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Box 1. *Causes of and Remedies for the Underuse of Survey Data*

Fostering the use of data in policymaking has increasingly become a focus of World Bank attention. Following are descriptions of some of the barriers to the use of data as well as remedies for the specific problem.

Unawareness. Many policymakers are not aware of the many ways that sound data analysis can help formulate policy. As a result many survey projects now include special seminars for policymakers and program managers to brief them on the survey and its potential uses. This article is also aimed at improving awareness.

Restrictions on Access. One of the biggest barriers to data use has been government policies, formal and informal, that deny analysts access to the data collected. The World Bank has attempted—with mixed success—to promote the availability of LSMS and Social Dimensions of Adjustment survey (SDA) data in the countries in which they were collected. Grosh and Muñoz (1996) describe policy and logistical requirements for ensuring widespread access to data; Hartke (forthcoming) offers guidance on how statistical agencies can disseminate data systematically.

The World Bank maintains central data archives for both LSMS and SDA. Grosh and Glewwe (1995) and the LSMS Home Page (http://www.worldbank.org/html/prdph.lsms/lsmshome.html) describe the data available through the LSMS archives and the procedures for obtaining the data. The "catalogue" and web site are the culmination of a multiyear effort to improve the documentation and dissemination of the LSMS surveys. Many of the survey datasets are now available to the public without restriction. Some require government permission, which is usually given promptly.

Scarce Analytical Capacity. Projects to support data collection increasingly also support the creation of analytic capacity, through training, provision of hardware and software, studies, and funding. Papers by Blank and Grosh (1996) and Synergie (1996) synthesize lessons from attempts to build analytic capacity in conjunction with LSMS and SDA surveys, respectively.

Inadequate Communication. In many projects, the survey is guided by a formal steering committee composed of policymakers and academics so that data users and data collectors have a forum for discussion. Grosh (1991) covers some of the institutional issues involved in ensuring that household survey data have an effect on policy decisions.

Stage 1. The first survey was conducted in August 1988. The preliminary abstract produced two months later showed that the food stamp program was better targeted to people in need than were food subsidies in general (STATIN and World Bank 1988). Thirty-one percent of the food stamps distributed went to the poorest quintile, while only 14 percent of the general food subsidies reached this target population. Although the overall finding was not unexpected, the fact that the size of the difference could be quantified probably added support to arguments in favor of reducing food subsidies and increasing the budget for food stamps (Grosh 1995).

Stage 2. In July 1989 a second round of the survey was fielded. An abstract drafted two months later showed that malnourished children used the public health system as often as those who were not malnourished, and that children who did not receive food stamps used the public clinics almost as often as those who did (STATIN and PIOJ 1989). Thus the food stamps directed to children

through clinics could continue to be delivered through health clinics without undue concern that the neediest children would be missed.

Stage 3. The Planning Institute of Jamaica commissioned a study of the survey data to help determine whether it was necessary to change the benefit levels and the criteria defining eligibility for the food stamp program (Gordon 1989; Anderson 1989). That report was completed in December 1989, and the new benefit levels and eligibility criteria, which largely followed the recommendations, were approved in January 1990.

Stage 4. To determine what changes in administrative procedures were likely to enhance the coverage of children and pregnant and lactating women, the Planning Institute commissioned further work, using existing survey data and the administrative records of the food stamp program (Anderson 1993). A special survey of mothers at urban health clinics was also carried out, along with observations at food stamp pay stations and interviews with program employees.

Stage 5. A special section on food stamps was added to the survey in 1989 and revised each year until 1992 and periodically thereafter. This section was designed to address various issues raised by policy analysts. Basic tabulations on how many people benefit, where they fall in the distribution of welfare, and why some people do not apply for food stamps have been reported annually in the Jamaican Survey of Living Conditions abstracts. The data collected were used to complement the administrative records used in the routine monitoring of the program.

The analyses were timely, well-suited to the policy question, clearly explained to the policy audience, and carried out in a logical, sequential fashion, largely in response to queries from policymakers at each stage of the process. Much of the work was also peer-reviewed and was made available to the public. Government officials, academics, and World Bank staff were all involved in the analyses. The questions on the SLC relating to the food stamp program were changed several times to make them more relevant to policy issues.

The Jamaican example is noteworthy not only because it demonstrates the many advantages of using survey data in policymaking, but also because such clear illustrations are rare. Other examples are less clearcut, although just as important. Two other examples of the use of survey data in policymaking are harder stories to tell.

Ghana and Peru

In 1990 the government of Ghana was considering an increase in the tax on petroleum products but was eager to cushion the impact of the price increase on the poor. Officials first considered subsidizing the price of kerosene to mitigate the effect of the tax increase. Data from the Ghana Living Standards Sur-

vey showed that the poor did not consume much kerosene, however, but instead used wood as fuel for cooking. Thus much of the subsidy would have benefited the nonpoor rather than the poor. The survey data prevented the government from making an inefficient and costly policy decision. Yet no special analysis was commissioned, and no conference was held; a few people associated with the policymaking process looked at some simple tables that were already available and made a better policy decision.

A dramatic contrast to Ghana's low-key use of household survey data is the story of welfare analysis in Peru using the LSMS surveys conducted in 1985, 1990, 1991, and 1994. The analysis is very visible, but its impact is more difficult to pin down.

The first survey was conducted by the government of Peru; subsequent surveys were carried out by a private firm. The results of the surveys are available in bookstores in Peru, are often quoted in newspapers and in widely read publications on national issues, and are easily available to academic researchers. The data have been used in policymaking (for example, an analysis of these statistics informed the poverty alleviation strategy that the government presented to a consortium of development agencies in 1993). The surveys showed that poverty had increased sharply during the economic crisis from 1985 to 1990 but that it had declined somewhat after macroeconomic reforms were introduced in 1991. A widely known, technically respected, and factual basis for statements about the level of poverty or the effect of macroeconomic policies on the poor must surely affect the way in which the debate over appropriate policies takes place either in the proverbial smoke-filled back rooms or in the streets. The survey's influence on the political debate cannot be measured, however.

These three examples show that there is no single formula for using household survey data to help make public policy. In all cases, however, two elements are necessary: the data must be analyzed in a manner pertinent to the policy question, and the analysis must be transmitted to policymakers. In the cases cited here, the analysts were sufficiently well-informed about the agenda to produce policy-relevant analysis, and they had the means to bring their results to the attention of policymakers who, fortunately, were receptive to the analysis. In Jamaica and Peru, policymakers actually determined the direction of the analysis and commissioned work to answer the relevant questions.

The Benefits and Limitations of National Survey Data

Before policymakers commission analyses of survey data, it is important for them to appreciate the benefits and limitations of such data. The discussion

here is based on surveys that are similar to LSMS and SDA surveys, that is, they are multitopic surveys designed to study household welfare, household behavior, and the effects of government policies. (See box 2 for an outline of the key features of these surveys.) Most of the lessons learned from these exercises also apply to data from other kinds of multitopic household surveys, which offer a broader range of interesting applications than do single-topic surveys.

Benefits

The first benefit of a good household survey is that it provides hard information, enabling policymakers to move from polemics to concrete and constructive discussions. For example, in 1993 the World Bank and the government of Guyana met to discuss health care financing. The Ministry of Health was not very interested in charging user fees for public health services. It saw such fees as part of an ideology that the Guyanese government did not share and that was not conducive to providing health care to the poor. But the 1993 Guyanese Survey of Living Conditions showed that only 61 percent of those in the poorest quintile who sought health care used the public sector (World Bank 1994, table 4.5). This fact helped to establish common ground in the dialogue. Because many of the poor were already paying for health care, the theoretical discussion of whether user fees should exist was rendered moot, and thus it was possible to proceed with a more practical discussion of how to improve the health of the poor with a mix of already existing public and private services.

A second benefit is that survey data help to answer the "what if" question in assessing the impact of actual or proposed policy changes. For example, the governments of Jamaica and Indonesia have both used household surveys to estimate how changes in user fees for public health services would affect the use of public health facilities and the revenues collected.

The third benefit, and one that is unique to surveys, is that they represent the whole population, including the rich and the poor, those who use public services and those who do not. In contrast, statistics gathered in the course of delivering public services are inherently biased because they do not include the population that is not receiving the service. Often those are the people about whom policymakers have most reason to be concerned; examples are unvaccinated children or those who are not in school. To illustrate, consider the differences in monitoring children's nutritional status using clinic-based, rather than survey, data. The children at clinics may not be a random sample of all children and may be sicker, poorer, and more malnourished. Alternatively, children who use clinics frequently may receive adequate preventive care and thus be less likely to be sick or malnourished than other children. Poor children may not use clinics because they are too distant. Conversely, wealthier children may

Box 2. *The Characteristics of Nationally Representative Multitopic Surveys*

The World Bank's Living Standards Measurement Study (LSMS) and Social Dimensions of Adjustment (SDA) surveys are programs designed to help governments gather comprehensive information on household welfare and to promote analyses of the data. Since 1985 such surveys, which attempt to find out how households behave and are affected by economic policies, have been implemented in some fifty countries (for a full explanation of these surveys, see Grosh and Glewwe 1995; Simonpietri and Ngong 1995).

Extensive Multitopic Questionnaires

The LSMS and SDA Integrated Survey questionnaires, which are designed to cover individual and household-specific information, are often complemented by separate questionnaires on prices and community services. The kind and extent of information gathered—and therefore the questionnaires used—vary greatly from country to country, but the surveys typically include the following:

- *Consumption.* Explicit food and nonfood expenditures; the value of home-produced food and food received as gifts, information to impute the value of durable goods and owner-occupied housing.
- *Income.* Wages and in-kind benefits from employment; net revenue from farming and from nonagricultural household enterprises.
- *Social dimensions of welfare.* Nutritional and health status, literacy, availability of water, quality of housing.
- *Access to and use of public services and subsidies.* Schools, clinics, agricultural extension services, welfare programs.
- *Other household decisions.* Fertility, migration, labor force participation.
- *Local conditions.* Prices, labor markets, availability of transport, commercial services.

The SDA Priority Surveys, which were designed for monitoring trends rather than for providing data for analyses, usually cover a subset of the indicators above. They often use shortcut measures

receive most of their health care from private physicians, who are not included in the nutrition reporting system. The direction and extent of the bias in clinic-based data is not clear. (See Grosh, Fox, and Jackson 1991 for a more complete discussion of this issue and a review of empirical evidence.)

Moreover, this bias may not be constant over time, making trends drawn from clinic-based data unreliable. During an economic crisis, for example, wages and employment fall and prices rise, which is likely to increase the incidence of malnutrition. And the pattern of use at clinics may change at the same time. Some families may be forced out of the system altogether, while others may forgo preventive visits but still use the clinics when their children are ill. Those who previously used private physicians may begin using public care. These kinds of changes in patterns of health care use would affect the amount of bias in the malnutrition rate as measured from clinic data, making any inferences about the effect of the economic crisis on malnutrition questionable. A carefully drawn household survey could elminate these biases.

of consumption, omit income measures altogether, and collect a reduced set of all others types of information.

Quality Assurance Mechanisms

The LSMS and SDA survey programs rely on a variety of mechanisms to preserve data quality (see Grosh and Muñoz 1996, for the LSMS surveys; Delaine and others 1992 for the SDA surveys). Among the most important are:

- *Questionnaire design.* In-depth consultation with policymakers and analysts; extensive field testing.
- *Questionnaire format.* Precoding, explicit wording, filtered questions, instructions to interviewers, use of graphic design to minimize interviewer error.
- *Training and supervising field teams.* Maintaining high supervisor-to-interviewer ratios, often 1 to 2.
- *Concurrent data entry.* Ensuring that quality control features are embedded in the data entry program so that mistakes encountered when the data are being entered can be corrected by revisiting the household.

Small Nationally Representative Samples

Most multitopic surveys that share the characteristics mentioned here aim to cover an entire country. The LSMS and SDA Integrated Survey are national samples covering from 2,000 to 5,000 households, to ensure high-quality fieldwork (and control for nonsampling error, to use statistical jargon). In budgetary terms, the relatively small size of the sample helps to counterbalance the costs of such extensive questionnaires and of quality control. Because SDA Priority Surveys are simpler, they can cover 8,000 to 10,000 households.

A fourth benefit is that surveys provide a reference group to which data from other special focus or special sample surveys can be compared. This can work in several ways. In Bolivia a survey of the labor force was used as a comparison group for a special survey of workers on the labor-intensive public works projects funded by the Emergency Social Fund. Unfortunately, the labor force survey was limited to urban areas, which meant that the evaluation of the impact of the public works projects had to be limited to urban areas.

And finally survey data can be used to study the links among many different topics, such as the effects of education on earnings or fertility, or the effects of health status on labor force participation or productivity, or the effects of welfare transfers on consumption behavior. To support such intersectoral analysis, however, surveys must gather information on many topics, which implies that much less information will be included on any one topic than would typically be gathered in a single-purpose survey. So this virtue carries with it a limitation in some respects.

This point is illustrated by a comparison of the information on fertility gathered through the LSMS with that obtained through the Demographic and Health Surveys, the state-of-the-art single-topic surveys on demography funded by the U.S. Agency for International Development and conducted by a private agency. The LSMS usually collects fertility information on a narrow range of demographic factors that basically relate to a woman's pregnancy and birth history and to her use of maternity services. Demographic and Health Surveys also measure these factors, but in addition they provide information on the woman's contraceptive knowledge and use, marriage history, and the number of children desired. Moreover, the samples in the single-topic surveys represent women aged fifteen through forty-nine, rather than the whole population, and are usually somewhat larger than the samples used for multitopic surveys. The single-topic surveys, however, contain very little information on the woman's income, consumption, labor activities, education, or health. Thus, while single-topic surveys are more accurate in measuring a wide spectrum of demographic variables related to fertility, multitopic surveys are better for studying the factors that determine fertility.

Limitations

Household surveys, even when they are regularly conducted, cannot address all policy questions. It is important to bear in mind three inherent limitations of such data. The first limitation is imposed by the size of the sample. The fairly small national samples do not allow reliable study of "rare events." Examples of rare events that are of interest to policymakers are infant mortality and enrollment in small government programs. Infant mortality by definition affects only children under twelve months, who usually account for about 2 percent of the population. Even with high infant mortality rates of 100 per 1,000 live births, or one-tenth of the cohort, only 0.2 percent of the sample would be affected. Thus, in a sample of 2,000 households (or 10,000 individuals), only 20 infant deaths would be detected. This is too low a figure to produce precise estimates of levels of infant mortality and certainly too low to study patterns.

This problem can be partly mitigated by asking about deaths over a longer period, say, five years rather than one, so that 100 deaths might be observed. Alternatively, the sample could be doubled to 4,000 households. Nonetheless, some events, although important, are not frequent enough to study with a small general sample. The planners of an LSMS conducted in Nicaragua in 1993, for example, were interested in studying the welfare of individuals disabled during the civil war. In the sample of 3,600 households, however, only eight people reported that their mobility was limited because of war wounds, and only fifteen people reported having war-related deformities.

The other aspect of the limitation imposed by the sample size is that the data cannot be reliably disaggregated into small subgroups, even for events that are not rare. Consider, for example, the issue of access to water. Policymakers commonly want statistics to apply to small geographic areas such as provinces or districts, especially where these levels of government are in charge of the infrastructure for water supply. A country could easily have twenty provinces, however, which would mean that for a survey of 2,000 households, the sample would include an average of only 100 families in each province—and fewer in smaller provinces. Moreover, it would be useful to contrast, for example, rural or urban households within the province, or poor and nonpoor, which would further shrink the number of observations from each group. The precision of the resulting estimates would be very low, and would entirely preclude the possibility of disaggregating the figures to lower levels, such as by district.

The second limitation stems from the survey's reliance on formal interviews that use predetermined, closed-end questions. Such questions are conducive to gathering some kinds of factual information but are less suited to studying perceptions, motivations, or nuances of opinion. In a few cases, notably the South Africa LSMS survey but also the 1993 Jamaica Survey of Living Conditions discussed earlier, a few closed-end attitudinal questions were included. Such questions could be added more regularly, but they can barely scratch the surface of such issues. To study fully attitudes, perceptions, or motivations, open-ended interviews or focus groups are more appropriate.

Moreover, the predetermined nature of formal questionnaires means that the survey planners have to know in advance what to measure, which in turn implies that they already know a lot about the phenomenon they want to study. To gather that knowledge, the survey planners can use qualitative studies as a foundation for learning which factors are likely to influence the outcomes that are being measured. Then the survey questionnaire can be better designed.

In Jamaica findings based on data from the Jamaican Survey of Living Conditions (World Bank 1995b) were compared with those from a participatory urban appraisal conducted in 1995 (Moser and Holland 1995). Many of the findings of these two different kinds of studies were broadly consistent—that the poor need better jobs, more human capital, and improved physical infrastructure and that crime and violence are significant obstacles to achieving these goals. The poverty assessment (which was *quantitatively* based) concluded broadly that growth and investment in basic services and infrastructure would aid the poor. The participatory urban appraisal (which was *qualitatively* based) was able to add subtleties to this basic understanding. For instance, the poor perceived the existence of an "area stigma" with respect to jobs. In other words, potential employers did not hire poor applicants after they revealed where they

lived. This information indicated that macroeconomic growth alone would not provide jobs for the poor.

Similarly, the 1989 survey questionnaire in Jamaica included a set of questions on the distance from the respondent's household to various public services. The results showed that these distances were generally not great, which was interpreted as meaning that the poor had access to these services. The participatory urban appraisal, however, revealed that violence in some urban areas often restricted residents' access to nearby services because there were only a limited number of hours in the day when people felt safe to move about or because they could not cross "turf lines" without encountering gang activity. Again, the qualitative work was able to identify problems (and thereby lead to solutions) that had not been observed in the formal, closed-end interviews conducted in the course of the quantitative survey.

A third limitation is that household survey data may not be sufficient to answer many important policy questions and thus may need to be supplemented with data from other sources. For example, at least four types of data are needed to find out how schools could teach students most efficiently. The first kind of data—the characteristics of the students and their families, such as age, education level, income, and work activities—can easily be gathered in a household survey. The second—information about students' scholastic levels—requires achievement tests. Such tests can be organized as part of a household survey, although it is much more common (and many educators would say, more reliable) to use a school-based survey.[1] Third, researchers need to obtain data on the educational process—the curriculum; teachers' qualifications; provision of supplies and equipment such as textbooks, blackboards, reference books, classrooms, and lab equipment—as well as data on such factors as how management affects these inputs. These data must be collected in schools. And finally, it is important to know the costs of providing materials and programs that affect how teachers teach. This data is most likely to be available from education planning offices.

Although this complementary data can be added to a household survey (as it was in 1988 in Ghana, in 1990 in Jamaica, and in 1990–91 in Morocco), the exercise is not easy. Developing the necessary instruments adds significantly to the complexities of planning, especially if it is necessary to identify or develop tests that produce valid comparisons across, for example, children in a wide range of grades (which is usually the case because the sample households do not have many children in each grade). Moreover, determining the sample of schools that should be included is difficult, particularly in urban areas where children have a choice among different schools. And finally, administering the tests and school questionnaires requires more fieldwork, although this is by far the most easily handled aspect of collecting the required ancillary data.

What Topics Are Suitable for Policy Analysis?

The range of potential policies that can be affected by survey data is very broad. All of the examples discussed here have at least been disseminated in policymaking circles, and in most cases the government agency involved actively participated in crafting the data collection and analyses, and the analyses were taken into account in the policymaking process. Space constrains the number of examples presented here, but I have tried to show the diversity available both in terms of the analytic issue that can be addressed and the sector to which the analysis pertains.

Policymakers need to consider four areas in connection with the issue to be analyzed. First, what are the outcomes that are of interest, such as the employment rate or the percentage of children who are malnourished? Second, what are the patterns in the use of the service? Who uses health clinics? Schools? Public transportation? Third, how will changes in policies (higher fees, say) or in the economic environment affect the community or the providers of the service? How does economic growth affect the poorest? And finally, what determines household behavior pertaining to the issue being analyzed, such as the number of children a family will have, or whether the children attend school? The range of sectors in which these different questions can be addressed is as broad as the set of topics in the questionnaires: health, fertility, nutrition, education, migration, employment, agriculture, housing, consumption, small business, and ownership of assets. The following examples illustrate the point.

The Study of Poverty

One way to evaluate the prevalence of poverty is to construct a poverty profile. Poverty profiles quantify and describe several dimensions of poverty, including who the poor are, where they live, how they earn their living, whether they have access to and use of government services and subsidies, and what their standard of living is with regard to health, education, nutrition, and so forth. To cover all these aspects of poverty, researchers use information from many parts of a multitopic questionnaire. Here I present part of a single table from the Ecuador Poverty Report (see table 1); the full report has many such tables.

Another way that surveys help to study poverty is to show how it changes over time. In the late 1980s Peru's economy experienced considerable upheaval. Gross domestic product per capita fell by about a fourth. The price index rose from 3,474 in 1985 to 40,216,592 in 1990. Net international reserves plummeted. Using data from 1985 and 1990 household surveys, Glewwe and Hall (1994) found that the consumption of the average household in Lima fell by slightly more than half during this period and that the welfare of the poorest

Table 1. *Ecuador: Some Characteristics of the Poor, 1994*

		Urban		*Rural*		*Total*	
Characteristic	*Region*	*Poor*	*Nonpoor*	*Poor*	*Nonpoor*	*Poor*	*Nonpoor*
Education							
Education of	National	5.2	9.1	3.2	4.7	4.0	7.5
household	Costa	4.9	8.3	2.8	3.9	3.9	7.1
head	Sierra	5.8	10.5	3.4	5.1	4.1	8.0
(years)	Oriente	5.9	8.8	4.5	7.4	4.6	7.8
Health							
Diseases treated	National	24.8	14.8	32.7	24.1	29.4	18.0
informally	Costa	27.3	19.0	45.3	33.7	36.4	22.6
(percent)	Sierra	19.7	9.6	21.4	19.4	20.8	13.7
	Oriente	26.3	10.7	20.1	14.4	20.4	13.2
Employment							
Informal sector	National	54.6	44.1	27.9	35.8	39.2	41.7
(percent)	Costa	54.6	44.1	19.6	24.8	37.6	41.6
	Sierra	56.3	41.3	35.1	42.6	42.3	41.9
	Oriente	54.9	40.8	25.7	41.1	27.3	40.9
Regulated sector	National	15.5	35.3	3.4	9.9	8.6	26.7
(percent)	Costa	11.8	31.1	1.1	3.1	6.6	24.4
	Sierra	22.1	41.3	5.4	12.6	11.1	29.2
	Oriente	8.7	40.0	6.4	26.8	6.5	31.0
Basic services							
Sewerage	National	57.3	83.4	12.4	28.2	29.6	63.8
connection	Costa	43.5	74.4	11.7	17.0	27.3	58.9
(percent)	Sierra	78.9	95.6	13.5	35.4	33.5	69.5
	Oriente	62.9	87.9	7.0	31.1	10.8	50.6
Electricity	National	97.8	99.5	62.0	75.8	75.8	91.1
supply	Costa	97.9	99.4	55.5	63.3	76.4	89.6
(percent)	Sierra	97.7	99.7	69.8	84.3	78.4	93.0
	Oriente	93.6	96.5	36.3	74.4	40.1	81.9
Water from	National	61.2	78.8	18.3	23.0	34.8	59.3
public network	Costa	48.9	67.1	6.1	9.1	27.2	51.4
(percent)	Sierra	79.9	94.5	27.9	34.0	43.8	68.2
	Oriente	85.3	92.5	12.1	23.2	17.0	47.2
Waste collection	National	59.7	76.7	1.1	5.6	23.5	51.5
(percent)	Costal	52.2	68.9	1.3	6.8	26.6	52.1
	Sierra	70.5	87.7	0.9	3.9	22.2	51.3
	Oriente	59.9	84.9	1.8	21.5	5.7	43.3

Source: World Bank (1995a), tables 2a and 2b.

Table 2. *Lima: Changes in Consumption Expenditures, 1985 to 1990*

Characteristics of heads of households	*Percentage change in expenditures*
Gender	
Male	−54.5
Female	−54.9
Education	
None	−58.7
Primary	−59.1
Secondary general	−55.1
University	−54.0
Other postsecondary	−38.9
Employer	
Government	−56.1
Private	−56.3
Private home	−54.7
Self-employed	−51.4
Occupation	
Agriculture	−50.4
Sales/services	−56.7
Industry/crafts	−52.3
White-collar	−54.1
Unemployed	−65.9
Retired	−50.2
All Lima	−54.6

Source: Glewwe and Hall (1994).

households dropped even more than the average (table 2). Households headed by individuals with little or no education experienced the greatest loss of welfare. Female-headed households did not fare worse than households headed by men. Poverty, defined as the inability to cover a household's basic nutritional requirements, increased from 0.5 percent of the population to 17.3 percent.

Understanding the Effects of the Economic Environment

Household survey data can provide information on the effects of changes in taxes, subsidies, or trade policies on individuals or groups. The following example from Tunisia illustrates an attempt to assess the impact of a change in the price of a consumer good.[2] Analogous work can be done for price changes on goods produced by farming households (see, for example, Deaton and Benjamin 1993).

For many years the Tunisian government subsidized the consumer prices of several staple goods. After 1990 the government began to change incrementally

the amount of the subsidy and the commodities included in the program in an attempt to increase the effectiveness and reduce the costs of the subsidy program. Table 3 shows some analysis done in the course of discussions between the government of Tunisia and the World Bank (see Tuck and Lindert 1996) to determine what policy changes should be adopted. The effect of various price changes on households' caloric intake by expenditure quintile was simulated, taking into account changes in the consumption of specific foodstuffs as a result of price changes, holding all other factors constant. The simulation was based on data from a survey conducted especially to help guide decisions about subsidy reforms. Analysts estimated that a 50 percent reduction in subsidies across the board would reduce the caloric intake of the poorest quintile by 30 percent. Targeted cuts in the subsidies of specific goods, however, were expected to lead to a much smaller reduction (about 19 percent), although simulations revealed that both scenarios would generate comparable fiscal savings for the government. Not surprisingly, the government adopted a strategy that included targeted changes in subsidies.

