

THE WORLD BANK ECONOMIC REVIEW

Volume 5

September 1991

Number 3

19598

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Manufactured in the United States of America
ISSN 0258-6770

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This journal is indexed regularly in *Current Contents/Social & Behavioral Sciences*, *Index to International Statistics*, *Journal of Economic Literature*, *Public Affairs Information Service*, and *Social Sciences Citation Index*®.

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The Impact of Changes in Job Security Regulations in India and Zimbabwe

Peter R. Fallon and Robert E. B. Lucas

Employment laws in India and Zimbabwe require employers to obtain permission from the government to retrench or lay off workers. The effect of these laws on the demand for employees in 64 manufacturing industries is examined using time series data. Little evidence is found indicating slower adjustments in employment levels and hence retardation in any structural adjustment following the new laws. However, in both countries a substantial decline in the demand for employees (other things equal) followed the new legislation. In Zimbabwe it is difficult to be precise about a causal connection between the drop in the demand for labor (allowing for concurrent increased wages) and the new legislation because enactment occurred simultaneously with Independence; however, the current economic climate induced high levels of investment in capital but not investments in long-term commitments to employees. But in India further evidence supports a causal connection: larger establishments covered by the job security regulations tended to experience a decline in the demand for labor while smaller, uncovered enterprises in the same industries did not; moreover the decline in demand for employees across industries in India was larger where the private sector predominates, where larger establishments covered by the new laws are important, and where a smaller proportion of employees are union members. Thus in both countries the policy implemented to protect jobs may have resulted in far fewer jobs.

Upon achieving independence in 1980, the government of Zimbabwe passed a new Employment Act, requiring employers to obtain permission from the Ministry of Labor to fire or lay off workers. Comparable regulations were imposed in India by the Industrial Disputes (Amendment) Act of 1976, requiring that written permission be obtained, normally from the relevant state government, either to close a plant or to retrench workers. The immediate goal of these items of legislation was to protect the livelihood of workers and to maintain jobs.

Any addition to economic security in the lives of workers is clearly a laudable goal in its own right. But the question addressed in this article is whether these particular job security regulations have had undesirable side effects, which may even have thwarted the original goals of the legislation. India and Zimbabwe are

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not alone in imposing permission requirements for retrenchment, although their laws are among the most stringent in the world. These two countries were selected for analysis because of this extremity, combined with the availability of high-quality industrial data.

In very broad terms one might expect that making jobs more secure would make employers less able to make rapid adjustments to changing market conditions. But, in addition, restricting employers' ability to fire workers may actually reduce the size of the work force employers wish to maintain. In turn, these two elements may have much wider ramifications, such as retarding structural adjustment, promoting greater capital intensity, and influencing the mix of evolving industries. These wider ramifications lie beyond the scope of this article, which focuses more narrowly on the employment effects.

To understand these employment effects and their potential importance, some relevant features of the labor markets in each country are briefly discussed. The coverage and enforcement of the job security legislation are then discussed, and the potential effects of such regulations are outlined in general terms. Time series data are used to estimate the magnitude of the new laws' impacts on employment in a wide range of manufacturing industries and to examine some of the factors that influence why some industries appear to be more affected than others.

I. THE INDIAN AND ZIMBABWEAN LABOR MARKETS

Recently evolved employment and institutional factors are likely to have affected the wage determination process in India and Zimbabwe.

India

Industrial employment in India has grown very slowly despite massive investments (Lucas 1986, 1988). By 1980 total employment in the manufacturing sector remained below 6 million. The relative share of the public sector in manufacturing employment has grown steadily, from 14.8 percent in 1966 to 25.5 percent in 1982, reflecting in part the dominant role of public sector investments. During the 1980s some limited liberalization of Indian industry has been permitted, and growth in industrial production has been significantly more rapid, but employment in the factory sector has declined slightly since 1982.

Industrial wages have grown significantly relative to the consumer price index for industrial workers. However, this wage growth does not appear to have been the result of a healthy, tight, overall labor market. The wages of agricultural workers have hardly risen relative to the consumer price index for agricultural workers. Thus a distinct dualism seems to characterize the Indian labor market.

One reason that industrial wages remain well above those for agricultural workers in India is the existence of a complex structure of minimum wage laws,

which vary from state to state and across industries and occupations within states. Although enforcement of these laws may vary a good deal, they seem to have a greater impact on the industrial sector than on agricultural laborers. But perhaps an even more important reason that industrial wages are higher has been the dramatic rise in union membership and militancy. Union membership increased by more than 150 percent between 1966 and 1979, and twice as many work days were lost in strikes in the 1980s as in the second half of the 1960s.

The future growth of industrial employment in India is likely to prove crucial to overall living standards and to the distribution of income. One of our key concerns therefore is to examine the effects that the job security provisions in the 1976 amendment to the Industrial Disputes Act have had on industrial employment. Industrial employment and how it has been influenced by public sector employment and workers' unions are also examined.

Zimbabwe

From Zimbabwe's Unilateral Declaration of Independence in 1965 until the first oil shock in 1974, gross domestic product (GDP) grew rapidly; it averaged 7.5 percent growth annually as import substitution proceeded. Meanwhile overall employment grew somewhat less quickly at about 3.7 percent a year, with growth in manufacturing employment leading the way at 7.2 percent. After 1974 the burgeoning civil war, emigration of whites, limited material access under trade sanctions, drought, and high oil prices helped to generate a recession in which overall GDP actually declined slightly from 1974 to 1979. Overall employment also fell in this interval, with employment declines in both agriculture and manufacturing.

From 1965 to 1979 the labor market treated Africans quite differently than Europeans, although systematic data are not available for much of the period. Skilled jobs, apprenticeships, and better education were largely reserved for the Europeans. Whereas a few unions existed for Europeans, only a negligible number of Africans were able to organize. The latest year for which data on earnings by race seem to be available is 1978, at which time the overall annual earnings of Europeans were some 10.4 times greater than those of African employees, the ratio being 7.3 in manufacturing and 24.5 in agriculture (Fallon 1987a). Real consumption earnings (annual earnings per employee deflated by the consumer price index) barely increased in manufacturing during the 1970s. The failure of real wages to rise, the decline in employment in the second half of the 1970s, and the wage differences for Africans and Europeans had a major impact on the attitude of the new government that came into power upon Independence in 1980.

Minimum wage laws played a key role after Independence. The minimum wage relative to the consumer price index was raised by 27 percent in industry and mining and by 43 percent in agriculture in the first 18 months after Independence. Wage scales have been deliberately compressed through the incomes

policies of employment boards and councils, in an attempt to reduce the extent of inequality. Unions have grown rapidly in size and coverage, although the union movement clearly started from a tiny base in 1980.

With the removal of sanctions upon Independence, the Zimbabwean economy experienced a brief boom, with 9.1 percent GDP growth from 1979 to 1982. However, agriculture and manufacturing have been stagnant or in decline since 1981. The initial growth, the dramatically rising minimum wage rate, and perhaps also the enhanced unionization resulted in a growth in real earnings in the first couple of years after Independence. The rapid rise in nominal earnings was overtaken in 1983 and 1984 by an even more rapid inflation in consumer prices.

Overall employment has expanded since Independence; by 1984 total employment had rebounded to its 1974 level. Much of the new employment is in public administration and teaching; employment in agriculture remains lower than at any time in the previous two decades (partly as a result of drought), and manufacturing employment declined after the 1982 peak.

The population grew at an average annual rate of 3.3 percent from 1970 to 1980. The fact that employment in 1984 stood only at the 1974 level implies a growing problem of unemployment. The 1982 population census estimates an open unemployment rate of 18.5 percent for the labor force, excluding communal farmers, and this rate has almost certainly increased since that time. Concern over this unemployment problem has played a major role in shaping the job security provisions of the Employment Act.

II. JOB SECURITY REGULATIONS IN INDIA AND ZIMBABWE

Many countries legislate certain steps to be followed when a worker is dismissed. Most typically these steps include a minimum period of notice or a formula for separation compensation (such as a fixed sum, some proportion of current pay, or an amount tied to length of service). In neither India nor Zimbabwe are these provisions particularly onerous by international standards. According to India's Industrial Disputes Act of 1947, in the event of retrenchment a factory worker with more than 240 days of service is entitled to one month's notice in writing, stating the reasons for retrenchment, and 15 days' compensation for each year of service at 50 percent of basic wages plus dearness allowance (a payment linked to inflation). In Zimbabwe the required period of notice is between one day and one month, depending on the periodicity of pay and length of service, while the only legislated severance pay is for the period of notice.

The job security provisions in India's and Zimbabwe's labor laws differ from those of most other nations because of their permission requirement. The 1976 amendment to India's Industrial Disputes Act of 1947 makes "lay off retrenchment and closure illegal except with the prior permission of the Government" (India, Government of, 1978, p. 303). The 1980 Employment Act of Zimbabwe

also requires that explicit permission be obtained from the government before any worker may be dismissed or laid off. Although similar in specifying the need for government permission, the coverage of these laws differs, and the restricted coverage in India will prove important to our subsequent analysis.

Coverage of the Regulations

The permission requirements in India's 1976 amendment covered all industrial establishments employing more than 300 workers on an average day in the 12 months before the amendment. (An exception was made for establishments which are specifically seasonal in character or in which work is performed only intermittently.) Subsequently a 1982 amendment extended coverage to establishments with 100 or more workers. Whether these provisions are constitutional has been challenged in a series of court cases on the principle that the right to be in business also implies the right to get out of business. The 1982 amendment and a further amendment in 1984 appear to have remedied some of the specific legal criticisms, and the latter amendment currently stands, although it is still being contested in the courts. The penalty for retrenchment or closure without permission includes both a prison sentence and a fine for the employer. The legislation does make an exception for retrenchment resulting from power shortages or natural disaster. Moreover *badli*, or casual workers, are not covered by either the compensation formula or the permission requirements, which apply to permanent workers (those paid for 240 days or more in a year).

The permission requirements in Zimbabwe's 1980 Employment Act cover all undertakings, industries, and occupations. The only exceptions are for officers of Parliament, unpaid workers in charitable institutions, and university students performing jobs required as a part of their curricula. The 1980 act was clarified and extended in three statutory instruments in 1981, 1982, and 1985. But these clarifications have served largely to reaffirm government commitment to the permission requirement and to define penalties for wrongful dismissal (currently amounting to reinstatement of the worker with back pay, a fine not exceeding Z\$2,000, and up to 12 months in prison for the employer). Even fixed-term contract workers are fully covered by Zimbabwe's permission clause. Casual workers, who may be employed no more than six weeks in any three-month period, are excluded from any permission requirement upon separation.

Implementation

In India it seems that no appropriate government body has yet granted permission either for closure or retrenchment within the stipulated period. Consequently plant closures in particular are frequently appealed in the courts, whose proceedings can be extremely protracted. Mathur (1989) notes that the number of plant closures diminished during the 1980s and suggests that the difficulty in obtaining permission for closure may have been a factor in this reduction. However, many employers seek alternative routes to retrenchment:

More vigorous de-manning approaches have involved "lock-outs," virtually generated in the hope that a prolonged cessation of operations will lead to separations more easily. In pursuit of de-manning, employers are known to have deliberately brought factories to a grinding halt on the plea of lack of power supply (achieved through nonpayment of electricity bills) or raw materials (Mathur 1989, p. 175).

Applications for permission to retrench a Zimbabwean worker are deliberated by the Retrenchments Committee in the Ministry of Labor. The Committee hears evidence from all concerned parties and then makes a recommendation to the minister. This process can be quite drawn out, and some applications take as long as a year to review. Moreover rulings generally recommend that some alternative solution be sought by the employer, rather than granting permission for actual retrenchment. Certainly implementation in Zimbabwe has been such that in an attitudinal survey of enterprises, the dismissal regulations were cited as one of the leading concerns among employers (Hawkins and others 1988).

In both countries the lack of coverage for temporary workers provides an obvious temptation to rely on such workers, but in both countries there are forces that militate against this route. In general temporary employees acquire less specific training and also lack the incentive to work hard. These forces are strengthened in India with the active and effective opposition of the unions to casualization of the work force and in Zimbabwe by a provision that all casual labor must be paid at least twice the going minimum wage.

The one situation in which permission is not required for separation in either country is when both parties agree to the termination of employment. Naturally, this opens the possibility of paying workers to quit or retire voluntarily. Indeed this practice seems commonplace throughout the formal wage sector in both nations and clearly represents the main escape clause available. But this method of escape can be quite expensive for the employer. Not surprisingly, there is considerable variation in the minimum offer necessary, depending on qualities of the individual and general labor market conditions, as well as on the incidence of collective bargaining. In India packages offering one month of pay for each year of service are not uncommon, although incidents of far higher offers have also been recorded. In Zimbabwe the going settlement is reportedly around eight months of pay (Fallon 1987a, 1987b; Mathur 1989).

III. POTENTIAL EFFECTS OF JOB SECURITY REGULATIONS

Whenever a firm's labor force changes, some costs in making adjustments are inevitable. On the hiring side certain components of these costs are apparent—the costs of attracting a pool of applicants, the costs of screening the applicants either before appointment or during an initial trial phase, and the costs of training. On the firing side costs may also be incurred. For example, if any worker possessing firm-specific skills quits, this typically imposes a net loss on the firm. Moreover, even without legislated requirements, firms may voluntarily

choose to enter a contract with their employees that promises severance pay. Such an arrangement can be profitable for the firm if workers are concerned with the risks of being laid off and hence are willing to accept a job paying a lower wage combined with promises of security or with financial compensation in the event of dismissal. In essence the reduced wages can be considered an insurance premium payment toward a claim in the event of job loss.

These various costs of adjusting one's labor force generally mean that employment decisions by firms become dependent not only on market conditions today but also on anticipation of future labor needs. Thus a firm will be reluctant to hire during a market upturn if it anticipates significant costs in again reducing the work force during a subsequent downturn. These ideas are well developed in the theory of dynamic demand for labor (Nickell 1986).

What is far less well developed in the literature is any analysis of the consequences of legislated intervention to provide job security, such as that in India or Zimbabwe. What are the potential consequences of imposing job security legislation when a voluntary arrangement has already been struck between employers and employees? It will be useful to distinguish at least four potential consequences; the first and second may affect the demand for employees directly, and the third and fourth may do so indirectly through their potential effects on wages and hours of work.

First, the greater the costs and obstacles are to adjusting the work force, the less flexible a firm is in reacting to changing market conditions. Thus the standard approach to adjustment costs in the existing literature focuses almost exclusively on the speed with which firms will change their levels of employment. In the extreme, if firms had to rely entirely on voluntary quits and retirements, the speed in adjusting employment levels may be severely retarded. If firms must incur additional costs in persuading workers to quit or retire, then the speed at which firms adjust their labor force to changing conditions may tend to be diminished by the additional job security regulation.

Second, the level of employment—not merely its speed of adaptation—may be affected by job security provisions. This may be true because the ability to fire workers may be an important aspect of maintaining worker productivity. It is common to apply on-the-job evaluations in the normal process of screening for more effective workers. If denied this capacity, firms will be stuck with workers who prove to be poor matches with the specific demands of the job, thus reducing overall productivity. In addition, if the job security regulations encourage the use of temporary laborers, as is certainly true in India, again productivity will generally decline since temporary workers acquire less firm-specific skills. Thus additional job security imposed on employers, who may already voluntarily be offering some degree of job security precisely because more permanent workers are more productive, may diminish worker productivity.

Even if a firm wishes to maintain a constant overall level of employees, labor adjustment costs affect the firm's employment decisions. There will be turnover in the specific composition of individuals comprising the steady number of employees because of quits and retirements, dismissals for disciplinary purposes,

and the process of on-the-job screening. Again, the effect of raising the cost of such adjustments in work force composition is to raise the cost of employing a given level of employees.

The effects of job security regulations on labor productivity have ambiguous effects on the demand for employees, but enhanced turnover costs do not. By raising turnover costs, and perhaps by lowering productivity, job security regulations may thus act as a tax on employment, effectively raising the cost of labor (Stiglitz 1974). Job security regulations would then tend to encourage adoption of more capital-intensive production techniques, to shift production away from more labor-intensive processes, and hence to reduce the demand for labor.

Thus the two direct potential effects of job security regulations on the demand for employees are a slower ability to adjust and an altered level of demand, which will tend to be lower unless substitution effects from lower productivity dominate. These two components will be examined empirically in section V. Other potential effects, such as changing the skill mix of employees and smoothing production through inventory fluctuations, are not examined here owing to the lack of appropriate data.

A third potential consequence of imposing job security legislation is that employers may generally be able to reduce the attractiveness of other contract features and still obtain workers of the same caliber. Thus one might expect that the imposition of greater security might lead to lower wages. Hamermesh (1988) explores the connection between the reservation wage and the probability of plant closure in the United States. In India this tendency may be thwarted by the combined influence of union wage bargains and minimum wage laws and in Zimbabwe by the latter alone. However, unions often bargain over a package of terms that includes both job security provisions and pay terms. The inability of employers to dismiss striking workers may actually strengthen the bargaining position of unions and insider workers more generally, which could result in an enhanced overall reward package including both greater job security and higher pay. Moreover not all workers earn only the minimum wage. Workers who earn more than the minimum may accept somewhat lower wages in exchange for the enhanced security. Lower wages could enhance the demand for employees, offsetting any direct consequences of additional job security in reducing labor demand.

To the extent that job security regulations raise the cost per employee, the fourth potential consequence might be longer hours per employee and less reliance on expanding staff levels. Rising costs of overtime combined with diminishing productivity from additional hours per employee mean that such substitutions are typically not costless.

IV. THE DATA

The chief source of the data on India is the *Annual Survey of Industries*, which covers two sets of factories. The census sector factories comprise all units em-

employing 50 or more workers and using power and those employing 100 or more workers without power. The sample sector comprises all remaining units employing 10 or more workers with power and those employing 20 or more workers without power. The census sector annual data cover 1959/60 through 1981/82 (except for 1972/73). These data encompass essentially the entire census manufacturing sector disaggregated to 36 industries. A second data set covers a subset of 23 more narrowly defined industries, with separate observations on the census and sample sectors within each industry from 1973/74 through 1981/82. Since the 1976 amendment in India covered only establishments with 300 or more workers, the sample sector is uncovered by this amendment, whereas a portion of the census sector is covered, which offers an important control for testing in this second data set.

For Zimbabwe the chief source of data is the annual *Census of Production* from 1960/61 through 1984/85, which covers all industrial establishments except those with very tiny levels of output. (In 1983/84 the cutoff for establishments in the census was a gross output of Z\$2,000—approximately US\$1,800.) The scope of this census combined with the availability of price information confine the analysis to the manufacturing sector disaggregated to 31 manufacturing industries.

V. EMPIRICAL EVIDENCE

The evidence amassed from these data will be discussed in three steps: the potential effects of the new job security regulations on wages and hours of work, their effects on the demand for employees, and the variations between industries in the estimated effects.

Wages and Hours of Work

Did the introduction of the job security regulations lead to less attractive terms in labor contracts and to diminished average wages in particular? The issue is whether firms can attract workers at a lower wage after the additional security is imposed. If they can, then the supply wage of workers is reduced.

A wage equation is therefore estimated in which the supply wage is measured by wages relative to the consumer price index. Real wages today are expressed as a moving average of real wages in the previous two years, plus any shift in wage patterns following the 1976 amendment in India and the 1980 Employment Act in Zimbabwe. The real wage terms are expressed in logarithms, and each equation is corrected for first-order serial correlation, by the Cochrane-Orcutt technique for India and by the Beach-McKinnon method for Zimbabwe. A different approach is needed for India because of the gap in the time series for 1972. Similar wage equations were also estimated based on a simple trend rather than a moving average, although results with respect to the job security dummy coefficient were essentially the same as those discussed in the text.

This equation is estimated for 36 industrial sectors in India and 31 in Zimbabwe. A significant drop (at the 10 percent significance level) in the movement of wages with the imposition of the job security regulations is observed only in three Indian industries—tobacco products, fertilizer, and miscellaneous chemicals. Thus there is insufficient evidence to suggest that employers were able to offset the effects of the new regulations by offering lower real wages. Instead the estimated shift in real wages is positive in most sectors. This finding would be consistent with the theory that enhanced job security endows insiders with greater bargaining strength, thus enabling them to achieve higher wages. However, whether or not this is the case cannot be discerned from this simple analysis.