Table 3. *Tunisia: Estimated Nutritional Effects of Alternative Price Policies*

Impact of hypothetical price changes	*Expenditure quintile*					
	1 (Poorest)	*2*	*3*	*4*	*5 (Richest)*	*Average*
(1) Subsidy cut of 50 percent						
Percentage change in calories as share of total caloric intake	−30.1	−24.3	−22.2	−20.6	−15.3	−21.9
Resulting caloric intake	1,483	1,688	1,813	1,975	2,549	1,902
(2) Targeted cut						
Percentage change in calories as share of total caloric intake	−19.5	−20.9	−22.6	−22.6	−22.5	−21.7
Resulting caloric intake	1,708	1,764	1,803	1,925	2,332	1,907
Base case						
1993 levels (Kcal)	2,122	2,230	2,330	2,487	3,009	2,435
Subsidized goods as a share of total intake (1993)	58.9	49.4	47.4	42.4	28.4	45.3

Note: Scenario (1): Impact of cutting subsidies by 50 percent from 1993 levels on quantities consumed. Scenario (2): Impact of eliminating subsidies on specific goods on quantities consumed (sterilized milk, *gros pain*, bottled generic oil). A negative number signals a loss in calorie intake. Estimations omit introduction of new goods since 1993. Recommended daily allowance: 2,165 calories per capita (National Statistical Institute).

Source: Tuck and Lindert (1996), tables 27 and 28.

The Provision of Public Services

The first question to address in thinking about service provision is who has access to these services. Findings from a subset of the information available for rural areas from the Viet Nam household survey (World Bank 1995c) showed that the poor had less access to services than the nonpoor but that the differences were relatively small (table 4). Health facilities are more accessible generally in the south than they are in the north, but the reverse is true of agricultural services and literacy programs.

The second question is who uses public services. Household surveys that include appropriate questions can answer this question. Figure 1 shows some results from a 1990 survey in Indonesia. Among respondents who were ill during the month preceding the fieldwork, 33 percent of those in the richest decile did not seek health care, compared with 44 percent of those in the poorest

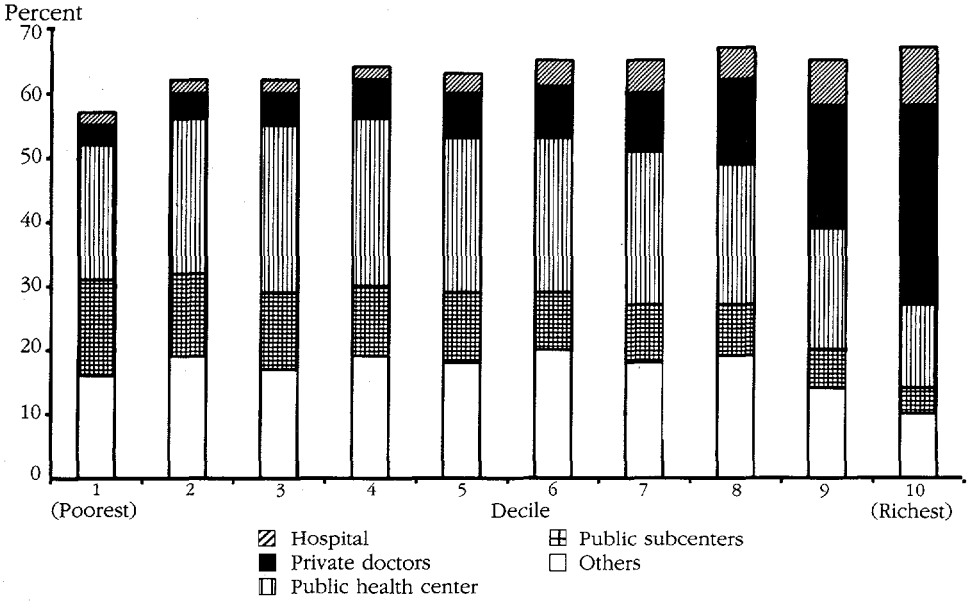
Table 4. *Viet Nam: Percent of Population Living in Rural Communes with Access to Infrastructure*

	South			*North*		
Infrastructure	*Total*	*Nonpoor*	*Poor*	*Total*	*Nonpoor*	*Poor*
Passable road	58.0	58.1	57.9	76.8	88.5	69.4
Public transport	61.2	61.1	61.3	47.2	54.3	42.7
Electricity/generator	91.6	91.6	91.6	85.6	90.0	82.8
Pipe-borne water	7.5	9.3	5.8	3.6	5.6	2.3
Permanent market	71.5	72.6	70.4	43.5	55.6	35.8
Post office	46.8	43.4	50.3	27.7	28.9	26.9
Lower secondary school	82.9	81.9	83.8	90.6	92.6	84.9
Upper secondary school	10.6	12.3	8.9	9.3	9.4	9.3
Dispensary	55.6	60.0	51.3	19.7	20.0	19.6
Pharmacy	78.3	80.7	76.0	65.5	72.0	61.3
Clinic	92.2	90.1	94.2	93.9	97.1	91.9
Doctor	50.9	60.8	41.0	34.7	42.5	29.8
Physician	100.0	100.0	100.0	94.0	96.8	92.2
Nurse	94.4	95.2	93.7	88.4	88.8	88.2
Agricultural extension office	18.4	22.2	14.5	27.8	29.9	26.4
Agricultural extension agent visits	72.1	68.9	75.3	71.3	75.8	68.3
Cooperative	8.7	8.9	8.4	90.6	94.2	88.3
Adult literacy program	81.9	81.0	82.8	85.3	86.9	84.3
Labor exchange	93.0	92.7	93.4	97.4	97.1	97.6

Note: The poverty line used is calculated for seven different regions and separately for urban and rural areas in each region. The national average poverty line is 1,117 thousand dong per person per year.

Source: World Bank (1995c), annex 3.1, tables 4 and 5, pp. 170–71.

Figure 1. *Indonesia: Percentage of Those Ill in Past Month Who Sought Health Care, by Decile and Place Where Care Sought*



Note: According to 1990 National Economic Social Survey.
Source: World Bank (1993), figure 1.10, p. 18.

decile. Of those in the poorest decile, 37 percent went to public health centers, while only 3 percent sought care from private physicians. In contrast, in the richest decile, only 17 percent used public health centers and 31 percent relied on private doctors.

The third question concerns how the value of the subsidy is distributed. To answer this question, information on the use of services from the household survey must be supplemented with information on the costs of providing services. This figure can come either from budget accounts or from special studies. When such information is available, it is possible to conduct analyses like that shown for Indonesia in table 5. The value of subsidies to education is greater than the combined value of subsidies to health and to consumption of kerosene. The absolute value of the subsidy captured by the richest decile is two to four times greater than the absolute value of the subsidy captured by the poorest decile. The share of household expenditure accounted for by the subsidies is greater for the poor than the rich, however, indicating that these factors do help to equalize the distribution of welfare.

A final concern is what would happen if user fees were raised. An important policy question in several sectors is whether charging (or increasing) user fees would affect the use of services and the revenues of the service providers. Using

Table 5. *Indonesia: Distribution of Selected Subsidies*

Subsidy	Year	Decile		National average
		Poorest	Richest	
Per capita (rupees per month)				
Education	1989	1,161	2,469	1,520
Health	1989	113	313	213
Kerosene	1990	94	447	243
Percentage of household expenditure				
Education	1989	13.18	4.04	6.57
Health	1989	1.00	0.38	0.70
Kerosene	1990	0.84	0.56	0.82

Source: World Bank (1993), annex 2.2, tables 3, 4, 8, 9, 13, 14.

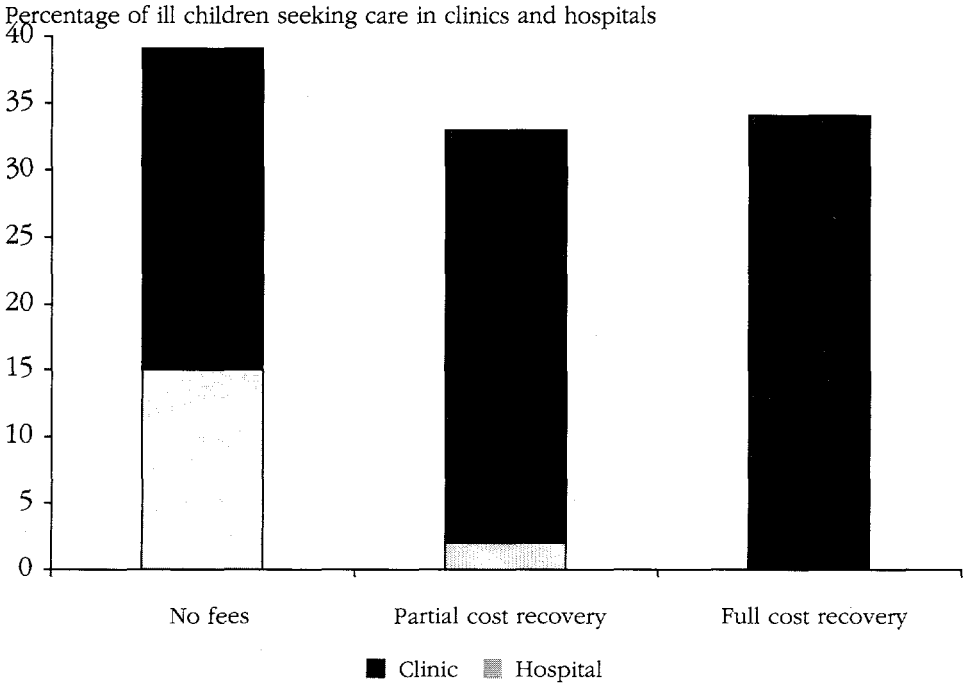
LSMS data, researchers have analyzed both of these factors, primarily in the health sector but also in education. Figure 2 presents a simulation by Gertler and van der Gaag (1990) showing how the use of health services for children in rural areas of Côte d'Ivoire might change in response to alternative pricing policies. Using econometric techniques, Gertler and van der Gaag attempted to compare the number of children that would seek care at (fee-charging) hospitals and (free) clinics with the number that were presently treated under a no-charge policy. They found that the introduction of such fees in hospitals slightly reduced the percentage of sick children seeking health care (from 38 percent under a no-charge policy to 33 percent with user fees), but that virtually all those seeking care would switch from hospitals to free clinics.

The Impact of Government Programs

Finally, household survey data can be used to assess the effect of government programs. Impact evaluations often require special sampling or other data sets to complement household survey data, but in the cases that follow, the special design features were kept fairly simple.

In the first case, Bolivian officials wanted to evaluate the effect of a public works program on poor workers. Such programs are often part of the effort to alleviate poverty. The idea is that the jobs will be self-targeted because only the truly poor are willing to accept temporary jobs that require hard physical labor and pay low wages. It is important not only to evaluate whether this self-targeting is effective but also how much workers benefit. If the public works program did not exist, poor workers who could not afford to be completely idle might instead be selling chewing gum on street corners or turning up each day at places where daily laborers are hired. The earnings from these other activities might be low, but they would bring in some income. Thus, for the workers, the monetary ben-

Figure 2. *Côte d'Ivoire: Simulated Impact of Raising Hospital Fees in Rural Areas*



Note: The source did not give the tables with the exact numbers. These graphs are approximations of the originals based on visual inspection.

Source: Gertler and van der Gaag (1990), figure 7-2, p. 106.

efit of a public works job is the difference between the wage it pays and whatever the workers might be able to earn in their alternative activities.

Thus, to evaluate the benefits from the public works programs financed by the Bolivian Emergency Social Fund, officials added a supplementary sample to the 1988 Permanent Survey, which was carried out periodically in urban areas throughout the country. In this supplementary sample, laborers on public works projects were interviewed using a questionnaire that included the questions from the 1988 Permanent Survey plus some additional questions. The two data sets were combined to estimate what the workers would have earned had they not been employed by the Emergency Social Fund. Newman, Jorgensen, and Pradhan (1992) analyzed the data and found that without the job program, 77 percent of workers would have been in the bottom four income deciles. Thus, the program was well-targeted. Moreover, it raised the distribution of income; earnings of workers increased over their preprogram level by 45 percent a week.

The second case involves the effect of government transfers on private transfers. Private, nonmarket transfers (such as remittances from abroad and support from the family) occur almost everywhere in the world, but they are an especially important part of economic life in developing countries. While 15 percent of individuals in the United States report receiving transfers, the figure in developing countries is 19–47 percent (Cox and Jimenez 1993). Thus the appropriate size of the public safety net depends in part on the size of the private safety net that is already in place.

Household surveys are crucial tools for analyzing patterns in interhousehold transfers of goods and cash, showing how private transfers are related to a household's access to public transfers. Policymakers need to know if government programs are likely to induce changes in private transfers. For example, increasing publicly funded pension benefits may not benefit the elderly as much as expected if their children react to this increase by reducing the amount of private transfers they give to their parents. Survey data can be used to simulate what would happen under different scenarios. Researchers have used household data sets from many developing countries—Colombia, Côte d'Ivoire, Ghana, Kyrgyzstan, Peru, the Philippines, Poland, Russia, and South Africa—to study the role of transfers.

In recent research, analysts have found that private transfers are directed toward those households that are often the focus of government benefits—households that include members who are poor, elderly, infirm, unemployed, or without access to formal credit (such as women and young people). Moreover, the research confirms that government policy affects private transfers. Evidence shows that public transfers can "crowd out" private ones. Cox and Jimenez (1993) estimate that, in Peru, an increase of 100 intis in public pension payouts would be associated with a decline of 17 intis in private transfers, leaving a net gain of 83 intis for the elderly household. This phenomenon is most striking in the Philippines, a country with a minimal welfare state and widespread private transfers. A 100-peso increase in public pensions to a retired household was estimated to reduce private transfers by 37 pesos. If unemployment insurance were introduced, private transfers would decline so much that jobless households would be only slightly better off. Although the transfers would still benefit targeted households, the net benefits would be considerably smaller than the gross benefit calculated without reference to the effects on private transfers (Cox and Jiminez 1993).

Determinants of Household Decisions

If the government hopes to influence certain outcomes, such as the number of children enrolled in school, the nutritional status of children, or the number of

children a woman bears, it must understand the factors that influence household decisions. A great deal of analysis of demographic issues has been done using survey data (see, for example, Ainsworth 1989, 1992; Benefo and Schultz 1994; Montgomery and Kouamé 1995; Oliver 1995a, 1995b; and Schafgans 1991). Questions related to fertility that can be investigated with survey data include the following.

- What effects do female schooling, male schooling, and household income have on fertility?
- What factors induce couples to have fewer children and to invest more in each child?
- How do the availability, quality, and price of family planning services affect contraceptive use? What are the socioeconomic characteristics of users and nonusers who have access to public family planning services and those who do not?
- What economic factors affect child mortality? How does child mortality affect the family's fertility decisions?

Using such data to collect information about fertility and contraceptive use in Côte d'Ivoire, analysts found that women in the highest consumption quintile had the lowest age-specific fertility rates, but those in the lowest consumption quintile had the next lowest current fertility. At the same time, current fertility was sharply lower among all women with secondary schooling and among women over age thirty with primary schooling. These data suggest that increasing incomes among the poorest Ivorian women will increase fertility unless levels of female schooling are also raised (Montgomery and Kouamé 1995).

The Benefits and Costs of Using Household Survey Data for Policy Analysis

By now, the reader may be convinced that analyzing household survey data can offer beneficial guidance in making some policy decisions and will be eager to know how much it will cost to reap the benefits of these data. Because a benefit-cost ratio for survey-based policy analysis is very difficult to calculate, there is little firm evidence.[3] But consider two contrasting anecdotes in which the benefit-cost ratio is relatively easy to guess.

Take, for example, the study of consumer-price subsidies of food products in Tunisia that was presented in the previous section. The analysis in that study was based on existing data on government budgets and on a small household survey conducted in 1993 specifically for this purpose. The costs incurred are fairly easy to quantify—about $55,000 ($33,000 for data collection in the small

special-purpose survey[4] and $22,000 for the analysis of the data and the dissemination of the results to policymakers). On the benefit side, the study identified reforms in the targeting of the food subsidies that, for a given caloric transfer to the poor, reduced the cost of the subsidies by 23 percent, or $74.5 million. Thus, the benefit-cost ratio was on the order of 1,300 to 1. Even if the cost estimate were doubled (to allow for things like unrecorded overtime, the cost of the time of policymakers involved in discussing the study, and items contributed in-kind and off-budget) and the policy analysis were ascribed only a weight of 10 percent in the decisionmaking process with the benefits reduced accordingly, the benefit-cost ratio would be 67 to 1.

Another situation in which the benefit-cost ratio is relatively easy to calculate is one in which a survey (or other data collection effort) has yielded data that have not been analyzed or results that have not been disseminated or results that have been ignored. In these cases, no actual calculations are needed to infer that the benefits are close to zero and that the benefit-cost ratio is discouraging. The reader can probably supply anecdotes of this sort from personal experience.

It is difficult to predict how the mix of high return cases and lost opportunities balance out. A final example helps to illuminate this issue. The government of Jamaica was keen to replicate its good use of policy analysis of the food-stamp program, but analytical capacity in Jamaica was limited. Therefore, the government applied to donors to support a project to improve capacity in social policy analysis. The project was designed to be implemented over five years and was expected to cost $3.4 million ($700,000 a year). Jamaica's annual social sector budget is about $400 million. The capacity-building project would only have to result in reforms leading to gains of about 0.2 percent of the social sector budget to yield a positive return

This discussion has aimed at helping policymakers identify situations in which sound analysis of household survey data may aid them in making policy decisions. It has shown how analysis can feed into decisions in a range of different ways, indicated the rich and varied policy analyses that can be done with data from national multitopic surveys, and outlined the general virtues and limitations of survey data. If this article helps planners to produce one or two well-done studies with policy impact or to avert a couple of badly designed studies, then its benefit-cost analysis will clearly be positive.

Notes

Margaret E. Grosh is a senior economist in the Development Research Group of the World Bank. Many people contributed to this article. Judy Baker, Lionel Demery, Polly Jones, and Kathy Lindert contributed to the understanding of policymaking in Ghana, Peru, Guyana, and Tunisia, respectively. Martha Ainsworth, Paul Glewwe, and Emmanuel Jimenez drafted

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1. Sometimes the goal of the achievement testing is not to study how schools induce students to learn but to study how learning affects labor force participation, job choice, or productivity. In this case, adult achievement measures are required, and testing in households rather than schools is more pertinent.

2. Although in general, consumer food price subsidies may affect households' decisions about whether and how much to farm, that is not pertinent in the Tunisian case. The subsidies studied are explicit and financed out of general government revenues. Producer prices are not reduced below border parity prices.

3. To calculate the benefits, one must first be able to calculate the monetary value of a gain in efficiency or equity due to a specific policy change. Occasionally, this is feasible. For example, one may be able to say that after a change in the targeting mechanism of a program, the minimum budget required to deliver *xx* dollars of services to the target group declined by *yy* dollars. Quantifying benefits is usually harder, however. A given reform may have multiple objectives that act in opposite directions. Moreover, reforms often include goals that are difficult to measure in dollar terms, such as increases in transparency, community participation, or sustainability. Second, one must be able to determine what weight the quantitative policy analysis played in the decision to reform the program. If it were wholly responsible, all the benefits would be counted as a benefit in the benefit-cost calculation, but if the analysis only played a minor role in the decision, then its share of the benefits should be discounted. One must also be able to determine the cost of the policy modeling. The costs of the analysts' time will be relatively easy to quantify, as will the costs of any special data collection effort mounted for the exercise. Most good policy analysis, however, relies at least in part on data collection efforts that go on irrespective of the particular policy modeling being evaluated (for example, administrative records, budgets, and ongoing surveys). What share of these costs should be included?

4. Note that this is less than the costs of many new, multipurpose household surveys. The median cost for LSMS projects is about US$750,000, although the range is from less than US$100,000 to US$3.1 million. The large variation depends on factors such as how much capacity building is incorporated into the project, how much technical assistance is used, how many vehicles are purchased, the size of the sample, the length of the questionnaire, and local prices. For more on costs for LSMS surveys, see chapter 8 of Grosh and Munoz (1996). Costs for SDA Integrated Surveys are of the same order of magnitude (see Delaine and others 1992).

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Formal Water Markets: Why, When, and How to Introduce Tradable Water Rights

Mateen Thobani

In most countries the state owns the water resources and the hydraulic infrastructure, and public officials decide who gets the water, how it is to be used, and how much will be charged for it. But costly inefficiencies in the supply and use of water support a shift from government provision to a market-based approach that is more effective and less wasteful.

Markets can allow rapid changes in allocation in response to changing demands for water and can stimulate investment and employment as investors are assured of access to secure supplies of water. Because of water's unique characteristics, such markets do not work everywhere; nor do they resolve all water-related issues. By designing appropriate water laws and regulations and by strengthening private and public institutions to administer them, formal water markets can effectively address rising demands for groundwater and for water found in rivers, lakes, and canals. Lessons from Chile's experience demonstrate that formal water markets can improve the economic efficiency of water use and stimulate investment.

In many developing countries, governments consider water to be too precious a resource or too difficult a commodity to be left to the market. Decisions about who gets water, at what price, and for what use have thus been entrusted to public officials. Although the state retains ownership of this asset, it typically endows private and public entities, such as farmers, industrial users, and power and water companies, with the right to use surface water or groundwater for a particular purpose. These rights are defined in a variety of ways and have been written into law or have evolved through custom (Sampath 1992). The allocation of water rights is typically the responsibility of the government, as is the construction, ownership, and operation of the infrastructure such as dams, reservoirs, and canals. In some countries that government even installs and oper-

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ates wells. Recently many countries have transferred operations and management responsibility to user associations; enforcement is the responsibility of public authorities or water user associations—or both. User associations are typically informal entities that play a role in distributing the water of a canal or river. In some countries, however, such as Chile, Mexico, and Peru, user associations are legally recognized bodies that set and collect fees for operating and maintaining the hydraulic infrastructure. Water companies and industries may belong to user associations, but most associations are made up primarily of farmers.

Publicly administered systems of water rights have all too often resulted in inefficiencies in the use and supply of water. Despite its growing scarcity and increasingly costly hydraulic infrastructure, water is often used wastefully. This is especially true in agriculture, which accounts for 70 percent of water use worldwide, compared with only 8 percent used for household consumption. It is not unusual in arid areas to find cities rationing water even as neighboring farmers grow low-value, water-intensive crops using inefficient irrigation technologies. Although governments normally reserve the right to reallocate water toward more desirable uses, in practice they have found it difficult to do so. Even in the face of rapidly changing demands for water, attempts to shift supplies from agricultural users to domestic urban consumers have often generated conflicts and fomented social disruption.

Moreover, government control has not been effective at ensuring that the poor have access to water. In many cities in developing countries, the poorest are not served by piped municipal water and must resort to buying water from private vendors at prices that are several multiples of those paid by better-off residents. And farmers who are politically influential manage to get easier access to water rights, which are obtained without charge and for whose use farmers typically pay only a nominal fee. Because farmers are unable to sell any surplus water, there is little incentive to conserve water by better soil or water management or by growing less water-intensive crops.

Nor has government control over water been effective at maintaining water or soil quality or protecting ecosystems in most developing countries. The discharge of municipal and industrial wastes, the runoff of agricultural chemicals, and poor land-use practices in agriculture, mining, and forestry have led to widespread degradation of land and water resources. Water-borne diseases cause an estimated three million deaths annually and render sick a billion more. In addition, poorly designed public irrigation projects and insufficient incentives for water conservation have resulted in extensive soil salinization (a process in which salts impregnate soils, making it unsuitable for agriculture) and contributed to ecological disasters in many countries (World Bank 1993). In many countries water from underground aquifers is pumped out at unsustainable

levels, threatening the livelihood of many agricultural and nonagricultural users, as well as seriously damaging ecosystems.

A system of publicly allocated water rights makes the private sector reluctant to invest in hydraulic infrastructure—or in activities whose operation requires large quantities of water. If the water in a reservoir built with private funds can be commandeered by the government to meet social or political objectives, investors will have little incentive to provide such infrastructure. If water can be reallocated from agricultural to urban users when shortages occur, investors are unlikely to invest in agriculture.

At the same time, public investment in hydraulic infrastructure has often been a losing proposition. There is no dearth of taxpayer-financed dams that were ill-conceived and, because of budgetary difficulties, long delays, and cost-overruns, cost far more than their eventual benefits were worth. Similarly, efforts to construct and operate public wells have also been unsuccessful. In many countries sizable shares of the public infrastructure budget have gone toward expensive hydraulic projects with low or negative economic rates of return (Holden and Thobani 1995). Despite high construction costs, many of these projects have not been adequately operated or maintained, leaving users, the bulk of whom are farmers, without a reliable supply of water and unwilling to pay higher water charges (Ostrom 1992).

The future looks bleak. Demand for water is rising, and because countries have already exploited the less expensive sources of supply, the cost of developing new supplies has increased sharply. Furthermore, as governments face increasing fiscal pressures, they are no longer willing to spend vast public resources to build new dams and wells or even to operate and maintain existing hydraulic infrastructure.

Market-Based Instruments for Water Allocation

Recent approaches to meet the growing demand for water have focused on voluntary mechanisms to conserve water and reallocate it among competing uses rather than on developing new sources of supply. At the same time, governments are seeking alternative ways to finance the operation and management of existing infrastructure and the construction of new infrastructure. These alternative approaches may be divided into three categories: pricing policies, informal water markets, and formal water markets.

Pricing Policies

By raising the user price of water to reflect its true scarcity, or opportunity cost (that is, the price the marginal user is willing to pay), authorities hope to induce

users to conserve water, making it possible to divert supplies to higher value uses (World Bank 1993).[1] In principle, if irrigation water near a city could be priced at what a water company would be willing to pay for the crude water (adjusting for conveyance costs), some farmers would give up farming, and others would switch to more efficient irrigation or grow less water-intensive crops. The higher charges would free up water that could be transferred to the water company for treatment and subsequent sale. They would also generate fiscal resources that could be used to improve the performance and maintenance of the existing infrastructure or to invest in new infrastructure.

Serious practical and political problems, however, have prevented any government from pricing water at its opportunity cost. Even if governments could find an inexpensive way to measure and monitor water flow, measuring the opportunity cost of water is difficult because it varies according to location, reliability, season, use, and water quality. Reliable and high quality groundwater close to a city that is rationing water will have a high opportunity cost (even after adjusting for pumping charges), while more polluted water along a more distant river with a variable flow will have a low opportunity cost. Even this difference will vary according to the year and season. In a year with average precipitation, the opportunity cost of water will be far lower than it is in a drought year, just as it will be lower in the rainy season than it is in the dry season. Water used for agriculture or mining will have a much higher opportunity cost than water that is used for hydropower generation and is returned to the river in roughly the same quantity and quality. But if water for hydropower is stored during periods when it is needed for other activities such as agriculture, its opportunity cost could be significant.

The political problems are even more intractable. It is politically difficult to charge a farmer for water from a river that serves a town (and therefore has a high opportunity cost) a higher price than a farmer using water from a river that is not near a town. Similarly, it is difficult to charge profitable hydropower companies less than poor farmers. Strong farmer lobbies typically pressure politicians to keep water charges well below their opportunity cost.

Another problem in pricing irrigation water at its opportunity cost is that the price of land already embodies the price of water rights. In areas of low rainfall, irrigated land may sell for ten times the price of unirrigated land, reflecting the expectation that the owner of irrigated land will receive water at a low charge. If charges are later raised to reflect the opportunity cost of water, this land will be valued the same as unirrigated land, resulting in an effective expropriation of the farmer's assets. Although government actions frequently alter the value of private assets, the sheer magnitude of asset expropriation implied, the numbers of people affected, and the socially disruptive aspects (in agricultural unem-

ployment) of such a policy make it highly unlikely that opportunity cost pricing can be introduced within a reasonable time frame.

A unique problem affecting water pricing involves "return flows." When a farmer waters crops, only part of the water is absorbed by the plant. Depending on the efficiency of irrigation, a significant share of the water—the return flow—will seep underground. This water may enter an underground aquifer and be pumped up by another user, or it may even rejoin the river and be diverted into a canal. If water were priced volumetrically, according to what was received rather than what was actually consumed, farmers using inefficient irrigation (thereby inadvertently helping out downstream users) would pay too high a price. These pricing difficulties do not mean that water should be provided at no charge, but they do suggest that setting water prices administratively to ensure rational use will be difficult in practice and that the consequences could well be socially and politically disruptive.

Informal Water Markets

Where governments have failed to respond to rapidly changing demands for water, local (spot) water markets have emerged in several water-scarce countries. Although such informal markets, in which users contract for water on their own, are technically illegal, governments usually turn a blind eye to them, perhaps because they manage to reallocate water quickly and voluntarily. In a typical transaction, a farmer sells a specified volume of his surplus groundwater or surface water for a season or a specified period to a neighboring farmer. Or several farmers collectively sell some of their water to a nearby town.[2]

In this way water is reallocated to more valuable uses without penalizing existing holders of water rights. At the same time the ability to sell provides an incentive for conserving water and using it more rationally. Such informal markets are widespread in South Asia (Pakistan Water and Power Development Authority 1990; Shah 1991; Saleth 1996). The author found them to have been widespread in Mexico even before the introduction of formal tradable water rights. (See also Meinzen-Dick 1996, who found that informal water markets in South Asia were able to increase poor farmers' access to water).

In some cases these trades have not performed well and have resulted in an economically inefficient allocation of water. In parts of South Asia, wealthier farmers with deep wells charge neighboring smaller farmers a high "monopoly" price for water. As a result crop output is lower than it would be if the water were priced at its opportunity cost—and income inequality is exacerbated. The opportunity to sell such a valuable resource also increases exploitation of groundwater, which can deplete underground aquifers (Saleth 1996). Moreover, be-

cause such transactions are illegal, it is difficult to enforce adherence to the entitlement (water right) and protect the aquifers.

A further complication is that these illegal markets may allow upstream users to sell more than they actually consume (because they may sell the return flow component of their water right), thereby infringing upon the rights of third parties. In addition the buyer lacks the security of an enforceable contract. Trades are therefore limited to spot sales or to sales for a single season, often between neighbors; longer-term trades are nonexistent, depriving potential investors or water companies secure long-term access to water. Finally, compared with opportunity-cost pricing, informal markets do not generate fiscal revenues, nor do they provide sufficient incentives or means for the creation of new infrastructure.

Formal Water Markets

Several governments have established legal tradable water rights in an attempt to retain and extend the advantages of informal water markets while reducing some of the negative costs stemming from their illegal status. The potential to sell water rights makes them more valuable and provides an incentive for conserving water and reallocating it to higher-value uses. In this sense, the outcome is similar to that under opportunity-cost pricing. Tradable water rights also allow leasing of water (for a season, say) and spot sales; in fact, they facilitate such transactions. Finally, by allocating initial water rights, without charge, to existing users or holders of water rights, tradable water rights can circumvent the political problems associated with raising water prices and setting nonuniform charges. Governments can monitor operations and more effectively enforce laws and regulations aimed at preventing the abuse of monopoly power, at ensuring that sales do not negatively affect the water available to third parties (that is, at addressing the problems of return flow), and at protecting the environment.

Chile and Mexico are the only countries that have established formal regimes of tradable water rights at the national level, but many of the western states of the United States and some states in Australia have such systems (see Rosegrant and Gazmuri 1995 and Pigram and others 1993 for descriptions of the California and Australian systems, respectively.) There are also pockets of semiformal water markets in some countries, where well-regulated water markets have existed for more than a hundred years, even though they are not consistent with national and state water laws (see Kemper 1996). In Australia and the United States, concerns about the environment and protecting third parties have led to many restrictions on water trading that have added to the cost of transactions—or blocked potentially beneficial trades. For example, water

markets in some areas of the United States, such as Colorado and New Mexico, which have few restrictions on trading, have functioned quite well for more than a century, but restrictions on trading have limited the usefulness of the water markets in California. As a result, farmers in California continue to grow low-value, water-intensive crops even when neighboring cities face water shortages and rationing. The Chilean and Mexican water market regimes are probably better models for developing countries facing water shortages.

CHILE. Under Chile's 1981 water code, the state grants existing water users property rights to both surface water and groundwater without charge.[3] These rights are separate from the land and, except for a few restrictions, owners may sell them to anyone for any purpose at negotiated prices. These water rights may also be leased, used as collateral, and inherited. Interested parties may petition to obtain new and unallocated water rights. If others are interested in the same rights, they will be sold at auction; if not, the petitioner will receive the rights without charge.

Rights are obtained by being recorded in a public registry as either consumptive or nonconsumptive, permanent or temporary (contingent). Nonconsumptive rights oblige the holder to return the same volume of water to a specific location (this right is useful mainly for hydropower generation). Temporary rights can be exercised only if all permanent rights have been met (useful when storage capacity exists). The rights are defined volumetrically (either in liters per second or in cubic meters), but revert to proportional rights (share of the streamflow or of the volume in a reservoir) if the available water does not permit all volumetric rights to be honored. This last feature is particularly important in Chile because few rivers have dams or reservoirs for storage.

Water users' associations are responsible for monitoring, distributing, and enforcing water rights at the level of the river basin, primary canal, and secondary or tertiary canal. They own and operate the bulk of the hydraulic infrastructure and set water tariffs. The government continues to manage the headworks for some large dams and reservoirs and to charge users for these services.

MEXICO. Under Mexico's 1992 water law, users may convert their existing nontradable water rights to more secure long-term concessions (with a typical maturity of thirty years). These concessions may be leased or sold as long as the sale does not negatively affect the water rights of other users. For nonagricultural users, farmer associations, and groundwater users, the rights are recorded in a public registry and are defined volumetrically. Because any deficits or surpluses are allocated proportionately, however, the rights are effectively proportional. For individual farmers using surface water, the rights are defined only in terms of area to be irrigated and are registered by the water users association.

Users may forfeit their rights if the water is not used efficiently or if it has not been used for three years. Thus, in principle, these rights are less secure than those in Chile. But Mexico's National Water Commission does not specify what constitutes inefficient water use, and the author found no evidence of users having forfeited their rights for this reason. Although the rights cover a fixed period, the water commission plans to renew the concessions for only a nominal administrative charge. Therefore, in effect, the rights are longer-term and more secure than they appear.

Why Establish Tradable Water Rights?

Tradable rights offer water owners an incentive to sell or lease part or all of their holdings to those who have higher-value uses for it. Tradable rights give buyers of water a strong incentive to conserve water to keep their costs to a minimum. Farmers who are considering purchasing new rights are thus more likely to use efficient irrigation techniques, and water companies are more likely to try to reduce water losses.

Such voluntary and flexible transfers that divert water to more productive uses have indeed occurred in the water-scarce areas of Mexico and Chile. In Mexico the transfers benefited some small farmers whose unprofitable farming activities had led to the accumulation of unsustainable debt. In the past they would have resorted either to selling their land and water rights, which would have forced them to leave the land, or to illegally selling their water rights at a lower price. Because they can sell the rights legally, however, and thereby obtain a better price, they have been able to use the proceeds to pay off their debts. Some have even been employed by the farmers that bought the water rights. Similarly, firms that formerly resorted to extracting groundwater illegally have begun buying groundwater rights legally, thereby reducing the problem of aquifer depletion while obtaining secure water rights.

In Chile farmers sold or leased their surplus water rights to more efficient neighboring farmers, industrial users, or water companies. The sales and leases have allowed some water companies and industrial users to obtain reliable access to water without expensive infrastructure investment. The results, according to one study (Hearne and Easter 1997), have been large gains to society. For example, the city of La Serena was able to purchase 28 percent of its water rights from neighboring farmers, allowing the government to postpone the construction of a proposed dam. Similarly, the city of Arica, in the arid north, has been able to meet the needs of urban residents by leasing groundwater from farmers. Such measures have contributed to Chile's success in providing water to virtually all urban residents.

Changes in the structure of water markets create new opportunities for conserving water. When Santiago's municipal water company, EMOS, was notified that it could no longer receive new water rights without charge, the company initially sought to purchase additional water rights. When potential sellers demanded too high a price, EMOS decided instead to rehabilitate its aging pipe structure to reduce water leakages. Similarly, farmers who must pay for water rights to expand production have an additional reason to install efficient irrigation, to use better soil management techniques, or to grow less water-intensive crops. Some Chilean farmers have even used options contracts as a way to avoid buying water that they might not need. The option allows a farmer (who needs to ensure that his trees, say, do not die if there is a drought) to pay a neighboring farmer growing an annual crop for the option of buying water at a prenegotiated price in case of a drought.

The conservation occurred even though water charges were not raised. In fact, several water users' associations in Chile reported that water charges fell after the new water law was passed in 1981. Even before the introduction of the current law, the government was charging users the full cost of system operations and maintenance, which was handled by public authorities. Under the new legislation, those who hold water rights are responsible for setting water tariffs as well as for operating and maintaining the infrastructure. Because they have been able to provide these services at a lower cost, water tariffs have declined.

The situation was different in Mexico, however, where water prices were so low that government subsidies for operating the infrastructure amounted to 0.5 percent of gross domestic product. Just before tradable water rights were introduced, Mexico began to move toward charging full recovery of service costs and to turn over operational responsibility to users. Although costs for operations and management fell, the savings were not enough to compensate for the reduction in subsidies, so water users in Mexico are generally paying higher water tariffs.

The Effect on Poverty Reduction

Secure and tradable water rights reduce poverty in several ways. First, they allow scarce resources to be redeployed for more productive purposes, thus leading to increased output and employment. This occurred, for example, when farmers in Chile and Mexico sold their water rights to more productive farmers or cities. Second, tradable water rights encourage new investment in activities that require large quantities of water. An investment in a fruit farm is more likely to be attractive if the investor knows that water will not be transferred to a neighboring city in times or scarcity and that additional water can be pur-

chased from farmers during water shortages. In Mexico investors built a water-bottling plant after negotiating for the water rights from a farmer. Not only was the farmer better off, but the increased investment also generated additional employment. A World Bank (1994) study on Peru found that tradable water rights have the potential to increase private investment in hydraulic infrastructure, freeing up public resources for other activities while allowing rapid and cost-effective development of hydraulic projects.

Third, by empowering user groups to have a say on the issuance or transfer of water rights, secure and tradable rights help protect the poor. When water rights are granted without charge by public authorities, it is typically the rich and politically influential who have easier access to them, often at the expense of the poor. This is the case, for example, in Peru. Fourth, secure and tradable water rights increase the value of the rights, which are often the most precious assets of poor farmers. In Mexico many small farmers were able to take advantage of their ability to sell their water rights while still remaining on the land.

Additionally, by making it easier for cities to obtain water, such markets benefit the poor because they are the most likely urban residents to have been excluded from piped service. Chile provides almost universal coverage of piped water in urban areas. A contributing factor to that extensive coverage is the ability of water companies to obtain "raw" water at a reasonable price (as in Arica and La Serena). In cities such as Lima or Karachi, where municipal water availability is often limited to certain hours of the day, improved availability of raw water would allow households to receive water at any time. Finally, because the transfer of water to higher-value uses occurs without confiscating water from less productive users (farmers) and without having to build new infrastructure, it is cheaper and fairer than alternatives, such as raising water charges substantially.

No one has measured the effect of tradable water rights on economic growth in Chile and Mexico. Anecdotal evidence and studies showing the gains from trading water suggest, however, that water rights have facilitated economic growth. Agriculture in Chile grew 6 percent a year in the decade following the passage of the water law. In Mexico more efficient farmers were able to expand their output substantially by buying surface water rights. Similarly, the purchase of groundwater rights made it possible for industry to expand production and employment. Without the opportunity to sell water rights legally, the adjustments following the peso's drop in December 1994, which led to changes in relative prices and a decline in domestic demand, would have been more difficult.

In principle, inadequately regulated water sales could lead to erosion from deserted land or threaten the environment if minimum flows at the lower sec-

tions of rivers are not maintained. In practice, neither the author nor Hearne and Easter (1997) found any evidence of such problems in Chile, mainly because Chilean farmers rarely sold all their water rights, because rivers in Chile are short, with little return flow, and because some water users' associations forbid trades that could reduce the availability of water downstream. In both Chile and Mexico, trades require the approval of the pertinent users' association as well as the public water authorities. Although Chile's water authorities recently reported instances of environmental degradation caused by water sales, such transactions do not appear to have caused serious problems. In fact, by inducing conservation, water markets have postponed the need to build new infrastructure, such as the proposed dam near La Serena in Chile, thereby averting potential environmental problems.

When to Establish Tradable Water Rights

If water markets have all these advantages and have worked well for several years in Chile, why have most other countries not adopted them?[4] There are many possible reasons, the relative importance of which varies.

- Some countries, for cultural or religious reasons, object to the idea that life-sustaining water should be bought and sold.
- Some fear that rich individuals or companies will buy up all the rights, excluding the poor from access to water and raising equity and monopoly concerns.
- Another concern is that small-scale farmers, either in desperation or ignorance, will sell their rights for a pittance and lose their livelihood.
- Some maintain that water transfers will damage the environment by depleting aquifers, increasing water pollution, or changing ecosystems.
- In some cases, the few that stand to gain from the current system may effectively oppose changing it.
- And because water use often has social benefits that exceed private ones, there may be a sense that public control of water is necessary to ensure adequate investment and low prices.
- The final reason relates to the costs stemming from setting up a new legal, regulatory, and institutional framework; from defining, measuring, and enforcing water rights; and from making necessary changes in water intake and in the conveyance infrastructure to effect the transfers. Closely related to these costs are the difficulties of implementing the initial allocation of water rights, of ensuring that sales of water by one user do not affect the water rights of others (the return flow problem), and of establishing or strengthening public and private institutions to permit a well-functioning market. Given

these costs, the potential benefits from trading water must be sufficiently large for governments to consider establishing tradable water rights.

These problems, however, are not unique to tradable water rights; even publicly administered systems of water allocation must cope with them. Water rights are difficult to define, measure, and enforce even when they are not tradable, and institutional arrangements are essential to manage allocation and distribution. Although water markets may require more complex infrastructure, delivery systems to transfer water are needed regardless of the method that is used to reallocate the water. And most publicly administered systems of water rights have not protected the poor. Efforts to keep water charges low have often resulted in poor service and excluded low-income residents even while better-off farmers and wealthier urban residents obtained water at highly subsidized prices. Although water markets can lead to monopolies, experience shows that suitable antitrust and tariff legislation often results in lower prices and a higher level of service compared with government management of the resource. Similarly, where social benefits exceed private benefits, a subsidy may be preferable to government ownership and control.

Formal water markets tend to reduce the extent of the water problems facing countries. For example, by increasing the implicit value of water rights and by empowering users, water markets provide better incentives to define, measure, and enforce rights to water, and they strengthen private institutions such as water users' associations. The infrastructure needed to implement the transfers is likely to be less expensive if it is undertaken by the users than by public authorities. Moreover, the users will build the infrastructure only when it is economical to do so. Government provision is often hampered by the demands of vested interest groups that promote costly projects, such as dams, tunnels, and other infrastructure, even when the benefits provided by such services are well below the costs of construction.

Before governments consider establishing a costly new legal and institutional framework, certain minimum conditions must be met. First, because of the costs of identifying potential trades and of making, recording, and enforcing changes in water intakes and conveyance infrastructure, water must be quite scarce—and therefore of high value. Additionally, the infrastructure must be flexible enough to allow trades (for example, adjustable gates rather than fixed-flow dividers). Second, society must be willing to enact legislation that respects private property rights to water and recognizes such rights for a reasonably long period. Where cultural, constitutional, or religious factors preclude this commitment, effective formal markets are unlikely to develop or to stimulate private investment and improved water use.[5] Third, minimum institutional capacity in the public and private sector must exist or be developed before tradable

water rights can be established. Private institutions such as user associations that operate at the level of a ditch, canal, or river basin are needed to help establish the initial allocation of water rights and to operate the system. Public institutions must establish the legal and regulatory framework to register the rights, to operate parts of the system that users cannot, and to settle disputes that cannot be resolved by user associations. Finally, because of the likely opposition from those with a vested interest in maintaining the status quo, the political leadership must be prepared to withstand the opposition. If these conditions are met for a substantial part of the country, governments should consider legislation establishing tradable water rights.

Introducing Tradable Water Rights

Even when policymakers are convinced of the advantages of tradable water rights, they need to address several issues to ensure a successful outcome. In addition they must be strongly committed and patient. Water allocation is an emotional subject and because of the technical and legal issues involved, the process of changing to a new regime may take several years.[6] Although the design and implementation of tradable water rights need to be tailored to specific country circumstances, the following guidelines, which build upon Chile's successes but avoid its mistakes, may be useful.

Conducting an Information Campaign

Experience shows that it is essential to explain to users and other affected groups the advantages of formal property rights to water. A well-designed information campaign can overcome the opposition to reform by powerful vested interests. The mechanics of trading could be explained by calling on the expertise of representatives from user associations in countries that have successfully introduced formal water markets. Users and other stakeholders can be invited to participate in designing and implementing the legal framework. Discussions and analyses of draft versions of the law demonstrate a willingness to accommodate the concerns of farmers and other users and are essential to successful implementation.

Registering Rights without Charge

The best way to ensure support for the law is to assign rights to users, without charge, based on their historic usage. Although this approach may provide a windfall gain to some farmers, it acknowledges that the land price already reflects access to water at low prices and that the government is unlikely to re-

cover directly the capital costs of investment in infrastructure. Because this procedure also rewards users that are taking more than their fair share of water, there may be merit in trying to rectify some of the most egregious wrongs. If the government were to try to use this opportunity to correct all such mistakes or to confiscate all illegally obtained rights, however, chances are good that the legislation will fail and the injustices will continue.

Once the rules are established, the individual registration process should be coordinated by water users' associations using "block-titling" methods, where the government provides titles simultaneously to all users in a geographic area (Holden and Thobani 1995). The establishment of a registry, whose officials are perceived to be honest and who are given an adequate budget, is a high priority. One way to ensure fiscal autonomy is to impose a small registration charge to cover operational expenses. The public media should be used extensively to enhance compliance with registration and to make sure that farmers are fully aware of the consequences of their failure to register or to sell their rights. Where large quantities of water are allocated for hydropower, the government should ensure that the initial assignment of such rights does not affect the historical supply available for downstream users. This may require specifying the minimum volume of water that will be released each week (box 1).

Auctioning New Rights

New and unallocated water rights should be sold at auction in an open and transparent manner, making active use of the public media. Before any auction, the government should establish a minimum reservation price and verify that the water is not being used and is not needed for environmental or recreational purposes. Information on prices and volumes of past auctions and on transactions in the area should be made public. Any costs to enter the auction should be kept as low as possible.

Protecting the Rights of Third Parties

Even if the initial allocation procedure protects existing users, subsequent sales could infringe upon the water rights of third parties—the return flow problem described earlier. In countries where the reuse of such flows is substantial, procedures to protect third parties must be instituted before trades are authorized. One way to do this would be to specify that all water rights have both a consumptive and a nonconsumptive element. While the former can be sold without restriction, supplies for hydropower use can be sold only if the distribution does not deprive other users of water. Thus for most transfers within the same water basin for the same use, owners would be free to sell 100 percent of their

Box 1. *Chile's Misunderstood Water Problems*

Despite its success in improving water use, Chile still suffers from conflicts between hydropower companies and farmers, from water quality problems, and from anticompetitive behavior in electricity generation.

Farmer-Hydropower Conflicts. The problem developed when the privatized hydropower companies were granted water rights that failed to set out their obligation to release specified volumes from the reservoirs when farmers need them. The problem was exacerbated when the companies requested additional water for nonconsumption uses from rivers where consumption rights had not yet been assigned (Rios and Quiroz 1995). This experience underscores the need to specify weekly releases of nonconsumption rights—whether the rights are tradable or not is irrelevant.

Water Quality. These problems reflect Chile's failure to enact regulations to enforce the high standards set in the environmental law. The security or tradability of the rights is not an issue.

Anticompetitive Behavior. Although not directly related to water markets, a shortcoming in Chile's water code has allowed one power company to obtain nonconsumption rights to most rivers, in a bid to keep out competition. Moreover, the company did not have to pay for these rights because the auction operates under rules that grant the rights to the petitioner without charge if no other parties approach. By establishing a minimum reservation price, by taxing holdings of water rights (analogous to land taxes), and by passing appropriate antitrust legislation, governments can prevent the abuse of monopoly power.

water rights. But if a farmer were to sell his rights to a water company whose return flows do not return to the same aquifer or river, he could sell only that amount which did not return to the aquifer or river.

Because of the technical difficulties in calculating the return flow component on a case-by-case basis, this approach may not be appropriate for developing countries. But it may be possible to calculate averages that specify the volume of water consumed by a certain crop or activity. In those cases in which return flows are an issue, this published volume would become the limit on the amount that owners could sell to buyers (Holden and Thobani 1995). This procedure would work for both surface water and groundwater. Even though the system has shortcomings, it would be a vast improvement over prohibiting all transfers or having no controls, as is the case with informal water markets.

In addition to these hydrologic effects, there may be other important third-party economic effects. It is neither feasible nor desirable to protect against all of these effects, but two points warrant attention. First, when sales of water from one canal system to another result in a loss of water tariff income to a water user association, it may be desirable to compensate the association for some of that lost income. For instance, in the La Lagunera region of Mexico, buyers must pay 70 percent of the water tariff to the original association and 30 percent to the new association. Second, where municipalities lose significant revenues when water rights are trans-

ferred to other regions, arrangements can be made to pay property taxes on these rights to the original municipality; alternatively, an exit lump-sum tax may be worth considering. This is an important issue in some western states of the United States where rural municipalities lose their revenue base when irrigation water is transferred to cities.

Addressing Monopolies through Taxes and Legislation

Because of the large number of owners of water rights and the high prices they will demand to sell those rights, a monopolistic structure in consumptive water rights (agriculture, industry, and so forth) is unlikely—with two exceptions. First, a monopoly could occur when governments auction new water rights, as happened in Chile (box 1). An appropriate minimum reservation price in auctions should help protect against this outcome. This arrangement could be accompanied by taxes on both consumptive and nonconsumptive rights. A tax on the rights, and not on the purpose for which the water is used or the quantity of water used, has desirable characteristics similar to those of land taxes: it does not distort production decisions, and it helps recover public investment costs in infrastructure. The level of the tax could, at a minimum, be set at the difference in land taxes between irrigated and unirrigated land. For reasons of equity and administrative efficiency, small holdings of water rights should be exempt from this tax. Second, monopolies could occur when awarding large volumes of new water rights in the process of privatizing public hydraulic projects under construction. To protect against this risk, an appropriate regulatory framework for each hydraulic project being privatized should be developed (World Bank 1994). In addition antitrust legislation could help protect against any possible monopolies arising from the auction of new water rights, such as in the granting of nonconsumptive rights for hydropower generation.

Water Pollution and Aquifer Depletion

Water quality standards or their enforcement need not be changed when establishing tradable water rights. If the standards need revision or enforcement needs to be improved, such measures can be introduced independently. But water markets could exacerbate aquifer depletion because they provide an additional incentive to pump more water from the ground. Formal water markets provide a feasible way to protect against aquifer depletion, because the law would require that groundwater rights be registered. In regions where aquifer depletion is a concern, groundwater users could form an association that would work with government officials to monitor the level of the water table and each

others' use. If the aquifer were not recharging adequately, the user association would decrease the extraction limits of its users proportionately. Moreover, if exploitation by a user resulted in a shortage of water available to others who are legally entitled to it, public authorities could establish proportional reductions in volumetric rights and bar new exploitation. Such a system is preferable to most existing regimes, whereby owners of the land above an aquifer have full rights to its water, even if their use results in its depletion.

Conclusion

Publicly owned water allocation systems have recorded costly inefficiencies in the supply and use of water. Even in water-scarce areas, water is wasted and public hydraulic projects are poorly conceived, implemented, and operated. Moreover, public approaches have failed to protect the environment or to make water accessible to the poor. With increasing populations and budgetary pressures, these water systems are likely to become even more untenable.

Informal water markets, which evolve spontaneously, are politically easy to implement and can lead to improved water use. But, because they are illegal and thus unregulated, they often result in problems. Formal water markets have greater potential for success.

Economic principles and lessons from experience suggest that formal enactment of tradable water rights permits rapid and voluntary changes in water allocation in response to changing demands, thereby improving water use. These formal water markets also increase user participation in allocating water and planning new investments, while allowing businesses to invest in activities that require assured access to water. The resulting increase in employment and income generation can help reduce poverty.