It is not surprising that for India and Zimbabwe there is no evidence that employers offer lower wages when they are obliged to provide greater job security. In India, in addition to the prevailing minimum wage legislation, the growing power of the unions may well have confounded any downward pressure on wages. In Zimbabwe the contemporaneous sharp rise in the minimum wage rate and a more active role for wage boards have probably helped to prevent any downward adjustment in wages.

With respect to hours of work, our analysis is confined to India because no data are available for Zimbabwe. Hours of work are regressed on a simple trend, with a dummy variable representing the new regulations and a lagged dependent variable. (Hours of work per employee are expressed in logarithmic form in these equations, and adjustment for serial correlation is again by the Cochrane-Orcutt method.) In 3 of the 36 industries a significant rise in hours is found following the 1976 amendment, but in three others a significant drop is found. In the remainder no significant departure from trend is estimated. Thus there is no systematic evidence to suggest that the new regulations in India simply caused employers to substitute longer hours for fewer workers. This is not altogether surprising, since hours of work and conditions for overtime are very highly regulated.

In sum, there is no evidence to suggest that employers in either India or Zimbabwe were able to offset any consequences of the new legislation simply by offering lower wages or by substituting longer hours to maintain overall labor input.

The Demand for Employees

In examining the direct effects of job security regulations on the demand for employees, our approach hinges on three main elements. First, if the costs to a firm of adjusting its labor force rise with how rapidly the transition is made, then changes will tend to occur more slowly and today's employment decisions will be strongly influenced by the inherited employment level from yesterday. If the new job security regulations impose even higher costs for rapid changes, we might expect to see an increase in the inherited effect. Second, higher adjustment costs may reduce the firm's demand for employees. Consequently the new regu-

lations may actually result in diminished employment. Third, today's employment decisions are influenced by expectations about the future, which we suppose are shaped by the recent past.

Industry labor demand equation. These three elements are expressed in the following equation for the demand for employees within a given industry:

$$(1) \quad N = [\beta + \alpha J + \sum \omega_{\tau} W_{-\tau} + \sum \gamma_{\tau} Q_{-\tau} + \sum \psi_{\tau} H_{-\tau}][1 - \lambda_0 - \lambda_j J] + \lambda_0 N_{-1} + \lambda_j J N_{-1}$$

where N is the logarithm of the number of employees, W is the logarithm of the wage rate deflated either by net producer price or the price of fuels, Q is the logarithm of output, H is the logarithm of shifts worked per employee, J is a dummy variable reflecting the imposition of the job security regulations, and $\beta, \alpha, \omega, \gamma, \psi$, and λ are the regression coefficients to be estimated. The subscript -1 indicates values in the previous year, and subscript $-\tau$ indicates values lagged τ years.

Even before the job security regulations were imposed, there were costs associated with rapid adjustment of the size of the work force. Those costs may have resulted in some sluggishness in changing employment levels. This would be reflected in a positive coefficient (λ_0) on the lagged dependent variable.

If the job security regulations raised the cost to a firm of quickly changing the level of employment, then the change in employment levels should prove even slower following enactment of the new laws. In the equation this is represented by the coefficient (λ_j) on the interaction between the lagged dependent variable and the dummy variable (the latter is set equal to one following enactment of the job security laws). If the costs of rapid adjustment have been raised, then this coefficient should prove positive.

The new regulations might have increased the effective cost of employing a given level of employees, rather than the costs of rapid adjustment. Such an escalation in costs should be reflected in a decline in the firm's desired level of employment, thus resulting in a negative coefficient (α) on the job security regulation variable.

Both current and previous values may generally be included for the real wage terms, for output, and for shifts worked. One should expect a negative coefficient (ω_0) on the current real wage and a positive association between today's output and labor demand (γ_0). However, hours of work and numbers of workers may be either complements to or substitutes for each other. Moreover the values to be expected for coefficients on all past values ($\omega_{-\tau}$, $\gamma_{-\tau}$, and $\psi_{-\tau}$) depend critically on the manner in which expectations are formed.

Estimation results. The equation was estimated for 35 industries in India and 29 in Zimbabwe. For the steel industry in India and the motor vehicles industry in Zimbabwe, no plausible estimate of a labor demand equation could be obtained over a wide range of alternative specifications explored. For the

Zimbabwean basic metals industry, it proved difficult to obtain convergence to a stable specification, so no results were obtained.

In 45 of the 64 industries for which the equation was tested, at least one lagged term proves directly to affect the current demand for labor in a statistically significant manner. Thus, at least a comparatively simple, adaptive process of expectations formation indeed seems relevant in shaping the demand for employees.

But this does not imply that today's employment levels are unaffected by wages and output levels further back than one or two years. In more than half of India's industries and in most sectors in Zimbabwe, the estimated coefficient associated with the lagged value of the dependent variable proves significantly positive. In other words, even before the new permission clauses were imposed, employers in many industries were reluctant to adjust rapidly firm employment levels under varying market conditions. Presumably this was because such speedy adjustments were costly. Since today's employment is thus affected significantly by last year's employment for these sectors, the entire history of the industry has at least some influence on today's demand for employees.

It seems that rapid adjustments in employment levels were costly even before the new permission clauses were enacted. The coefficient on the interaction between the job security dummy and lagged employment is found to be statistically indistinguishable from zero in most sectors. But this does not imply that the new regulations had little or no effect on labor demand. Our attention is drawn to the effect of the job security provisions on employers' desired level of employment, instead of on alterations in how rapidly employers adjusted the size of the work force.

The quantum shift in employers' desired level of employment is represented by the coefficient on the job security dummy. This estimated coefficient proves negative in 53 of the 64 industries. In statistical tests in which a time trend is appended to each equation, this quantum drop does not appear to be a consequence of a more general downward trend in demand for employees. In 45 out of the 53 cases this negative effect is statistically significant at a 75 percent confidence level; in half of the cases it is statistically significant at a 90 percent confidence level. This estimated coefficient proves positive in only 4 industries at a 25 percent significance level.

Additional evidence from India. Thus far all of the results for India refer to factories within the census sector (that is, factories with power employing 50 or more workers or without power employing 100 or more workers). However, the 1976 amendment imposed a permission requirement for retrenchment and closure only for factories having 300 or more employees. It has been demonstrated that within the census sector there was indeed a significant drop in employment in many industries. Thus declines within factories employing more than 300 employees were not completely offset by expansion in census sector factories

with less than 300 employees. But declines in the census sector may have been compensated for by expansion of activity and employment in smaller factories lying outside the census sector. To test this, the labor demand equations are examined with data from both the census and the sample sectors. This additional step enables us to explore whether the drop in census sector employment may have resulted from unobserved elements that might also have caused a decline in employment within the sample sector.

The data on 23 comparable census and sample sectors are limited to nine years, covering 1973/74 through 1981/82. It was necessary to combine observations on any given industry from the census and sample sectors for estimation. Thus there were 16 observations on each industry, after omitting one observation from the sample and one from the census sector to allow for a one-period lag. The specifications adopted are similar to those in equation 1, although the job security dummy is suppressed for the sample sector to reflect the fact that these smaller enterprises were not covered. The specifications permit the smaller establishments in the sample sector to have a different intercept (by means of a sample sector dummy). All other coefficients are constrained to be the same in the census and sample sectors within an industry, although there are too few degrees of freedom to conduct Chow tests on whether pooling is appropriate.

The quality of the sample sector data is clearly inferior to that for the census sector. This fact, plus the constraint required in pooling, meant that plausible estimates of the labor demand equations could not be obtained for 12 of the original 35 pooled sectors identified in our data set (for example, if positive wage terms proved stable over a wide range of specifications).

In the resulting estimates negative coefficients are again found on the job security dummy in all but four instances. In half of the negative cases the effect is statistically significant at at least a 90 percent confidence level, and in no case is the coefficient significantly positive even at a 25 percent significance level. The job security dummy is set equal to one only for census sector observations after the 1976 amendment. If a similar job security dummy for the sample sector during the same time period is also inserted into the equations, the associated coefficient proves insignificantly different from zero at a 90 percent confidence level in all but three industries. Of these latter three industries, a significant negative coefficient is obtained in one case and a significant positive coefficient in the other two. However, in none of these three industries is a significant fall in employment associated with the job security dummy for the census sector.

Thus no evidence is found to suggest that job loss in the census sector as a result of the 1976 amendment produced job gains in parallel sample sector factories through transfer of workers across establishments, through subcontracting, through putting out of work, or through major adjustments in establishment size. Nor does this evidence suggest that the significant drops in census sector employment were a result of spurious industry developments, which also caused drops in the parallel sample sector factories.

Possible causes of the drop in employment in Zimbabwe. In Zimbabwe a question might arise as to whether the observed drop in employment is really a consequence of the declining availability of European labor through time. The latter half of the 1970s witnessed a substantial rate of emigration by Europeans. Almost no data are available to undertake a detailed examination of the consequences of this exodus for the operation of the labor market. However, at least a simple test may determine whether the decline in demand for labor in various industries was really a result of the mounting emigration of Europeans rather than of a sudden drop at the time of the new Employment Act. In particular a measure of aggregate, net European emigration may be added to the regression equations. But no significant change in the estimated coefficients on the job security dummy is found with this addition.

We are unable to test directly whether some other, concurrent change in the labor market at the time of Zimbabwe's Independence actually induced the observed drop in labor demand. The major change was the sharp rise in wages, but this is explicitly accounted for in the regressions. It might be tempting to suggest that the shift to a socialist regime prompted a sudden loss in confidence on behalf of employers and hence a reluctance to commit to longer-term activities. But in fact an investment boom occurred in manufacturing immediately following Independence, so loss of confidence seems an implausible explanation. Rather it seems that the investment boom may well have remained very capital intensive precisely because of the new job security regulations and hence the reluctance to employ commensurate additional labor.

Effects of the Job Security Regulations in Various Industries

Here we consider the size of the estimated magnitudes of the associated drop in labor demand and what might explain some of the differences across industries in the two countries. Tables 1 and 2 display the estimated long-run effects of job security regulations in India and Zimbabwe, respectively. The estimated reduction in employment after any delays in adjustments have been worked through is given by industry. In many industries the estimated effects are very substantial. In India employment is estimated to have been reduced more than 5 percent in 25 of the 35 industries and more than 15 percent in 7 of them. But the estimated long-run employment effects of the new regulations vary considerably across the 64 sectors. We therefore enquire whether something systematic distinguishes those industries in which the consequences of the new regulations are greatest.

Interindustry variations in India. At least three factors might be at work in India. First, during our period of observation the job security provisions of the 1976 amendment were limited to establishments employing more than 300 employees. Consequently, a smaller drop in employment as a result of the legislation should be expected among industries in which smaller factories predominate, even within the census sector. Second, public enterprises commonly hoard

labor, often under political pressure to provide employment and offer patronage. As a result, industries in which public enterprises dominate are less likely to have been affected by the new legislation. Third, more highly unionized sectors probably already provided greater job security even before the new legislation, and in addition it seems likely that stronger unions are better placed to resist any decline in private sector employment resulting from the new legislation.

Table 1. *Estimated Long-Run Reduction in Employment Resulting from Job Security Regulations for 35 Industries in India*

<i>Industry</i>	<i>Percentage reduction</i>
Dairy	13.6
Flour and bakery	3.3
Sugar	11.1
Edible oils	6.1
Tea	11.6
Miscellaneous food	0.0
Beverages	3.6
Tobacco products	0.0
Cotton textiles	36.1
Silks and synthetics	44.8
Jute	2.4
Woolen products	6.3
Textile products	0.0
Wooden products	7.4
Paper	5.1
Leather products	0.0
Rubber products	10.0
Oil and coal products	0.0
Basic chemicals	13.2
Fertilizer	11.0
Paints and dyes	6.0
Plastics	18.5
Pharmaceuticals	10.3
Soaps and cosmetics	33.3
Miscellaneous chemicals	7.4
Cement	6.7
Nonmetallic mineral products	10.6
Nonferrous metals	25.4
Metallic products	11.5
Agricultural machinery	0.0
Nonelectrical machinery	42.8
Electrical machinery	10.3
Railway equipment	19.6
Motor vehicles	7.4
Bicycles	3.2
Weighted average	17.5

Source: Authors' calculations.

These three factors are explored in the following regression in which each observation represents one industry:

$$(2) \quad A = 0.113 + 0.175 \text{ PP3} - 0.145 \text{ PUM}$$

$$(3.48) \quad (2.92) \quad (2.51)$$

$$N = 35, R^2 = 0.13$$

where A is the estimated long-run job security effect, PP3 is the proportion of employees in private sector establishments employing more than 300 employees, and PUM is the proportion of employees who are union members. This equation is estimated by ordinary least squares, adopting the heteroskedasticity robust computation of the variance-covariance matrix suggested by White (1980).

The positive coefficient estimated on PP3 is consistent with the first two anti-

Table 2. *Estimated Long-Run Reduction in Employment Resulting from Job Security Regulations for 29 Industries in Zimbabwe*

<i>Industry</i>	<i>Percentage reduction</i>
Meat	27.7
Food canning	20.7
Grain mills	14.5
Bakery products	0.0
Confectionery	10.6
Miscellaneous food	6.3
Alcoholic beverages	8.5
Soft drinks	4.7
Tobacco products	31.1
Cotton textiles	64.0
Knitted products	3.3
Other textile products	0.0
Apparel and footwear	18.9
Wood products	0.0
Furniture	12.9
Paper products	99.7
Printing	18.7
Fertilizer	97.6
Paints	20.3
Soaps and pharmaceuticals	91.0
Miscellaneous chemicals	3.1
Basic chemicals	27.6
Rubber products	54.9
Plastic products	40.2
Structural clay products	0.0
Nonmetallic mineral products	35.9
Metal products and machinery	15.1
Electrical machinery	36.5
Other vehicles	0.0
Weighted average	25.2

Source: Authors' calculations.

pated patterns. Thus the estimated decline in employment as a result of the 1976 amendment is greater in industries in which the fraction of employees in private sector enterprises employing more than 300 workers is greater. The negative coefficient on PUM supports the third argument that the drop in employment within a sector was less the greater the strength of unions.

Interindustry variations in Zimbabwe. A similar approach may be adopted for the results for Zimbabwe and generates the following regression across industries:

$$(3) \quad A = 4.544 - 5.215 \text{ AFR} + 2.408 \text{ SZE} + 1.319 \text{ QGR}$$

$$(1.61) \quad (1.60) \quad (1.74) \quad (1.47)$$

$$N = 29, R^2 = 0.14$$

where AFR is the proportion of employees who are African, SZE is the number of employees per establishment, and QGR is the average annual proportional growth in output after 1980.

The negative coefficient on AFR suggests that the new regulations have been most effective in raising the cost of adjustment in those industries with the lowest proportion of African workers. This does not seem to have been the original intent of the Employment Act. But it does mean that the job security regulations have at least weighed against displacing previously disadvantaged African employees. However, we cannot discern the extent to which this result reflects a residual effect of European emigration, causing sharper employment declines in industries that employed more Europeans.

The positive coefficient on SZE tells us that the industries with larger factories have reduced employment levels most as a result of the new regulations. This may well reflect greater administrative difficulty in imposing such regulations on smaller firms and perhaps greater diligence in enforcing the new regulations on larger firms. The positive coefficient on QGR indicates that industries that have grown most rapidly during the boom after Independence are estimated to have been most affected by the new regulations: the potential for new job creation in the boom thus appears to have been denied by Zimbabwe's regulations.

VI. CONCLUSIONS

The cumulative evidence from this study shows that the extreme job security regulations in India and Zimbabwe significantly reduced the demand for workers at given levels of output. No evidence was found to suggest that employers were able to compensate by lowering wages or (at least in India) by increasing hours per employee. The magnitude of the estimated decline in demand for employees varies considerably from industry to industry but does follow a significant pattern. The more interesting pattern is in India, where industries with more public enterprises seem to have been less affected, where stronger unions have resisted reductions and probably already offered greater

security, and where coverage restricted to larger enterprises has limited the impact on industries with smaller plants.

The weighted, average estimated impact on jobs, given output, is quite large in both countries: employment declined 17.5 percent in India and 25.2 percent in Zimbabwe. In both countries this lack of wage jobs should be of serious policy concern, because open unemployment remains high in Zimbabwe and the industrial labor market is hardly tight in India. The boom after Independence in Zimbabwe revealed that entrepreneurs had sufficient confidence to invest in plant and equipment but not in tenured jobs: the rapid growth industries apparently were quite reluctant to hire following the new regulations. In India coverage of the job security provisions was extended in the 1980s, and unusually high industrial growth has been accompanied by employment declines in the covered sector. To what extent this more recent drop may be attributed to the job security regulations must remain a matter for speculation and future analysis, because sufficient recent data are not available for adequate investigation.

Given actual implementation, the regulations thus indeed appear to have offered greater job security to those fortunate enough to obtain jobs. However, the cost has been in less jobs. Almost no evidence is found to suggest that the new regulations actually retarded employment adjustments under changing market conditions, although slow adjustments were a feature of industrial labor markets in both countries even before the new regulations. (This lack of evidence on slower adjustments may, however, result from the availability of only annual data, masking more sluggish changes within a year.) Apparently the potential for structural adjustments may thus not have been significantly retarded—adjustments can be made at considerable cost, thus leading to the lower employment estimated.

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Diversification of Macroeconomic Risk and International Integration of Capital Markets: The Case of Mexico

Luis F. de la Calle

This article tests the arbitrage pricing theory in the context of the unstable macroeconomic years in Mexico, 1977-87. Using information on returns on assets available to domestic investors—primarily stocks traded at the local stock exchange—an attempt is made to ascertain the extent to which these assets have offered premia for a set of proposed sources of risk. The pervasive factors that play an important role in asset pricing in Mexico are unexpected inflation, unexpected money growth, innovations in the Standard & Poor's 500 price series, and innovations in the dollar oil price. A residual market factor is obtained, using the McElroy and Burmeister model. Given that these risks get premia over and above the riskless rate, expected rates of return in Mexico have been higher during the years of erratic macroeconomic conditions. Mexico is not considered to be well integrated with the international capital markets because local sources of risk—such as inflation—are not priced in the United States, whereas international sources of uncertainty—such as oil price shocks—are priced locally but not in the United States.

Capital markets are becoming increasingly important in developing countries. Because of the international debt problem, it seems unlikely that semi-industrial nations will be able to raise substantial amounts of funds in the international financial markets. The development and growth of modern domestic capital markets will allow these economies to tap additional savings and to improve the allocation of scarce funds. Organized and liquid capital markets are a vital factor in promoting overall development: they provide a means of allocating capital to alternative private and public projects, and they furnish essential information for evaluating investment undertakings (Ross 1978; Black 1988).

We use the arbitrage pricing theory (APT) model (Ross 1976) to ascertain how different sources of nondiversifiable risk imply cross-sectional variation of prices

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of assets that Mexican investors are likely to hold. We apply this model to a quite unstable macroeconomic period in Mexico and conclude that the economy has offered premia for a set of identifiable pervasive risks. Moreover we are unable to reject the cross-equation restrictions implied by APT pricing.

If the market has priced the various risk sources for investors in Mexico, the prices will unveil the extent to which the assets' returns have carried premia as compensation for uncertainty. A highly unstable environment such as Mexico's is an excellent proving ground for asset-pricing models because the sources of risk—high rates of inflation and volatile exchange rates—are probably easier to identify there than in a more stable economy. In addition this high variability improves the efficiency of standard procedures used to estimate and test economic models.

This article first looks at the increased riskiness in the Mexican economy, then briefly describes the APT model, and discusses the extension of the model to an open economy. Four macroeconomic risk factors are defined: unexpected inflation, unexpected changes in the Standard & Poor's (S&P) 500 price index, innovations in the dollar price of oil, and innovations in the Mexican M4 money supply. Because estimation of an APT system of equations depends crucially on including all pervasive sources of risk, the residuals of the return on a well-diversified portfolio are used to mimic an extra factor.

An empirical estimation of the APT model shows that the proposed sources of risk appear to be priced in the Mexican economy and thus that expected returns offer premia for this unwanted riskiness. Data show that the Mexican economy is not well integrated with international capital markets.