But tradable water rights are not a panacea, and an effective system is not easy to introduce. Chile's experience and the demonstrated superiority of markets over publicly administered means of resource allocation in general suggest that markets are preferable when water is scarce, when the infrastructure to effect transfers exists or can be cheaply developed, when there is a minimum institutional capacity to implement trades, and when there is political will to establish appropriate legislation.

Notes

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1. Note that a policy of pricing water to cover the full cost of building and managing the infrastructure (the long-run marginal cost) is not optimal if the infrastructure is ill-conceived and built at high cost. In the unlikely event that full cost pricing could be enforced, most irrigators, who typically account for the bulk of water use, would be unable to afford water and would be forced to give up farming. Most of the water would therefore go unused.

2. It is useful to distinguish between the water charge paid by a user for system operation and maintenance and the price paid to a seller to use a given volume of water or to lease a certain volume of water for a given period. To draw an analogy from the condominium market, the former is the condominium fee, while the latter is the fee paid for renting the condominium from its owner.

3. The registration process is costly, however; it requires posting announcements in major newspapers, so most small farmers do not actually register their rights. Nonetheless, these rights continue to be honored, but the farmers are unable to sell their rights independently of their land.

4. Because of the limited sales of such rights as well as serious water-related problems, some observers question this statement. In fact, although few trades occur in the high rainfall southern regions and in canals that use fixed flow dividers, many beneficial sales and leases of water are made in the water-scarce north. Also, Chile's water problems are largely unrelated to water markets (see box 1).

5. Mexico chose to get around the constitution by calling water rights long-term concessions but treating them as if they were property rights for land.

6. In Peru, despite more than three years of debate and technical assistance, passage of a law establishing tradable water rights is still uncertain.

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An Exchange on Agricultural Extension Programs

An occasional series of articles and comment, presenting differing views.

The Impact of T&V Extension in Africa: The Experience of Kenya and Burkina Faso

Vishva Bindlish • Robert E. Evenson

Agricultural extension programs based on the Training and Visit (T&V) system are operating in some thirty-one Sub-Saharan African countries. Evidence from Kenya and Burkina Faso shows that T&V management enhances the effectiveness of extension and that such programs support agricultural growth and produce high returns on investments. The data indicate that areas served by extension have higher yields and that within these areas the highest yields are achieved by farmers who participate directly in extension activities. As a result, extension helps to close the gap between the yields attainable with existing technologies and those actually realized by farmers. Closing this gap improves agricultural productivity in the short run, but long-term increases in output in Sub-Saharan Africa will depend on the development of improved technologies that are relevant to local conditions.

Slow growth in agricultural production has been a serious problem in Sub-Saharan Africa, challenging domestic and international policymakers. Accelerating that growth will require important contributions from agricultural extension and research. Although these two interact to complement agricultural growth, their respective roles depend on the general level of agricultural development.

Through the Training and Visit (T&V) system of extension, first introduced by the World Bank in the late 1960s (Benor, Harrison, and Baxter 1984), better production methods and new technologies are being introduced to farmers at the field level. T&V aims at closing the gap between the yields attainable using best-practice technologies and the yields farmers actually achieve. This gap is likely to be particularly large in situations such as those in Sub-Saharan

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Africa, where farmers have little education, research and extension are unavailable, and markets and infrastructure are relatively undeveloped. Correcting this gap under these conditions can result in a considerable—and permanent—increase in agricultural growth.

But the role of extension becomes more restrained once most of this gap has been exploited; at this point its contribution depends mainly on the productivity of the agricultural research system and the dissemination of the recommended innovations. Extension thus has considerable potential to make a significant contribution to agricultural growth in Sub-Saharan Africa. But if it is to realize this potential and embrace the vast majority of small subsistence-oriented farmers, the public sector must be involved. Currently, private-sector extension, although valuable in advanced countries, is provided in Africa mostly by commodity organizations and by companies that supply inputs (seeds, fertilizer, and so on); it thus tends to cater to the better-off farmers who produce high-value crops with modern inputs. As a result, not only are small farmers who produce traditional crops unlikely to benefit from private extension, but the economic gulf between poor farmers and those who are more successful may widen.

Extension is a high priority in the World Bank's strategy for accelerating agricultural growth in Sub-Saharan Africa (Cleaver 1993). This strategy is aimed not only at propagating improved practices, but also at helping farmers to become better managers and more adept at organizing their operations and conserving natural resources. As farmers' skills improve and demand for yield-increasing research and other services rises, extension services provide the blend of basic science and practical experience essential to stimulate agricultural growth.

Extension programs supported by the World Bank now operate in some thirty-one Sub-Saharan African countries. These programs employ about 30,000 people and directly or indirectly reach some 100 million farm households (Schorosch 1993). The World Bank's financial commitments for these operations, which are in addition to the expenditures incurred directly by their governments, amount to almost $450 million (Bagchee 1994). The T&V system provides comprehensive agricultural extension services (for crops, livestock, and so on) within a single line of command. The strategy that has been developed has four key elements: regular visits by extension workers to designated contact farmers and contact groups, carefully selected to achieve a "spread effect" to farmers who are not in direct contact with extension; a cadre of subject matter specialists, who are trained by research scientists and who in turn train field-level extension workers; the regular supervision of extension staff at all levels; and fixed work programs and specific responsibilities. Extension workers gradually disseminate technological packages to farmers, focusing on a few simple messages on each visit. The initial emphasis is on improving crop husbandry (land preparation, timing of different operations, planting densities, fertilizer application, and so on).

The strategic role assigned to extension—and the resources being invested in it—make it important to evaluate how much extension contributes to production and whether the value of the increase in production justifies the investment. A recent review of the literature on the economic impact of extension concludes that extension services do increase agricultural production but finds limited evidence on the returns on these investments (Birkhaeuser, Evenson, and Feder 1991). Of the forty-eight studies reviewed, only eight reported estimates of the returns on investment. The review found no recent work on the profitability of extension in African countries, and only one study, on India (Feder and Slade 1986), evaluated T&V extension.

This article examines the effect of T&V extension on agricultural production in Kenya and Burkina Faso and attempts to measure the value of the increase attributable to it. The article draws on the results of two evaluations—Bindlish and Evenson (1993), and Bindlish, Evenson, and Gbetibouo (1993). We first review the financial allocations and personnel requirements of the extension programs in both countries as well as the characteristics of the farmers in the sample. We then summarize the results, looking at whether farmers ignore or adopt the advice of extension workers, and examine how effective farmer-to-farmer communication is in delivering extension messages. Finally, we review the impact of extension on production in order to analyze extension's contribution to profitability and growth.

Agricultural Extension Services in Kenya and Burkina Faso

In 1982 Kenya introduced a pilot T&V program in two administrative districts. By 1985 the program had expanded to cover thirty districts, or about 90 percent of the total arable land. The remaining areas are being covered under the second phase of the project, which is expected to operate until 1998. In Burkina Faso T&V was introduced across the country's twelve administrative units, known as CRPAs (Centres Regionaux de Promotion Agro-Pastorale) during a four-year period ending in 1989, at which time it was adopted as the national system.

The study sample for Kenya consisted of 676 farm households selected randomly from seven representative districts (Bungoma, Kericho, Kisumu, Machakos, Murang'a, Taita Taveta, and Trans Nzoia). These seven districts account for about a fourth of Kenya's population, a fifth of its arable land, more than a third of its maize production, and about a fifth of the output of most other crop and livestock products. The farms were spread over all thirteen agro-ecological zones found in Kenya. The study sample for Burkina Faso, which included 3,609 farm households, was much larger and covered all twelve CRPAs.

In both Kenya and Burkina Faso, T&V replaced earlier extension systems that, while productive, were considered to have certain weaknesses (see, for example, World Bank 1983). These weaknesses related to deficiencies in the training of field extension agents and poor supervision of staff. Because these weaknesses are precisely the kind that the T&V management structure seeks to address, the question was whether T&V had a greater impact on production than the extension system it replaced.

To test this hypothesis one must compare the data from a period when T&V programs were operating with a period preceding its introduction. Although Kenya had such data, Burkina Faso did not.[1] This meant that a before-and-after framework could not be used in the case of Burkina Faso. But T&V was phased into Burkina Faso during the four-year period from 1986 through 1989. Thus the hypothesis tested instead was that T&V's effect on production, estimated on the basis of data collected in 1990–91, would be greater in those CRPAs in which it had been introduced earlier. A second hypothesis was that farmers who were members of a T&V contact group were more likely to adopt recommended practices, although other farmers were also considered to have benefited.

Resource Allocations

In Kenya extension expenditures increased 19 percent, or 75 cents, a year per farm household, after the introduction of T&V (table 1). The total number of field extension agents in the seven Kenyan districts increased from 774 in 1982 to 1,071 in 1990–91, reducing the average number of farm households served by each agent from 913 to 816. In Burkina Faso extension expenditures actually declined after the introduction of T&V, falling by 29 percent from $10.27 per farm household in 1985–86 (the year preceding the introduction of T&V)

Table 1. *Resources Allocated to Extension*

	Kenya[a]		*Burkina Faso*[b]	
Allocation	*Before T&V*	*After T&V*	*Before T&V*	*After T&V*
Extension expenditures per farm household (1991 dollars)	3.92	4.67	10.27	7.25
Average number of farm households per field-level extension worker	913	816	679	1,001[c]

a. Based on data for the seven sample districts. The "before T&V" estimates refer to 1982–83; the "after T&V" is the average for 1983–84 to 1990–91.

b. The "before T&V" refers to 1985–86; the "after T&V" is the average for 1989–1990 to 1990–91.

c. 1990–91 alone.

Source: Bindlish and Evenson (1993); Bindlish, Evenson, and Gbetibouo (1993).

to an average of $7.25 a year from 1989–90 to 1990–91, when T&V was the national system. That drop reflects a government decision to rationalize the use of staff resources by reducing the number of agents employed from 1,005 to 839. As a result the average number of households each agent served rose from 679 to 1,001.

Extension Advice

Farmer groups, traditionally an important feature of rural society in Africa, were the main contact points for extension agents in both Kenya and Burkina Faso. Accordingly, a high proportion of Kenyan farmers who reported receiving extension advice after the introduction of T&V were members of such groups. In Burkina Faso 21 percent of the sample farmers belonged to a T&V contact group.

After the introduction of T&V in Kenya, the proportion of farmers who reported receiving extension advice increased from 6 percent to 48 percent (table 2). Eighty-eight percent of the respondents reported that this was the first time they had been reached by extension services. In Burkina Faso 31 percent of the farmers reported being served by the T&V-based extension system. Twenty-nine percent had participated the previous year in scheduled meetings between field agents and their contact groups, but only 21 percent reported actual membership in T&V contact groups; thus it appears that an appreciable number of farmers who were not contact-group members also participated in group activities. Virtually all those who received extension advice considered it to be useful.

Under T&V, extension appears to be reaching female farmers, although the small number of women in the Burkina Faso sample makes it difficult to draw inferences from the data for that country. In Kenya roughly the same proportion of farmers from female-headed households (45 percent) and male-headed households (50 percent) received extension advice, as did similar proportions of small- (45 percent), medium- (45 percent) and large-scale farmers (53 percent).[2] In Burkina Faso only 21 percent of the small-scale farmers and 30 percent of the medium-sized farmers, compared to 47 percent of the large-scale farmers, participated in scheduled contact group activities. This low level of participation suggests that small-scale farmers should be explicitly targeted for membership in contact groups.

Influencing Awareness

Table 3 shows how effective T&V programs were in making farmers aware of new production practices. In Burkina Faso more than 80 percent of the farmers

Table 2. *Sample Characteristics and Extension Advice*
(percentage of sample)

	Kenya	*Burkina Faso*
Sample characteristics		
Contact farmers	4	—
T&V contact group members	31	21
Members of female-headed households	36	4
Attended at least primary school	55	33
Small farms[a]	49	31
Medium farms[a]	34	43
Large farms[a]	18	27
Members of households with agriculture as primary source of income	72	—
Extension advice		
Farmers reporting receiving extension advice since T&V introduced	48	31
Members of male-headed households	50[b]	—
Members of female-headed households	45[b]	—
Farmers reporting receiving extension advice before introduction of T&V	6	—
Members of male-headed households	7[b]	—
Members of female-headed households	3[b]	—
Extension advice by farm size		
Small	45[b]	21[b]
Medium	53[b]	30[b]
Large	45[b]	47[b]

— Not available.

a. Small farms are defined as two hectares or less; medium farms are between two and five hectares in Burkina Faso, two and eight hectares in Kenya. Farms more than five hectares in Burkina Faso and more than eight hectares in Kenya are considered large.

b. Refers to the percentage of sample farmers in the indicated category.

Source: Bindlish and Evenson (1993); Bindlish, Evenson, and Gbetibouo (1993).

who were members of T&V contact groups and 50 percent of those who were not said they were aware of the extension messages. (The relatively low level of awareness about improved cultivars might reflect a preference for local varieties or the general paucity of improved crop varieties for environments with low and uncertain rainfall.)

In Kenya awareness of extension messages declined with the complexity of the practice. More than 80 percent of the farmers were aware of basic husbandry practices, such as spacing, planting dates, improved cultivars, and basal fertilizer applications. In contrast, less than a third were aware of advice on top-dressing of fertilizer, plant protection chemicals, and stalk borer control, which are more complex practices.

Table 3. *Farmer Awareness, Testing, and Adoption of Extension Messages for Selected Practices*
(percentage of sample farmers in the indicated category)

	Awareness			*Testing*			*Adoption*		
Category	*All farmers*	*T&V contact group members*	*Non-members*	*All farmers*	*T&V contact group members*	*Non-members*	*All farmers*	*T&V contact group members*	*Non-members*
Kenya									
Spacing	76	—	—	—	—	—	71	—	—
Planting dates	79	—	—	—	—	—	76	—	—
Improved cultivars	80	—	—	—	—	—	74	—	—
Basal dressing	100	—	—	—	—	—	63	—	—
Top dressing	33	—	—	—	—	—	10	—	—
Chemical use	12	—	—	—	—	—	10	—	—
Stalk borer control	22	—	—	—	—	—	11	—	—
Burkina Faso									
Soil preparation	88	96	86	21	34	18	60	71	55
Seed treatment	91	97	89	31	43	28	67	83	56
Improved cultivars	58	78	53	11	24	8	21	38	13
Seed drilling	91	98	89	21	39	16	49	67	38
Organic fertilizer	94	98	93	20	28	18	67	69	63
Chemical fertilizer	87	92	86	20	36	16	32	53	21
Pesticide	66	83	62	8	20	5	21	38	11
Animal draft	95	98	94	18	33	14	34	53	23
Motorized draft	66	82	62	1	3	1	1	1	1
Crop rotation	73	86	70	17	27	15	50	57	44
Erosion control	85	94	82	15	24	13	36	43	29
Agro forestry	59	79	54	8	13	7	14	19	9

— Not available.

Note: Kenyan farmers have a long tradition of organizing into groups to market output, obtain credit, and so on — and the extension system has sought to work with some of these existing groups. Thus data are not presented separately for group members and other farmers, as in the case of Burkina Faso. In Burkina Faso, contact groups have been created specifically for extension purposes.

Source: Bindlish and Evenson (1993); Bindlish, Evenson, and Gbetibouo (1993).

Testing and Adoption of Recommended Practices

Farmers have been encouraged under T&V to test extension recommendations on small areas in their fields before adopting them. Such testing was common in Kenya in the years immediately after T&V was introduced, but the practice has decreased over time. In Burkina Faso, however, a significant amount of testing still appears to take place, particularly among members of contact groups (see table 3). Farmers who did not belong to contact groups reported some testing, but no more than 20 percent of such farmers tested most recommended practices.

The level of adoption of extension advice was lower than the level of awareness. For Kenya 63 to 75 percent of the sample farmers adopted extension recommendations covering the four simpler practices (spacing, time of planting, improved cultivars, and basal dressing of fertilizer), but only about 10 percent adopted the three more complex practices (top dressing, plant protection chemicals, and stalk borer control). The differences in adoption rates between male- and female-headed households, and among small, medium, and large farms, were significant only for fertilizer, which suggests that female-headed households and small-scale farmers face relatively greater financial constraints and may not be in a position to purchase inputs.

Overall adoption rates in Burkina Faso tended to be modest, although they were higher for T&V contact group members than for other farmers. Note that although the twelve practices selected for analysis have wide regional applicability, their relative importance varies by agroclimatic area. Thus, adoption rates were higher in the regions best suited to these practices. For example, more than 80 percent of the sample farmers located in the northern Sahel followed the recommended use of organic fertilizer, and about one-half adopted complex anti-erosion methods (Bindlish, Evenson and Gbetibouo 1993, table 13). These two practices were also adopted by farmers in the central plateau and eastern zones, both of which have serious soil erosion problems. In contrast, in the western and southwest zones, where crop production is important, a high proportion of farmers followed crop rotation (89 percent) and soil preparation (99 percent) practices and invested in chemical fertilizer (80 percent) and improved cultivars (62 percent).

Farmer-Identified Constraints

Kenyan farmers cited the cost of inputs as the key constraint in their efforts to increase the use of purchased inputs, suggesting a possible need to expand access to agricultural credit. Although they identified labor shortages as the main reason for ignoring recommendations concerning spacing and timely planting, that constraint is also likely to reflect financial problems that prevent farmers from hiring labor. Farmers in Burkina Faso also identified the cost constraint as the main reason they failed to use purchased inputs, but they cited insufficient knowledge as the critical factor limiting their adoption of a majority of the other practices. Insofar as high proportions of farmers reported being aware of the extension messages for individual practices, this apparent contradiction suggests that farmers lack detailed knowledge about the correct methods of application. To achieve better results, extension may need to work more closely with farmers to familiarize them with all facets of the messages. Notably, only a small proportion of

the sample farmers in both countries cited the unavailability of inputs as an impediment to adoption.

Sources of Information

The extension service cannot reach all farmers directly, and T&V, like all extension systems, assumes that messages will spread to other farmers from those contacted directly (table 4). Even some of the sample farmers in Kenya apparently first acquired their knowledge of extension messages from other farmers; 48 percent of the sample farmers reported receiving advice from extension agents, but only 25 percent indicated that these agents were their initial source of information. In Burkina Faso, as noted earlier, many farmers who are not members of T&V contact groups attend extension meetings. Forty-one percent of the farmers who were not members of such groups identified other farmers as their source of extension messages. The majority of farmers who were members attributed their knowledge of extension to the T&V agent. In both countries, radio broadcasts were a small, but positive, influence.[3]

If farmers feel that they do not have enough information to invest in new practices, extension may have a larger direct role to play in delivering more complex and specialized messages (see Bindlish and Evenson 1993, table 29, on Kenya; Bindlish, Evenson, and Gbetibouo 1993, table 17, for Burkina Faso.) For instance, more sample farmers in Kenya attributed their initial knowledge of simpler practices to other farmers than to field agents, but for the more complex practices, about the same number attributed their initial knowledge to field agents as to other farmers. In Burkina Faso higher proportions of farmers who were not in T&V contact groups identified extension agents rather than

Table 4. *Sources of Information*
(percentage of sample farmers in the indicated category)

Source	Kenya, all farmers	Burkina Faso		
		All farmers	Contact group members	Nonmembers
Extension workers	25	44	74	36
Other farmers	41	36	14	41
Radio	2	10	7	11
Input suppliers	2	n.a.	n.a.	n.a.
Marketing agents	2	n.a.	n.a.	n.a.
Other sources	5	11[a]	5[a]	12[a]
Not stated	23	n.a.	n.a.	n.a.

n.a. Not applicable.
a. Includes input suppliers and marketing agents.
Source: Bindlish and Evenson (1993); Bindlish, Evenson, and Gbetibouo (1993).

other farmers as their primary source of information on practices using modern inputs (chemical fertilizers, pesticides, and improved cultivars).

Determinants of Advice, Testing, Awareness, and Adoption

Efficiency at the farm level has both technical and allocative components. Farmers must use improved production techniques in combination with a more effective allocation of resources. Because extension is primarily concerned with delivering technical messages, its contribution to economic efficiency is largely through its effect on technical efficiency. How effective has T&V extension been in contributing to technical efficiency in Kenya and Burkina Faso? Using econometric techniques to analyze rates of change, we examined whether T&V had led to earlier and greater awareness, testing (in Burkina Faso), and adoption of improved practices than would have occurred otherwise. (Adoption was based on data aggregated to the area covered by the extension agent for Kenya and to the village level for Burkina Faso.) We also looked at the probabilities of individual farmers becoming aware of and responding to these messages. The focus was on the specific practices for Kenya and Burkina Faso discussed earlier.

Participation in extension activities as contact farmers and members of contact groups would reflect a direct involvement with the T&V system and determine, to an important extent, its impact on farmers' efficiency. The decision to participate is endogenous, however, because farmers decide whether they want to be contact farmers or contact group members. Thus, we analyzed the effect of participation using a two-stage procedure. In the first stage, we statistically "predicted" participation in an analysis of interest in its own right. In the second stage, we included predicted participation as an explanatory variable in the analysis of the determinants of awareness, testing, and adoption.

The decision to participate is influenced by the farmers' demand for information as well as by the available supply of information services. The demand factors used in the model to predict participation comprised farmer characteristics, the state of community services and activities (because participation frequently occurs in a group context), and climatic conditions. Variables focusing on farmers' sex, age, and education were used to represent farmer characteristics. Community characteristics were represented by the community means for farm size, education levels, and age; climatic factors by weather variables. Additionally, in Kenya the community characteristics included indicators of the availability of road and transport facilities, and the climatic factors included indicators relating to topographic features and agronomic potential. (All areas

of Kenya have been classified according to whether they have a high, medium, or low agricultural potential.)

Because the supply of extension services is an important determinant of participation, the variable reflecting this supply should measure the services provided relative to the number of farmers served. The Kenya and Burkina Faso studies rely on the most appropriate and widely used variable for this supply index—the ratio of field workers to farmers in a community. The main appeal of this variable is that farmers generally have no control over the number of field agents employed by the government, so one may assume that increased field services contribute to more information and advice. (A more detailed discussion of this variable and possible endogeneity problems follows in the next section.)

The analysis provides useful insights regarding the types of farmers likely to seek direct contact with extension services. For example, in Kenya farmers from households headed by women or by persons with higher levels of schooling have a higher probability of participating as contact farmers or members of a contact group. This finding conforms to expectations: female farmers are more likely to seek extension advice than male farmers because it can substitute for other factors, such as inputs and credit, to which women might have less access; more educated farmers have a greater appreciation for extension advice and expect to benefit from it. The probability was also higher for farmers in areas with only a small number of farm families per field agent and in areas with a low or medium agronomic potential. Again, these findings conform with expectations that relatively high coverage would encourage participation and that farmers would seek extension advice to compensate for agronomic inadequacies. In Burkina Faso contact group members tended to be younger, full-time farmers with more land. Here, too, farmers in areas with fewer farm families per agent were more likely to be in T&V contact groups.

In analyzing those factors that affect a farmer's decisions, we used three variables: predicted participation, an indicator of the year in which T&V was introduced in an area, and the agent-to-farmer ratio. The reason for using the agent-farmer variable again was to see whether extension staffing had an impact independent of participation. In addition, we also incorporated the effects of learning from other farmers in the form of a learning curve. In Burkina Faso we also considered the relationship between testing and adoption.

The data used in the analysis consisted of a time series for 1979–90 for Kenya and 1984–91 for Burkina Faso and were based on the farmers' recollection of the year in which they had first become aware of, tested, or adopted a practice. Thus, the potential for recall error exists, although a chronology of technology diffusion would have been impossible to develop otherwise. For the agent-to-farmer ratio (defined at the "location" level for Kenya, and the zonal level for Burkina Faso), time series had to be constructed. In Kenya we asked extension

staff in 1991 how many years the agents then posted in a location had been there. Because they were unable to provide information on personnel who had been transferred elsewhere, an adjustment was made for these field agents on the basis of the available district-level data. A similar adjustment was made for Burkina Faso using provincial data to derive time series for extension agents at the zonal level.

The results of the rate-of-change analysis and the farm-level probability analysis were generally consistent for both countries, although the results were stronger for Burkina Faso, where T&V had a positive and statistically significant effect on testing for ten of the twelve practices and on adoption for nine practices. Using participation in T&V contact groups or the variable indicating the year in which T&V was introduced in an area gave similar results, suggesting that the impact of T&V is not confined to contact group members but extends to other farmers. Participation in T&V contact groups in Burkina Faso increased the probability that farmers would test and adopt most of the recommended practices. It also confirmed the positive effect of testing on adoption. Farmers with more land and farmers with higher levels of schooling were more likely to learn from other farmers and to test and adopt new technology.

The findings for Kenya were not as clear-cut; evidence regarding the effects of T&V on farmers' awareness of recommended practices tended to be weak, reflecting perhaps the conceptual problems commonly encountered in collecting such data. Because farmers may be unable to define or express their awareness clearly, evidence that the advice has been adopted is a more effective measure of extension's impact. And, in fact, the findings on adoption were more robust. T&V generally had a positive effect on all the recommended practices, and it had a statistically significant effect on most. The response to three of the four basic practices covered in the analysis—spacing, planting dates, and the use of improved cultivars—was particularly strong. As in Burkina Faso, higher levels of schooling led to more and earlier awareness and adoption.

Measuring the Impact on Production

The effect of T&V on farmers' economic efficiency was measured by the change in farm output.[4] An important procedural issue related to the choice of extension variables. Several different specifications were used in earlier studies reviewed by Birkhaeuser, Evenson, and Feder (1991). These included the number of farmer contacts with the extension system, participation in groups that were in contact with extension agents, adoption of a recommended technology, and the ratio of field extension workers to farmers in a region. With the exception of the last, the other variables reflect actions of or choices made by farmers.

Thus, when more productive farmers seek out extension workers for advice more frequently than less productive farmers, one cannot infer that extension has increased their productivity. And, unless an econometric procedure is devised to correct for this endogeneity, they cannot be used as independent variables. (In the previous section, a predicted participation variable, which took endogeneity into account, was created to explain awareness and adoption, and that variable was available for the productivity analysis.)

Most previous studies of this type, however, relied on a measure of extension supply that is determined by the government and is not a farm-specific variable. As noted earlier, the logical choice is a ratio measuring the supply of field services to a target group of farmers. The supplying staff may use different techniques to reach farmers and may provide more services to some farmers than to others, but it is expected that the more staff services available, the more advice and information farmers will receive and that areas with more services will, on average, be more productive.[5]

Governments have been known to locate extension personnel in choice agricultural areas in an attempt to demonstrate the success of extension programs, effectively creating a selectivity bias. Such behavior creates a spurious correlation and causes the estimated relationship between extension and productivity to be biased upward (Evenson and Kislev 1975). Our studies attempted to deal with this potential bias in two ways. First, we examined the strategy behind the geographical expansion of T&V. It appeared that in both Kenya and Burkina Faso, the expansion of T&V management at the aggregate level was random once the programs had graduated from the pilot phase; in Burkina Faso the expansion occurred in all regions at roughly the same rate. Nonetheless, decisions concerning the location of extension agents within districts in Kenya and CRPAs in Burkina Faso may still have been biased. Second, we applied statistical tests to determine the endogeneity of the agent-to-farmer variable (meaning that its value is not affected by factors outside the model). The tests did not indicate an upward bias, but the possibility is nonetheless real (see the appendix).

There is also a timing dimension between an agent's year of service and farmers' productivity. Not only is extension advice likely to be reinforced as farmers gain experience, but it also takes time to spread the word among farmers. Thus the impact of extension services provided in a given year will extend into the future. This assumption was incorporated into the agent-to-farmer variable in the form of an accumulated stock of field-agent years.

In Kenya the ideal way to look at the effect of extension after the introduction of T&V would have been to compare differences between the data for 1981–82 and 1990. Such an analysis was impossible, however, because 1981–82 data were available only for a limited number of inputs. Instead, we estimated separate models for each period.

The 1990 specification for Kenya was relatively complete. Aggregate farm production was related to inputs, geoclimatic conditions, weather, farmer and community characteristics, and the agent-to-farmer ratio. Two additional variables were used for Burkina Faso: the number of years that T&V had been operating in an area, and the proportion of farmers in a village who were members of a T&V contact group. In both countries, different econometric techniques consistently gave similar results. In addition, the estimates for the nonextension variables (land, labor, and capital) appeared reasonable and inspired confidence in the measures of the extension variables.

The results for Burkina Faso showed that important determinants of production were not only the agent-to-farmer ratio, but also the variables measuring the proportion of farmers in a village who were members of a T&V contact group and the number of years T&V had operated in the area. In Kenya the estimates for the agent-to-farmer ratios were considerably higher for 1990 than for 1981–82. But the impact of extension may have been underestimated for 1981–82, given the weaknesses in the data for that year. Furthermore, the analysis did not take into account changes in other complementary factors, such as rural infrastructure (feeder roads), access to agricultural credit, and new technologies, which might have improved farmers' ability to respond to the extension messages.

All the same, there is little to suggest that major increases in the supply of such factors actually occurred in Kenya between 1981–82 and 1990. Indeed, the study suggests that farmers lacked access to agricultural credit during this period, which might have reduced the effectiveness of extension. Similarly, few new technologies were introduced at this time, because the agricultural research system was being reorganized. As for investment in feeder roads, the government seems to have been more concerned with maintaining the existing network than with adding to it. Therefore, although the difference between the 1990 and 1981–82 estimates cannot unequivocally be attributed to T&V, the system seems likely to have increased the productivity of extension. Notably, the results showed that subject matter specialists with technical education and research experience and extension agents with knowledge of on-farm research were more effective in raising farm productivity than those without such credentials.

Economic Analysis

Policymakers are interested in knowing not only whether extension has increased agricultural output, but also how the benefits compare to the costs of achieving this goal. What can be learned from experience in these two countries? To find out, we computed rates of return for T&V extension in both

countries and for extension services before T&V was implemented in Kenya. The computed rates of return are "marginal," that is, they refer to the social return that would be realized on an additional public sector investment, given the investments already made. The statistical methods applied in the study were not suited to estimating average returns, which in any case are not a practical calculation for on-going programs such as extension.

One caveat applies to these results. The high rates of return reported here are a consequence of improved technologies adopted by farmers who had not previously employed such techniques and whose productivity had been low. The impressive increase in output that resulted from these technological innovations (improved crop management practices, seed, fertilizers, and other inputs) is unlikely to be repeated. Further productivity increases will occur as existing practices are modified and improved, but the large initial gains in output are unlikely to continue.

For Kenya the computations showed a marginal rate of return of more than 100 percent for the T&V-based 1990 extension and 28 percent for the pre-T&V 1981–82 extension. For Burkina Faso the computed marginal rate of return was 91 percent.

What do the results for Burkina Faso imply for growth of agricultural productivity? At the level of extension expenditures in the early 1990s (slightly under 1 percent of the value of production), the effect of additional extension agents is less beneficial than participation in T&V contact group activities. (Estimated crop yields for the contact groups were 29 percent higher than average.) For example, as shown in table 3, about 30 percent of the sample farmers participated in T&V contact-group activities in 1990, four years after T&V was first introduced. If the proportion of such farmers increased in the following six years to 75 percent, which would be about the expected peak, that increase would imply a considerable increase in agricultural production at the end of the ten-year period.

Conclusion

The evidence from the evaluations supports the hypotheses that extension programs in Sub-Saharan African countries have a positive long-term effect on agricultural growth and that T&V management improves extension performance. Two elements of this management structure appear to be particularly important. One relates to the discipline of regular extension visits to farmers, and the other to the role of the subject matter specialists. In response to the involvement of these personnel, the extension service is under constant pressure to provide timely and competent advice.

The evaluation for Burkina Faso, which shows that extension made two important contributions, is especially revealing. The first contribution is that farmers in villages with more extension staff time recorded higher crop yields. The second, which augments the first and is more substantial, is that the higher yields are associated with direct participation in contact group activities. This contribution has the effect of closing the gap between the "best-practice" yields possible with the existing technologies and the yields farmers actually obtain. This improvement can move the agricultural economy to higher levels of productivity, beyond which progress will largely depend on how quickly new technologies can be developed.

This transition has very significant economic value. It can provide African countries "breathing room" to stimulate their agricultural research systems and achieve the kind of growth potential attained in Asian countries through the application of new technologies. This transition will be realized only with well-managed, disciplined, and effective extension programs. Previous extension programs have not been able to mine this source of growth, but contemporary T&V programs appear to be doing so.

It is not clear how many Sub-Saharan African countries still can tap this source of growth. Kenya has probably made most of the transition to the next stage. It has relatively well-developed markets and infrastructure as well as higher levels of farmer education. The high rate of return estimated for its T&V-managed extension system is probably attributable, at least in part, to the closing of the gap between best-practice yields and actual yields. Markets, infrastructure, and farmer education are less well developed in Burkina Faso, which has a large gap between actual yields and best-practice yields. Its situation is likely to be replicated in much of Africa.

The high rates of return estimated in these two studies cannot be used to justify expanding the agricultural extension systems in Sub-Saharan Africa to intensity levels above those characterizing other, more successful developing countries. The estimates imply that extension programs have sharply decreasing marginal effects as the programs expand. The statistical reliability of the estimates also declines for calculations far from the mean of the sample. Perhaps of more importance is the fact that the high returns estimated for these programs are based on two important features of extension programs, only one of which is replicable or permanent. Extension effectiveness based on better management and design of extension systems produces permanent gains if the better management and design elements are maintained. Extension effectiveness based on the gains from mining the best-practice potential in economies with very low levels of marketing and related institutions cannot be sustained for long periods of time.

Appendix. Note on Simultaneity

The following procedure describes the test for simultaneity bias arising from governmental decisions concerning the location and size of extension staff. Note that for the economic analysis, conclusions regarding the economic impact of extension were drawn from measurements of the *supply* of extension services to farmers.

To determine the potential endogeneity of the extension supply variable itself, a three-stage least-squares procedure was used. The variable was defined at the location or village level. In Kenya each location includes several sublocations, which represent the area covered by an extension agent. The extension supply equation included two classes of sublocation variables. Current variables, which were included in the aggregate production function, comprised:

- Sublocation indicator of medium and low potential land
- Sublocation indicators for hilly and undulating land.

Lagged (that is, 1981–82) variables were treated as instruments in the first-stage extension supply equation. The argument for these variables is that they are unlikely to be correlated with the error term in the current extension supply equation. (This is a common argument for lagged extension supply.) These variables included:

- Sublocation proportion of farms with national roads within five kilometers in 1981–82
- Sublocation proportion of farms with bus service within five kilometers in 1981–82
- The number of farms in the sublocation in 1981–82
- The size of the sublocation served (square kilometers)
- Mean household education in sublocation in 1981–82
- Mean household size in sublocation in 1981–82
- Sublocation indicator of extension supply in 1981–82
- Sublocation mean area per farm in 1981–82.

For Burkina Faso we did not have comparable data from an earlier period. The first-stage extension supply equation for Burkina Faso included three household-level variables (production, area, and education) that were in the second-stage production specification. The instruments included:

- The number of households in the village (the extension staff variable covered several villages)
- Number of years since T&V was introduced
- Dummy variables for political units (the CRPAs).

T&V was phased into Burkina Faso during a four-year period. The T&V coverage each year was similar in different political units. The third-stage production functions did include soil and climate class variables, but not the political CRPA dummy variables.

In both Kenya and Burkina Faso, the simultaneity correction produced slightly higher coefficients.

Notes

Vishva Bindlish is with the World Bank's Technical Department for Africa; Robert E. Evenson is with the Department of Economics and the Economic Growth Center at Yale University. The authors wish to thank Kevin Cleaver and the anonymous referees for comments on earlier drafts of this paper, as well as Jock Anderson, Gerson Feder, and Dennis Purcell. The authors would also like to thank Madhur Gautam for pointing out an error in the estimation of the agent-to-farmer variable. The economic implications of the corrected estimate are not substantially different from those originally reported.

1. The data for Kenya were based on a countrywide rural household budget survey undertaken in 1981–82, the year immediately preceding the introduction of the T&V program. In 1990–91, when the data for the evaluations were collected, the farmers from the 1981–82 survey were randomly resurveyed. The 1981–82 survey was not as extensive, particularly in terms of the use of inputs. This discrepancy means that the hypothesis could not be tested conclusively.

2. Small farms are defined as those up to two hectares. Medium farms are between two and eight hectares in Kenya and between two and five hectares in Burkina Faso. Farms of more than eight hectares in Kenya and five hectares in Burkina Faso were considered large.

3. Only a small proportion of farmers became aware of extension messages through the radio. Virtually all who did considered the radio messages useful and suggested an increase in the length of the programs or a change to evening hours when they would not interfere with farming activities.

4. Previous studies have used either an aggregate production function model or a productivity decomposition model (Birkhaeuser, Evenson, and Feder 1991). To implement the latter, an aggregate input index needs to be formulated, using cost shares as weights. (Typically, constant cost-share weights are derived from farm management studies.) In contrast, an aggregate production function specification does not require cost-share data and implicitly permits marginal products to differ from cost shares. This more flexible approach was used in the Kenya and Burkina Faso studies to estimate production coefficients using a simple Cobb-Douglas production function. More complex functional forms require more parameter estimates, and while they may enable more precise identification of parameters, they typically reduce the precision with which one can estimate the extension impact because of increased multicollinearity. National prices were used to aggregate the production of individual crops. (Livestock production could not be included because of the lack of data.)

5. We attempted to link the evidence on participation and adoption from the last section to the T&V impact on production, but the exercise was inconclusive for several reasons. First, the adoption of several practices was relatively incomplete in 1990. Second, the adoption of these practices alone does not capture the full effects of extension on farm productivity. Good farm management includes proper timing and response to weather conditions and efficient allocation of household resources among activities. And there is considerable scope for management

improvement after particular practices have been adopted. For instance, the practices themselves can be more effectively implemented after their initial adoption.

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Public and Private Agricultural Extension: Partners or Rivals?

Dina Umali-Deininger

This article examines the roles of the public and private sectors in agricultural extension. Extension services are classified according to their economic characteristics to identify areas where opportunities for private (for-profit and nonprofit) participation will arise. The author finds that commercialization of farm operations gives rise to demand for specialized client- and location-specific extension services that can be provided by private for-profit firms, although the main buyers will likely be market-oriented medium and large farmers. Because of market failures, some types of extension services will require public funding—although not necessarily public delivery. A critical government role in a pluralistic extension system would be to provide the appropriate regulatory framework to ensure fair competition and maintain quality standards.

Many countries recognize that ensuring an effective agricultural extension system is critical, especially in view of the major challenges facing the agricultural sector today. Rapidly growing populations have unleashed a spiraling demand for food, while the food-producing capacity in many nations is increasingly constrained both by diminishing opportunities to bring new land into production and by the declining productivity of over-cultivated areas caused by natural resource degradation (Crosson and Anderson 1992, Brown and Kane 1994, McCalla 1994). At the same time, the significant majority of the poor continue to depend on agriculture for most of their livelihood. Of the 720 million poor identified by the World Bank (1996a), 75 percent live in rural areas. Thus increasing farmers' incomes through improved productivity is an important element in agricultural development and poverty reduction strategies.

The adoption of improved technologies and sustainable farm management practices opens new opportunities to meet these challenges. The agricultural extension system is one of the primary vehicles for diffusing these technologies and therefore clearly has an important role to play in the development process.

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The major dilemma for most governments, however, is who should sit in the driver's seat in the extension system—the public sector, the private for-profit sector, the private nonprofit sector, or some combination of the three.

The traditional view of the "public-good" character of agricultural extension services and the positive benefits they generate has led many governments to take exclusive responsibility for delivering extension services. A 113-country survey, conducted by the Food and Agriculture Organization in 1988–89, showed that national, state, or provincial governments conducted approximately 81 percent of the extension work in the surveyed countries (Swanson, Farmer, and Bahal 1990). Nongovernmental organizations (NGOs) accounted for 7 percent; parastatals, 3 percent; universities, 2 percent; the private for-profit sector, 5 percent; and other providers, 2 percent.

Although selectivity bias and methodological problems have clouded the measurement of the benefits from agricultural extension, there is general agreement about its positive contribution to the adoption of new technologies and the increase in farm productivity and profits.[1] The debate centers more on the absolute magnitude of the returns. A review of forty-seven studies by Birkhaeuser, Evenson, and Feder (1991) reported "a significant and positive extension effect" in thirty-three cases. Eight studies that calculated net rates of return reported highly positive results in nearly all cases. The rates of return to extension varied across countries and commodities, ranging from 13 to 500 percent in Brazil, 75 to 90 percent in Paraguay, 100 to 110 percent in the United States, and 14 to 15 percent in two states in India. Studies of extension returns in Asia, Africa, and Latin America showed returns of between 34 and 80 percent for nonstaple crops.

Three major developments have brought about a rethinking of the appropriate channel for delivering agricultural extension. First and most important, fiscal crises and economywide budget cutbacks, often associated with structural adjustment programs, have forced governments to make sharp reductions in the budgets of public extension programs. Financial sustainability and cost-effectiveness have became the priority concerns.

Second, the poor performance of some public extension programs, as reflected by the slow adoption of extension messages, has spurred the search for alternative approaches to improve extension services. As Rivera (1991, p. 5) notes, "Public sector extension [in the 1980s] was criticized for not doing enough, not doing it well, and for not being relevant." This failure was attributed to bureaucratic inefficiencies and the poor formulation and implementation of extension programs. As a result, many extension programs were inadequately funded and lacked a coherent link both with their farmer clientele and with the agricultural research sector. A recent review of thirty-one World Bank–supported extension projects, of which 90 percent were modeled after the pub-

lic training and visit extension system (T&V), found persistent problems arising from a failure to address the needs of particular farmers, inadequate human resource capacity, weak government commitment, and the likelihood that such programs will not be able to function without continued government support (table 1). These weaknesses in turn fueled the debate about the cost effectiveness of public extension systems. Although studies have shown the positive

Table 1. *Frequency of Problems Raised in Ex-Post Evaluation Reviews of Free-Standing Extension Projects*
(percent)

Description of problem	*Satisfactory projects n=23*	*Unsatisfactory projects n=8*	*Total projects n=31*
Funding			
Recurrent cost funding inhibiting field operations	87	100	28
Client orientation			
Inadequate research-extension linkage	74	100	26
Insufficient technology available	39	63	12
Entrenched "top-down" approach	48	75	17
Inadequate consideration for production risk and access to resources	39	50	13
Human resource capacity			
Limited practical knowledge of extension staff and technology available for dissemination	43	88	17
Low level of education limiting analytical and response capacity	22	38	8
Methodologies			
"Blue-print" approach (region, state, nation) ignored local characteristics and requirements	35	50	12
Inadequate attention given during preparation phase "Contact farmer" system was not effective, farmer group approach had better results	43	75	16
Government ownership			
Lack of government commitment	48	50	15
Weak monitoring or if developed not used	35	38	11
Sustainability of the system*			
Likely	33	n.a.	n.a.
Uncertain	58	60	n.a.
Unlikely	8	40	n.a.

Note: These ratings measure the extent to which a project met the relevant objectives in a cost-effective and administratively efficient manner.

* Includes only twelve of the satisfactory and five of the unsatisfactory projects evaluated in 1989.

n.a. Not applicable.

Source: World Bank (1994a).

benefits from the T&V system (see Feder and Slade 1986; Bindlish and Evenson 1993; Bindlish, Evenson, and Gbetibouo 1993), it is by no means clear whether more cost-effective approaches and therefore higher rates of return could have been achieved through alternative nongovernment delivery systems. (The training and visit system is a purely public sector extension service delivery approach that rests on the use of "contact farmers" for the delivery of extension messages on a regular basis; see Benor and Baxter 1984.)

Third, agriculture's dependence on more specialized knowledge and technologies has changed the economic character of the services delivered by the extension system. The institutionalization of mechanisms that permit the seller to appropriate the returns from new inventions and new species of plants (for example, patents, copyrights, plant breeders' rights, and so on) has improved the private for-profit sector's incentives to provide extension services. The growing commercialization of agriculture and increased competition in domestic and international markets have further strengthened the economic incentives for farmers and other rural entrepreneurs to treat extension as another purchased input to agricultural production and marketing activities.

In the search for a new paradigm of the agricultural extension system, developing countries are wrestling with several questions: What are the appropriate roles for the public and private sectors? Can the private sector deliver services more efficiently? What are the welfare implications for small-scale farmers and the rural poor?

The Nature of Agricultural Information

Information transmitted to and from farmers through the agricultural extension system can be divided into two broad categories: pure information, and information that is embodied in new products or equipment (Ruttan 1987).

Pure Agricultural Information

Pure information includes all types of self-standing advice on practices in four main areas:

- Cultural and production techniques, such as timing for planting and harvesting, use of inputs, animal husbandry and livestock health, crop protection, and farm-building design;
- Farm management, such as record-keeping, financial and organizational management, and legal issues;
- Marketing and processing information, such as prices, market options, storage procedures, packaging techniques, transport, and international standards for quality and purity; and

- Community development, such as the organization of farmers' associations.

Embodied Agricultural Information

Farmers can also obtain agricultural information indirectly, through technologies used in farm production, such as new agricultural equipment, chemicals, seeds, pharmaceuticals, and livestock breeds; technologies that facilitate farm management, such as telecommunications, laboratory equipment, computers, and software; and postharvest equipment, such as threshing, drying, milling, storage, and packaging technologies. Various combinations of these technologies have often been promoted as a package that includes credit and technical assistance. The most frequently cited examples are the Green Revolution technological packages of high-yielding crop varieties (rice or wheat), irrigation, credit, fertilizers, pesticides, and extension.

The potential providers of agricultural extension services fall into three major groups: the public sector, the private nonprofit sector, and the private for-profit sector. The distinction is important because of the different range of services each, and particularly the private for-profit sector, has the incentive to deliver. The public sector is represented by ministries or departments of agriculture at the federal, state, provincial, and municipal levels and by international and regional organizations, such as the Consultative Group on International Agricultural Research and the South East Asian Research Center for Agriculture. The private for-profit sector in the extension system comprises all economic agents whose objective is to generate profits directly or indirectly for their owners, members, or shareholders. This sector covers commercial enterprises operated by a farmer or group of farmers, including cooperatives; commercial production and marketing firms, such as input manufacturers and distributors, agromarketing and processing firms; commodity boards; and private consulting and media companies (publishing and telecommunications firms). The private nonprofit sector differs from the for-profit sector in one important respect: rather than distributing the residual earnings (if any) to individuals who exercise control, it must reinvest profits to finance future activities. In this category; are nongovernmental organizations (NGOs), universities, foundations, professional and trade associations, and other noncommercial groups.

Economic Incentives for Delivering Extension Services

Extension information could be classified according to its economic character, based on whether it is closer to being a *public good* or a *private good,* using the

economic principles of rivalry and excludability. Rivalry (or subtractability) applies when one person's use or consumption of a good or service reduces the supply available to others. The purchase of an improved small-scale hand tractor reduces the total supply of equipment available to others. Excludability applies when only those who have paid for the product or service benefit from it (Feldman 1980, Kessides 1993). The farmer who purchased the hand tractor has the sole proprietorial right to use the equipment. Any good both rival and excludable is a private good; those that are neither rival nor excludable are public goods. Private firms are unwilling to supply goods and services with public-good characteristics because restricting the benefits derived from those goods only to those who paid for them is usually impossible. A farmer will not be willing to pay for information on soil conservation techniques that is also reported by radio, because other farmers can freely tune in and obtain the same information.

Purely public and purely private goods occupy opposite ends of the economic spectrum. In between the two extremes are *toll goods* and *common-pool goods* (figure 1). Toll goods are excludable, but not rival; for example, the supply of information provided by a private extension consultant exclusively to a group of farmers is not reduced by the addition of another member to the group. Toll goods cannot be accessed by people who do not pay for the service, although a decision of a member farmer to pass on information that the group had paid for would not reduce the group's consumption. The ability to exclude those who have not paid for the service provides the incentive for the private sector to supply such goods. Public regulation, however, will be necessary to establish property rights, conditions of competition, and pricing and quality standards for the toll services.

Common-pool goods are those that are rival but not excludable; in other words, other people cannot be stopped from using them. For example, the purchase of high-yielding self-pollinated seeds such as rice and wheat reduces the supply of such seeds, but their ease of replicability makes exclusion difficult and costly in the long run. Farmers do not buy rice and wheat seeds every season, because they can set aside part of their harvest for planting the next crop.

Some types of information embodied in technologies produce *externalities.* These occur when an individual, in using (or producing) a product or service for which payment is received (or made), coincidentally benefits other people from whom payment cannot be exacted or adversely affects others whose claims for compensation cannot be enforced (Pigou 1932). Typically, the individual responsible for the externality will not consider the positive or negative effects when deciding how much to produce or consume. As a result, either too little (for positive externalities) or too much (for negative externalities) is produced or consumed. Markets may develop their own mechanisms to account for these

Figure 1. *Economic Classification of Agricultural Information and Technologies Delivered by the Agricultural Extension System*

Rivalry	Excludability: Low	Excludability: High
Low	**Public goods** • Nonexcludable agricultural information (LT) • Mass communication of agricultural information	**Toll goods** • Nonexcludable agricultural information (ST) • Excludable agricultural information (Cultural and production practices, farm management, marketing, processing)
High	**Common-pool goods** • Modern technologies (Self-pollinated seeds [LT])	**Private goods** • Modern technologies (Machinery, chemicals,* hybrid seeds, self-pollinated seeds [ST], biotechnology products,* veterinary supplies and pharmaceuticals)

*Use may involve externalities; ST=short term, LT=long term.
Source: Umali and Schwartz (1994).

externalities. If these mechanisms do not develop naturally, government intervention of some kind is justified, such as subsidizing the desirable activity to increase consumption, or regulating or taxing the use of those activities that result in a negative externality to reduce private consumption to socially desirable levels.

Problems of asymmetric information also arise with the use of some types of agricultural information or technologies. Consumers may be unable to assess the quality of the product they are purchasing—for example, the difference between good or bad seed, an adulterated or pure livestock feed, or good or bad advice. In some cases, suppliers may enforce quality control to maintain brand loyalty (Blankart 1987), or trade associations may enforce industrywide quality standards. Even if these market-based measures exist, however, the public sector should be responsible for maintaining and enforcing quality standards.

These concepts provide the basis for classifying the type of information delivered by agricultural extension providers and thus the appropriate roles for the public and the private sectors.

Agricultural Technologies

For most modern technologies, such as agricultural machinery, agricultural chemicals, hybrid seeds and livestock, and veterinary supplies and pharmaceu-

ticals, agricultural information is embodied in the invention. These technologies are classified as private goods because of their high subtractability and excludability. The use of legal mechanisms (such as patents, copyrights, and plant variety protection) provides a high degree of excludability. These technologies are thus especially attractive to producers and distributors, which have the incentive to supply these technologies and the supporting technical information to all farmers at socially optimal levels. Where these products or services are too costly for individual farmers, channeling them through client organizations (farmer associations or commodity foundations) enables poor farmers to take advantage of new opportunities. These institutions, in consultation with their members, determine the level of services needed and charge farmer members according to the services provided.

The use of some technologies involves externalities or spillover effects. A farmer's use of a veterinary drug or vaccine results in positive externalities because it reduces the risk that livestock disease will be transmitted to neighboring animals. Inappropriate use of a pesticide can result in negative externalities: polluting the food supply, causing pest-resistance, and destroying natural enemies. Different mechanisms have evolved in the market to deal with these externalities. Increasing concern about pesticide use has spurred the search for new technologies to detect pesticide residues in food and the effects of exposure to toxic materials and has changed consumer preferences, as reflected by the price premiums consumers are willing to pay for organically grown, pesticide-free produce (Phipps 1989).

Some types of agricultural technologies, such as self-pollinated seeds, are private goods only in the short term, that is, in the introductory phase. In the medium- to long-term, they become common-pool goods. Private firms supplying these seeds, therefore, have to compete with farmers who use their own seeds, resulting in very low or negligible profit margins. Consequently, only relatively small local private firms with low overhead costs that produce consistently high-quality seeds may be expected to earn adequate profits (Jaffee and Srivastava 1992). The size of the market and the efficiency of the operation determine whether the private sector will participate in the production and distribution of self-pollinated seeds. If these conditions are not met, state and local governments and private nonprofit agencies will have to distribute the seeds.