I. INCREASED RISKINESS IN THE MEXICAN ECONOMY

From 1955 to 1972 in Mexico the average annual inflation rate was 4.7 percent; real gross domestic product (GDP) grew by an average of 7.0 percent annually, with a standard deviation 2.1 percent; and the exchange rate was stable at Mex\$12.5 per dollar. The 1970s opened with higher than normal inflation rates of foreign origin, and in 1973 the Banco de Mexico abandoned its long-standing conservative monetary policy and became a major source of public sector financing. Subsequently, Mexico suffered a series of balance of payments crises, preceded by important appreciations of the real exchange rate. From 1973 to 1987 the economy grew by an average of 4.0 percent annually, with a standard deviation of 4.5 percent; the consumer price index increased by 300 percent; and the domestic currency was acutely overvalued between 1972–76 and 1977–81 and depreciated substantially in real terms afterward.

A large body of literature documents the effects of high inflation rates on the variability of inflation, on relative prices, and, especially, on relative price variability (Cukierman 1983; Fischer 1982; Taylor 1981). These studies contend that increases in the variability of the unexpected component of inflation may cause a real misallocation of resources. Moreover the policies designed to reduce

the rate of increase in prices may produce still more uncertainty. Blejer and Leiderman (1982) present evidence that unexpected inflation and relative price variability are strongly and positively correlated in Mexico. Aspe and Blanco (1984) find negative correlations between uncertainty and production and employment. They conclude that the expansionary government policies of the 1970s and the 1980s increased overall uncertainty and led to a decline in real output.

II. ARBITRAGE PRICING THEORY

Ross' (1976) APT is used to analyze the extent to which the increased riskiness in the Mexican economy was reflected in higher expected returns and to determine whether different exposure to a set of domestic and international sources of risk explains differences in expected returns across assets. The APT decomposes the total premium offered by any one asset into as many parts as there are sources of systematic risk. Thus, for example, we can ascertain whether a specific security offers a positive or negative premium for inflation risk, exchange rate risk, and so forth.

The APT assumes that the set of systematic risk factors determining asset prices is small compared with the number of assets available to investors and that, as a consequence, many linear combinations of assets' returns are close substitutes. Thus the exhaustion of arbitrage opportunities implies specific cross-sectional restrictions on the asset-pricing equations. Neither the capital asset-pricing model nor the APT model are universally accepted as adequate frameworks for pricing assets in actual economies. The empirical applicability of the capital asset-pricing model has been contested over the years because it is necessary—although virtually impossible—to identify the market portfolio to test the model (Roll 1977). Applications of the APT have been challenged on grounds that it is not plausible to interpret the estimates of risk prices (Shanken 1982). However, McElroy and Burmeister (1988) have shown that the use of measured macroeconomic factors is crucial in giving economic meaning to estimated risk prices, and de la Calle (1989) has demonstrated that in a competitive model the prices do have an economic meaning.

The APT model is applied to the study of relative prices of assets held by Mexicans. We estimate the model for 1977–87 to discover systematic sources of risk that are priced in equilibrium and to test the cross-equation restrictions derived from the no-arbitrage-opportunity condition. This research is, to our knowledge, the first comprehensive attempt to use returns on stocks traded at the Bolsa Mexicana de Valores S.A. de C.V. to test asset-pricing models.

The Model

The APT model is an arbitrage model that determines prices of assets and the associated risk premia for each kind of pervasive risk assets face, on the assumption that the expected return of an arbitrage portfolio is zero. The assumption of

no arbitrage profits means that the expected return on a portfolio with no net outlay of capital and subject to no risk should be zero. The implication of this condition is illustrated by assuming that dollar asset returns are generated in each time period by a linear factor model. Dollar—not peso—asset returns are used to overcome the econometric difficulties presented by the Mexican peso problem. The linear factor model used is:

$$(1) \quad R_{it} = a_{it} + \sum_{j=1}^K b_{ijt} \cdot f_{jt} + \epsilon_{it} \quad \begin{array}{l} i = 1, \dots, n \\ t = 1, \dots, T. \end{array}$$

The rate of return of asset i at time t is denoted by R_{it} . The expected rate of return of asset i at time t , denoted by a_{it} , is conditional on information available at the end of period $t - 1$. The sensitivity, or factor loading, of asset i to risk factor j at time t is denoted by b_{ijt} , and there are K risk factors. The value the innovation of pervasive risk factor j takes at time t is denoted by f_{jt} . And a random unobservable error specific to asset i at time t is denoted by ϵ_{it} .

According to equation 1, the realized return of asset i at time t might differ from its conditional expectation if either the specific risk ϵ_{it} or any one of the risk factors f_{jt} takes on a nonzero value. Ross (1976) assumed that equilibrium asset prices followed the linear factor model and showed that the no-arbitrage-profit condition implied that in a sequential economy the expected return of asset i at time t is given approximately by

$$(2) \quad a_{it} = \lambda_{ot} + \sum_{j=1}^K b_{ijt} \cdot \lambda_{jt} \quad \begin{array}{l} i = 1, \dots, n \\ t = 1, \dots, T. \end{array}$$

In equation 2 λ_{ot} denotes the risk-free rate of interest, and λ_{jt} is the premium (or discount) offered to investors for assuming one unit of risk from factor j . Thus equation 2 indicates that asset i has an expected return exceeding the riskless rate by an amount that depends on the sensitivities (denoted by b_{ijt}) of its return to realizations of the K risks and on the market “prices” (λ_{jt}) of these risk sources.

The risk premium a portfolio offers as compensation for being subjected to a particular source of risk j is given by $b_{ijt} \cdot \lambda_{jt}$ because this is asset i 's excess expected return, net of other riskiness, over and above the riskless rate λ_{ot} . The market pays premia, in the form of different expected returns across assets, only for risk factors that are systematic; there is no compensation for diversifiable riskiness. The APT holds at any point in time, and thus the factor loadings (sensitivities to risk factors) and the risk prices do not have to be constant. However, for estimation purposes we will assume they are constant (b_{ij} and λ_j) for the corresponding sample.

Combining equations 1 and 2 yields a set of n APT equations that will be empirically estimated:

$$(3) \quad R_{it} = \lambda_o + \sum_{j=1}^K b_{ij} \cdot \lambda_j + \sum_{j=1}^K b_{ijt} \cdot f_{jt} + \epsilon_{it} \quad \begin{array}{l} i = 1, \dots, n \\ t = 1, \dots, T. \end{array}$$

This set of APT equations represents the evolution of returns to individual assets and portfolios. The return to an equally weighted portfolio, denoted RDP_t , is given by

$$(4) \quad RDP_t = \lambda_o + \sum_{j=1}^K b_{pj} \cdot (\lambda_j + f_{jt}) + \epsilon_{pt} \quad t = 1, \dots, T,$$

where

$$b_{pj} = \sum_{i=1}^n (1/n) \cdot b_{ij}, \quad \text{and} \quad \epsilon_{pt} = \sum_{i=1}^n (1/n) \cdot \epsilon_{it}.$$

We will assume that RDP_t is the return of a well-diversified portfolio, that is, of a portfolio free of nonsystematic risk. (See McElroy and Burmeister 1988 and de la Calle 1989 for a discussion of this assumption.)

Macroeconomic Risk Factors in an Open Economy

The theory of arbitrage pricing has not been used to identify which unexpected events are likely to be pervasive and thus affect the expected returns to assets. Early empirical work used maximum likelihood factor analysis to identify a number of factors that explained an arbitrarily fixed percentage of the variance of returns (Roll and Ross 1980; Dhrymes, Friend, and Gultekin 1984). Although this approach can produce good estimates of expected returns, it has been criticized because neither the factors nor the associated risk prices that result from such an exercise have a clear economic interpretation. More recent studies (Burmeister and Wall 1986; Chen, Roll, and Ross 1986; McElroy and Burmeister 1988; Burmeister and McElroy 1988), however, have proposed the use of measurable macroeconomic factors as likely sources of risk. Their central claim is that risk premia estimated with the APT using factors we can clearly identify are susceptible to economic interpretation.

International finance economists use the term “perfect capital mobility” to describe the situation of perfect substitutability of assets in different countries and instantaneous adjustment of portfolios (Dornbusch 1980). Perfect capital mobility implies that yields are continuously equalized and that asset holders are continuously in portfolio equilibrium. The concept of perfect capital mobility is used to explain the equilibrium trajectory of the real exchange rate and to determine the ability of the central bank to conduct monetary policy.

To accommodate real-world developments that cannot be accounted for by the assumption of perfect capital mobility, it is often supposed either that assets are not perfect substitutes or that frictions exist that hinder the free flow of capital. For instance it is assumed that only nationals of one country can hold domestic assets or that the sole way to increase foreign holdings is through current account surpluses.

The admission of uncertainty of returns—many international models assume perfect foresight—represents a departure from perfect capital mobility. There is

no reason to believe that assets in different countries react equally to any one shock or, more important, that they are subjected to the same set of shocks. Conventional wisdom then is that under uncertainty we should expect differences in expected rates of return across a sample of countries with dissimilar assets.

In an APT world the concepts of capital mobility and domestic and international securities have a special meaning, nonetheless. It is not only the intrinsic nature of assets that determines their pricing and expected returns, but also the composition of the market portfolio (de la Calle 1989). We take as an example a small country whose wealth as a proportion of the world's is negligible and which has no exchange controls, so that its citizens can hold internationally well-diversified portfolios. If the world market is able to diversify away all of the small country's risk, then returns to assets in the small country will offer expected returns with premia only for internationally pervasive sources of risk. The small country's domestic riskiness will not be compensated for in equilibrium. Thus the expected returns of purely domestic assets, such as real estate, will not carry premia for domestic risks regardless of the fact that these assets are not traded internationally. In short, for small countries perfect capital mobility means that all domestic sources of risk are idiosyncratic at the world level and that therefore they play no role in the equilibrium pricing of assets.

There are two conditions under which a premium will be paid for any domestic source of risk. First, if the country is small but movement of capital is restricted, expected returns to domestic assets will carry an extra premium and the expected domestic market return will be unnecessarily high. Second, there will be a premium if the country is not small enough to have its specific sources of risk eliminated through international diversification.

*Macroeconomic Variables Likely to Influence Returns
on the Assets of Mexican Investors*

The APT provides no information about which macroeconomic factors are likely to influence returns. However, if asset prices are discounted expected cash flows, then all systematic variables affecting cash flows or the discount rate help to determine asset returns. Also variables that convey information about the future state of the economy are likely to affect returns.

There are six Mexican and international macroeconomic variables whose innovations might explain a substantial percentage of the variability of returns on assets held by Mexican investors.

- Unexpected changes in the domestic inflation rate not only affect the cash flow of many securities and the discount rate but also might change relative prices. In addition, inflationary innovations are probably good predictors of future devaluations, especially when exchange rates are fixed.
- Unexpected growth in the domestic money supply is a valuable source of

information concerning the state of public finances and the response of government policy to exogenous shocks.

- Unexpected devaluations of the Mexican peso have a clear impact on asset returns. The exchange rate influences both the general price level and relative prices.
- Innovations in the domestic rate of productive activity should affect stock returns through cash flows.
- Unexpected changes in the international price of oil have enormous consequences on the Mexican economy: they affect the terms of trade and thus real disposable income, and they have a definite impact on the budget deficit.
- Innovations in the S&P 500 price index summarize many of the international risks that are likely to disturb Mexican stocks.

This list does not include a variable that would capture directly the dynamics of the debt problem. If the APT holds, under certain conditions we could use the return of debt in the secondary market—which would follow the linear factor model—to mimic a pervasive factor. Unfortunately, it is extremely difficult to construct a long series (1974–87) of innovations of debt returns of equal maturity in the secondary market. Moreover the evolution of the debt problem is captured in our residual market factor.

III. ESTIMATION OF THE MACROECONOMIC RISK FACTORS

Ways to measure the macroeconomic risk factors described above are specified to obtain time series of unanticipated movements. The unanticipated innovations are specified by the forecast errors of a Bayesian vector autoregressive model. The model is used to develop four primary factors, and a proxy for a fifth missing factor is composed of the residuals of a regression of the return on a well-diversified portfolio on the four primary factors (McElroy and Burmeister 1988).

The macroeconomic risk factors are estimated as forecast errors from Bayesian vector autoregressions, as in Litterman (1986). The Bayesian procedure can represent more accurately the uncertainty about the structure of the economy and therefore generate probability distributions of future economic events that are significantly better than those produced by conventional techniques.

The Four Primary Factors

Seven variables comprise the first approximation of the vector to be estimated: the price index constructed from the equally weighted average of the peso-denominated returns on 54 assets (see appendix A), the Mexican consumer price index, the dollar S&P 500 price index, the international dollar price of oil, the rate of increase in the peso-dollar exchange rate, an index of industrial

production in Mexico, and the Mexican M4 money supply. The aggregate M4 includes bills and coins, demand deposits, time deposits of several maturities in commercial banks, dollar-denominated demand deposits, and dollar-denominated time deposits of several maturities in Mexican commercial banks. Other monetary aggregates—M1 and the domestic credit component of the monetary base—were tried unsuccessfully. The seven variables were defined as logarithms of levels, because in this form they are more likely to approximate the random walk specification of the Bayesian system.

The Bayesian system was estimated for the seven variables from 1974:1 to 1987:12, using 12 lags for each variable. Since agents in the economy form expectations conditional on the information they have at the time, it would not be entirely correct to use the whole sample to estimate the system's coefficients and then to utilize the residuals as forecast errors. In order to form conditional forecasts, a Kalman filter technique was used to update monthly the information used in the estimation. The system's initial parameters were estimated from data from 1974:1 to 1977:2 and were then updated by the Kalman filter.

For several different sets of assumptions, four factors usually had significant explanatory power on the return to an equally weighted portfolio, RDP_t : unexpected inflation (cpi), unexpected changes in the S&P 500 (sap), oil price shocks (op), and money shocks ($M4$). Unexpected devaluations were marginally significant, and unexpected changes in industrial production were statistically insignificant.

The four macroeconomic measures were used in the APT estimation to estimate the value of the four risk factors, f_{1t} , f_{2t} , f_{3t} , and f_{4t} :

$$(5) \quad \begin{aligned} f_{1t} &\equiv cpi_t - \hat{E}[cpi_t/t - 1], \\ f_{2t} &\equiv sap_t - \hat{E}[sap_t/t - 1], \\ f_{3t} &\equiv op_t - \hat{E}[op_t/t - 1], \\ f_{4t} &\equiv M4_t - \hat{E}[M4_t/t - 1]. \end{aligned}$$

The $\hat{E}[\cdot/t - 1]$ terms are the estimates of the unobserved expectations held by agents at the end of period $t - 1$.

The statistical characteristics of the macroeconomic variables show they are far from perfectly correlated, and no one variable can be substituted for another. Each of them is expected to make an independent contribution in explaining the variability of returns. Rationality was tested by a Lagrange Multiplier Test for serial autocorrelations of the residuals (Engle 1984). For all four factors we are unable to reject the null hypothesis that these residuals are not autocorrelated at any commonly used level of confidence.

The Proxy for a Missing Factor

The derivation of the pricing equation 2 rests on the presumption that there is an unlimited number of assets. Thus, by applying the law of large numbers, the economy is able to diversify entirely all nonsystematic risk. However, Dybvig (1983) and Grinblatt and Titman (1983) have shown that an explicit upper

bound can be placed on the deviations of the individual assets' expected returns from APT pricing in finite economies. Their result hinges crucially upon the assumption that the random error ϵ_{it} in the linear factor model (equation 1) is indeed a disturbance specific to asset i and is free of systematic risk, and thus the impact of idiosyncratic risk in a diversified portfolio is very small.

In this light it is very important that the set of macroeconomic pervasive factors be made as complete as possible in the econometric testing of APT. The absence of factors can produce gross mispricing of some assets and cause the APT restrictions to be rejected even if they are true.

Following the work of McElroy and Burmeister (1988), the return on a well-diversified portfolio is employed to mimic the time series of a potentially missing factor. Assuming that one of the K factors is unknown, equation 4 can be rewritten as:

$$(6) \quad RDP_t = \lambda_o + \sum_{j=1}^{K-1} b_{pj} \cdot (\lambda_j + f_{jt}) + \lambda_K + f_{Kt} + \epsilon_{pt} \quad t = 1, \dots, T,$$

where b_{pK} is normalized to equal 1. Given that the missing factor, f_{Kt} , is unknown, equation 6 is written more simply:

$$(7) \quad RDP_t = a_p + \sum_{j=1}^{k-1} b_{pj} \cdot f_{jt} + u_{pt} \quad t = 1, \dots, T,$$

where $u_{pt} = f_{Kt} + \epsilon_{pt}$. The residuals of equation 7 contain valuable information about the missing factor f_{Kt} . If we assume that the portfolio at hand is well diversified and thus has negligible idiosyncratic risk, then ordinary least squares residuals \hat{u}_{pt} are a consistent estimator of f_{Kt} (under the assumption that f_{Kt} is orthogonal to the other factors). Intuitively, as the portfolio grows in size, the weight of any one asset is reduced and the impact of idiosyncratic shocks on returns greatly diminished.

We attempted to develop a fifth missing factor by assuming that the portfolio was well diversified and by regressing its return, RDP_t , (measured in dollars) on the four macroeconomic factors obtained from the Bayesian system. The results are shown in table 1. Except for the money shocks risk factor, each factor has

Table 1. *Regression of the Return to a Well-Diversified Portfolio on Four Primary Macroeconomic Risk Factors*

	Constant	Inflation shocks	Change in the S&P 500	Oil price shocks	Money shocks
Coefficient	3.160 (2.20)	-360.73 (-3.66)	133.84 (3.33)	27.412 (1.58)	28.90 (0.39)
$R^2 = 0.23$					
D.W. = 1.92					
Sample period 1979:1 to 1987:12					

Note: t -statistics are in parentheses below the estimated coefficients. Ordinary least squares regression was applied to obtain these results.

Source: Author's estimates; see appendix A.

significant explanatory power on the return of the portfolio. Together they account for almost one-fourth of the variation of the portfolio as indicated by the value of R^2 . We cannot accept the null hypothesis that the four factor loadings are zero at commonly used levels of confidence. Given that we intend to utilize the residuals of equation 7 as a proxy for the fifth factor, the regression results were carefully scrutinized for heteroscedasticity and autocorrelation of residuals (de la Calle 1989).

To estimate the system of APT equations 3, we defined as a fifth macroeconomic factor the ordinary least squares residuals of a regression of the return of the portfolio on the four primary factors, as shown in table 1. The inclusion of this fifth factor in the estimation ensures that the list of pervasive factors is as comprehensive as possible. This factor is especially important because it was developed using stock market information. Because of the relatively smooth nature of most macroeconomic series, we cannot expect them to capture all the information available to the market in some period. Stock prices, however, respond very quickly to public information. Thus we can guess that a residual factor derived from stock market data would help to explain expected returns across assets. The fifth factor was defined as

$$(8) \quad f_{5t} \equiv RDP_t - \hat{RDP}_t.$$

Since the fifth factor proxies an unobserved source of risk, it is difficult to attach to it any particular meaning. It might be a measure, for instance, of surprises in "market psychology," or it might capture "rumors of imminent controls on capital mobility."

The Mexican Peso Problem

We first attempted to develop the residual market factor by running the peso return of the portfolio on the four primary factors. The results obtained were very similar to those in table 1, but with two main differences. First, inflation innovations were insignificant, and monetary surprises were significant. Second, the residuals showed acute first-order autocorrelation, which is attributed to the endemic presence of the Mexican peso problem in Mexican asset returns. The term "Mexican peso problem" describes the observed phenomenon of a considerable time period during which an expected event (a large devaluation) does not materialize. This generates measured surprises that have nonzero means and are autocorrelated (Lizondo 1983). Autocorrelated residuals were found only in large portfolios. In regressing the peso returns of individual assets on the four primary factors, no autocorrelation was detected. However, when the number of assets in the portfolio was increased, the autocorrelation increased correspondingly. This occurs because the aggregation of individual returns eliminates the idiosyncratic risk (not autocorrelated), while it leaves the nondiversifiable autocorrelated factor. We interpreted this phenomenon as indicating a missing pervasive factor, itself autocorrelated, that was discovered only as individual assets were aggregated in increasing portfolios. The prime candidate for an autocorre-

lated pervasive innovation was the time series of unexpected devaluations of the peso. Running the APT model with returns measured in dollars bypasses the econometric problems encountered with autocorrelated residuals (neither residuals of individual asset dollar returns nor those of portfolio dollar returns are serially autocorrelated) and adds information in that the model encompasses the effect of exchange rate movements and of the missing factor (de la Calle 1989).