General or Nonexcludable Information

Information designed to improve existing cultural and production practices, farm management, or marketing and processing techniques and provided by traditional agricultural extension approaches is a toll good in the short term. Although transmitting such information does not reduce its availability to oth-

ers, attendance at extension meetings is constrained by the facilities and infrastructure and by the time it takes for word of mouth to reach a critical mass of interested farmers. But the diffusive nature of nonexcludable information transforms it into a public good quickly. Similarly, nonexcludable information that is transmitted through public broadcasts and public distribution is a public good. Thus, how quickly information is diffused determines whether the private sector has an incentive to provide it. If the information diffuses easily, the possibilities of charging for it are limited, and private firms will have little or no incentive to provide such services; thus delivery of nonexcludable information will remain the responsibility of the public sector or of private nonprofit agencies.

In special situations, the private for-profit sector will provide nonexcludable information. For example, agroprocessing and marketing firms will undertake extension activities when the revenues they realize from a more assured supply, improved timing, and higher quality are greater than their costs of providing the extension information. Private firms may also provide information to their customers about the appropriateness or the range of uses of their products as part of their advertising campaigns to expand or protect their market shares.

Excludable or Specialized Information

As farm operations become more commercialized and agricultural technology more specialized, the corresponding extension services needed to support these activities also become highly specialized. Such specialization lends exclusivity to the information and, therefore, the extension activity. For example, the results of a soil analysis or the development of computer programs to facilitate farm operations are location- and client-specific. Such information may not be useful to other farmers, and even if it is, the farmers receiving the information may reserve it for their own exclusive use and not transmit it freely to others, thus slowing or blocking the diffusion process. These characteristics qualify specialized information as toll goods and provide adequate economic incentives for the private for-profit sector to supply such information at optimal levels. Asymmetric information problems, however, increase the difficulty of assuring quality. Unless the private fee-for-service extension industry can effectively police itself to ensure the quality of the information communicated, public intervention will be necessary to enforce quality standards and legal contracts.

In some cases, significant externalities may also be associated with specialized types of information. The prime example is natural resource management techniques, which directly benefit the farmer-cultivator by promoting sustainable agricultural production and at the same time benefit society—present and fu-

ture. In these instances, public-sector interventions, such as subsidies to promote beneficial techniques that could raise usage to socially optimal levels, are needed. The private nonprofit sector can also play an important role in disseminating this information.

Private Agricultural Extension Services

Experience in several countries attests to the broad scope of agricultural extension services that the private sector could deliver efficiently and profitably. These are described below.

Agribusiness Enterprises

Agroprocessing and marketing firms promote a wide range of commodities through the use of in-house agricultural extension services for farmers who grow for them under contract arrangements. These private firms typically focus on the type and levels of use of inputs, disease prevention or control, and harvest and postharvest techniques. They are designed to increase farmer output, reduce postharvest losses, and improve the quality, consistency, and timeliness of the crop. Examples from various developing countries include broilers, fruits and vegetables, cotton, and tobacco (Zijp 1991; Rama 1985; de Janvry, Runsten, and Sadoulet 1987; Rogers 1987; Glover 1990; Schwartz 1992; Okidegbe 1996; Venkatesan 1995; and Agribusiness Worldwide 1982). In Kenya, the large local fresh produce exporters, such as Indufarm, Sunripe, KHE, and Homegrown, currently provide inputs and extension services to farmers producing for them on contract.

During the 1970s dairy farmers in Argentina faced serious obstacles. Livestock there was unproductive; the milk supply was unstable and often of poor quality. These problems were mainly the result of poor animal nutrition and inadequate farm hygiene. The two largest dairy processors, Santa Fe–Cordoba United Cooperatives (SANCOR) and La Serenisima, whose own growth was jeopardized by the plight of the dairy farmers, launched extension programs to overcome these constraints. SANCOR created an extension department with eight regional offices, each managed by an agronomist assisted by middle-level technicians. Each office provided extension services to almost forty cooperatives and assisted small groups of farmers (usually six to fifteen) who met monthly to discuss a visited farm's progress and problems. SANCOR initially financed technical assistance for these small groups, but after thirty months, each group took on the cost of the professional agronomist. By 1990 SANCOR had 120 farmer groups participating in the program. Artificial insemination services as well as

accelerated heifer-rearing programs were also organized. In addition, SANCOR supplied and financed a varied list of farm inputs. As a result of the program, milk production increased by 15 percent between 1976 and 1985 despite a 24 percent decrease in the number of dairy farms participating in the cooperative.

La Serenisima also formed a strong technical assistance department, but it deliberately targeted medium- to large-scale farmers. It established five regional offices, each with five branch offices, which worked with groups of up to twenty-five farmers. Magazines, bulletins, radio broadcasts, and television programs were all part of the development effort. During 1978–85, although the dairy farm areas feeding La Serenisima shrank by more than 6 percent, production increased by almost 50 percent (World Bank 1989).

Private Consulting Firms

Private consulting firms provide agricultural extension services in many developing countries (Pray and Echeverría 1990; World Bank 1987, 1990a, 1990b). In 1988, for example, more than 2,000 private consulting firms were working in Brazil, largely catering to the highly specialized extension needs of the commercial livestock sector. Firms conducting extension services in Asia tend to concentrate on plantation crops, and a growing number are staffed by former plantation managers and technicians.

Farmer Associations

A large number of farmer associations also provide agricultural extension services to their members. These associations cover a wide range of commodity-specific topics, including new technologies, production techniques, farm management, disease prevention and control, and marketing and processing procedures.[2]

In France large cooperatives hire technical advisers directly and cover the cost by charging members a fee. Four major French farm organizations also manage agricultural development services at the local, regional, and national level, including seventeen applied research institutes. The National Fund for Agricultural Development is a joint venture under the control of the *Association Nationale pour le Developpement Agricole* (National Association for Agricultural Development), an association subject to government control and jointly managed by representatives of the government and farm organizations. This fund accounts for approximately one-fourth of the total resources and is also used to ensure that each area receives its fair share of funding (LeGouis 1991).

A similar association (AACREA) in Argentina, based on the French model, consists of 15 regional groups and 176 local groups with more than 2,000 mem-

bers. Each local group of eight to twelve farmers is led by a professional agronomist who visits each of the farmers in the group for one day a month. The farmers also visit a member's farm each month to discuss specific operations and problems. The cost to each farmer is about $60 a month (equivalent to one farm laborer's monthly wage), of which 80 percent covers the professional's fee and the rest goes to the organization.

In the Central African Republic, the National Federation of Central African Livestock Farmers (FNEC) was organized to facilitate the distribution of veterinary drugs after the government livestock service nearly collapsed in 1973. In 1989 FNEC also began providing extension services and education programs to its members, who include more than 60 percent of all herders in the country (Umali and Schwartz 1994).

In Zimbabwe 9,000 small-scale commercial farmers and 65,000 smallholders belong to the Zimbabwe Farmers Union. The Commercial Farmers Union (CFU) has a membership of 4,450 large-scale farmers and serves as the umbrella organization for several commodity-specific associations, such as those for flower and tobacco farmers, coffee growers, and sheep and cattle farmers. The CFU is the organizing force behind a range of research and extension activities, such as the Agricultural Research Trust, a weekly magazine called *The Farmer,* and bimonthly reports. In addition, the CFU provides leadership for some commodity-specific activities, such as the Cotton Training Center at Kadoma (Schwartz 1992).

Several factors stimulated the farmers' associations in Zimbabwe to get involved in research and extension. First, the emphasis of public extension shifted from a plantation to a smallholder clientele. Second, the shift in emphasis left commercial farmers anxious to ensure their access to quality services. Third, a number of European extension staff who left public service became available for the associations to hire. The associations employ extension specialists (referred to as district councillors) who work directly with the farmers in an area, usually on specific commodities. Most farmers are members of multiple associations and have a variety of information sources (including private consultants). The CFU and the commodity-specific organizations maintain links with and provide some services to public-sector research and extension. The CFU extension staff provides training at the Cotton Training Center and engages in collaborative efforts in the field such as the Agricultural Research Trust farm trials in communal areas and pesticide demonstrations at farm shows (Schwartz 1992).

Nongovernmental Organizations

NGOs have also began to assume a greater role in agricultural extension, frequently focusing on areas that the government has neglected. One reason for

their success has been their community-based focus. In West Africa, for example, the *Se Servir de la Saison Séche en Savanne et en Sahel* (the 6-S Program for the Savannah and the Sahel) promotes village organizations, helps groups establish community development programs, and provides funding and technical assistance for projects including village crafts, cereal banks, market gardening, soil conservation, and reforestation. With an annual budget of $1.25 million, 6-S is now operating in Burkina Faso, Mali, and Senegal. Since its founding in 1976, it has established 2,000 farmer organizations (averaging eighty members per group) in about 1,000 villages (Amanor and Farrington 1991). In Northern Ghana the Agricultural Information Service, funded by the Presbyterian Agricultural Station at Langbensi, works with more than twenty church-based agricultural stations and coordinates with the government research station at Nyankpala (Amanor and Farrington 1991). In Pakistan the Aga Khan Foundation is involved in rural development projects, dealing with technology transfer and training of farmer representatives to become specialists in livestock, plant protection, marketing, and forests (Khan 1992).

Some NGOs have organized regional networks. In Latin America, eight NGOs representing seven countries have formed the *Consorcio Latinamericano Agroecologa y Desarollo* (CLADES—Latin American Consortium on Agroecology and Development) to promote, develop, and diffuse agricultural information to small-scale farmers, in association with institutions committed to sustainable agriculture (Altieri and Yurjevic 1989).

Many NGOs perform both research and extension activities. In India the Bharatiya Agro-Industries Foundation (BAIF) serves 8,000 villages in six states with a program to improve dairy cattle. It operates 450 artificial insemination centers and provides veterinary and extension services (Amanor and Farrington 1991). In fact, some state governments have subcontracted with BAIF to provide artificial insemination services (World Bank 1996b).

Fee-for-Service Extension

The demand for agricultural extension services, and therefore the willingness to pay for them, depends on the expected benefits from the new information. The type and level of demand will be determined by the magnitude and value of the farm household's marketable surplus, the cost of the extension service, and the additional income generated as a result of adopting the extension information. Given that a farmer cannot buy only part of the service and that a fixed or negotiated fee is usually paid, medium- and large-scale producers can spread the cost, resulting in lower per-unit costs and higher rates of return. Conse-

quently, the larger the farm operations, the greater the potential demand for "fee-for-service" extension.

Strong market competition associated with high-value tradable commodities could also enhance effective demand for new information, because the new information and technologies may provide the competitive edge. In contrast, because the value of their marketable output is low, resulting in higher per-unit costs, small-scale farmers typically find it less attractive or profitable to "purchase" the extension service. Subsistence farmers have limited, if any, incentive to pay for extension services.

Government policies can greatly affect the demand for extension services, through their (direct and indirect) influence on commodity prices and aggregate demand. High (direct and indirect) taxes on agriculture reduce farmers' incentives to adopt improved technologies. Similarly, high inflation and macroeconomic instability limit access to the capital necessary to finance such new technologies. The allocation and level of public expenditure on rural roads, markets, and irrigation infrastructure, for example, influence the development potential of particular localities and thus the return on investments in technologies that enhance productivity. Public expenditures on education, especially in rural areas, have a strong influence on the capacity of farmers and consumers to absorb new information.

A major implication of the shift in the classification of information from a "free good" to a "purchased good" is that the demand for paid agricultural extension services will originate almost exclusively from market-oriented farming operations and particularly from medium- and large-scale farmers. It also follows that such farmers will be more capable of sustaining a "fee-for-service" agricultural extension business. Conversely, private for-profit firms will tend to neglect areas composed of more marginal farmers.

Private Supply

The costs of and returns to the services a firm provides will determine the level at which private extension services will be supplied. Costs are influenced by the supply of and demand for qualified extension personnel, economies of scale in delivery operations, and government policies; revenues reflect the factors that influence farmer demand. The use of and returns to extension subsequently affect the nature and level of supply of domestic information (pure or embodied in technologies). Government restrictions on imports of technology (such as improved seeds, livestock breeds, and agricultural chemicals) reduce the menu of products available for extension providers to disseminate.

Because profitability is the main criterion for private extension providers, their tendency is to cultivate a clientele of commercial farmers. The issue of

"cherry-picking" thus becomes a major concern. The Chilean experience illustrates this problem. When Chile privatized its extension system in the 1970s, commercial farmers were not seriously affected, but small-scale and subsistence farmers were priced out of the extension market. To remedy this inequity, the government had to take active measures to target extension services to these farmers.

Provided farmers can overcome the difficulties of organizing into a group, farmers' associations can allow small farmers to pool their resources to purchase extension information that individual farmers may not be able to afford on their own. The association may employ part-time or full-time staff or contract out its extension requirements to consulting firms.

When should extension be funded by the public sector? Where extension delivers public goods and information with high externalities, such as environmental or conservation-related information, complete privatization is neither desirable nor feasible. Two other arguments could justify public subsidization of extension to small farmers: first, when small farmers may be unaware of the benefits of improved technologies and unable to afford them; and second, when small subsistence farmers may derive considerable nonmonetary benefits (including better nutrition and health) from adopting new technology.

Public-Private Partnerships

Several Latin American countries are attempting to address problems with public extension systems by integrating the private sector into public extension activities. These new approaches include subcontracting to the private sector and an extension voucher system, both of which have partial cost-recovery components.

Private Sector Subcontracting

Subcontracting extension delivery to the private sector (profit and nonprofit) could provide a mechanism for getting around the institutional inefficiencies associated with public delivery (table 2). In 1992 Chile launched an extension project that included subcontracting extension services to private consulting firms (Wilson 1991). To qualify as subcontractors under the plan, private firms must meet technical and professional staffing criteria, bid for contracts, and agree to have their activities monitored by a designated public agency. Similar programs have also been launched in Mexico and Venezuela (World Bank 1994b, 1995b).

Table 2. *New Approaches to Agricultural Extension Delivery*

	Funding		*Delivery*	
Country	*Public*	*Farmer cost sharing*	*Public*	*Private*
Chile				
Large farmers	n.a.	Full costs	Commercial	Commercial
Small/subsistence farmers	Majority	Increasing share	Subcontracted	Subcontracted
Colombia	National trust fund + municipality	Free	Municipality	
Mexico	National trust fund	Increasing share (FG)	n.a.	Subcontracted
Venezuela	National + state + municipality	Increasing share (FG)	n.a.	Subcontracted
Nicaragua	National	Increasing share (FG)	(Vouchers)	(Vouchers)

n.a. Not applicable.
FG Farmer group formation.
Source: Wilson (1991); World Bank (1993, 1994b, 1995a, 1995b).

Extension Vouchers

In an on-going pilot program in Nicaragua, the government issues extension vouchers to farmers allowing them to choose their extension supplier, either public or private. Suppliers include established input providers, nongovernmental organizations, and former personnel of the *Instituto Nicaragense de Reforma Agraria* (Nicaraguan Institute for Agrarian Reform) and the Ministry of Agriculture who have established private firms. Under the program, farmers form small groups of at least ten members who submit a signed master service contract to the Ministry of Agriculture for review. A three-member panel, consisting of a representative from the agriculture ministry, the Institute of Agricultural Technology, and the National Development Bank (BANADES), award the contracts according to established criteria. Each farmer group receives fifteen vouchers a year, 40 percent of which can be applied to group visits and the remaining 60 percent to individual visits. Each voucher was valued at $15 and can be redeemed only by qualified providers at the regional branches of BANADES (World Bank 1993; Keynan, Olin, and Dinar 1997).

The Nicaraguan government has implemented several measures to ensure the effectiveness and quality of the services provided, including the accreditation of technical assistance providers by the Ministry of Agriculture, the establishment of selection criteria for these providers, and the development of standards for monitoring and evaluating the program. Initially, a promotional campaign was launched to announce and describe the program to potential

suppliers and clients. Technical assistance providers can be either individuals or legally established organizations, such as NGOs, service cooperatives, and private firms. Some general criteria include at least three years experience at the professional level (university graduate) in technology generation and transfer of technology to small- and medium-scale farmers; at least five years experience at the technical level in these areas; satisfactory completion of the basic training course offered by NIAT; and formal enrollment with the Ministry of Agriculture. To ensure the integrity of the suppliers, independent auditors review the performance of the technical assistance providers.

Strengthening Client Orientation

Three approaches introduced in Latin America are designed to foster increased client orientation—farmer cofinancing of extension services, decentralization of financing and planning to municipalities, and use of farmer groups. Under the first approach, a user fee is charged to cover part of the cost of the service, to foster a more demand-driven system, and to serve as an important transitional phase in developing a market for fee-for-service extension. The minimal charge is designed to increase farmers' commitment to extension advice and to empower them as fee-paying customers. Cost-recovery components are incorporated into programs in Chile, Mexico, Nicaragua, and Venezuela. (For a description of the program in Nicaragua, see the article by Keynan, Olin, and Dinar in this volume.)

Under the Integrated Technology Transfer Program in Chile, for example, farmers are required to finance 15 percent of the extension cost (Wilson 1991). In Mexico the government plans to raise the level of cost-sharing in some of the more commercial areas to 100 percent over time (World Bank 1994b). The programs in Colombia and Venezuela feature cost-sharing by municipalities as part of the government's fiscal decentralization program (World Bank 1995a, 1995b). Decentralization of control to the municipalities is also aimed at improving client orientation and ownership. Increased reliance is being placed on farmer groups as a primary point of contact between farmers and extension providers. This strategy is intended not only as a way to recover some of the costs of extension, but also to capitalize on the economies of scale associated with extension delivery.

The extent to which the participants in a program can be induced to adopt and consistently maintain sound new technologies is a vital consideration. A review of Chilean experience revealed that after three years, both farmers' and private consultants' interest in the program declined. Several factors seem to have been involved. First, demand from farmers declined as the effective cost of the extension services increased—the farmers' share of the cost increased while

the package of services provided was reduced. Second, the quality of the extension services deteriorated. Third, a seemingly "top-down" approach reduced farmers' sense of ownership. This was due, in part, to poor feedback mechanisms in the system; because new demands were not transmitted back to the program planners and the advice was not tailored to local needs (McMahon 1994).

Social and economic factors strongly influence the change in demand that occurs in response to a change in the price of extension services. Consideration of these factors is essential in predicting and "managing" farmers' response to changes in the fee structure, and extension staff need to be trained to be more responsive and flexible to meet the changing extension demands of farmers.

Conclusion

In view of the challenges facing farmers today, the structural transformation of agricultural extension systems around the world is unavoidable. This change is being hastened by the significant fiscal constraints faced by many countries. Several countries are actively pursuing greater involvement by the private nonprofit and for-profit sectors as a means of improving the effectiveness and sustainability of agricultural extension systems. Capitalizing on the comparative advantage of each of the different sectors helps to ensure the success of this endeavor.

For countries that are at the crossroads, fostering a smooth transition from the traditional purely public agricultural extension system to a more pluralistic one will require close attention to four key areas: source of funding, client targeting, cost recovery, and delivery channels. The first major issue is who will pay for the extension service—the government, farmers, or private nonprofit organizations? The responsibility for funding different types of extension products will be influenced primarily by the economic characteristics of the extension information to be disseminated and the structure of the local farm sector. Farmers will pay willingly only for private goods or information that is characterized as a toll good.

The second and third major concerns—client targeting and cost recovery—are closely associated with public sector financing. Budgetary constraints have brought to the forefront the issue of targeted as opposed to blanket provision of extension services. Given the government's limited resources, should the public sector focus its efforts exclusively on providing an "extension safety net" for small and subsistence farmers and let medium- and larger-scale farmers rely on private providers? And should the public sector institute cost recovery? Charging farmers a nominal sum for services can encourage them to exercise their

rights as information consumers, thereby ensuring program effectiveness. The business relationship introduced with cost recovery also imposes new demands on extension providers. In particular, it implies that farmers can choose who will provide the service and that the extension providers must respond quickly to meet the farmers' information demands. Consequently, marketing and sales skills have to be included in the basket of technical skills that extension agents offer.

Whether delivery of extension services should remain a public monopoly or be fully or partially subcontracted to private organizations, either for-profit or nonprofit, will also need to be resolved. Two determinants of the optimal choice of institutional delivery channel will be the capacity of the contractor to minimize production costs and the capacity of the government to minimize the transaction costs associated with monitoring and regulating services. Another critical factor is the capacity of the domestic private sector. In some countries, the development of private extension capacity has been suppressed, and it is absent or very weak. Special programs that encourage public extension agents to leave public service and set up private operations have been used in Latin America to address this problem. Like an infant industry, the development of for-profit and nonprofit sectors may have to be promoted in the initial stages. The public sector should develop an appropriate regulatory framework with explicit standards and monitoring operations to ensure that quality standards are met.

Promoting a more pluralistic agricultural extension system requires important ideological adjustments on the part of governments and international donors. This new perspective is crucial for agricultural and economic progress.

Notes

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1. Selectivity bias occurs because measurements of the economic rates of return of extension are based on country- and commodity-specific studies. Thus, these measurements may be subject to a systematic upward bias relative to the "global average" because they do not account for less successful extension activities in other commodities and countries. Methodological problems include an upward bias that occurs because more innovative farmers tend to adopt extension advice first; a downward bias that results when farmers share information among themselves rather than receiving it directly from the extension service; the influence of location-specific variables; the appropriate designation of the extension variable; and times of measurement (early or late stages). Exogenous factors, such as price, trade, education, technology, and monetary and fiscal policies, could also influence the results.

2. Some successful associations include *Asociacion Argentina de Consorcios Regionales de Experimentacion* (AACREA—Argentine Association of Regional Agricultural Experimentation Consortia) in Argentina (Tobar 1996), the Tobacco Producers', Commercial Cotton Growers', Commercial Grain Producers', Ostrich Producers, and Crocodile Producers' associations in Zimbabwe (Schwartz 1992); the *Cooperativa Integral Campesina* (COINCA—Integrated Farmers Cooperative) for grapes in Bolivia (Tendler 1983); the Anand Milk Union Ltd. and other dairy marketing cooperatives under Operation Flood in India (Umali and others 1994); the Vegetable Cooperative in Uganda (Narayanan 1991); and the Poultry, Flower, and Vegetable associations in Turkey (Zijp 1991). COINCA was instrumental in teaching farmers techniques for improving the quality of their grape output, thus enabling them to take advantage of the quality premiums offered by the distilleries.

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Cofinanced Public Extension in Nicaragua

Gabriel Keynan • Manuel Olin • Ariel Dinar

How effective is agricultural extension? Is it worth the vast sums governments spend to provide it, mostly as a free service, to farmers worldwide? Relatively few studies exist that measure and compare the benefits of extension activities against their costs. In the absence of such data, this pilot activity concentrated instead on demand. Would demand for extension services be high if they were no longer free? The existence of solid demand would presuppose some benefits from the service. Further, might charging for the service actually improve its quality and sustainability?

The pilot program in Nicaragua described here set out to test whether a truly demand-driven extension system aimed at farmers with small- and medium-size holdings could be developed. The principal mechanism was a contribution by the farmer paid as a bonus to the extensionist: the aim was to introduce incentives for providers to improve the service through rewards linked to the quality of their work and to establish direct accountability of extensionist to client. The outcomes showed that the cofinancing concept can be successful. The article describes the design, implementation, and results in the expectation that the lessons learned may be of interest elsewhere.

Governments have spent large sums providing agricultural extension as a free service to farmers—some US$6 billion worldwide in 1988 alone, according to estimates from the Food and Agriculture Organization (1990). Is expenditure on that scale justified by commensurate benefits?

Evidence does exist that extension has increased productivity and income (Birkhaeuser, Evenson, and Feder 1991; Bindlish and Evenson 1993; Bindlish, Evenson, and Gbetibouo 1993), but it is not clear that the investigated cases are typical. Evaluation of the cost-benefit relationships has been surprisingly thin. As Birkhaeuser, Evenson, and Feder (1991, p. 643) observe: "Given that an extension organization exists in almost every country and in view of the large volumes of public funds directed to extension, there is scope for much more

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empirical work on this issue." In the same vein, Purcell (1994, p. 10) notes (of World Bank–financed projects) that "quantification of the impact of extension investments in economic terms is normally not undertaken in either ex-ante or ex-post analysis."

In the absence of data, unsatisfactory results are frequently assumed: ". . . the poor performance of many public extension programs . . ." (Umali 1996, p. 2), and "the public sector extension services in which developing countries often at the behest of donors have invested large sums are achieving only limited impact . . ." (Farrington 1994, p. 1). Nonetheless, there is a common conviction that, whether universally successful or not, extension is the only means available for increasing production "given the limits on land and irrigation and likely breakthroughs in technology, future increases are apt to . . . come from technological improvements derived from identifying, developing and applying more efficient practices" (Antholt 1994, p. 4).

Another way of deducing the value of extension services would be to find out whether farmers have expressed demand for them. Pressure from interest groups in the form of petitions or strikes when the service has been discontinued would be a fair indicator of demand (Guttman 1980; Rose-Ackerman and Evenson 1985). It is instructive, for example, that no strike took place in Nicaragua in December 1995 when the government announced a substantial cut in public expenditures that would affect the extension budget, whereas the concurrent announcement of a corresponding cut in financial support to universities was met with a very violent strike.

The farmers' lack of reaction suggests limited interest, even apathy toward the service and obviously therefore calls into question its impact on farmers' economic condition. Because failure to react to removal or reduction of extension is common to most extension services in the developing world, it is likely that the services provided often leave farmers' indifferent to them.

An extension service should be designed to make the outcome of its actions advantageous to both the farmer and the extension institution. Without a stake in the outcome, the extensionist will make little effort: "The amount of effort . . . depends on the value of a reward and the probability of receiving the reward. The perceived effort and probability of actually getting a reward are, in turn, also influenced by the record of actual performance" according to the Porter and Lawler model of motivation (Koontz and Weihrich 1990, p. 326).

Accountability, which Kessides (1993, p. 17) defines as "the ability of service providers to serve the interests of users and other financiers," also needs to be built into the design of the service. "Competitive markets meet this criterion of accountability in that the profit-oriented suppliers have an incentive to satisfy the demands of their customers" (Kessides 1993, p. 17). In standard extension organizations, these incentives are lacking. Data on performance are rarely col-

lected, so potential reward cannot be related to any record of performance, and public institutions in any case rarely offer performance-based incentives to their employees. Consequently, little effort is likely to be expended toward satisfying clients' needs.