IV. ESTIMATION AND INTERPRETATION OF THE APT RISK PREMIA

Armed with the five risk factors developed above, we can now estimate the nonlinear system of equations 3 by using an iterated nonlinear, seemingly unrelated regressions technique (the data are described in appendix A and the details of the technique in appendix B). Estimates were computed for two distinct subsamples of 24 assets each for 1980:1 to 1986:12 (a compromise between sample size and computer capabilities). One-month holding period returns of U.S. Treasury bills were used as a proxy for the risk-free rate of interest (λ_{ot}) as done by McElroy and Burmeister (1988). Tables 2 and 3 display the estimates of the factor loadings for the two samples.

Most of the factor loadings (or sensitivities) with respect to the inflation risk factor (f_{1t}) are very significant and, generally, negative. The residual risk factor (f_{5t}) is also overwhelmingly significant. The two “foreign” factors—innovations on the S&P 500 price index (f_{2t}) and on the dollar price of oil (f_{3t})—are significant in more than half of the cases. Factor loadings with respect to the S&P-500-price-index risk factor are positive in all cases. They are negative in some cases with respect to the dollar-price-of-oil risk factor. In these two samples the monetary-surprises risk factor (f_{4t}) appears not to exert a remarkable influence on returns.

Table 4 reports the risk factor prices for samples 1 and 2. The price of the inflation risk factor turns out to be marginally significant and positive in both samples. This, coupled with negative factor loadings, implies that the securities in the sample are generally good countercyclical hedges with respect to unexpected inflation and thus have a low expected return, other things being equal. Risk factor prices for changes in the S&P 500 index and the residual risk factor are significant in both cases; the former is negative, and the latter is positive. The price of the oil-price-shocks risk factor is also significant and switches signs between samples. The price of the money-shocks risk factor, as anticipated, appears to play no major role.

Table 4 presents the Lagrange multiplier test results for the APT restrictions as well. We are unable to reject at commonly used significance levels the null hypothesis that the restrictions in equation 2 hold. It looks as if, under the maintained hypothesis that the linear factor model holds, the APT restrictions are not too stringent to impose on the data, and thus that expected returns are linearly related to their sensitivities with respect to macroeconomic surprises.

Table 2. *Estimated Asset Sensitivities to the Five Risk Factors, Sample 1*

<i>Asset</i>	<i>Inflation shocks</i>	<i>S&P 500 price index</i>	<i>Dollar price of oil</i>	<i>Money shocks</i>	<i>Residual factor</i>
14	-643.39 (-4.35)	108.48 (1.83)	49.061 (2.07)	136.33 (1.34)	1.598 (10.94)
54	-161.89 (-2.29)	51.316 (1.77)	9.162 (0.79)	-133.78 (-2.74)	0.362 (5.15)
28	-540.48 (-5.58)	86.239 (2.22)	51.349 (3.30)	78.289 (1.18)	0.914 (9.55)
11	147.17 (0.40)	76.394 (0.52)	-69.740 (-1.19)	-316.81 (-1.27)	1.921 (5.34)
42	-482.73 (-11.02)	101.36 (5.74)	30.989 (4.39)	22.229 (0.74)	0.995 (22.96)
52	-285.23 (-4.88)	45.754 (1.91)	5.236 (0.55)	-117.18 (-2.91)	0.532 (9.18)
16	-250.47 (-0.60)	110.25 (0.66)	58.716 (0.88)	301.33 (1.05)	1.661 (4.04)
47	104.63 (1.89)	73.388 (3.21)	13.460 (1.48)	18.754 (0.49)	0.066 (1.20)
33	-521.25 (-12.10)	75.977 (4.24)	17.953 (2.52)	25.926 (0.87)	0.833 (19.48)
29	-807.37 (-7.58)	154.25 (3.58)	52.652 (3.06)	82.380 (1.12)	1.260 (11.95)
23	-804.38 (-6.67)	76.017 (1.56)	39.917 (2.06)	-43.749 (-0.53)	1.167 (9.79)
15	-177.63 (-1.30)	80.304 (1.46)	48.486 (2.20)	1.774 (0.02)	0.949 (7.02)
09	-593.43 (-3.59)	110.87 (1.69)	24.317 (0.92)	-10.232 (-0.09)	0.849 (5.20)
30	-684.75 (-6.98)	76.157 (1.93)	32.329 (2.05)	40.191 (0.60)	0.946 (9.75)
34	-571.26 (-4.28)	125.73 (2.36)	52.103 (2.44)	94.244 (1.03)	1.457 (11.05)
17	-224.29 (-2.18)	177.11 (4.20)	60.074 (3.58)	18.523 (0.26)	1.150 (11.27)
10	-319.31 (-2.83)	27.494 (0.60)	-19.327 (-1.06)	-127.12 (-1.64)	0.909 (8.15)
35	-396.70 (-2.84)	50.227 (0.90)	1.814 (0.08)	-23.389 (-0.24)	1.118 (8.10)
40	-219.38 (-2.06)	66.165 (1.55)	-14.529 (-0.85)	-63.779 (-0.87)	0.660 (6.28)
05	-449.65 (-2.28)	187.08 (2.35)	-0.877 (-0.03)	83.525 (0.62)	1.686 (8.65)
06	-658.99 (-5.40)	98.968 (2.03)	30.847 (1.58)	-48.180 (-0.57)	1.531 (12.70)
19	-620.62 (-4.78)	78.499 (1.49)	57.276 (2.72)	-82.149 (-0.92)	1.120 (9.34)
41	-619.87 (-5.62)	109.06 (2.48)	22.734 (1.29)	-28.868 (-0.38)	1.159 (10.64)
02	-316.94 (-2.36)	105.36 (1.97)	51.124 (2.39)	84.535 (0.92)	0.894 (6.74)

Note: t-statistics in parentheses. The 24 assets are in random order and are distinct from those in table 3. The assets are numbered but not named to preserve confidentiality.

Source: Author's estimates; see appendix A.

Tables 2 and 3 in combination with table 4 can be used to explain why particular assets have high or low expected returns. Four assets have high expected returns essentially because they are highly procyclical; their factor loadings with respect to the residual factor are high and very significant as well. Three other assets produce high expected returns by combining large factor loadings with respect to the residual risk factor with big and significant factor loadings with respect to oil shocks. One asset presents a very high total premium because it mixes a large and positive residual risk factor sensitivity with a relatively low, but negative, inflation risk factor sensitivity.

Several assets present low expected returns. In general these assets are good countercyclical hedges and thus have relatively low factor loadings with respect to the residual factor. Other assets display low expected returns regardless of their having large and significant residual risk factor sensitivities, thanks to offsetting sensitivities to other pervasive factors.

The results of the iterated nonlinear, seemingly unrelated regressions technique show that the estimation of the risk prices is very sensitive to the set of assets chosen, at least with the sample size we used. To get good estimates of the risk factor prices requires a good deal of variability of the factor loadings across assets. If in the selected sample many of the assets are close substitutes, the estimates of the risk factor prices will be generally poor because of the multicollinearity of the matrix of factor loadings. A sound estimation of an APT system does not require an infinite sample but rather a varied menu of assets.

The different estimates of the risk prices in samples 1 and 2 are a disturbing result because we should expect an equilibrium model to price equally pervasive sources of risk in any subset of securities. Estimates of the risk prices with samples containing assets from samples 1 and 2 and other assets show that estimates of risk factor prices for inflation, change in the S&P 500, and the residual risk factor are robust to the partition, whereas risk factor prices for oil price shocks and money shocks change across samples. For this reason estimates of the risk factor loadings and risk premia were also obtained through the two-step procedure of Fama and MacBeth (1973). This allowed us to increase the sample size and to estimate the model for 25 rolling samples starting every quarter of the year. The results make patent the fact that the risk factor prices are statistically different from zero in most sample periods, but not in all of them. They also confirm our suspicion of variable risk premia.

V. IMPERFECT CAPITAL MOBILITY

The existence of domestic risk factors priced in Mexico is important from the policy point of view. Macroeconomists contend that in an open economy monetary policy is effective as a tool to the extent that the central bank is able to affect the expected return of domestic bonds. Several studies (Cumby and Obstfeld 1983; Kamas 1986) have concluded that at least in the short run the monetary authorities in Mexico have followed a relatively independent policy. The behav-

Table 3. *Estimated Asset Sensitivities to the Five Risk Factors, Sample 2*

<i>Asset</i>	<i>Inflation shocks</i>	<i>s&P 500 price index</i>	<i>Dollar price of oil</i>	<i>Money shocks</i>	<i>Residual factor</i>
13	-583.33 (-2.64)	275.89 (2.80)	-9.310 (-0.32)	-42.719 (0.31)	1.584 (7.37)
12	-269.25 (-2.11)	84.917 (1.50)	-1.046 (-0.06)	-11.044 (-0.14)	0.617 (4.98)
30	-676.62 (-6.93)	62.849 (1.45)	30.879 (2.32)	48.064 (0.78)	0.964 (10.15)
51	-351.61 (-6.68)	36.830 (1.56)	0.086 (0.01)	-102.64 (-3.00)	0.507 (9.81)
24	-522.16 (-3.88)	110.03 (1.84)	30.816 (1.74)	40.200 (0.48)	1.187 (9.09)
37	-738.81 (-5.41)	45.542 (0.75)	64.256 (3.41)	67.437 (0.78)	1.564 (11.75)
31	-569.99 (-5.34)	143.96 (3.03)	15.864 (1.11)	-63.805 (-0.95)	1.172 (11.30)
06	-663.61 (-5.44)	112.54 (2.07)	22.845 (1.39)	-35.446 (-0.46)	1.523 (12.84)
18	-656.27 (-9.64)	117.67 (3.88)	25.792 (2.75)	27.381 (0.63)	1.119 (16.87)
32	-509.07 (-4.40)	113.74 (2.21)	17.685 (1.16)	11.379 (0.16)	1.125 (10.02)
04	-397.79 (-2.92)	176.47 (2.89)	-54.694 (-2.76)	-78.028 (-0.89)	0.827 (6.19)
36	-760.72 (-7.17)	50.398 (1.07)	23.890 (1.67)	-24.228 (-0.36)	1.286 (12.46)
22	-421.14 (-1.49)	108.88 (0.86)	36.411 (0.91)	374.40 (2.07)	0.364 (1.32)
26	-395.18 (-3.82)	202.20 (4.38)	42.213 (2.86)	29.607 (0.45)	1.486 (14.72)
39	-953.73 (-5.80)	-30.08 (-0.41)	33.798 (1.51)	13.134 (0.13)	1.103 (6.89)
46	112.75 (1.19)	84.768 (2.00)	20.614 (1.50)	25.635 (0.42)	0.062 (0.67)
01	-228.49 (-2.03)	38.552 (0.77)	58.830 (3.73)	94.357 (1.31)	0.858 (7.80)
21	-742.06 (-5.95)	75.370 (1.36)	40.105 (2.36)	68.950 (0.88)	1.421 (11.71)
33	-517.90 (-12.20)	64.288 (3.39)	26.462 (4.38)	11.418 (0.42)	0.838 (20.21)
08	-812.48 (-3.67)	54.612 (0.55)	40.701 (1.31)	162.35 (1.15)	1.649 (7.63)
20	-479.72 (-2.65)	190.34 (2.36)	14.848 (0.62)	-30.752 (-0.27)	1.332 (7.57)
43	-335.98 (-7.01)	29.032 (1.35)	4.149 (0.60)	-79.940 (-2.59)	0.523 (11.15)
27	-299.15 (-2.08)	165.18 (2.58)	11.622 (0.60)	-19.173 (-0.21)	1.135 (8.12)
10	-335.30 (-2.97)	46.340 (0.92)	-5.700 (-0.35)	-163.61 (-2.26)	0.870 (7.88)

Note: t-statistics in parentheses. The 24 assets are in random order and are distinct from those in table 2. The assets are numbered but not named to preserve confidentiality.

Source: Author's estimates; see appendix A.

Table 4. *Estimated Risk Factor Prices and Other Sample Statistics for Samples 1 and 2*

<i>Item</i>	<i>Sample 1</i>	<i>Sample 2</i>
<i>Risk factor</i>	<i>Estimated price</i>	
Inflation shock (λ_1)	0.0042 (1.70)	0.0065 (1.29)
Change in S&P 500 (λ_2)	- 0.0316 (-3.17)	- 0.0282 (-1.64)
Oil price shock (λ_3)	0.0655 (2.66)	- 0.1083 (-2.09)
Money shock (λ_4)	- 0.0008 (-0.15)	0.0214 (1.57)
Residual risk factor (λ_5)	4.0995 (2.80)	8.8789 (2.01)
<i>Sample statistics</i>	<i>Value</i>	
Average total premium (percent)		
Monthly average	1.3071	1.3138
Per year	16.86	16.96
RDP total premium (percent)		
Monthly average	0.8911	0.4553
Per year	11.23	5.6
Lagrange multiplier test statistic for APT restrictions	18.47	24.00
$\chi^2_{10\%}(19)$	27.20	27.20

Note: t-statistics in parentheses.

Source: Author's estimates; see appendix A.

ior of the real exchange rate in Mexico in the 1970s and 1980s reflects both the short-run autonomy and the balance of payments "crises" that obtain when an unsustainable policy is pursued (Calvo 1987). A major weakness of these empirical endeavors is that they are unable to distinguish clearly between ex post and ex ante rates of return. The APT model allows us to see whether there is a Mexican component in the expected rates of return.

Our earlier discussion seems to indicate that Mexican expected returns include premia for three domestic sources of risk: unexpected inflation, money innovations, and the residual risk factor. However, we cannot conclude from this that Mexican stocks face a set of pervasive factors different from the set that affects returns in other countries, because innovations in these three factors might reflect international shocks or because all this riskiness might be purely an expression of exchange rate risk. Thus, if inflation innovations only update the expected rate of devaluation, the pricing of the inflation risk factor will be mistakenly interpreted as evidence of imperfect capital mobility. Realizations of the inflation risk factor might also reflect shocks in the world rate of inflation. Similar arguments apply for the monetary-shocks and residual risk factors.

In order to present conclusive evidence about Mexican stocks paying for noninternational riskiness, appendix C assesses whether Mexican returns are sensitive to risk factors with no international components and uncorrelated with

changes in the expected rate of devaluation. The result is that the inflation and residual risk factors exert a statistically nonnegligible influence on the returns of stocks held by Mexicans.

In most of our results risk factor prices for inflation, the dollar price of oil, monetary shocks, and the residual risk factor (λ_1 , λ_3 , λ_4 , and λ_5) have explanatory power over the expected returns in our sample. To discover whether these factors are also priced in other countries, the returns of several Wall Street broad indexes were regressed on the original inflation, dollar price of oil, monetary shocks, and residual risk factors (f_{1t} , f_{3t} , f_{4t} , and f_{5t}). Table 5 demonstrates that these four factors have insignificant explanatory power over the proposed portfolios.

The coefficient of the inflation risk factor is significant in explaining the return of the S&P 500 and New York Stock Exchange financial indexes. This is probably due to the relation between changes in inflation rates in the United States and Mexico.

It is remarkable that the dollar-price-of-oil risk factor plays so minuscule a role in the U.S. financial markets. The fact that this international factor is priced in Mexico and not in the United States reinforces our previous intuition that the composition of the market portfolio determines the size of the premium. The American economy appears to be well hedged against sudden changes in oil prices, but the Mexican economy does not. (For more on the effects of the dollar-price-of-oil risk factor in different countries, see Chen, Roll, and Ross 1986 and Brown and Otsuki 1989.) The Mexican economy is not well diversified with respect to unwanted variability in its terms of trade. This is a power-

Table 5. *Summary Statistics on the Explanatory Power of the Risk Factors over Wall Street Broad Indexes*

<i>Wall Street index</i>	\bar{R}^2	$F(4,88)$
<i>New York Stock Exchange index</i>		
Industrial	-0.004	0.91
Transportation	0.000	1.01
Utility	-0.028	0.36
Finance	0.028	1.66
<i>S&P corporation index</i>		
Industrial	0.002	1.05
Capital goods	-0.009	0.79
Consumer goods	0.006	1.13
Transportation	-0.004	0.91
Public utilities	-0.033	0.26
Finance	0.035	1.84
500 Composite	0.002	1.04
<i>Dow Jones industrial average index</i>	-0.019	0.56

Note: The returns of the Wall Street indexes were regressed on the original inflation, dollar-price-of-oil, monetary-shocks, and residual risk factors (f_{1t} , f_{3t} , f_{4t} , and f_{5t}).

Source: Author's estimates; see appendix A.

ful argument for free capital mobility; it means that small economies that are specialized in production, but hold portfolios that are well diversified, can minimize the effects of variable terms of trade on investment decisions.

VI. SUMMARY AND CONCLUSIONS

This article has applied the APT to the study of relative prices of securities held by Mexicans. A sample of domestic and international assets that are typical of portfolio holdings for Mexican investors was used to estimate the model for 1977 to 1987. We tried to determine whether different exposures to a list of systematic state variables can explain dispersion of expected returns across assets held by Mexicans. Moreover we analyzed whether the increased riskiness accompanying the macroeconomic instability of the 1970s and 1980s was reflected in higher expected returns. We estimated the APT system of equations for 1977 to 1987 to discover systematic sources of risk that are priced in equilibrium and to test the cross-equation restrictions derived from the no-arbitrage-opportunity condition.

In most cases four factors had significant explanatory power on the returns of diversified portfolios: unexpected domestic inflation, unexpected changes in the S&P 500 price index, dollar oil price shocks, and monetary innovations. In addition the residuals of a regression of the return on a well-diversified portfolio on the four factors were used to mimic an extra factor. The five risk factors were used to obtain estimates of the factor loadings and risk prices by using an iterated nonlinear, seemingly unrelated regressions technique. The macroeconomic factors turned out to be important in explaining observed returns of individual securities. The iterated nonlinear, seemingly unrelated regressions technique allowed us to perform a nested test of APT pricing versus the alternative linear factor model. We were unable to reject the hypothesis that APT pricing restrictions are consistent with the data.

The main finding of this article is that the Mexican economy has paid excess premia because of unstable macroeconomic conditions. The returns are sensitive to the macroeconomic factors, and the market prices such sources of risk. This translates into higher expected returns and probably into a lower investment level and is one of the hidden costs of an erratic macroeconomic environment. The total premium in dollars for an equally weighted portfolio of all assets in the sample was estimated to be between six and eleven percentage points a year above the riskless rate (see table 4). Thus we should expect that government policies that foster stability would lower the rates required by investors. Such policies include stable monetary and fiscal policies, the development of a financial market able to create a varied menu of financial instruments, a liberal foreign exchange policy that would allow international diversification, a non-distorting tax system, and so forth.

Finally, it was shown that the Mexican economy is not well integrated with international capital markets because U.S. stock returns are insensitive to inno-

vations in the factors priced in Mexico. We found that domestic sources of risk, such as Mexican inflation, are not priced in the United States. Oil price shocks, an international source of risk, are priced in Mexico but not in the United States. This finding indicates that the Mexican economy is not well diversified with respect to oil price shocks. Furthermore, not only are the signs and sizes of the risk factor premia determined by the intrinsic characteristics of assets' returns, but the composition of the market portfolio also plays an important role.

APPENDIX A. DATA USED TO ESTIMATE THE APT MODEL

Ideally the list of returns used to estimate an APT model should be as comprehensive as possible, and it should include a menu of distinct assets in such a way that the risk premia can be estimated. If the collection of assets chosen contains many very close substitutes, it will become virtually impossible to estimate the premia. During the course of a chronic inflation and recurrent devaluations, investors tend to diversify their portfolios to a great extent. It is not uncommon to observe people investing in real estate, durables, the stock market, real estate overseas, foreign currency denominated bonds, and so forth.

We collected monthly data on the returns of 55 assets Mexicans can hold, including 42 stocks actively traded in the Bolsa Mexicana de Valores S.A. de C.V.; a sample of dollar-denominated assets (gold, silver, the S&P 500 price index, U.S. Treasury bills, and Mexican Petrobonos); peso-denominated bonds (certificados de deposito and certificados de tesoreria or CETES); and five durable goods.

Using information published by the Bolsa Mexicana de Valores S.A. de C.V. in several issues of its *Anuario Bursatil y Financiero*, we calculated for 1975:1 to 1987:12 ex post returns of the Mexican common stocks previously mentioned, by correcting the ex-dividend price series by cash dividends, stock dividends, splits, reverse splits, and subscription rights.