This article describes the methodology applied in establishing and delivering a demand-driven, accountable, and possibly sustainable extension system. A pilot activity to test the system was carried out in Nicaragua in 1995 in the context of the Agricultural Technology and Land Management Project (ATLMP), financed by the World Bank and the Swiss government. The intention of the project was to make the extensionist accountable to the client through incentives directly related to the client's satisfaction with the service. A key mechanism is the client's power to influence the quality of the service through "exit" and "voice" (Hirschman 1970)—dissatisfied farmers will cease to be clients (exit) or demand a replacement of the service provider (voice). In this design the drop in the extensionist's income that would result from exit or the threatened decline that would result from voice may be expected to induce a corrective or recuperative action. Such mechanisms do not exist in a standard extension organization.

To put the account in context, the article first reports on extension experiences in countries other than Nicaragua in which farmers share in the cost of the service and goes on to provide some background on the extension service in Nicaragua as a whole. Subsequent sections discuss the methodology used in the pilot, the results and lessons learned, and authors' conclusions.

Cofinanced Public Extension in Various Countries

Farmers now share the costs of extension services to varying degrees in several industrial and developing countries, a shift in policy intended primarily to reduce costs (see "The Public and Private Sector in Agricultural Extension" by Dina Umali-Deininger in this issue, pp. 203 to 24).

Wilson (1991) reports on several models of cost sharing in Latin America. In Chile INDAP (the National Agricultural Development Institute) has contracted with consulting firms to provide extension services for a period limited to three to five years. In this plan farmers in higher income categories are required to pay 15 percent of the cost, financed by a credit provided by INDAP. In Mexico farmers at higher income levels are currently required to pay 15 percent of the cost of extension services, a share scheduled to increase gradually until it reaches 50 percent. In the Imbabura region of Ecuador, the extension agents purchase inputs and sharecrop with the farmers; the extentionist's share covers the interest on the loan for the purchase, the risk involved in the enterprise, and a payment for the services provided.

In Colombia responsibility for providing extension has been devolved to the municipalities, financed mainly by the central government with a share covered by the municipality (Garfield, Guadagni, and Moreau 1996). In Costa Rica a pilot project, planned to evaluate trade in extension vouchers, awards vouchers for extension services to farmers on the basis of the type of farm and level of technology; farmers may trade vouchers based on their needs (Ameur 1994). In Argentina groups of voluntarily formed and self-supporting neighboring farmers and ranchers organize to promote their common interests. Each group hires and pays for the services of an agricultural advisor (Garcia Tobar 1996). In China individual farmers or farmer associations contract with research institutions, universities, and individual scientists to provide technical assistance (Ameur 1994).

In Europe cost sharing is common. About three-quarters of the operating extension budget in France is collected at the farm level through direct payments, contributions of agricultural organizations, and other direct and indirect taxes on agricultural inputs and products (Ameur 1994). The U.K. extension agency, which remains partly government-funded, now charges for some services, originally offered free of charge, on a time-cost basis (Dancey 1993; Ingram 1992, pp. 51–58). The Dutch Extension Service began a privatization process in 1993 in which the share of the extension budget to be funded by the farmers increased from nothing in 1993 to 60 percent in 1996; in 1998 farmers are expected to cover 80 percent of the budget (Tacken 1996).

Since 1990 extension in Queensland, Australia, has been project-based, with up to 30 percent of the budget funded by the clients. The cost-sharing formula for the cofinanced projects is set in negotiations; the government typically pays fixed costs such as salaries and equipment, while the farmers provide in-kind contributions such as the use of farm equipment, demonstration sites, and livestock (Coffey and Clark 1996).

Extension in Nicaragua

In 1994 agriculture accounted for about one-fourth of Nicaragua's gross domestic product and employed about one-third of the labor force (Banco Central 1996). The total number of farmers was estimated at some 250,000 (Centro de Investigaciones 1988). Agricultural products, mainly coffee, sugar, and beef, account for as much as three-fourths of the country's total exports.

Public agricultural extension in Nicaragua dates back to at least 1942, when the U.S. Department of Agriculture under cooperative agreements established two experimental stations in the country (Hernandez 1991). The extension service underwent numerous conceptual and organizational changes over the

years, but at all times remained highly dependent on external financing. Although public extension was funded through the public budget, the government's financial contribution was always limited. In 1996, for example, almost 60 percent of the basic extension budget was financed from external sources (of this, 80 percent was from a World Bank loan and the rest from Canada, Holland, Japan, Norway, Switzerland, and the European Community). Extension activity waxed and waned according to the fluctuations in foreign aid.

The Instituto Nicaraguense de Tecnologia Agropecuaria (INTA) was created in 1993 as a semi-autonomous institution, primarily to remove it from political influences in staffing and to define it as a professional organization serving agriculture. It is divided geographically into five regions with its headquarters in Managua. The regions are all located in the west (Pacific) and center of the country where economic and agricultural activity have traditionally been concentrated.

In 1996 INTA employed some 160 extensionists throughout the country, serving some 21,500 farmers in its five regions (INTA 1996). Another 47 extensionists provided service to 5,400 farmers through a private technical assistance (PTA) program cofinanced by the government and contributions from the farmers, who are expected eventually to undertake most of the cost. In total, INTA's various programs reach about 27,000 farmers (about 11 percent of the country's total).

INTA's service is free, with the exception of the program described in this article and the one provided through five private firms in the PTA. Under the PTA program the farmers were to cover some 20 percent of the cost in the first year (1996), and their contribution was scheduled to rise to cover most of the costs of the service within five years. In 1997 no farmer was paying more than 30 percent of the cost. An estimate of the average cost of public extension provision in Nicaragua (based on the INTA budget for 1995) suggests a cost per farmer of $115 a year.

Extension is also provided to a very limited extent by other bodies such as UNICAFE, the coffee growers association; UNAG, an association of primarily small farmers; and numerous nongovernment organizations (NGOs). In December 1995 UNICAFE reported employing fifteen full-time extensionists, while APENN (a national NGO) employed three. UNAG employed only two technicians in 1994, but also fielded a larger number of promoters in their "Campesino a Campesino" (farmer-to-farmer) program. (The promoters have very limited training.) NGOs generally provide extension free of charge. UNAG's program requires the farmers to offer a meal to the visiting promoter. The UNICAFE program is financed through a charge on coffee exports and is in effect a tax on production. Extension services of all types reach only a small proportion of the farmers of the country.

Designing and Planning Cofinanced Public Extension in Nicaragua

In 1994 INTA's budgetary difficulties forced the agency to rethink its relationships with its clients and the way it provided extension services. In particular, the agency thought it necessary to create accountability in the service and to institute payments by farmers that would make it possible to reward extensionists who delivered good results.

The Concept

With those objectives in view, the ATLMP sponsors—the World Bank and the Swiss government—sought to develop a demand-driven extension system. The principal shortcomings of the existing extension service to be corrected were:

- Unclear objectives: extensionists did not have a clear sense of what they were expected to accomplish.
- Poorly motivated workers and management: there were no incentives to produce results.
- No accountability to clients.
- Little consumer interest in obtaining quality service.

The design of a delivery system for demand-driven extension services was based on the following assumptions:

- Extension is an economic input.
- Extension generates new income.
- Farmers, even if poor, will be willing to pay for an input whose expected value is greater than its cost.

The objective of extension in this concept is to help farmers who receive the service to increase incomes derived from agricultural activities by increasing yields, reducing losses in the field and after harvest, reducing costs, improving exploitation of available resources, and designing a better mix of products.

The principal mechanism proposed by the sponsors to achieve the objectives and correct the shortcomings was to charge for the service, on the rationale that payment serves the following purposes:

- Extension staff begin to regard farmers as clients to whom they are accountable.
- When their remuneration is linked to economic results, extensionists have a stake in the farmer's success.
- People are committed to a service they pay for; they are careless of a service they get free.

Promoting the Concept of Cofinancing

When payment for public extension service was first broached in February 1994, the Nicaraguan authorities and the leadership of the major agricultural associations rejected it as unworkable, unfair, and contrary to tradition. Implementing a payment system over such objections would clearly have been impossible, so a discourse with all the various interest groups was initiated to persuade them to withdraw their opposition. Project sponsors approached leading officials in the Ministry of Agriculture and Livestock, the board of directors of INTA, and the leaders of the major agricultural associations individually, in each case presenting the rationale for payment, accompanied by many examples related to the work of the institution being visited. Free discussion generally led to grudging acceptance and finally to agreement. Ultimately, this campaign was so successful that cofinanced public extension is now accepted by all sectors, including the associations of small farmers.

The next step was to determine the reactions of the principal players—the extensionists and the farmers—and to identify, understand, and deal with any reservations and qualms that they might have. Formal and informal discussions with extensionists and other staff in INTA extension districts revealed that extensionists lacked self-confidence and conviction about the effectiveness of extension and its impact on farmers' income. They doubted that any farmer would be willing to pay for it.

To help build confidence and to deepen their understanding of extension objectives and performance, extensionists were invited to participate in group discussions with INTA management and sponsors in their regions. Using actual cases suggested by the extensionists themselves, they were guided on how to identify benefits from their service and to calculate the value of the advice they had given to farmers. Directed questioning helped them think through a process and assign a value to their work. These discussions succeeded in increasing their confidence and reducing opposition to the concept.

At the same time, meetings were held with small groups of farmers throughout the country. Following the same format and process as the meetings with the extensionists, these discusions helped farmers identify some benefits of the extension that they had received and place an economic value on the service. At the conclusion of these meetings, they were asked if they would be willing to pay for a service that increased their income. Although none evinced enthusiasm, in all but one case the farmers agreed that they were. These discussions served several purposes simultaneously: they helped farmers to place an economic value on extension; they showed extensionists (who attended the meetings) that farmers would not reject the idea of payment; and they sent a message to farmers that payment for the service was being considered. These discus-

sions, which set the stage for implementation, were carried out intermittently over several months before the concept was tested in the field.

Concurrently, INTA management, prodded by the sponsors to reflect on the probable economic situation in which the institution would no longer have access to external loans, generally acknowledged that the government could not maintain funding at the current rate, and that payment by farmers for extension services might help to fill the gap.

The Field Test

The field test was carried out in 1995 in the *postrera* season (the second of Nicaragua's two agricultural seasons: *primera*, which begins about May; and *postrera*, which begins in August). The purpose of the field test was to find out whether farmers would in practice pay for agricultural extension services—they had accepted the concept in theory in the previous round, but no one was asked to "put your money where your mouth is." The objects of the exercise were to test farmers' reaction, to show that extension has economic value, to gain farmer confidence by delivering on promises, and to establish the principle that the service is not free. It was decided to test the principles on four farmer groups in two regions.

In preparation for the test, a workshop was held with staff from the two regions, Esteli and Matagalpa. After the concept was presented, virtually all participants declared that it could never work. Although all had participated in the earlier discussions, the threat of actual implementation on their own turf again raised opposition. By the end of the day's discussion, however, there was actual enthusiasm for the idea and a genuine willingness to test it. The turning point was the clarification that the extensionists would retain all the money received from the farmers.

Because farmers would join the program voluntarily, the concept would have to be "sold" to them. They would have to be convinced that it was to their benefit to pay for the service. The guiding principles for the test were voluntary participation, no threats that existing services would be discontinued, negotiation on services to be given and received, and negotiation on price and terms of payment. Because only these four farmer groups would be paying, the package offered for payment had to be superior to the package given free of charge to all other farmers.

The workshop identified potentially interested groups, a short outline of what they would be offered, and how much they would be asked to pay (table 1). All agreed that the farmers most open to such a program would be those

Table 1. *Field Test, 1995: Payment Scale for Major Crops*

Crop	Payment scale (córdobas per manzana per month)[a]	Duration of season (months)
Tomatoes	10	3
Beans	6	3
Maize	4	4

a. At the time of the field test, US$1.00 = 7 cordobas, one manzana = 0.7 hectares.
Source: Data collected by INTA staff and processed by the authors.

who raised a cash crop, who had access to some credit, and whose yields could readily be increased by better farm management.

The prices set had to meet the following criteria: the sum had to be one to which a farmer would not be indifferent; and the total income expected (the sum of all payments) had to be a sum that would constitute an incentive to an extensionist. The prices were unrelated to either costs or benefits. Rather they were based on the sum paid monthly by low-income families for electricity. This was felt to be an indicator both of their ability to pay and of how much they would be willing to pay for a service promising some benefit.

Each region was permitted a great deal of latitude on the services offered and the rate charged. Cost recovery was not an objective either of the test or of the concept in general. Each region was free to propose any program within the scope that INTA thought to be attractive to the farmers, provided that the services offered did not go beyond those that extension traditionally provides. The essence of the package offered was greater frequency of visits of extensionists to farmer groups and included the right to a few visits to the plots of individual farmers. Extensionists would not offer advice on what crops to grow unless specifically requested, and not before gaining the confidence of the farmers by helping them to achieve better results than they traditionally obtained.

The selling process consisted of meetings with the farmer groups originally targeted, as well as others added later. The farmers accepted the idea of payment with relative ease. They generally claimed to have no access to credit, however, and maintained that without credit they would be unable to pay for the service; it soon became clear that they would not participate without being given access to credit. In Matagalpa the groups approached were also targeted by a local NGO dedicated to the export of nontraditional crops. This NGO offered intensive extension along with credit, land preparation, and marketing. The farmers rejected INTA's offer as inferior. No alternative groups were located in Matagalpa, probably because the INTA team felt weak in comparison with the "competition" and was demoralized by the failure of its first attempt.

In Esteli the farmers also conditioned their participation in the scheme on access to credit. INTA's regional director took the initiative of directing the funds for seed production, which he had available from another NGO, to groups of farmers that would agree to participate in the test. Two groups accepted the offer and entered into an agreement with INTA.

The agreement was basically between the farmers and the extensionist: INTA backed it. The farmers wanted a weekly visit to the group (rather than the customary biweekly visit) and asked for visits to individual fields on demand. Because the groups were centrally located and readily accessible, this request was easy to accommodate. INTA required the extensionist to devote some personal time to this service, including visits on Saturdays and Sundays.

Payment would be on the basis of the crop rates suggested above (see table 1), but only half the sum collected would go to the extensionist. The farmer groups had decided to use this opportunity to build up their own capital by retaining the other half in a fund. They also requested that payment be based only on some of their crops; they did not feel the need for advice on the farm as a unit. These changes were not desirable but were approved to get a field test of the system up and running.

A meeting to evaluate the experience was held by INTA managers and the sponsors at the end of the season to hear reports by the farmers and the extensionist. The farmers reported that the extensionist had visited even more than once a week. They also readily acknowledged that the test had been a success and that they were satisfied with the results. The most notable improvements were in tomatoes. They reported harvesting about 800 boxes of tomatoes per manzana instead of the 600 boxes they traditionally harvested, a difference they ascribed to extension. The extensionist, however, was not content with the return for his efforts. He had devoted a great deal of his own time to the test and had assumed that he would earn a higher sum than he ultimately did—the equivalent of about one week's salary for the three-month season (table 2). He acknowledged, however, that the field test was a preparatory phase and

Table 2. *Amounts Paid to Extensionist*

Crop	*Area (manzanas)*	*Rate (córdobas/month)*	*Duration of season (months)*	*Total paid (córdobas)*	*Paid to extensionist (córdobas)*
Tomatoes	12	10	3	360	180
Beans	18	6	3	324	162
Maize	6	4	4	96	48
Total	n.a.	n.a.	n.a.	780	390

n.a. Not applicable.

Source: Data collected by INTA staff and processed by the authors.

showed promise for the future. He was also proud of the reputation he had gained among his clients and of his status among his peers.

The farmers were asked how they had arrived at the decision to pay the sum of 5 córdobas per manzana per month and whether they did not feel that a higher sum was justified. They replied that they were too poor to spend more on the service. Upon further questioning, they reported that the average price received was about 15 córdobas per box of tomatoes, giving a gross additional income of about 3,000 córdobas per manzana. They calculated their additional costs (mainly for boxes and transportation) at some 1,800 córdobas, leaving them with a net income of about 1,200 córdobas per manzana. They had earned this sum in return for an expenditure of about 15 córdobas per manzana (three months at 5 córdobas). When presented with this calculation, they were surprised at the extent of the economic benefit and agreed that it was far in excess of what they had paid.

In proving that the approach was feasible, albeit on a very small scale, the positive results of the test gave a strong impetus to the program. When it was announced that the trial would be expanded and a pilot carried out during the following season on a larger scale, extensionists throughout the country were eager to participate.

The Pilot

The pilot program was launched in the *primera* of 1996, after completion of the test, building on the lessons learned to apply the concept on a larger scale.

Strategy

Before broadening the scope, a strategy had to be developed for introducing cofinancing into forward planning for public extension as a whole. The plan defined three classes of service: free (traditional); participative (cofinanced, carried out by INTA's staff); and private (cofinanced, carried out by private consultant firms). The essence of the strategy was that future extension would end up in one of the two cofinanced modes after a process of transfer from free to cofinanced extension. Free extension was to be limited to a maximum period of two to three years, after which the farmer would either transfer to cofinanced extension or would cease to receive the service.

Free extension was to be viewed as a "free sample" to interest new clients in the service and would at any time in the future be only a small percentage of the total clientele. For current clients, free extension would also be phased out and the service either transferred to one of the cofinanced modes or discontinued,

but a decision as to the date was postponed until more experience with the concept could be gained.

Tools

Extensionists were trained to use tools developed for use in the pilot, principally the preparation of contracts, forward planning of both farm and extension activities, measurement of results, and monitoring of progress.

The *contract* formalizes the arrangement between a group of farmers and the extensionists: what services are to be provided at what price. The contract establishes the seller-buyer relationship between the extensionist and the farmer. It contains an outline of the services that a group of farmers might want and the price thought acceptable. It is meant to be revised after negotiation.

Rapid analysis of the farmers' resources and constraints, to be based on information about the fundamental features of the farm, gathered using a standard data collection form, is a tool for extensionists to use in planning and advising farmers.

Farm planning in this context does not imply a farm plan in the normal sense; rather, it is a means of setting objectives in order to create a "promise" on the part of the extensionist and an "expectation" on the part of the farmers, as well as a benchmark for measuring the success of the service. The form used places the "traditional" yield and the "promised" yield side by side.

Plans for the extensionist's activities must be relevant to the farm plans and not general to the extension service. On this basis the extensionist selects and plans the subjects to instruct in, the types of field demonstrations relevant to the farmer groups, and where and when to carry them out.

The farmers themselves must *measure results* because the extensionist cannot be present at all harvests and all times of production. Measurement by the farmer includes both products sold and those used in home consumption and must be continuous or intermittent, depending on the crop. Extensionists are advised to check regularly to see whether the forms are being filled in and whether the farmer has encountered any difficulties in this activity. After all harvesting is concluded, the farmer and extensionist should jointly estimate the value of increased yields, calculate and deduct any additional costs associated with the recommendations, and finally calculate the outcome.

An intense *program of support and monitoring* was prepared, to be carried out by the pilot promotion team and a person assigned to provide support in each region, selected because of his or her dynamism and enthusiasm for the program. This support person would maintain regular contacts with the extensionist and the groups. The promotion team would visit each region once a month, and the support persons from all regions would congregate once a month in a

different region, coinciding with one of the promotion team's visits. The meetings would include sessions with the extensionists and with the farmer groups. In addition a workshop was programmed for the end of the season.

Results

Eighteen groups signed up to participate in the pilot by early 1996. Of these, seventeen remained and received extension services throughout the season (the eighteenth dropped out because of early flooding of its fields). Some individual farmers who had misinterpreted the payment for extension as meaning that it was a credit program, dropped out of the groups. Ultimately, 280 farmers were served. Several changes and adjustments occurred during the pilot. Many of the agreements changed after signing, partly because early losses of crops obliged the farmers to revise their original farm plans late in the season. Although such revisions may be common, their design and the provision of advice for the new plans constituted an important part of extension work. Another element of the original design, the rapid analysis form, was dropped because it proved so time consuming to complete.

A breakdown of the area grown by different crops and by farmer groups is shown in table 3; the results, reported in terms of yields and net benefits to farmers, are presented in tables 4 and 5; and sums payable to extensionists and the actual payments (by June 1996) appear in table 6.

Table 3 shows that more than 50 percent of the area was devoted to beans, a crop grown by ten of the seventeen farmer groups. The three major crops—beans, corn, and rice—covered 85 percent of the total area of the pilot.

Table 4 shows the data on basic crops reported by twelve of the seventeen groups. Four others specialized in cattle raising or, less commonly, in vegetables.

Table 3. *Crops Contracted*

Crop	*Percentage of area*	*Number of groups with this crop*
Beans	54	10
Corn	22	8
Rice	9	2
Tomatoes	6	6
Sesame	4	2
Sorghum	3	4
Other crops	2	4
Livestock	n.a.	4

n.a. Not applicable.

Source: Data collected by INTA staff and processed by the authors.

Table 4. *Net Incremental Income by Regions and Crops*

Region/group	Number of farmers	Crop	Area (manzanas)	Yield (quintal/mz)		Farm incremental yield (quintal)	Price per unit of yield (córdobas)	Farm		
				Traditional	Actual			Gross incremental income (córdobas)	Incremental production costs (córdobas)	Net incremental income (córdobas)
A-1/Quetzalgue	23	Corn	6	20.0	10.0	−60.0	55	−3,300	−690	−2,610
A-2/Masaya	27	Beans	27	9.0	10.0	27.0	220	5,940	4,430	1,510
A-2/Carazo	16	Beans	15	12.0	9.8	−33.0	500	−16,500	1,530	−18,030
A-2/Ticuantepe	16	Beans	18	9.0	13.9	88.2	250	22,050	3,714	18,336
		Corn	1	20.0	20.0	—	100	0	205	−205
A-2/Cardenas	19	Rice	26	64.0	68.9	127.4	140	17,836	11,401	6,435
B-3/Jalapa	24	Beans	24	8.0	6.0	−48.0	180	−8,640	2,760	−11,400
B-3/Ocotal	25	Beans	4	6.5	10.0	14.0	150	2,100	137	1,963
		Corn	22	26.0	41.1	332.2	55	18,271	3,713	14,558
B-3/Condega	22	Beans	15	8.0	3.0	−75.0	150	−11,250	3,375	−14,625
B-5/Barro	31	Beans	21	12.0	8.6	−71.4	200	−14,280	5,607	−19,887
		Corn	19	15.0	14.2	−15.2	60	−912	2,701	−3,613
B-5/Cebadilla	15	Beans	17	8.0	5.3	−45.9	200	−9,180	3,288	−12,468
		Corn	12	12.0	7.1	−58.8	40	−2,352	−4,106	−6,458
C-6/Boaco Viejo	16	Beans	12	15.0	19.1	49.2	200	9,840	143	9,697
		Corn	10	15.0	18.5	35.0	40	1,400	120	1,280
C-6/La Libertad	9	Corn	2	20.0	18.7	−2.6	80	−208	400	−608

Note: Corn, beans, and rice only.

Source: Data collected by INTA staff and processed by the authors.

One group in Region C-6 did not provide information on its results. Of the sixteen groups reporting, eight recorded net gains and eight net losses. Three of the groups that had losses, reported increased income in one or more of the crops. Table 5 summarizes the results reported by all groups by region.

The quality of the data received from the fields was questionable. Some data on yields and income were inconsistent and had unexplained variations among farmers. For example, in some cases the yields and the net benefits with extension were reported to be lower than without this service. This would be a very unfortunate fact indeed, if true. But, because almost all farmers reported their satisfaction with the service and signed contracts for the following season, it could not have been true. The more likely conclusion is that farmers were not aboveboard, overestimating traditional yields and underreporting actual yields; they probably also inflated their traditional costs of production. The potential for such misreporting revealed a weakness in the reporting system as well as a professional weakness among the extensionists, who were themselves unfamiliar with traditional yields and unable to estimate visually the expected yields by observing the fields during the season.

Some data on drop in yields, however, were correct. On some farms a variety of beans was promoted that was not suitable to the prevailing conditions. Also, in some areas flooding and late planting because of heavy rains clearly affected the yields.

The farmers paid more than 60 percent of their fees within a reasonable time (June 1996, see table 6), indicating that they were willing and able to pay. Recovery might have been higher, but many extensionists were reluctant to collect, feeling uncomfortable with this activity. Most of the remaining farmers ultimately paid their outstanding balances, because all were informed that ful-

Table 5. *Net Incremental Income by Farmer Groups*

Region	*Number of farmers*	*Area of crops (manzana)*	*Number of livestock*	*Value of difference (córdobas)*[a]	*Incremental production costs (córdobas)*[b]	*Net incremental income (córdobas)*
A-1	55	21	95	−13,710	−170	−13,540
A-2	78	88	—	28,808	21,389	7,419
B-3	75	77	—	22,457	14,789	7,668
B-5	46	77	—	−38,488	16,062	−54,550
C-6	26	35	362	114,288	14,836	99,452
Total	280	298	457	113,355	66,906	46,449

a. Difference between previous season yields (*primera* 1995) and *postrera's* 1995 yields, multiplied by market price.

b. Additional production costs in the *postrera* 1995 compared with the situation before the test (i.e., *primera* 1995).

Source: Data collected by INTA staff and processed by the authors.

Table 6. *Payments for Extension Services, Postrera 1995*

Region	Total agreed (córdobas)	Total paid by June 1996 (córdobas)	Percentage paid	Range of percentage paid by group
A-1	3,258	1,457	44.7	20.7–61.5
A-2	2,056	1,594	77.5	47.8–100.0
B-3	3,970	2,820	71.0	0.0–100.0
B-5	1,410	1,410	100.0	—
C-6	1,061	158	14.9	0.0–27.0
Total	11,755	7,439	63.3	—

— Not available.

Source: Data collected by INTA staff and processed by the authors.

filling their payment agreements was a condition for receiving the service in the following season.

Lessons Learned

Several preliminary lessons drawn from the pilot were applied in the subsequent season and may guide other countries interested in similar application of cofinanced extension.

The System Works

Farmers agreed to pay for the service, and most of them paid as agreed. They uniformly voiced their satisfaction in discussion with INTA staff and the pilot sponsors and voted with their feet by signing new contracts for the following season. The most common comment was that the extensionist was much more attentive and responsive to their needs than in the past. This had indeed been the primary objective of the concept.

The additional income extensionists earned in the course of the pilot instilled both a desire to seek out more clients and to serve existing clients better. A notable expression of this spirit was pressure by the extensionists to decrease the number of days devoted to training (which was reduced by management to a maximum of two days per month), whereas previously they had pleaded to be included in all training and workshops offered regardless of how this would affect their visits to the farmers.

The principal indicator of the success of the method is that all seventeen original groups have continued and by the *postrera* of 1996 (one year after the

testing of the pilot was initiated), the number had increased to 135 groups with 1,737 farmers.

The Process of Persuasion Is Critical

The sponsors proposed a concept that held high promise but that was also contrary to tradition and unpopular politically. Identifying the sources and reasons for the opposition, understanding the nature of the objections, resolving problems, and making allies of the opponents, all before any action was taken, were crucial steps to success. Actors at all levels, including farmers, participated in discussions and in developing the practical aspects and tools of the system. Many of their ideas were accepted and integrated, even when serious doubts existed about their viability or desirability, as long as they were not contrary to the basic principles. As long as the idea did no damage and could be corrected later, the support of the participants was considered to be paramount. Care was taken to ensure that the staff never felt that the concept was being imposed on them but rather that they were part of it.

It was also essential to avoid pushing too hard or too fast. Ideas are absorbed gradually, and even when understood intellectually, they are not truly assimilated until they become reality. Quantitative goals projected more than one season ahead appeared too outlandish and only indicated to INTA's staff and the farmers that the speaker did not have his feet on the ground. In the event, later goals were easily achieved and even surpassed.

The deep commitment and conviction of the sponsors and their perseverance was another element critical in the success. A high percentage of the time devoted to this pilot went into jawboning. Sponsors resisted the temptation to rush headlong into field testing, delaying implementation until the entire stage was properly set.

Start with a Comprehensive Strategy

From the outset the philosophy underlying the pilot was clearly articulated and concentrated on a small number of principles. Although the pilot was small, the sponsors and INTA management regarded it as a test of the methodology of the future, and consequently of interest to all—never as an activity affecting only a few staffers and a few clients. INTA management agreed to a strategy for full implementation of the concept, even while the pilot was little more than an idea. Thus the pilot was always part of the big picture and staff members knew where they were heading.

Staff at all levels participated in discussions on the whys and wherefores of the approach. No one was asked to do anything without first receiving explana-

tions of the logic behind it. Furthermore, detailed tools for all the major stages were developed and training given in them, even though the pilot was small. Many more staffers were trained than would actually participate in the pilot.

Key Issues

The pilot proved that the concept was feasible and accomplished its purposes. But the pilot also highlighted problems and issues that needed to be dealt with in order to refine the concept and make it more generally applicable.

ABILITY AND WILLINGNESS TO TAKE INITIATIVE AND TO ADAPT. Although informed that the typical contract was a model and had to be adapted to the specific agreement negotiated between the extensionist and the farmer group, virtually no extensionist modified a contract. More accustomed to following instructions than to adapting to the specific needs of their clients, they retained the original form down to ". . . visiting every other Thursday . . . ," not even changing the day. This is a big problem, with implications far beyond its manifestation in the issue of contract modification, and requires both better staff selection and training to make extensionists capable of showing more initiative.

PRICING POLICY, PRICE OF SERVICE, AND TIMING OF PAYMENT. The matter of pricing was approached pragmatically and allowed for many variations. The only firm requirement was that some payment be made for the service. There was never any intention to charge by cost of service. The sponsors had set out to test whether farmers would pay for extension, and whether this would make extensionists responsive to their clients, not whether the full cost could be recovered from the clients. It was felt that realistic prices could be defined only after sufficient experience had been gained, and any price set at the outset would be no more than a "bargaining price." Payment was set by crop and area during the course of the growing season, because the growing season sets the cycle of farm expenditure and earning and the policy would therefore be explicable and acceptable to farmers; farmers never questioned this policy.

Payment was divided into two categories: by crop and time (payable throughout the season); and as a percentage of increased yield (payable at the end of the season). The payment as a percentage of incremental yields is problematical, because the greater the increase in yield, the greater the payment. The farmer then has good reason to withhold information on higher yields and, because the extensionist cannot be present at every harvest, a potential for misreporting is introduced. The sponsors agreed to include this form of payment despite reservations; in the event, this was probably partly responsible for the misreporting of yields.

Pricing the products also presented some problems. Many products are sold over a period of time during which prices vary; the farmer does not necessarily keep accurate track of the prices received nor of the quantities sold at each time—and is unlikely in any case to share this information with the extensionist. And how to deal with products stored and sold later? Those who sell immediately upon harvest receive a lower price than those who have invested in storage facilities and are able to hold on until the price rises. Should the extensionist share in the increased profit?

Having decided what to charge for the service, the question remained when the payment should be made. To offset the risk of default, the sponsors wanted payment to be made throughout the season, not only at the end. Initially there was some resistance to this, but ultimately more than half of the sums were paid during the season. It is expected that as both farmers and extensionists become more accustomed to the system, the bulk of the payments will be made during the season (with the exception, obviously, of the portion based on yield increases).

MEASUREMENT AND REPORTING. The method of measurement applied in this pilot was oversimplified and inaccurate, but it did accomplish its main objectives. It made the farmers aware of the need to measure the value of the service, put pressure on the extensionists to perform, and served as an important exercise in analyzing information and trying to learn from the results. The method deliberately ignored the fact that, insofar as extension delivers a previously unfamiliar technology that increases yields and income, the flow of benefits continues for many years—in other words, that the actual value gained by the farmer is far in excess of the net benefit gained in one season. Only those benefits that could be measured easily and only improvements in the "cofinanced crops" themselves were measured. More complex, difficult-to-measure phenomena and benefits gained as a by-product in other activities were excluded. There is then a strong downward bias of the value. Farmers are reminded that the benefit is "at least such and such a sum."

One weakness identified in the reporting system was that management was undemanding about the quality of the data, primarily because of inexperience in actually using the data in its decisionmaking. Extensionists were aware of this laxity and therefore tended to supply figures with little basis in fact. Strong action was taken to correct this. Cavalier reporting will probably be a problem in other places as well and should be dealt with early.

PROFESSIONAL QUALIFICATIONS. In the course of the pilot, the promotion team focused only on the method of delivery and on its management and organization. It was assumed that the extensionists were already equipped with know-

ledge on a range of agricultural technologies, farm problems, and their solutions, and had the necessary ability and experience to diagnose problems adequately and to suggest remedies. These assumptions were found to be only partially sound. Farmers expect the extensionists to be at a very high professional level. Extensionists cannot simply be conveyors of messages to farmers. They must be able to provide advice on more complex farm management issues. Farmers' expectations are important both in evaluating the resources necessary to provide such a service and in calculating its cost. The service cannot work with poorly trained technicians.

As well as training in farm management and basic economic analysis, training for extensionists in elementary marketing skills to sell the service to potential clients was also found necessary. When establishing a new system, extensionists should be selected according to their training, experience, and proven abilities to analyze and diagnose. Well-trained people are likely to be available in any given country.

PARTICIPATION OF WOMEN. Women constituted some 21 percent of the clients in this pilot. (No special effort was made to target women.) Although INTA does not collect data on the number of women it serves under its regular program, indirect indicators show that the pilot served about the same number of women as the regular program. The potential impact on women in a demand-driven extension system is a subject that merits further study.

DISTRIBUTION OF INCOME AMONG SUPPORTING STAFF. The scope of the pilot was too small to apply all elements of a fully operational system. Distributing the small sums collected among the staff would have nullified the incentive effect; consequently, the entire payment remained with the extensionist. The long-range plan, however, is to distribute the income widely among the staff members who contribute to the effort, as more clients are added and income increases. The extensionists depend on subject-matter specialists for problem solution, on administrative staff for transport, and on others to enable them to provide a satisfactory service to their clients. A formula has been developed for distribution as income increased, to be applied in subsequent stages.

Conclusions

The sponsors of the pilot set out to test whether a truly demand-driven extension system aimed at farmers with small- and medium-size holdings could be developed. Central to the design was the principle of accountability of extensionist to client: the farmer would be charged for services received, and

the extensionist would benefit in direct relation to this payment. The incentive system thus introduced proved effective: by the end of the season, 60 percent of farmers had paid for the service, and all of the rest had agreed to pay their debts as a condition for receiving the service in the following season. The principal indicators of success are the repeat contracts with all participating groups, and the continuing expansion of the service (from 17 groups and 280 farmers in the 1995 pilot to 135 groups with 1,737 farmers in 1996). Critical to the project's viability was the period of intense activity before field testing dedicated to persuading the various actors of the viability of the concept, identifying and analyzing opposition, and making necessary corrections and adaptations. Without this careful stage-setting, a cofinanced system would have had little chance of getting off the drawing board.

The success—albeit on a small scale—of the pilot shows promise that the concept could contribute to the sustainability of extension activities in general. Ideally, agricultural extension services should continue to be offered as long as there is demand for them, even after World Bank–financed project funding is terminated. Given the notorious unreliability of government funding, the only sound basis for sustainable operations is demand, in the form of willingness to pay, and the returns for supplying a service, in the form of payment. The test did not set out to discover whether a demand for extension exists at a market price, but the results do indicate that farmers will pay something for the service. In most European countries, farmers pay about half the cost of extension, with government covering the other half (Ameur 1994). Clearly the prospects for sustainability are much improved if farmers are willing to pay a 50 percent share.

In sum, the results of the pilot operation in Nicaragua suggest that cofinanced agricultural extension could contribute to the quality and sustainability of the service elsewhere. If the lessons learned are absorbed, the process described in the article could be followed to apply the concept successfully in a wide variety of situations in developing countries to the benefit of the farmers served by the extension service.

Notes

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Reconsidering Agricultural Extension

Robert Picciotto • Jock R. Anderson

The institutional design of agricultural extension programs in developing countries has always been subject to heated debate. But whereas previous disagreements centered on the relative efficacy of different organizational approaches to public service delivery, the questions currently raised by agricultural policymakers and extension practitioners go far deeper. They reflect a new conception of the role of the state in the rural economy (Pasour 1990; Timmer 1991; Meerman 1997), the continuing revolution in communications technologies (Zijp 1994), and the growing influence of the "new institutional economics" in development thinking (Hoff, Braverman, and Stiglitz 1993; Klitgaard 1995).

Rural Development Antecedents

Fifty years ago agricultural extension organizations in developing countries mirrored the administrative traditions of the former colonial powers (Axinn and Thorat 1972). Like other agricultural support services, extension services were geared to producing and marketing export commodities. Accordingly, crop-oriented extension programs were common. The scope of extension programs expanded in the 1950s as the newly independent states of Asia and Africa sought to increase food production and to spread the benefits of improved farming techniques more widely. As extension organizations sought to expand their reach both to more farms and to more types of farming, their production orientation weakened (Baxter, Slade, and Howell 1989; Macklin 1992; Schwartz and Kampen 1992; Anderson and Hoff 1993).

The economic strategies of these pioneering years relied on heavy state intervention, import substitution, and rapid industrialization. In this context the urban bias of development policies, the adverse terms of trade faced by farmers, and the limited stock of improved technologies available for dissemination all hindered the productivity of rural development programs. In turn, extension

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programs often relied on the proposition that farming productivity was held back not so much by technological and economic constraints as by farmer apathy, inadequate social arrangements, and lack of local leadership. Often, extension agents came to be viewed as the foot soldiers of "nation-building" campaigns aimed at multiple economic and social objectives.

In the 1950s and the early 1960s, the agricultural extension service tended to be subordinated to multipurpose rural development programs. Extension agents carried out a variety of functions, ranging from credit delivery and input distribution to sundry coordination duties. And because extension agents were among the few government officials available at the village level, they were often asked to undertake clerical, statistical, or even political chores. Typically, the service had only weak connections to agricultural research.

Looking back, the rural development movement was the victim of a poor enabling environment for agricultural development. Eventually, it fell into disfavor as lack of profitable technical packages and an overly broad agenda led to a thin spread of resources, excessive administrative costs, and slow agricultural production growth. Still, considering the constraints then prevalent, integrated rural development achieved notable success by nurturing local leadership, enhancing the influence of rural constituencies, and creating a physical and administrative infrastructure at the local level that proved invaluable for future production-oriented programs (OED 1988; Donaldson 1991).

The Advent of the Training and Visit System

In the late 1960s and early 1970s technology diffusion became the focus of agricultural extension. The economic rationale for the shift was powerful: new high-yielding, fertilizer-responsive crop varieties were available for dissemination, and food shortages forced output prices high enough to make the use of the new technologies profitable (Lipton with Longhurst 1989). These conditions in turn created a favorable situation for the adoption of a major organizational innovation—the training and visit, or T&V, system (Benor, Harrison, and Baxter 1984).

Under T&V agricultural extension was expected to act as a transmission belt between agricultural research centers and millions of small farmers. The reorientation of the agricultural extension system from a desk-bound bureaucracy to a field-based, professionally motivated cadre of agents, closely connected to research and geared to the systematic promotion of improved cultural practices through a strict calendar of daily visits and weekly training sessions, amounted to a major reform of agricultural services.

Yet the degree to which the remarkable food production gains of the green revolution can be attributed to any particular institutional mechanism, such as

T&V, has long been disputed (see Raman, Balaguru, and Manikandan 1988; Lipton with Longhurst 1989; Antholt 1991; Feder and Umali 1993; Foster and Rosenzweig 1996; and Evenson, Pray, and Rosegrant forthcoming). In any event T&V has often cohabited with other means of diffusing new technologies. Even in India, the cradle of the T&V method, alternative approaches to extension continued to operate in many states, and agricultural research organizations never abandoned their farm demonstration programs.

Similarly, crop-oriented extension programs did not completely disappear, and funding continued to be provided for diffusing veterinary and milk production advice through the cooperative dairy movement. With help from the United States Agency for International Development, the land-grant college approach (which links extension activities to university-based research and training programs) retained influential adherents and scored significant successes, especially in the Uttar Pradesh and Punjab regions of India.

This said, T&V has dominated agricultural extension in South Asia and Africa for more than two decades, partly because of the strong support offered by the World Bank. About 5 percent of the Bank's agricultural lending has been devoted to extension. Currently, sixty-four active Bank-financed projects include extension components, a majority of which apply T&V principles.

Agricultural extension today is at a crossroads. The T&V star has risen high on the firmament of agricultural policy only to become prey to severe criticism and to a new, pluralistic doctrine of agricultural extension (Zijp 1996, World Bank 1997). What explains the rise of an alternative paradigm?

Evaluating T&V Projects

A World Bank study (Purcell and Anderson 1997), based on independent evaluations of thirty-three free-standing agricultural extension projects, shows that 70 percent had satisfactory outcomes, that is, they met their major relevant objectives efficiently. The share of satisfactory outcomes varied widely across regions—from a high of 83 percent in South Asia to a low of 53 percent in Africa. Although this success rate is higher than that of the Bank's overall agricultural lending portfolio, it compares unfavorably with the performance of the human resource portfolio (about 80 percent).

The T&V approach was used in 90 percent of the projects reviewed. All successful projects helped to heighten the government attention to technology transfer and to increase the volume of work achieved by the implementing agency, resulting in better-trained staff, enhanced coverage of farmers, expanded focus on technology, and improved delivery of extension services. In particular, T&V increased extension agents' contacts with farmers, thanks to staff mobility and the programming discipline associated with the approach.

The study, however, highlighted several disturbing deficiencies.

- Ninety percent of the projects faced budgetary constraints, in part because almost half did not evince strong borrower or implementing agency ownership
- More than half of the projects suffered from inadequate extension messages resulting from research weaknesses or poor linkages between extension and research
- Twenty-five percent of the projects were hindered by the low education level of frontline staff
- The training programs of more than half of the projects did not give the frontline staff sufficient practical knowledge, and
- Almost 40 percent of the projects suffered from inadequate adaptation to local conditions.

T&V's hierarchically organized and strictly programmed method of agricultural extension presumes the availability of a sustained flow of research innovations coupled with the ability of implementing agencies to secure, retain, and motivate good technical staff. Where both of these elements were available, T&V may well have accelerated the spread of new agricultural technologies on a rewarding scale. Where the initial conditions were not suitable—for instance, because farming conditions were highly differentiated, the research pipeline was empty, and either a disciplined organization or adequate skills, or both, were lacking—T&V proved poorly adapted to the challenge.

T&V usually has been introduced on a national scale after only limited pilot programs—a pattern that has usually led to sharp increases in budgetary outlays. Antholt (1991) notes that the long-term consequence of increased payrolls has had detrimental effects on resource allocations, as nonsalary requirements eventually have been squeezed by the increased emoluments of an aging extension cadre. As a result frequent concerns have been expressed regarding the fiscal sustainability of the T&V system.

To be sure, the blueprint nature of extension programming associated with T&V has been modified to encourage adaptation to local conditions, but the hierarchical mode of operation still lacks flexibility and fails to encourage cost recovery, development of farmer-led programs, or private-sector participation. T&V has thus remained dependent on outside sponsorship and support.

In countries with a supply of relevant research innovations and able staff, as in India, "trait making" (that is, the adoption of an imported institutional model; see Hirschman 1967, p. 131) succeeded, and the innovation was integrated into the agricultural administration. Elsewhere (for instance, in Turkey, where it was first tried), the management discipline of the system eroded, and T&V was eventually abandoned. Remarkably, the Bank study found that only 33

percent of the extension projects with satisfactory outcomes were considered sustainable (Purcell and Anderson 1997).

Thus several Asian countries have found the T&V approach poorly adapted to their needs (Antholt 1994). After a five-year trial of T&V in the early 1980s, Thailand moved to a participatory approach, driven by farmers deciding at the local level what extension service is desired. Malaysia, focusing on tree crops, has emphasized since 1984 a market-driven model, under which farmers contribute to the costs of the extension services received. Neither Bangladesh nor Pakistan was able to induce better extension practices through T&V, and in Indonesia T&V had little impact in dryland, multicrop systems. Currently, T&V's momentum is restricted to Sub-Saharan Africa.

Economic Analysis of Extension Projects

In principle, the economic analysis of extension projects requires systematic comparison of costs and benefits with and without the project (Birkhaeuser, Evenson, and Feder 1991). In practice, systematic social experiments comparing different methods of extension in similarly situated areas have not been conducted. Where extension programs have been evaluated by comparing outcomes in similar contiguous areas, the results have been nuanced. Work by Feder, Slade, and Lau (1985); Feder and Slade (1986); and Feder, Lau, and Slade (1987), which compared productivity differentials in Haryana and Uttar Pradesh in India, suggest that T&V had no significant impact on rice production but yielded economic returns of at least 15 percent in wheat-growing areas. Similar work in Pakistan (Hussain, Byerlee, and Heisey 1994) found smaller effects in wheat areas, although they recorded an increase in the number of contacts between farmers and extension agents, suggesting that the contacts were ineffective.

By contrast, the extraordinarily high rates of return for expenditures on agricultural extension estimated by Bindlish and Evenson in this issue are not robust because of inadequate baseline estimates, uncertainties about the causes of technology adoption, unknown lags in causal effects, and so on.[1]

Of greater relevance to policymakers is the analysis in this volume by Umali-Deininger (1997), which throws light on the appropriate roles of the private, voluntary, and public sectors in funding and delivering agricultural extension services. The paper is a useful exploration of public-funding rationale, as canvassed by Lindner (1993) and recently recommended by Devarajan, Squire, and Suthiwart-Narueput (1997). The implication is clear: where the knowledge being diffused is embedded in or closely associated with market goods (for example, plantation crops, tractors, or hybrid seed), it is best to leave the deliv-

ery of advisory services to the private sector within an appropriate regulatory framework.

Where, however, the technology or practice being promoted is associated with a toll good (such as farm management or marketing information), delivery of extension advice is best handled by a judicious combination of public and private entities (Umali and Schwartz 1994). If a common-pool good is involved (forestry, fisheries, common pastures), it is critical to connect the extension effort closely to cooperative or voluntary action. Only where market and participation failures are high—for example, where subsistence farming dominates, as it does in Sub-Saharan Africa, or where social conditions preclude voluntary action, as they do in Myanmar—is a pure public-sector approach to agricultural extension desirable.

Toward a New Paradigm

Umali-Deininger's thesis reflects the growing influence of the new institutional economics in development thinking (for example, Hoff, Braverman, and Stiglitz 1993; Picciotto 1995). It offers a pragmatic approach to institutional design, equidistant from the dogmas of massive market failure and cynical "public choice" theory. The paper may prove seminal, for it provides the theoretical rationale for a pluralistic approach to extension far better adapted to the current challenges of agricultural development than the assembly-line model of technology diffusion embodied by T&V. Three challenges underlie the need for a new approach.

First, developing country governments are under severe strain. Not only can these governments ill afford to employ large numbers of extension workers on a permanent basis, but their administrative capacities are severely strained by the demands of an increasingly far-flung and technically sophisticated organization of extension agents, who they are not always equipped to train, reward, and motivate (Antholt 1994, p. 28). A new role for the state is emerging that gives pride of place to the creation of enabling environments for private and voluntary action rather than to the direct provision of services.

Second, the perception of agriculture's potential and constraints has changed. In many situations the dissemination of standard packages of inputs and practices is no longer relevant, if indeed it ever was (Simmonds 1988). What is increasingly required is an approach that can generate custom-made, environmentally friendly solutions based on the farmers' involvement (Anderson 1991; Axinn 1991; Eponou 1996; Purcell and Anderson 1997).

Third, the spread of education and modern communications and the rise of commercial farming have created opportunities for alliances among the public,

private, and voluntary sectors. More open and liberalized agricultural markets are bringing the knowledge and skills of private agribusiness to farmers without involving public-sector intermediaries. In both more- and less-developed countries, farmer-led approaches to extension are spreading, while farmers' associations, cooperatives, and self-help agencies are contributing handsomely to the diffusion of modern technology.

According to Tendler (1997), informal performance contracts between Brazilian farmers and extension agents have increased the commitment of extension workers, improved the customization of advice, and increased productivity. In Indonesia integrated pest management programs held at the Food and Agriculture Organization's farmer field schools show the value of turning farmers into extension agents and extension agents into farmers, as well as the diffusion potential implicit in group learning and the use of farmers as trainers (Kingsley and Musante 1996).

A total shift from public funding to client funding may not be in the public interest, given the external benefits of technology diffusion and legitimate equity concerns (Dinar 1996). But there are obvious benefits, above all value for money, associated with a demand-driven approach. In some settings public extension systems still need to be involved in the diffusion of technology; in others governments should divest themselves of these support services. Everywhere governments should seek to enhance the voice of farmers and the cost-effectiveness of service delivery. In other words, unbundling the twin government roles of financing extension and actually delivering extension services has become essential.

Centralized mainline extension services must continue to give way to a variety of hybrid solutions, combining public support with private delivery methods. Cost-sharing and voucher systems can increase the voice of farmers in the management of extension systems (World Bank 1990; Antholt 1994). Contract extension, where extension agents contract with farmers to provide the information they request, long practiced in China, can increase responsiveness. In Ecuador extension agents sharecrop with farmers for a profit. Costa Rica has experimented with vouchers that promote private technical assistance to small- and medium-scale producers.

Similarly Chile publicly finances 70 percent of the costs of private technology-transfer firms, which contract with small-scale producers; similar services operate in Mexico and Venezuela. In New Zealand gradually rising cost-recovery targets were set for the public extension service and were easily exceeded from 1988 until 1994, at which time the service was profitable and the operation was privatized (Milligan 1997). Finally the successful introduction of cost recovery for extension services on a pilot scale in Nicaragua, described in this volume by Keynan, Olin, and Dinar (1997) confirms the feasibility of a demand-driven

approach directed to smallholders and the bracing impact of pricing on service standards.

Conclusion

In an effort to contribute effectively to the well-being of rural areas in developing countries, agricultural extension organizations are adjusting to a new order characterized by less government funding and more differentiated requirements. Agricultural extension will increasingly rely on new information technologies and multiple knowledge networks involving the private sector and civil society. There are many ways to gradually divest the public sector from its extension activities. Workable and sustainable extension systems call for tailor-made experimentation informed by global experience.

Accordingly, rather than pressing governments for increased budgetary allocations for public-sector extension systems, development assistance agencies should support policies aimed at increasing the role of users, private companies, and the voluntary sector and should assist governments in enhancing the cost-effectiveness and quality of existing services through institutional innovation and outsourcing. This approach would allow the public sector to concentrate its limited resources on providing services to neglected areas and high-leverage actions directed at education and training, information technology, and the creation of enabling frameworks for equitable and environmentally sustainable rural development.

Notes

Robert Picciotto is director general of operations evaluation in the World Bank Group. Jock R. Anderson is evaluation adviser in the Operations Evaluation Department. The authors are grateful to Charles Antholt, Daniel Benor, Vishva Bindlish, Hans Binswanger, John English, Robert Evenson, Gershon Feder, Madhur Gautam, Jacob Meerman, Michel Petit, Roger Slade, and Willem Zijp for their comments.

1. In experimenting with alternative specifications using the authors' data from Kenya, minor adjustments were found to cause radically different implied extension effects, indicating a lack of robustness in the key findings.

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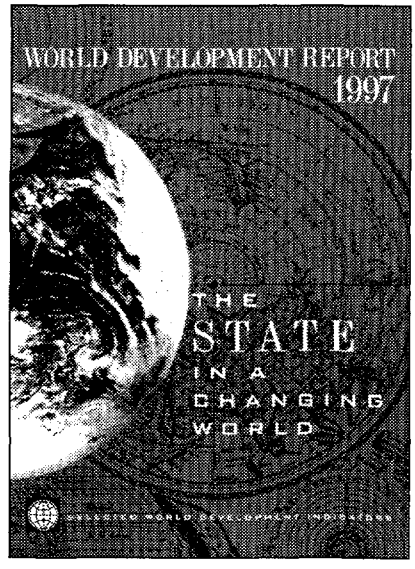

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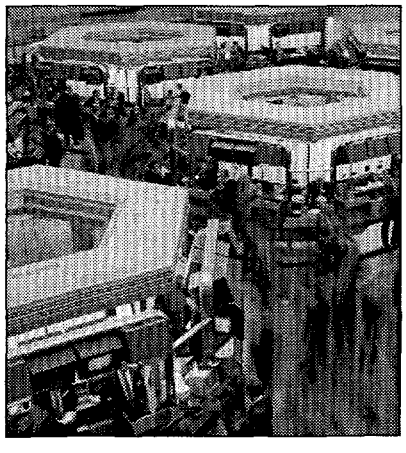

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