The Subdireccion de Estudios Economicos y Bursatiles of the Bolsa Mexicana de Valores S.A. de C.V. generously provided the following time series: Indice general de precios de la BMV, monthly realized returns on CETES, and monthly realized returns on Petrobonos.

The Direccion de Investigacion Economica of the Banco de Mexico assisted us with time series for the price indexes of gold, silver, and all durables.

The following series were obtained from *Indicadores Economicos* of the Banco de Mexico: M1, monetary base, international reserves, domestic credit, M4, index of industrial production, consumer price index, and peso-dollar exchange rates.

The S&P price indexes series, the New York Stock Exchange price indexes series, and the Dow Jones Industrials price index were drawn from CITIBASE. The U.S. consumer price index and the U.S. Treasury bill rates of return were obtained from *International Financial Statistics* of the International Monetary Fund.

The dollar oil price series were f.o.b. prices of Saudi Arabian light crude petroleum from 1975:1 to 1983:12 and Brent North-Sea spot prices from 1984:1 to 1987:12. Oil price series were obtained from the *Basic Petroleum Data Book* of the American Petroleum Institute.

APPENDIX B. ITERATED NONLINEAR, SEEMINGLY UNRELATED REGRESSIONS TECHNIQUE

Traditionally portfolio pricing models have been tested in two steps (Black, Jensen, and Scholes 1972; Fama and MacBeth 1973; Roll and Ross 1980; Chen, Roll, and Ross 1986). As noted by Gibbons (1982) and McElroy, Burmeister, and Wall (1985), this two-step procedure suffers from an errors-in-variables problem, because the estimated risk factor sensitivities b_{ij} used in the second step are not the true parameters and because this procedure is relatively inefficient because it does not take into account the cross-equation restrictions implied by equation 3. A nonlinear, seemingly unrelated regressions technique avoids the errors-in-variables problem for the factor loadings, and the risk prices are estimated simultaneously. It is relatively more efficient than using ordinary least squares on one asset at a time because it takes into account the cross-equation restrictions. A nested APT versus linear factor model test is well defined, and the cross-equation restrictions can be tested with standard hypothesis testing techniques.

Estimators for an iterated nonlinear, seemingly unrelated regressions technique are consistent and asymptotically normal even without normally distributed errors (Gallant 1987; McElroy, Burmeister, and Wall 1985). This is very important in light of the large set of evidence documenting the departure of returns from normality (Fama 1965; Clark 1973; Blattberg and Gonedes 1974; Epps and Epps 1976; Tauchen and Pitts 1983). In this study we found that the residuals of asset returns in dollars indeed deviate from normality. This makes patent the need to use methods that are robust with respect to non-normal errors, such as the iterated nonlinear, seemingly unrelated regressions technique.

APPENDIX C. NONINTERNATIONAL RISKINESS AND MEXICAN STOCKS

The inflation, monetary-shocks, and residual risk factors are "cleaned" by running regressions on the current rate of U.S. inflation, on the current rate of devaluation, and on 15 leads of the rate of devaluation of the peso. The residuals from these three regressions were used as factors orthogonal to U.S. inflation and present and future devaluations. Table A-1 displays the adjusted \bar{R}^2 and F -test statistics for the three regressions.

In all three cases we reject the joint hypothesis that the two sets of coefficients are zero. When we test for the significance of the coefficients of devaluation and its leads, we cannot reject that they are zero for both the inflation and residual risk factors, but we reject that they are zero for the monetary shocks risk factor.

Table A-1. *Summary Statistics from Regressions on U.S. Inflation and Present and Future Devaluations*

<i>Risk factor</i>	\bar{R}^2	$F(17,97)^a$	$F(16,98)^b$
Inflation shocks	0.24	3.14	1.84
Money shocks	0.22	2.90	2.94
Residual risk factor	0.23	2.58	0.59

Note: The 5 percent critical point of an $F(16,120)$ is 2.06; of an $F(17,120)$, 2.01.

a. F -test for zero coefficients of current U.S. inflation, current devaluation, and 15 leads of the rate of devaluation.

b. F -test for zero coefficients of current devaluation and 15 leads of the rate of devaluation.

Source: Author's estimates; see appendix A.

This last test is a Sims causality test of inflation, money, and the residual factor on the rate of devaluation (Sims 1972). Thus money innovations are a good predictor for devaluations, but inflation and residual risk factor shocks are not, at the 5 percent level.

The next step was to use the cleaned residuals as pervasive factors and to run regressions of the dollar returns of a host of portfolios on these factors and on the S&P-500-price-index and dollar-price-of-oil risk factors. The returns of 30 portfolios of 1 to 15 holdings were regressed against the redefined factors. In each case the R^2 drops when the redefined factors are substituted for the original ones.

This exercise shows that, despite the fact that the inflation and residual risk factors were made orthogonal with respect to future devaluations and U.S. inflation, they continue to exert a statistically non-negligible influence on the returns of stocks held by Mexicans.

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Debt Relief and Economic Growth in Mexico

Sweder van Wijnbergen

Could external restraint and internal balance in Mexico have been reconciled at levels of savings and investment that allowed satisfactory growth in output without the 1989–90 restructuring of debt? What are the likely implications of Mexico’s “Brady deal” on economic growth? What are the macroeconomic effects of debt-equity swaps? This article develops and estimates a model to address these issues. The analysis concludes that the 1989–90 agreement in Mexico will contribute materially to macroeconomic stability and the restoration of economic growth.

On March 28, 1990, \$48.9 billion of Mexico’s commercially held debt was exchanged for new debt instruments that either implied a cut in principal, a cut in interest rates, or an obligation to increase exposure in Mexico by 25 percent. Such a rewriting of existing contracts should be undertaken only if this is the only way in which macroeconomic stability and growth can be restored. This article presents the analysis used to assess whether the debt agreement would indeed contribute to the restoration of economic growth in Mexico. (See van Wijnbergen [1991] for a description and analysis of the 1989–90 debt restructuring, otherwise known as the “Brady deal.”)

The crisis leading to this agreement was indeed acute in Mexico. Between 1982 and 1988 Mexico’s gross domestic product (GDP) did not grow at all, while Mexico transferred on average no less than 6 percent of its GDP to external creditors. Moreover the macroeconomic problems of that period triggered an increase in inflation of a magnitude not seen earlier in Mexico’s economic history, in spite of an equally unprecedented fiscal adjustment program. Thus the issue was not just how to restore growth, but how to do so while maintaining a fiscal stance that would allow inflation to come down.

A brief historical overview sets out the developments leading to the situation immediately preceding the Brady debt restructuring in Mexico. Then a quantitative framework is applied to assess the limits on fiscal policy imposed by the macroeconomic targets embedded in the stabilization program initiated in 1988

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and the extent to which the recently concluded debt agreement relaxes them. Next a model is developed and estimated to determine whether satisfactory growth in output can be achieved within these constraints without jeopardizing external balance. The role of exchange rates and fiscal policy and the impact of external developments on growth and external debt in Mexico are discussed. The model is then used to assess the impact of the recently concluded debt agreement on Mexico's prospects for growth.

I. STABILITY, EXPANSION, AND COLLAPSE: A BRIEF REVIEW OF THE PAST

Between 1950 and 1974 real growth averaged 6.4 percent annually in Mexico, inflation was in single digits, and external debt accumulation was moderate. In the early 1970s rapidly expanding government involvement in the economy pushed up the rate of economic growth. However, increasing government expenditure was not matched by rising public sector revenues, and a decline in incentives prevented an adequate increase in private savings. As a result the inflation tax (the increase in nominal money balances necessary to keep the stock of real money constant) and external debt became increasingly important sources of finance.

Although sharp adjustment measures were implemented briefly in 1976, major oil discoveries and subsequent increases in the price of oil provided relief for fiscal and external problems. The government sector increased its share in value added by almost one-third, and the real exchange rate appreciated again, eroding the gains of the 1976 devaluation. This expansion was largely fueled from abroad: Mexico's external debt increased from \$16 billion to \$86 billion between 1975 and 1982, tripling in real terms.

In 1982 rising world interest rates and falling oil prices put an end to the expansionary policies. The subsequent cutoff from external capital markets after Mexico announced a moratorium on debt service in August 1982 left no option other than fiscal retrenchment. Mexico, which had run noninterest current account deficits in each of the preceding 30 years, suddenly needed to run surpluses. The ratio of external debt to GDP shot up anyhow under the influence of rising interest rates and falling growth rates. The gap between real interest rates on external debt and real growth in GDP went from -6.3 percent in 1980-81 to a full 10.5 percent in 1983. Differences this high meant that, even without deficits on the noninterest current account, the burden of debt increased rapidly, simply through the compounding effect of interest on debt inherited from the past. In addition came substantial capital losses on external debt resulting from the necessary depreciation in the real exchange rate. Real depreciation was unavoidable, given the decline in oil revenues and rise in real interest obligations, but it added 30 percentage points to the ratio of external debt to GDP during 1982 to 1987.

In 1983 a stabilization effort supported by the International Monetary Fund was implemented. Mexico's fiscal adjustment effort since then is probably un-

matched on a sustained basis in any country. The primary (net of interest) fiscal deficit, which was 7.1 percent of GDP before the crisis, turned within three years into a surplus of 5 percent of GDP, a surplus that increased further to an average of no less than 8 percent of GDP during 1988 to 1990. This turnaround was achieved even though revenues from oil exports declined by more than 7 percent of GDP. Noninterest government expenditure was reduced from 34 percent of GDP in 1982 to about 21 percent of GDP in 1989.

There was some expansion of the economy in 1984 and 1985, but the authorities adopted a new stabilization program in July 1986. This program called for renewed monetary and fiscal austerity and a concerted financing effort on the part of Mexico's external creditors. The 1986 package included new policy reforms designed to eliminate structural rigidities in the economy. The most significant change was a major reorientation toward exploiting the benefits of international trade.

The fiscal retrenchment since 1982 was partly brought about by a sharp cutback in the investment budget for the public sector, from almost 10 percent of GDP in 1982 to 4.5 percent of GDP in 1989. Private investment did not make up for the decrease in public sector investment. In response to the resulting decline in total investment and tight demand-management policies, growth stopped, and per capita income actually fell between 1982 and 1988. Inflation increased toward the end of the period, partially in response to a sharp nominal devaluation. This devaluation had become necessary because of the abrupt decline in oil prices in 1986. The subsequent *de facto* targeting of the real exchange rate, together with an increase in the frequency of wage and cost adjustments, introduced an element of instability into the system. This instability became more apparent toward the end of 1987, when the stock market plunge triggered a run on the peso. The run on the peso resulted in reserve losses and a 37 percent depreciation, which fueled inflation and expectations of further depreciations in the exchange rate.

In 1987 the Mexican government initiated a concerted effort to bring down inflation. Further fiscal adjustment was combined with an elaborate social pact involving wage and price controls in the private sector and wage and price restraint on the public sector after substantial price hikes up front. (To date, this effort to bring down inflation has been successful. The inflation rate, which averaged more than 70 percent during 1980–88, was about 20 percent during the second half of 1988 and all of 1989, and, after a relapse to 30 percent in 1990, is expected to fall well below 20 percent in 1991.) Nevertheless fears about sustainability lingered. Domestic interest rates remained well over 30 percent in real terms in the period preceding the debt negotiations, mostly due to uncertainty about the impact of the external debt on public finance and the exchange rate.

In July 1989 Mexico reached an agreement with representatives of its creditor banks to restructure most of its commercially held external debt. This agreement, which was implemented over the next eight months, reduced the net

transfer Mexico has to make to its external creditors by around \$4 billion a year (van Wijnbergen 1991). The restructuring of the debt has taken substantial pressure off public finances and the external account and has allowed the modest restoration of growth that began in the second half of 1989 to continue.

II. CONSISTENCY OF FISCAL POLICY

A fiscal stance compatible with sustained low inflation is necessary, although possibly not sufficient, to allay inflationary fears. This section assesses the extent to which the debt package restored consistency between fiscal policy, inflation targets, and the objective of renewed growth.

The Financeable Deficit

There are three sources for financing public sector expenditure beyond revenues from the regular tax system: monetization, domestic interest-bearing debt, and external borrowing. The revenue from each source can be combined into the calculation of a financeable deficit (see Phelps 1973 and Sargent and Wallace 1982 for the theory underlying this approach to inflation, and Anand and van Wijnbergen 1989 and van Wijnbergen, Rocha, and Anand 1988 for the empirical application used here; refer also to Buiters 1988). A financeable deficit does not require more financing than is compatible with sustainable external borrowing, existing targets for inflation and growth in output, and a sustainable policy on internal debt. If the actual deficit equals the financeable deficit, fiscal policy is consistent with macroeconomic assumptions and targets. Of course, consistency with macroeconomic targets does not guarantee that they can or will be achieved; it implies only that the fiscal deficit is not inconsistent with them.

A simple model of the financial sector that incorporates reserve requirements and other bank regulatory policies is used to derive the demand for reserves by commercial banks. The demand for currency is derived from a model describing private portfolio choice as a function of inflation, output, and interest rates. The demand for reserves and the demand for currency are combined to estimate the total demand for base money, which is used to derive total revenue from monetization, net of interest payments on reserves, for different output growth rates, interest and inflation rates, and regulatory policies.

In Mexico the real interest rate on domestic debt, at almost 40 percent just before the debt package was announced, was well above the growth rate of the economy. In such circumstances, increasing domestic debt to finance the deficit would escalate debt service as a percentage of GDP. Therefore, in calculating the financeable deficit for Mexico, it is assumed that the real value of domestic debt remained constant.

Table 1 summarizes the results of the analysis. The required deficit reduction is the difference between the actual deficit and the financeable deficit: a decrease in the deficit equal to the required deficit reduction would restore the deficit to a level consistent with other macroeconomic targets. The operational deficit is the

Table 1. *Foreign Financing Options in Mexico in 1988 and the Deficit Reduction Required to Achieve a Financeable Deficit*

<i>Case</i>	<i>Foreign financing (percentage of GDP)</i>	<i>GDP growth rate (percent)</i>	<i>Target inflation rate (percent)</i>	<i>Required deficit reduction (percentage of GDP)</i>
1. Nominal value of foreign debt constant (in dollars)	0.0	1.5	0.0	5.1
	0.0	1.5	5.0	4.8
	0.0	1.5	15.0	4.4
	0.0	1.5	50.0	3.3
2. Foreign debt as share of GDP constant	4.0	1.5	15.0	0.4
3. Real value of foreign debt constant	3.1		15.0	1.3
4. Increased GDP growth rate with target ratio of debt to GDP constant	3.1	0.0	15.0	1.5
	4.0	1.5	15.0	0.4
	5.5	4.0	15.0	-1.3
	6.0	5.0	15.0	-1.9

Note: A financeable deficit is one that is compatible with sustainable external borrowing, existing targets for inflation and growth in output, and a sustainable policy on internal debt.

Source: Author's calculations.

deficit of the comprehensively defined public sector, which includes only real interest payments on domestic debt.

In the first case in table 1, the nominal dollar value of foreign debt is assumed to be constant. The 1988 operational deficit (4.4 percent of GDP) was in that case seriously out of line with inflation targets. For compatibility with an inflation target of 15 percent, the entire operational deficit would have needed to disappear. Mexico received very little from the inflation tax and more in general from *seigniorage*,¹ mostly because of low GDP growth at the time and the practice of paying interest on reserves. Even with a target inflation rate of 50 percent, the required deficit reduction would have amounted to 3.3 percent of GDP.

Increased access to foreign financing would have made a difference in the required deficit reduction. Case 2 in table 1 shows that, if enough foreign financing had been available to at least maintain a constant ratio of debt to GDP, the 1988 operational deficit would have almost been compatible with an inflation target of 15 percent (the required deficit reduction would have been only 0.4 percent of GDP). Case 3 illustrates a less liberal target, in which the real value of external debt is held constant, rather than allowed to rise with real GDP. The table indicates that the additional stringency would have required almost an additional percentage point of fiscal adjustment.

Case 4 in table 1 shows how, under a constant ratio of debt to GDP as a target

1. *Seigniorage* refers to the resources the government acquires through the issue of nominal money balances. Part of the increase in nominal balances just serves to keep the real value of money constant; this part is the inflation tax.

for foreign borrowing, fiscal leeway increases with growth in output. The required deficit reduction would have been 1.5 percent of GDP if the real GDP growth rate had been zero, and -1.3 percent of GDP if the real GDP growth rate had been 4 percent. Seigniorage increases with higher growth, as does allowable foreign borrowing, if a constant ratio of debt to GDP is the target. The actual need for adjustment might even have been less, as higher growth boosts tax revenues as a share of GDP because of the slightly progressive tax structure.

The message of the table is clear: absence of foreign financing can very well create a vicious circle. Less foreign financing requires fiscal cutbacks; if these cutbacks slow down growth—as mentioned, Mexico had to more than halve its public investment outlays between 1982 and 1988—substantially larger cutbacks are in turn required to maintain consistency with the same inflation targets.

Fiscal Implications of Debt Management

Debt management takes on great fiscal importance when differences in real interest rates between domestic and foreign debt are large. This can be illustrated by a scheme to swap public debt for private equity in which \$10 billion in public debt is retired and a corresponding amount of domestic debt is issued by the public sector to acquire the private equity used in the swap. Because the difference in real interest rates before the Brady deal was 25 percentage points, such an operation would have increased the burden of the real interest rate by an amount equal to 1.5 percent of GDP, thus raising the required deficit reduction for a given inflation target correspondingly. The impact on the operational deficit would have been 1.2 percent of GDP. The model indicates that such a swap of debt for equity would have raised the equilibrium inflation rate (defined as the rate for which no fiscal adjustment is required) by no less than 50 *percentage points*.

The figures in table 2 illustrate the extent to which high real interest rates are at the root of Mexico's current fiscal problems. In this exercise it is assumed that there is no net increase in the nominal value of foreign debt. The equilibrium inflation rate decreases as the real interest rate on Mexico's internal debt is decreased. Alternatively, as inflation rises, additional revenue from inflation tax falls, necessitating increasingly larger increases in inflation to cover a given increase in the operational deficit.

Table 2. *Equilibrium Inflation and the Real Interest Rate on Domestic Debt* (percent)

<i>Variable</i>	I	II	III
Equilibrium inflation rate	150	22	0
Real interest rate on domestic debt	30	15	10

Note: GDP growth rate is 1.5 percent. There is no foreign financing.

Source: Author's calculations.

This table highlights that the secondary impact of the Brady package, through its impact on domestic interest rates, was in fact significantly more important from the point of view of fiscal consistency, than was the direct reduction in required foreign debt service.

III. CAN MACROECONOMIC STABILITY, EXTERNAL BALANCE, AND GROWTH BE RECONCILED? A QUANTITATIVE FRAMEWORK

Below is a simplified exposition of the model used to assess the likely impact of debt relief on economic growth in Mexico. The theoretical structure draws on van Wijnbergen (1985). The model parameters have been estimated econometrically and are reported in the next section.

Model Structure

The model focuses on intertemporal choice and the relative price governing it—the real interest rate. Both intertemporal production decisions (investment) and consumption decisions (savings) are endogenous. A second issue involves intratemporal rather than intertemporal trade; because foreigners spend less on Mexican goods on the margin than Mexicans do, any external transfer has immediate implications for the real exchange rate.

The aggregate supply of non-oil Mexican goods, y_s , depends on their relative price against foreign final goods (the real exchange rate, e), the real wage, w , the relative price of imported intermediate goods in terms of foreign final goods, P_M , and the stock of capital, K :

$$(1) \quad y_s = y(e, w, P_M, K).$$

Adding oil revenues, R_{oil} , and subtracting interest payments on external debt, i^*B , yields national income $y = y_s + R_{oil} - i^*B$. Tomorrow's capital stock, K_{t+1} , depends on today's capital stock plus net private and public investment (I_p and I_G , respectively):

$$(2) \quad K_{t+1} = K_t(1 - \delta) + I_p + I_G.$$

Aggregate expenditure consists of private consumption, C , private investment, I_p , and government expenditure, G . The real rate of interest is denoted by r , and y_A denotes after-tax income. Thus the current account surplus, CAS , can be written as

$$(3) \quad CAS = FS + NPS(r, e) = FS + y_A - C - I_p$$

where FS is the fiscal surplus and NPS is the net private savings surplus. The private sector's surplus of savings (S_p) over investment (I_p), $NPS = S_p - I_p$, depends on the real rate of interest.

Until now, this article has focused on the current account, fiscal deficits, and the real rate of interest. But what about the real exchange rate? The approach adhered to views the real exchange rate as the relative price of Mexican (non-oil)

goods in terms of foreign goods. The “market” that the real exchange rate clears is the market for Mexican goods.

One component of the aggregate demand for Mexican goods comes from Mexican consumers (and investors). At a more appreciated real exchange rate, Mexicans will tend to allocate their aggregate expenditure toward foreign goods rather than toward Mexican goods. Similarly, an appreciated real exchange rate will cause lower export sales (X_d).

The aggregate supply of Mexican goods (y_s) increases when the real exchange rate appreciates, because intermediate imports will become cheaper in terms of Mexican goods. Thus commodity market equilibrium can be written as

$$(4) \quad y_s(e) = C_d(e, C) + I_{p,d}(e, I_p) + G_d + X_d.$$

Growth, Real Interest Rates, and the Exchange Rate

As long as domestic interest rates are not completely linked to foreign interest rates (plus expected exchange rate depreciation), changes in domestic real interest rates can resolve potential discrepancies between fiscal deficits and external targets through their impact on the net private savings surplus (that is, private savings minus private investment). The effect on private investment, and hence on the growth of output, is one of the more important links between fiscal policy and output growth embedded in the model. Figure 1 is based on the following identity:

$$(5) \quad \begin{aligned} \text{CAS} &= \text{FS} + \text{NPS}(r) \\ &= \text{FS} + S_p(r) - I_p(r). \end{aligned}$$

A higher real interest rate will slow down private sector investment and possibly increase private savings, thus increasing the net private savings surplus.

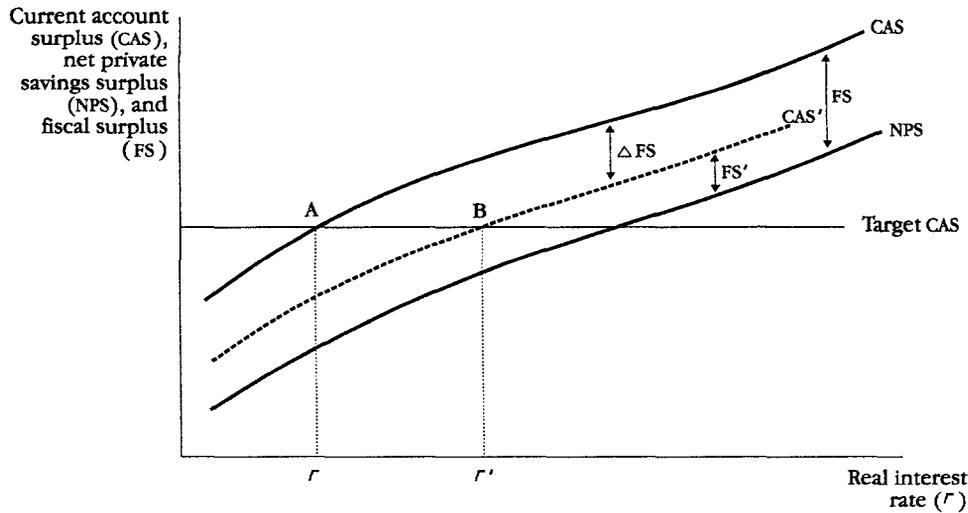
The net private savings surplus plus the fiscal surplus equals the external deficit that is compatible with given real interest rates and the fiscal surplus. The real interest rate at which the target value for the current account surplus equals the actual current account surplus is the real rate at which fiscal policy and current account targets are in line (r in figure 1, for current account target CAS).

An increase in the fiscal deficit (decline in the fiscal surplus, from FS to FS') leads to a downward shift in the feasible current account surplus (from CAS to CAS'). An increase in the interest rate (from r to r') is needed to call forth the extra net private savings required. Conversely, with a cut in the fiscal deficit, a given current account target can be met with a lower real interest rate and hence higher private investment.

However, growth in output depends not just on private investment, but on the sum of public and private investment. The impact of changes in fiscal deficits on growth in output will depend on whether the underlying adjustment is made out of public investment or out of public consumption. The model therefore breaks down public expenditure into consumption and investment.

Arbitrage between domestic and foreign interest rates may eliminate any lee-

Figure 1. *The Current Account Surplus, the Net Private Savings Surplus, and the Real Interest Rate in Mexico*



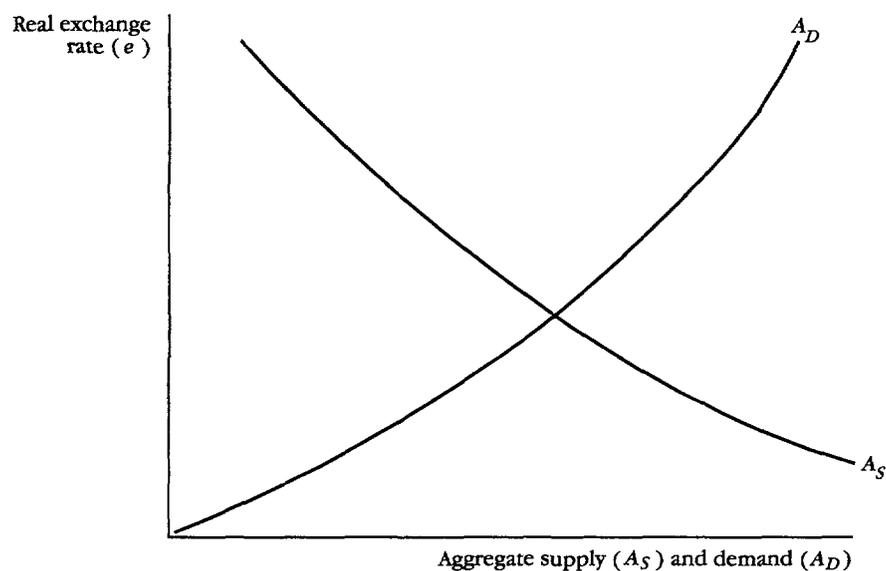
way for the domestic real interest rate to reconcile fiscal deficits with current account targets. Because there is in fact evidence of a very high degree of capital mobility between Mexico and the United States, the empirical application presented in section V uses the model for given real interest rates, rather than fixing the fiscal deficit and having the real interest rate adjust endogenously.

Commodity Market Clearing and the Real Exchange Rate

The real exchange rate can be viewed as the relative price of Mexican non-oil goods (hereafter referred to as Mexican goods) in terms of foreign goods. The real exchange rate clears the market for Mexican goods (possibly only after periods of disequilibrium); it is thus a static relative price in that it measures the rate at which two different (aggregate) commodities can be exchanged at a given moment in time.

Figure 2 illustrates the determinants of aggregate demand and supply in the market for Mexican goods (see Edwards and van Wijnbergen 1989 for a similar approach in a static framework). One component of aggregate demand for Mexican goods comes from Mexican consumers and investors. As the real exchange rate appreciates, Mexicans will tend to allocate more of their aggregate expenditure toward foreign goods rather than Mexican goods. Similarly, an appreciated real exchange rate will, all things being equal, cause lower export sales, as foreign demand falls off. This situation is represented by the upward sloping curve A_D .

The aggregate supply of Mexican goods is likely to increase when the real exchange rate (foreign over domestic prices) appreciates, because intermediate

Figure 2. *The Real Exchange Rate and the Market for Mexican Goods*

imports will become cheaper in terms of Mexican goods (as shown by the econometric evidence presented below). The aggregate supply curve A_S is therefore downward sloping.

The equilibrium exchange rate is the rate at which aggregate supply and demand for Mexican goods are in equilibrium (the intersection of A_S and A_D). When the real exchange rate is above the equilibrium level, there is excess demand for home goods, and output will be determined by supply: the exchange rate is undervalued (excessively depreciated). When the real exchange rate is below the equilibrium level, there is an excess supply of Mexican goods, and output is hence determined by demand: the real exchange rate is overvalued and there is Keynesian unemployment (van Wijnbergen 1986). An increase in government expenditure on home goods would shift the A_D curve down and so reduce excess supply and Keynesian unemployment problems. As a consequence, the commodity market clearing equilibrium real exchange rate would appreciate.

The Real Exchange Rate, Interest Rates, and the Current Account

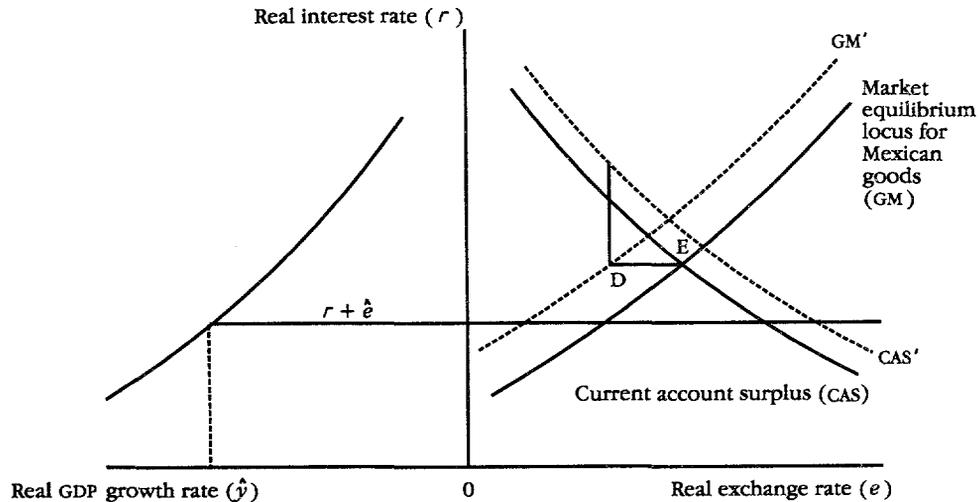
An external deficit indicates that aggregate expenditure by Mexicans on foreign and domestic goods exceeds aggregate income. It provides no indication, however, that aggregate demand by Mexicans and foreigners for Mexican goods exceeds aggregate supply of Mexican goods at the going real exchange rate. Various combinations of the real exchange rate and real interest rate will allow

the achievement of a particular current account target for given fiscal policy. Higher real interest rates will, other things being equal, reduce private consumption and investment and thus improve the current account balance. In which direction will the real exchange rate have to move to bring the current account into line with its target? Theory suggests, and the empirical analysis presented below confirms, that the answer is sometimes unclear.

For a constant rate of time preference the exchange rate has no effect on private consumption (Razin and Svensson 1983). Mostly because of its impact on intermediate import prices, a devaluation will have a negative effect on investment, but this effect takes place after a lag. In the short run, the only effect is the negative impact of a real depreciation on aggregate supply. Thus, in the short run, a real devaluation is in fact likely to deteriorate the current account (the current account curve slopes upward). In the longer run, because of the negative impact on investment, an appreciation will be necessary (the current account curve has a negative slope). Because this analysis focuses on the medium run, this article will concentrate on the case where the slope is negative (see figure 3).

What does this analysis suggest will happen if, because of inertial inflation and a fixed nominal exchange rate, the real exchange rate becomes overvalued? This possibility is represented by the move from E to D in figure 3. First, there will be an excess supply of domestic goods and hence falling exports, declining capacity utilization, and Keynesian unemployment. In the medium run a deterioration in the current account is likely according to the empirical analysis presented below. If the government responds to the rising unemployment and falling capacity utilization by raising government purchases of domestic goods

Figure 3. *The Effects of an Overvalued Exchange Rate in Mexico*



rather than devaluing, the market curve for Mexican goods shifts to the left (from GM to GM' in figure 3), and the commodity market problem is resolved. If this fiscal expansion is not matched by increased revenues, however, the current account will deteriorate, and the current account curve will shift up (from CAS to CAS'). The upward shift means that the original current account target will increasingly get out of reach. Thus an overvalued exchange rate will lead to unemployment and possibly to a deteriorating current account as time goes by, or to no unemployment but a real current account problem if fiscal policy is used to offset the employment effects of the overvalued exchange rate. Thus the appropriate policy response to falling exports and sluggish capacity utilization is a real depreciation.

As in the preceding subsection, interest rate arbitrage takes away one degree of freedom: the real interest rate, for a given rate of depreciation, confines the economy to the line at $r^* + \hat{e}$ in figure 3. It also pins down the growth rate for a given public investment program (see the left half of figure 3).

IV. AN EMPIRICAL APPLICATION TO MEXICO

This section presents an empirical application of the framework using Mexican data for 1965 to 1987.

The Real Interest Rate and the Market for Mexican Goods

The measure of permanent income is based on a simple trend regression of real disposable income, y_D , on time, t , with a trend break from 1984 onward because of the decline in 1983. Disposable income equals gross national product (GNP) minus government revenue plus the domestic real interest rate on government debt times the part of domestic government debt held outside the public sector.

$$(6) \quad \log(y_D) = 2.19 + (0.063 - D83PLUS*0.017)*t.$$

(64.9) (21.3) (7.21)

$$R^2 = 0.96, DW = 1.58, 1965-87 OLS$$

Permanent disposable income, y_P , is taken to be the predicted value of this regression in each year; the residual equals temporary disposable income, y_T .

Inflationary expectations are derived from a four-year moving average of actual CPI inflation rates. The predicted value of this weighting procedure is used to calculate real after-tax interest rates. The nominal rate used is the nominal, after-tax time deposit rate series presented in Gil-Diaz (1988) for 1965-86, and the three-month, after-tax time deposit rate for 1987.

Aggregate expenditure. With these definitions of temporary and permanent income and the real interest rate, the econometric results are given below for equations for the two components of aggregate expenditure that are sensitive to interest rates: private consumption and private investment. Expenditure for

P_{GNP}/P_f (an aggregate of the peso-based wholesale price index of Mexico's main trading partners, with 1980 export weights).

$$(9) \quad \log(y/K) = -2.02 + 0.39*\log(P_{GNP}/P_f) + 0.18*\log[P_{GNP}(-1)/P_f(-1)] \\ (2.15) \quad (5.51) \quad (2.95) \\ - 0.13*\text{PDL}\log[P_M(-1)/P_{GNP}(-1)] \\ (1.64)$$

$$R^2 = 0.96, \text{DW} = 1.38, 1974-87 \text{ 2SLS}$$

where PDL indicates a polynomially distributed lag. Equation 9 shows a strong positive response to the (inverse of the) real exchange rate: a real appreciation increases aggregate supply. Also, an increase in the relative price of intermediate imports or a decrease in the capital stock both lower aggregate supply.

Aggregate employment, N , depends on the real product wage, w/P_{GNP} , and on aggregate non-oil output (dlog X indicates the log difference, $\log X - \log X(-1)$):

$$(10) \quad \text{dlog}(N_t) = 0.006 - 0.13*\text{dlog}(w/P_{GNP}) + 0.54*\text{dlog}(y). \\ (1.11) \quad (1.87) \quad (5.22)$$

$$R^2 = 0.67, \text{DW} = 1.74, 1966-87 \text{ 2SLS}$$

The elasticity of real wages is small, negative, and significant at a 10 percent level, and the elasticity of output is substantially less than 1 percent.

Next year's capital stock depends on this year's capital stock minus depreciation and on total fixed capital formation:

$$(11) \quad K_{t+1} = (1 - 0.04)*K_t + (I_p + I_G).$$

The depreciation rate of 4 percent is derived from government data, with some correction for the likely understatement of true depreciation in the national accounts in inflationary periods because of historical cost-accounting practices.

Allocation of Expenditure and the Real Exchange Rate

This section focuses on intratemporal trade; the relevant relative price variable is the real exchange rate. The allocation of domestic expenditure over foreign and domestic goods is analyzed by explicitly estimating import demand equations for the different import categories (capital goods, consumption goods, and intermediate imports); then the equation for export demand is specified.

The volume of capital goods imported, M_K , depends on the relative price of imports that are capital goods versus those that are investment goods in general (the GNP deflator for investment) and on aggregate investment:

$$(12) \quad \log(M_K) = 14.11 - 1.12*\log(P_{M_K}/P_I) - 0.74*\log[P_{M_K}(-1)/P_I(-1)] \\ (5.93) \quad (5.63) \quad (2.72) \\ + 0.71*\log(I_p + I_G) - 0.88*M_R(-1). \\ (5.77) \quad (4.52)$$

$$R^2 = 0.94, \text{DW} = 1.40, 1970-87 \text{ 2SLS}$$

The variable M_R is the fraction of imports covered by quantitative restrictions; it is included in an admittedly crude attempt to capture the many changes in trade regime that have taken place in Mexico over the sample period. The results show relatively high elasticities, all estimated with great precision (high t -statistics). The trade regime variable picks up the degree of repressiveness of the trade regime in that it has a strong negative sign.

Consider next the volume of consumption goods imports, M_c :

$$(13) \quad \log(M_c) = 2.34 - 2.12 \cdot \log(P_{M_c}/P_{cpi}) - 1.23 \cdot \log[P_{M_c}(-1)/P_{cpi}(-1)] \\ (0.94) \quad (4.85) \quad (2.70) \\ + 1.31 \cdot \log(C_P) - 0.96 \cdot \log M_R(-1). \\ (4.15) \quad (2.54) \\ R^2 = 0.82, \text{DW} = 1.54, 1970-87 \text{ 2SLS}$$

The regression results indicate high and significant price elasticities and a strong negative impact of the proxy for trade intervention.

Demand for intermediate imports, M , equals

$$(14) \quad \log(M) = -18.7 - 0.64 \cdot \log(P_M/P_{GNP}) \\ (2.20) \quad (5.29) \\ + 2.84 \cdot \log(y) - 0.96 \cdot M_R(-1). \\ (10.2) \quad (1.34) \\ R^2 = 0.91, \text{DW} = 1.40, 1970-87 \text{ 2SLS}$$

Equation 14 shows a somewhat lower, although highly significant, price elasticity and an unusually high income elasticity.

Total demand for Mexican goods by domestic residents in any given period can be deduced by combining the import demand equations with the equations for aggregate domestic expenditure and scaling by the relevant relative prices. To complete the analysis of commodity market equilibrium in the market for (non-oil) Mexican goods, an additional element is needed, however: foreign demand for Mexican goods, or export demand.

In the specification of the equation for export demand (X_d), it was assumed that Mexican exporters compete not so much with domestic producers in Mexico's export markets, but with other exporters to the same markets (primarily the United States and the European Economic Community). Thus the relevant activity variable is aggregate imports into Mexico's export markets (weighted by their share in Mexico's total exports), and the relevant relative price variable is the ratio of Mexico's export price over the aggregate price index of imports into Mexico's export markets. This yields

$$(15) \quad \text{dlog}(X_d) = 1.55 - 0.95 \cdot \text{dlog}(X_P) - 0.12 \cdot \text{dlog}[X_P(-1)] \\ (0.96) \quad (2.79) \quad (0.40) \\ + 1.50 \cdot \text{dlog}(M_v^*) \\ (3.38) \\ R^2 = 0.59, \text{DW} = 2.56, 1968-87 \text{ 2SLS}$$

where $X_p = (P_x/P_M)$ is the dollar price of Mexican non-oil exports over the aggregate dollar-based price index of imports into Mexico's export markets. M_v^* is the volume of imports into those markets (again, weighted by each country's share in Mexico's total non-oil exports). Analysis of the error structure suggested estimation in terms of rates of change rather than of (log) levels. The equation performs reasonably well: the price elasticities are significant, and the "income" elasticity is high and significant.

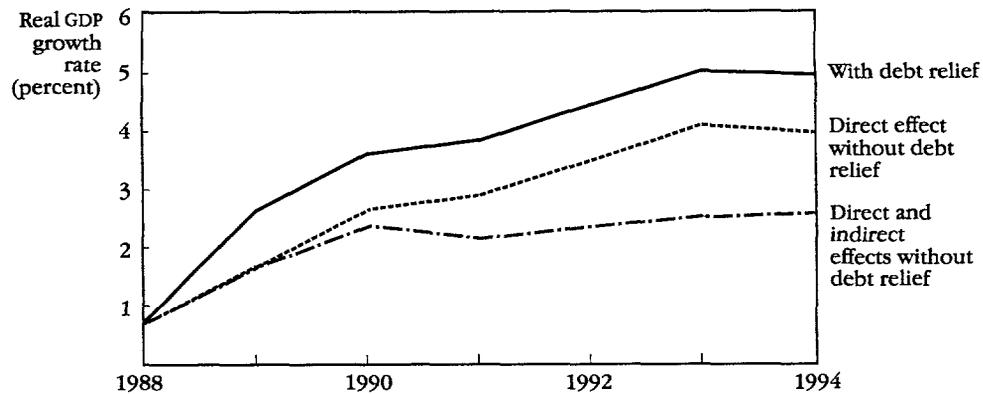
V. THE 1989-90 DEBT PACKAGE AND THE RECOVERY OF ECONOMIC GROWTH

The debt relief package has reduced the net transfer Mexico needs to make to its creditors by almost \$4 billion a year during 1989-94, or on average slightly below 2 percent of GDP. Half of this amount is due to the lengthening of maturity implied by the agreement, with the rest coming from lower interest payments and new money disbursements from the banks that decided not to choose one of the two options for debt service reduction. The reduction in required external transfers will have a direct beneficial impact on Mexico's fiscal situation and output. However, at least as important are the indirect, "secondary" effects of renewed confidence. A reduced net external transfer means reduced pressure on the exchange rate. Also, because this is a medium-term agreement, uncertainty about future exchange rates, financial regulation, and taxation has been reduced considerably. This situation greatly reduces the risk associated with peso-denominated, public sector debt. One should therefore expect domestic interest rates to decline. Developments since the details of the package became known in July 1989 support this argument. Nominal interest rates fell from 56 percent to around 36 percent on an un compounded basis immediately after the details of the package became known; they fell further to around 25 percent toward the end of 1990.

Without the debt package Mexico would have had to service full interest and amortization on all public commercial debt out of a budget that was already severely cut back. Therefore, the government would have been forced to cut back public investment in line with the decline of "allowable" external net borrowing. The drop from the top line to the middle line in figure 4 indicates the direct impact on growth that this cutback in public sector investment would have had. In the simulations, benefits of the debt agreement are shown for 1989, even though the agreement was implemented in 1990. However, a number of policy changes implemented earlier would not have taken place if it had been known there would not be a debt agreement. This is in particular true of an important, fiscally costly accelerated depreciation scheme made effective in late 1988. The fiscal consequences of full debt service would have made such reforms impossible.

It is assumed that the government would have attempted to maintain its stabilization effort. It would then have been highly unlikely that domestic interest rates would have come down without a debt package. Therefore domestic

Figure 4. *Projected Impact of Debt Relief on Growth of Output in Mexico, 1988-94*



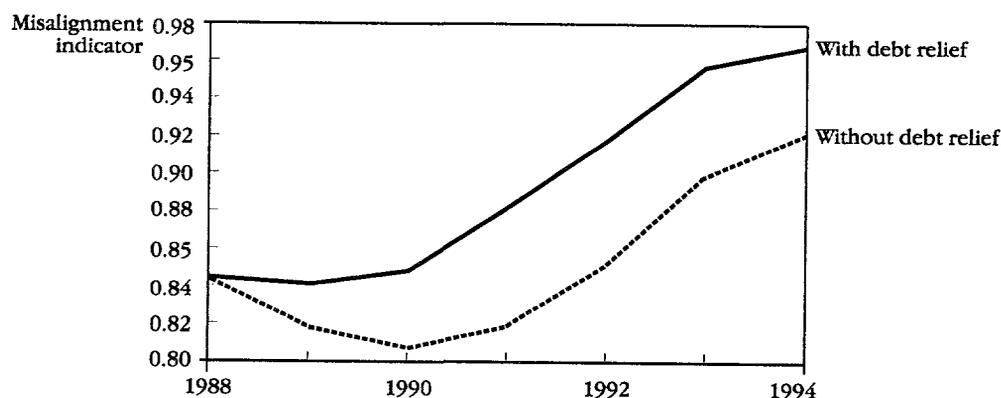
Source: Author's calculations.

real interest rates stayed at 30 percent in this simulation; 30 percent is the value that prevailed on average in the year preceding the debt accord. Thus private investment would have declined because of higher real interest rates, compounding the negative impact on growth caused by the fall in public investment. This secondary effect would have caused the further decline in growth from the middle to the bottom line in figure 4.

Both effects would have had a major impact on growth. Growth in output would have been lower by one percentage point initially; the difference in growth would have deepened to more than 2 percent by 1994, as both private and public investment would have declined. During 1988-94 average growth would have been almost two percentage points lower, to reach only 2.6 percent of GDP by 1994. About half of the final slowdown in growth would have resulted from the impact that a failure to implement a debt agreement would have had on domestic real interest rates, which, in turn, would have reduced private investment. Not surprisingly, employment growth would have slowed down as well, by about one percentage point on average.

In this scenario, without access to external funds, a real devaluation would have been unavoidable. Devaluation of the real exchange rate is, of course, the main channel through which uncertainty on the external debt situation influences domestic real interest rates. Figure 5 indicates the importance of debt relief for the real exchange rate.

Figure 5 gives the value of a qualitative real exchange rate misalignment indicator with and without the debt package. The indicator equals the ratio between aggregate demand for domestic goods (by foreigners and Mexican nationals alike) and capacity output. This variable can be different from one if the model is run with a predetermined real exchange rate. A number less than

Figure 5. *Projected Exchange Rate Misalignment Indicator, 1988-94*

Note: An indicator value of less than one corresponds to overvaluation.

Source: Author's calculations.

one corresponds to overvaluation in the sense that a real depreciation would be needed to clear the commodity market. The figure clearly shows the extent to which debt relief is likely to take pressure off the exchange rate by raising the real exchange rate compatible with planned policy settings.

If, instead of fully servicing debt obligations, principal were rescheduled but interest fully paid, the net marginal impact of the debt package on growth would still be substantial. In that case the direct transfer effect would be halved, for a total of less than 0.5 percent a year instead of slightly under 1 percent a year. But a pure rescheduling exercise would leave a substantial financing gap (\$10.8 billion), so no favorable domestic effects should be expected from rescheduling alone. Accordingly, the full secondary impact of the debt agreement through its impact on domestic real interest rates and investor confidence would not be affected. Thus, even judged against this less extreme alternative, one would still expect a net marginal effect of the debt agreement on GDP growth of around 1.5 percent a year during 1989-94.

Such econometric results should be interpreted with caution; however, in a well-defined, formal sense, they represent the best use of currently available information. Based on these results a clear conclusion emerges: the debt package does meet the minimum requirements for restoring growth.

VI. CONCLUSIONS

This article has presented a model to analyze the interaction between fiscal policy, real interest rates, and the real exchange rate. The model was estimated for Mexico and used to analyze the impact of the recently concluded debt agreement on Mexico's prospects for economic growth.

Without renewed access to foreign capital markets, Mexico would have faced

a grim fiscal situation. As demonstrated, without a net nominal increase in foreign debt or an equivalent cut in scheduled debt service, and at preagreement interest rates, a target of 15 percent inflation would have required an increase of more than four percentage points in the noninterest surplus for fiscal consistency. The primary surplus in 1988 was already extraordinarily high at 7.6 percent. An increase of four percentage points would have been equivalent to scrapping the entire public sector investment program. An adjustment this large would clearly have been impossible after the massive fiscal retrenchment that had already taken place in the preceding years.

As demonstrated further, servicing the face value of the current debt without substantial amounts of new money would have been incompatible with renewed growth in output. The analysis suggests that the recently concluded debt agreement between Mexico and its creditors brings restoration of growth within reach, leading to cautious optimism about the prospects for recovery of growth in Mexico.

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A SYMPOSIUM ON TAX POLICY IN DEVELOPING COUNTRIES

This symposium draws on papers presented at the World Bank Conference on Tax Policy in Developing Countries, held in Washington, D.C., in March 1990. The articles in the symposium were refereed in the usual way. The Editorial Board invited the organizers of the conference, Javad Khalilzadeh-Shirazi and Anwar Shah to write the introduction to the symposium.

Introduction: Tax Policy Issues for the 1990s

Javad Khalilzadeh-Shirazi and Anwar Shah

In recent years, in the wake of fiscal crisis, developing countries have increasingly begun to restructure their tax systems to seek higher revenues or to improve the revenue elasticity and buoyancy of the tax structure (Chhibber and Khalilzadeh-Shirazi 1988). These reform movements have also aimed to eliminate the disincentive effects of onerous levels of taxation, to reduce the economic inefficiencies induced by the distortionary taxation of assets and sectors, to protect the poorest of the poor from the tax net, and to provide partial relief from the unwelcome effects of inflation.

This introduction to the following articles on tax policy first gives an overview of tax reform in developing countries. It then distills lessons for tax reform from past developing-country experiences and reviews selected issues that are expected to dominate tax policy research and discussions in the 1990s. The five other articles in this symposium provide an in-depth review of applications of tax policy models in developing countries and analysis of tax policy toward foreign direct investment, taxation of agricultural land and financial assets, and the redistributive impacts of various taxes.

I. TAX REFORM IN DEVELOPING COUNTRIES

Many developing countries have undertaken tax reform in recent years. Their successes and failures can provide guidance for countries in similar circumstances, which may now or in the future attempt to reform their tax systems. Tax reform in these countries has varied in substance, process, context, and timing. For example, in Colombia, the Republic of Korea, and Turkey there was a long drawn out period of tax reform. In Indonesia and Malawi major changes in the tax system were implemented in a single episode over a short period. A review of these experiences provides some coherent themes about the current status and future directions of tax reform and points to some unresolved issues that will continue to invite controversy and debate in the coming years.

Directions of Reform

The emphasis on the redistributive role of the tax system is gradually waning, as a direct consequence of pervasive tax evasion. Theoretically progressivity

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remains high on the political agenda. However, the political will to enforce income tax compliance is often lacking. Vertical equity is increasingly being perceived as an elusive goal and, therefore, is being assigned a lower order of priority in tax reform.

Trade liberalization policies in many developing countries have resulted in a persistent and discernible trend toward reduced reliance on narrowly based trade taxes. To overcome revenue shortfalls associated with such policies, there has been increased emphasis on broadly based, hybrid value added taxes. To reduce the disincentive effects of taxation, average and marginal effective tax rates are being brought down by broadening tax bases through the elimination of ineffective tax preferences while leveling the rates. These measures, however, compromise vertical equity. The protection of the poorest of the poor has been attempted by exempting or zero rating foods under a value added tax (VAT) and by raising the threshold of personal income, urban property, and agricultural land taxes.

Distortions between sectors and between assets are being reduced by eliminating special preferences and replacing cascading turnover or sales taxes by more neutral VATs. In Latin America there have been attempts to mitigate the unwelcome effects of taxation in highly inflationary economies by partially indexing the tax system. Regional and international tax competition to attract foreign investment has been intense.

Although broad directions of reform are remarkably similar, several unresolved and controversial issues remain. For example, all recent attempts at tax reform have curtailed tax preferences, especially for investment. But some economists would argue that some tax incentives, such as the investment tax credit, are desirable because they lower the user cost of (new) capital and thereby encourage greater capital formation.

The proper role of progressive income taxes in developing countries is also subject to much controversy and debate, as is the advocacy of fewer tax brackets and rates for the personal income tax for the sake of simplicity. Moreover there is a trade-off between simplicity and progressivity. Perplexing philosophical and transitional issues continue to dominate the issue of replacing income taxes by broadly based consumption (expenditure) or cash flow taxes. Broadly based consumption taxes in their pure form would tax wage income only (Zodrow and McLure 1988). Because capital income is not taxed, except for rent, the equity implications of such taxes would invite considerable controversy and debate. Cash flow taxes would be, in principle, simple to design, and they are conceptually superior to the existing income taxes—especially the corporate (equity) income tax in a closed economy. In open economies the noncredibility of cash flow taxes under the existing foreign tax credit regimes and their unsuitability as withholding taxes discourage consideration of adopting cash flow taxes in developing countries. Moreover implementation is currently considered to be so difficult that no country has yet adopted such a tax (except in enclaves such as mining).

Lessons for Tax Reform

A review of tax reform experiences offers some important insights into tax policy design and institutional development. Here we describe several important lessons for tax reform in developing countries.

Using the VAT. The VAT should be the instrument of choice for most developing countries contemplating reform of their sales taxes. The revenue enhancement and tax neutrality (economic efficiency) arguments in favor of a VAT are well documented. Vertical equity is also enhanced through the trade component of a VAT, which reduces rents accruing to the wealthy recipients of import or foreign exchange licenses. A VAT can further help improve the collection of other taxes. This potential, though, has yet to be exploited by a developing country. A VAT, however, is not necessarily superior to a well-functioning retail sales tax in small, island-type economies. And it is not suitable for administration by levels of government other than the central government.

Broadening tax bases. The tax base of existing taxes should be broadened when taxes are reformed. This would enhance revenue and improve the simplicity, neutrality, and equity of the tax system. Neutrality is enhanced because broadening the tax base usually reduces different tax treatment among assets and sectors of economic activity. Vertical equity is enhanced because tax expenditures that offer disproportionate levels of benefits to the rich are curtailed.

Setting lower and fewer tax rates also enhances neutrality objectives but is not compatible with vertical equity objectives. And broadening the base of existing taxes and having fewer and lower rates continue to be compromised by difficulties in tax administration. Lack of success in this area is attributable to selective and lax enforcement; ineffective tax administration, in part from political inertia; institutional and political difficulties associated with bringing agricultural incomes into the tax net; and an overall disenchantment with income taxes as revenue instruments in an evasion-prone environment.

Limiting special tax preferences. The provision of special tax preferences through the tax system often drains the national treasury by conferring windfall gains on existing activities or through shifting resources away from nontax-preferred activities. Thus, in devising tax policies to meet economic and social objectives, potential gains must be weighed against the potential losses in efficiency and the revenues that might be associated with these measures.

Recognizing initial conditions. The design of tax reform must reflect initial conditions at home and abroad. In reforming their tax systems, developing countries are severely constrained not only by their own institutional settings but also by the tax structure in capital-exporting countries. For example, the U.S. foreign tax credit regime discourages developing countries from adopting a cash flow system of taxation. And in developing countries there would probably be serious transitional difficulties if tax systems were redesigned from scratch.

Improving credibility. The credibility of the tax regime is key to the success of any tax reform. A stable tax policy environment encourages businesses to take a longer-term perspective in their finance and investment decisions. Tax changes should be made after transitional arrangements have been adequately considered, and they should be presented as part of a long-term strategy. Establishing business confidence in the credibility of the tax regime requires greater attention to preparation, analysis of reforms, advance consultation, and provision of a reasonable period of adjustment before implementation.

Coordinating tax reform. Coordinated tax reform offers significant advantages over isolated piecemeal tinkering with the tax system. A coordinated reform ensures consistency of individual tax changes with the overall objectives. Thus the objectives of both protection (through custom duties) and revenue enhancement (through a sales tax and a VAT) could be secured. For example, reduction in tariffs without a corresponding increase in other taxes, generally of a value added type, can increase the fiscal deficit and exacerbate macroeconomic difficulties. To enhance overall economic performance, tax reform should be integrated closely with overall structural adjustment measures.

Political Economy of Tax Reform

In developing countries tax reform initiatives are usually seriously considered only when there is a major fiscal crisis. In theory, comprehensive reforms would enable the tax system to meet the objectives of revenue, efficiency, equity, growth, and simplicity. In practice, because the gains from comprehensive reforms become visible only in the medium to long term, it is difficult to get politicians to commit themselves to a comprehensive reform. Therefore often the most pragmatic course is to strive for periodic, incremental reforms.

However, it is difficult to maintain tax reform. For example, in Colombia, although a net wealth tax was considered an important progressive element of taxation in the 1974, 1986, and 1988 reforms, it was repealed in 1989. Similarly, the broadening of the base of income taxes, when accompanied by the lowering of tax rates, does not invite significant opposition. If, however, after introducing these changes, tax preferences are later restored to appease special interests, the initial tax reform effort would have contributed to tax "deform" (deterioration of the tax structure) because, in the final analysis, lower rates would be applicable to still narrower bases (see Thirsk, forthcoming). Broadening bases and lowering rates can also lead to tax "deform" in an environment in which tax evasion is pervasive.

Tax changes create winners and losers. Also each tax change introduces some efficiency and vertical equity trade-offs that must be recognized and appropriately addressed. In developing countries the regressivity of the VAT is dealt with by using exemptions. It is important to identify gains and losses by income class, by geographic region, and by political affiliation so that the long-run viability and sustainability of the reform measures can be objectively evaluated.

Country experiences suggest that tax reform proposals must carefully consider the institutional features of each country. For example, in low- to middle-income countries, such as Colombia, Indonesia, Malawi, and Turkey, large revenue gains are not expected from the broadening of income taxes, and therefore the VAT is expected to be the mainstay of the revenue-raising effort. However, in newly industrial countries, such as Korea, there is considerable potential for enhancing revenue by broadening the tax bases. In a federal country, the way powers of taxation are assigned among levels of government typically constrains tax reform choices. For example, in India the introduction of a federal VAT is being opposed at the state level. States are worried that a federal VAT would not leave much room for state and local sales taxes. In Pakistan the *octroi* tax, which is a tax on intermunicipal trade, could not be repealed because it is a significant source of local revenue.

Tax administration plays a key role. Experience suggests that compartmentalizing public policy in various departments (or even various branches of the same departments) limits tax reform options. In addition, the local political and civil service elite in the country must assume the “ownership” of the proposals if the reforms are to succeed. Further, participation by local experts in designing the reform enhances the chances for its success.

A public debate on the reform proposals, which would indicate which popular expenditure programs would be at stake, would help induce compliance. A coherent overall plan should be in place before implementation, and tax reforms must remain flexible to respond to changing economic and social conditions.

II. SELECTED TAX POLICY ISSUES FOR THE 1990S

Although a review of past reforms is helpful, it offers little guidance on a number of emerging tax policy issues. Several issues are emerging, some of which are analyzed by the authors of the articles that follow.

Optimal Taxation versus Optimal Tax System

Ramsey (1927) argued that the efficiency cost of taxation could be minimized under a system that equalized the deadweight loss per unit of tax revenue for all commodities. Under certain strong simplifying assumptions, this argument is expressed as an “inverse elasticity rule,” in which the tax rate is inversely proportional to a commodity’s own compensated elasticity of demand (Slemrod 1990, p. 159). Diamond and Mirrlees (1971) assume either constant returns to scale or 100 percent profit taxation (fairly unrealistic assumptions) to demonstrate that commodity taxation alone can ensure production efficiency and that the use of taxes on capital income, tariffs, and investment incentives would be inconsistent with production efficiency requirements.

Deaton (1987) notes that calculating optimal commodity tax rates under the above rule requires global knowledge of preferences both in the present period and intertemporally. Since this is an unattainable proposition, this result is not

operationally significant (see also Feldstein 1978). Optimal commodity tax rules further assume the absence of other tax instruments. If income tax is available, for example, the usefulness of the inverse elasticity rule is further clouded (Atkinson and Stiglitz 1976; Stern 1987). Slemrod (1990) argues that once the literature on optimal taxation abandons the assumption of a representative consumer and admits redistributive considerations, then optimal commodity taxes should vary by the circumstances of the individual—a completely impractical proposition.

Slemrod (1990) has argued that the optimal tax theory can serve as a guide to designing “optimal tax systems” only if it considers the technology of tax collection. This technology would include the feasibility of tax instruments and the cost of tax administration and compliance. Most analyses of tax reform in developing countries assume the infeasibility of agricultural income and land taxation. Under an optimal tax system one would equate the marginal excess burden of taxes to the marginal administrative cost, and therefore such extreme assumptions could be avoided. Thus optimal tax considerations for differentiated rates must be weighed against the administrative feasibility and cost of such a system. Similarly the marginal resource cost of enforcement must be equated to its marginal social benefits. Thus tax administration limits tax policy choices and also plays a vital role in the success or failure of attempts to reform taxes.

Fiscal Federalism Dimensions of Tax Reform

The way taxing and spending authorities are delineated can have important implications for tax reform. Thus the multilevel government dimension of the tax system should be addressed in developing tax reform proposals.

In India sales taxes are assigned to the state level, excise taxes are administered by the central government (which shares proceeds with the states), and taxes on intermunicipal trade are administered locally. As a measure to reform the existing structure of sales taxation, a broadly based VAT to be administered by the central government has been proposed. However, such a measure can not be implemented because of strong opposition by states. The states are also dissatisfied with the central administration of excises, which does not allow the states to vary revenues and rates from this source. The central government has been tempted to raise additional revenue from administered prices rather than excises because the proceeds from the latter have to be shared with the state governments. The *octroi* tax is a source of significant revenue for local governments. Thus it remains a popular tax at the local level in spite of its antitrade bias (Shah 1991a).

The constitutional assignment of sales taxes in Brazil has created similar difficulties. All three levels of government have partially overlapping responsibilities to develop and administer policy for value-added type taxes. The federal government is responsible for a sales tax on manufactured goods. The municipalities can levy a VAT on services. The states have the mandate of a general VAT, whose base encompasses the bases for federal and municipal sales taxes. This

multiplicity in administration raises the administration and compliance costs of these taxes. Further, Brazil is the only country in the world with a state-level general VAT. This has the potential of evolving into a tax with multiple rates on nonuniform bases (Shah 1991b).

The issues discussed above are particularly acute in enterprise taxation in nonmarket economies. The revenue from such taxes is usually collected at the local level and shared with higher levels of government. This creates incentives for lax administration of enterprise tax (a shared tax) at the local level but more active administration of local charges and fees (nonshared revenues) levied on enterprises.

The Design of Indirect Taxes

In most developing countries the design of indirect taxes plays a central role in the ability of governments to raise revenue without major distortionary economic impacts. Two key issues are coordinating the reform of tariffs and domestic indirect taxes and designing a VAT. Mitra (forthcoming) argues that tariffs should not be reformed without reforming other indirect taxes because potential losses in public revenue arising from reduced tariffs need to be offset so as not to exacerbate macroeconomic difficulties. A coordinated reform of these taxes would combine reductions in tariffs with an offsetting or, preferably, revenue-enhancing upward adjustment in the sales tax or VAT, which would apply equally to both domestic production and imports. Revenue neutrality can be preserved under this scheme, or the sales tax rate structure can be raised to meet the demand for any assistance for trade liberalization that may become necessary.

As noted earlier, the introduction of a VAT is the most pervasive feature of tax reform in many developing countries. Experience offers several insights for other developing countries. First, preretail VATs cause significant amounts of distortion and administrative complexities and therefore are not worth adopting. Second, all services (except health care, education, social welfare, banking, and insurance) should be included in the base. Third, rate differentiation should be minimized, although protecting the poor may warrant reduced rates for food, essential consumer items, drugs, electricity and fuel, newspapers and books, and public transportation. If luxuries are to be taxed at a higher rate, then special excises should be levied rather than increasing the VAT. Fourth, the VAT is an ideal tax for large, integrated economies with sophisticated production and distribution channels. It is less suitable for small, island-type economies that have a narrow manufacturing base and that depend heavily on cross-border trade.

Corrective Taxes

The theoretical case for corrective taxation has been amply demonstrated in the economic literature; yet it has been neglected in tax policy discussions in developing countries. Summers (1991) has argued that using corrective taxes to

protect the environment or to discourage "sins and bads" (through taxes on cigarettes, alcoholic beverages, and so forth), and rent seeking also raises a significant amount of revenue. For example, a tax at a rate of \$10 per ton of carbon contents of fossil fuels, if imposed by the United States alone in 1991, could raise \$13 billion a year at a deadweight loss of only \$100 million. A global carbon tax of the same order could raise roughly \$50 billion in government revenue. A global tax, however, raises questions about the resource transfer associated with alternatives for revenue disposition and the implications of such a tax for the growth and international competitiveness of individual developing countries.

Tax Expenditures

Governments in developing countries often rely upon the tax system to further social and industrial policy objectives. A wide variety of incentives are used to implement these objectives. However, often insufficient attention is paid to the consistency of the incentives with the stated policy objectives. As a result cost-effectiveness of such measures escapes public scrutiny.

Major tax expenditures in developing countries are typically in the areas of investment and savings promotion. Investment incentives through the tax system include tax holidays, investment tax credits, accelerated depreciation allowances, lower tax rates, and tax rebates. Nontax incentives include publicly subsidized utilities, cash grants, and technical assistance. Of these incentives only investment tax credits, accelerated depreciation, and tax rebates are often automatically granted; the others are subject to varying degrees of administrative discretion. Properly designed investment incentives play an important role in stimulating investment. Investment incentives can offset the corporate tax distortion, attract foreign investment, create employment, promote risk sharing, and correct information asymmetries (Shah forthcoming). However, administrative discretion often discourages potential investors, especially nonresidents.

Developing countries offer a wide variety of savings incentives through the personal income tax system. The relative efficacy of these incentives in relation to investment incentives remains an unexplored area of research for developing countries. The experience of industrial countries suggests that investment incentives are superior to savings incentives in stimulating capital formation. Investment incentives in a life-cycle framework redistribute from the old to the young and thereby reduce current consumption and increase current investment. The same is not true of savings incentives (Auerbach and Kotlikoff 1989; Summers 1981). In general considerable controversy surrounds the effects of taxation on savings.

Taxation of Foreign Investment

Perceptions regarding foreign investment in developing countries have changed rapidly in recent years. Developing countries have come to recognize that positive economic gains can be associated with foreign capital, particularly

technology transfers and access to world markets. This realization has sometimes led to fierce competition among developing countries to provide tax incentives to attract foreign capital. However, in many instances such incentives may simply transfer resources from the host developing country to foreign treasuries without providing any special benefit to foreign investors. Thus the taxation of multinationals by a developing country cannot be examined in isolation from the tax regime of the home country, from tax havens and conduit countries, or from transfer pricing practices. These factors will have a bearing on the tax sensitivity of foreign direct investment (FDI).

Recent theoretical work by Leechor and Mintz (forthcoming) indicates that home country taxes influence the user cost of capital, even when retained earnings are used at the margin. In addition foreign firms in a typical host country face substantial variations in the user cost of capital depending on the country where capital is owned, the type of organization, the rate of remittance, financial policy, and the net foreign tax credit position. Leechor and Mintz's calculations for Thailand show that effective tax rates vary depending on the source of funds, on the type of organization, and on rates of remittances. They argue that the policy options of the host country are usually constrained by the tax rules in capital-exporting countries and by the strategic behavior of multinationals. They conclude that, given international capital mobility, tax neutrality on a global basis is possible only through a comprehensive multilateral agreement on the coordination of capital income taxes.

In the literature the disincentive to invest that is caused by the tax system is usually implicitly measured by an average tax rate. But the incentive to undertake new investment depends upon the effective marginal tax rate, which can deviate substantially from an average tax rate concept. Shah and Slemrod (this issue) empirically examine the relevance of host and home country tax regimes to FDI using data on U.S. multinational transfers and reinvestments in Mexico. Their empirical model distinguishes FDI financed by transfers from that financed by retained earnings. It incorporates tax and nontax factors for both the host and the home country, including host country risk factors and the credit status of multinationals. Both the marginal and the average effective tax rate formulations are incorporated into the analysis. They conclude that FDI in Mexico is sensitive to tax regimes in Mexico and in the United States, to the credit status of multinationals, to country credit ratings, and to the regulatory environment.

Taxation of Agricultural Land

Agricultural income in many developing countries is brought into the tax net indirectly by distorting taxes on agricultural exports, by marketing boards, and by overvalued exchange rates. The possibility of replacing these with a non-distorting land tax is examined by Skinner (this issue). He examines the merits and demerits of the land tax, both in theory and in practice, in selected developing countries. He concludes that a land tax is not necessarily a superior alternative to export taxes for raising federal government revenue because its design is

too inflexible to deal with the instability in agricultural incomes and with administrative and political difficulties. He argues that progressive tax rates on land holdings are nearly impossible to administer, by citing the example of Bangladesh, where the top marginal rate on the wealthiest farmer's land is nearly 50 times the minimum rate. In reality there is little or no evidence that rich farmers pay more than three times the minimum rate.

Skinner further argues that the record to date suggests that land taxes have not been effective in attaining nonrevenue goals. Such goals would include transferring resources from the agricultural to the nonagricultural sectors, discouraging inefficient or speculative land use, assisting in land reform, and promoting environmentally sound land management. A land tax, however, is a suitable instrument for local government financing because it would be seen as a benefit tax or simply as a user charge for local public services.

Taxation of Financial Assets

Developing financial markets is commonly considered to be a key element in growth strategy. Most developing countries consider their banking, insurance, and finance sectors to be lightly taxed. Chamley (this issue), however, argues that the financial sector in many developing countries is heavily taxed if one includes both explicit and implicit taxes in the analysis. Implicit taxes for this purpose include seigniorage, reserve requirements (earning below market rates), lending targets at nonmarket rates, and interest ceilings combined with inflation. These taxes are never reported as tax revenues in standard national accounts but yield revenues far in excess of traditional taxes. Inflation is often overlooked as a source of tax revenue.

Using a partial equilibrium framework, Chamley argues that most of the incidence of the effective taxation of financial institutions falls on deposits. Although the revenue from taxation of financial assets is difficult to measure because of the complexity of the instruments, its efficiency cost is very large when the rate of taxation is greater than 40 percent. At lower rates, for example, less than 20 percent, the efficiency cost is lower in relation to revenue. Removing onerous levels of taxation stimulates financial intermediation if such a move is seen as a permanent policy change. The results vary by the initial conditions (tax rates, level of development, and inflation rate) and the credibility of the tax regime that is observed in each country. For example, in countries that have relatively developed financial markets and in all countries that have annual inflation rates above 100 percent, the supply of financial assets is highly responsive to tax changes, provided the policy change is seen as credible. As countries develop a large and sophisticated menu of financial assets, such as Indonesia and Thailand, greater possibilities for substitution emerge, which produce higher efficiency costs of financial taxation. Most countries in Latin America and Southeast Asia and Ghana, Somalia, Uganda, and Zaire in Africa either experience high inflation or have sophisticated financial systems. In these countries the reduction in the level of financial assets in the formal sector that is associated

with implicit taxes is estimated to outweigh the revenue gains from such taxation. The impact of taxation is estimated to be significantly weaker in countries with inflation rates of 60 percent or lower, such as Niger, Tanzania, and Zambia.

The Distributional Impact of Taxation

The incidence of various taxes has been the subject of considerable controversy and debate. The central theme of Shah and Whalley (this issue) is that tax incidence analysis for developing countries continues to be based on the same assumptions about tax shifting that are used in studies of industrial countries. However, developing countries typically have very different nontax policies and regulatory environments from industrial countries, with features such as higher protection, rationed foreign exchange, price controls, black markets, and credit rationing. For several taxes, taking such features into account can substantially change estimates of incidence from those that would be produced by conventional thinking. The authors present calculations for Pakistan on the incidence of selected taxes.

Quantitative Tools for Tax Policy Analysis

A quantitative evaluation of the impact of changes in tax structures is essential for reasons of economics as well as political economy. Dahl and Mitra (this issue) draw upon the work done by the World Bank in analyzing taxes in Bangladesh, India, and China and illustrate how applied general equilibrium analysis can help to address a wide variety of questions in tax policy analysis. The Bangladesh model, for example, combines revenue and incidence effects in a single measure to rank various sectors with respect to the efficiency and equity costs of raising revenue. The China model evaluates whether it is appropriate to recommend that socialist economies should adopt broadly uniform tax rates for large numbers of sectors. The India model examines the coordinated reform of tariffs and indirect taxes. The authors further discuss the resources required to carry out such analyses. They argue that establishing a consistent data set is the costliest element of modeling and that computing and software costs are small by comparison. They suggest that cost considerations must be weighed against the substantial gains that model analyses make possible in producing consistent recommendations and formulating sound policy decisions on structural reform.

III. CONCLUDING REMARKS

Recent research has yielded important insights on tax policy issues for developing countries. The success of tax policy changes depends heavily on the administrative ability (and, of course, the political will) to collect revenue through fair and efficient enforcement. This is reflected in all recent efforts at tax reform that emphasize the simplicity of tax design and the ease of its administration as the fundamental criteria for choosing among alternative proposals. Unfor-

tunately, in this area both a framework for evaluating alternative policies in terms of administrative efficiency as well as estimates on the relative orders of magnitudes of marginal administrative costs of various tax instruments are scarce. Additional theoretical and empirical research on the efficiency of tax administration can potentially yield important insights for tax reform. A better theoretical and empirical understanding in this area could ensure that the criterion of simplicity in the design of tax reform is put in appropriate perspective and not overemphasized at the expense of equity and other policy objectives.

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Do Taxes Matter for Foreign Direct Investment?

Anwar Shah and Joel Slemrod

The tax sensitivity of foreign direct investment (FDI) has important policy implications. If FDI is not responsive to taxation, then it may be an appropriate target for taxation by the host country. This question is examined for Mexico by estimating the response of FDI from retained earnings and transfers from abroad to the tax regimes in Mexico and the home country, the credit status of multinationals, country risk factors, and regulatory and trade regimes in Mexico. FDI in Mexico is found to be sensitive to the tax regimes in Mexico and the United States, the credit status of multinationals, country credit ratings, and the regulatory environment. Thus Mexico's current policies to dismantle regulations and employ a tax system competitive with the United States are expected to have salutary effects on FDI in Mexico.

The 1980s have seen a remarkable growth in foreign direct investment (FDI), which has sparked a renewed interest in the effect of FDI on the economic performance of both the host and the home country and in the appropriate government policy toward FDI. Not surprisingly, a critical consideration in this discussion is the responsiveness of FDI to taxation of the income that it generates. If FDI is not responsive to taxation, then it may be an appropriate target for taxation by the host country, which can raise revenue without sacrificing the economic benefits of FDI. If, however, the volume of FDI declines with taxation, the host country must consider the trade-off between the possible revenue gains from increased taxation and the economic costs of discouraging FDI. This issue is very important for countries in which the degree of FDI penetration is large and the revenue raised from taxing FDI represents a significant fraction of total tax revenue. For example, in Ecuador, Egypt, Indonesia, Nigeria, Peru, and Trinidad and Tobago tax payments by U.S. corporations alone as a share of host country corporate tax revenues exceed 10 percent (Alworth 1988, p. 33).

Because of the ready availability of data on investment to and from the United States, most of the recent empirical literature on the tax sensitivity of FDI has focused on U.S. inward FDI. In this article we extend the standard methodology used in these studies to examine the effect of taxation on FDI in Mexico. The recent empirical literature on FDI in the U.S. is reviewed. The salient features of

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the environment for FDI in Mexico that are relevant for extending the research done on U.S. FDI are discussed. An empirical framework is presented, the data issues are outlined, and the empirical results are reviewed.

I. REVIEW OF THE EXISTING EMPIRICAL LITERATURE

The empirical study of the effects of taxation on inward FDI in the United States was pioneered by Hartman (1984). Using annual data from 1965 to 1979, he estimated the response of FDI, both for investment financed by retained earnings and for transfers from abroad, to three variables: the after-tax rate of return realized by foreign investors in the United States, the overall after-tax rate of return on capital in the United States, and the ratio of the tax rate on U.S. capital owned by foreigners to that on U.S. capital owned by U.S. investors. The first two variables are proxies for the prospective return to new FDI. The first term is more appropriate for firms that are considering expanding their current operations and the second more applicable to the acquisition of existing assets. The third variable captures the possibility that tax changes that apply only to U.S. investors will, by affecting the valuation of assets, alter the foreign investor's cost and, therefore, return from acquiring the asset. Hartman does not measure an effective withholding tax rate or the foreign income tax rate applied to the aggregate of FDI. He defends the absence of these variables by noting the likelihood that the average values of these tax rates are relatively constant over time. Furthermore no attempt is made to measure the alternative rate of return available abroad to foreign investors.

Hartman's regressions show a positive association of both after-tax rate-of-return variables with the ratio of FDI financed by retained earnings to U.S. gross national product (GNP) and a negative association of this FDI-GNP ratio with the relative tax rate on foreign-owned capital compared with domestically owned capital. The model does not explain investment financed by transfers from abroad as well as that financed from retained earnings, although coefficients of all three variables have the expected sign and are significantly different from zero. Hartman concludes that the effect of taxes on FDI, regardless of the source of financing, is quite strong.

Subsequent studies of U.S. FDI have essentially followed Hartman's approach but have differed primarily in the data series used. Boskin and Gale (1987) use the updated tax rate and rate of return series from Feldstein and Jun (1987) to reestimate Hartman's equations. Although the estimated elasticities of FDI to the rates of return on capital are somewhat smaller, none of the point estimates changes by more than one standard deviation. Boskin and Gale also extend the sample forward to 1984, and in some cases backward to 1956, and experiment with a variety of alternative explanatory variables and functional forms. Although the empirical results are somewhat sensitive to sample period and specification, they show that Hartman's qualitative conclusions are robust. Young (1988) uses revised data on investment, GNP, and rates of return earned by

foreigners to estimate similar equations. The estimated elasticities with respect to the rate of return realized by foreigners and the relative tax rate are larger, but the equations for new transfers of funds estimated using the 1956–84 data yield very poor results.

While attempting to replicate Hartman's and Boskin and Gale's results, Newlon (1987) discovered that the series measuring the rate of return on FDI, used in all earlier articles, had been miscalculated from the original Bureau of Economic Analysis data for 1965 to 1973. Using the corrected series, the equation explaining FDI from retained earnings does not fit as well, although the equation explaining FDI from transfers fits better. In the former case the estimated coefficients on the return to FDI and the tax ratio are slightly larger in absolute value and remain statistically significant, although the estimated coefficient on the net return in the United States is smaller and no longer statistically significant. For transfers of funds the estimated coefficient on the return to FDI is much larger and becomes significant, although the estimated coefficient on the net return in the United States becomes smaller and insignificant. Using the extended sample, Newlon's results also differ from those of Hartman and Boskin and Gale; in particular, the equation explaining FDI from the transfer of funds fits poorly, and all estimated coefficients are insignificant.

The narrow focus of the previous empirical research is reason enough to explore alternative methodologies. Furthermore the standard approach is problematic and could be improved. In the studies cited, the disincentive to investment caused by the tax system is implicitly measured by an average tax rate, computed as total taxes paid divided by a measure of profits. The incentive to undertake new investment, however, depends on the effective marginal tax rate, which, as is well known, can deviate substantially from an average tax rate concept. Slemrod (1990) extends and updates a Hartman-style model of aggregate FDI in the United States, in part by replacing the average rate of tax by a measure of the marginal effective tax rate on new investment; U.S. effective rates of taxation are found to have a negative impact on total FDI and on new transfers of funds, but not on FDI from retained earnings.

A second problem is that none of the studies estimates the effect of the home country's tax system on FDI in the United States. Of course collecting the appropriate data is difficult, and perhaps, as Hartman argued, these tax rates have not varied much. The observed stability of tax rates, although, applies to statutory rates and not necessarily to the more appropriate effective marginal tax rates. Hartman (1985) has also argued that because the home country's tax reduces the parent company's return to an investment and the opportunity cost of making an investment remitting a dividend to the parent, only the host country's tax system matters for investment coming from subsidiaries' earnings. For any subsidiary whose desired investment exceeds earnings, however, the tax due upon repatriation of earnings does matter. This situation is likely to arise for newly formed subsidiaries, which makes it worthwhile to investigate the impact of both the home country's rate of taxation and its system of taxing foreign source income.

Finally, as stressed by Newlon, the interpretation of the coefficient on the rate of return to FDI is problematic. This rate of return is defined as the after-tax income from direct investment divided by the stock of direct investment. When the home country has a foreign tax credit with deferral, it is often optimal for the subsidiary to finance investment by first using retained earnings and, only when these earnings are exhausted, using funds transferred from the parent firm. This hierarchy of financing implies that whenever a subsidiary's investment exceeds its retained earnings, its retained earnings will exactly equal its income. In these cases we would expect a direct association between the calculated rate of return on FDI (in which after-tax income is the numerator) and retained earnings, regardless of whether the average rate of return in fact influences decisions concerning new FDI. As Newlon notes, if subsidiaries were following a fixed dividend payout rule (for example, paying out a fixed fraction of income), a direct association between income and retained earnings would also be observed.

II. FOREIGN DIRECT INVESTMENT IN MEXICO

Historically, because Mexicans have viewed foreign investment as a vehicle for political and economic domination of Mexico, the thrust of government policy through the National Foreign Investment Commission has been to regulate rather than to promote foreign investment. From 1948 to 1982 policy toward foreign investment became increasingly restrictive. First, important industries such as telecommunications, electric power, timber, and film distribution were nationalized. Second, foreign investment in most industries was restricted to minority participation subject to prior authorization from the central government. The regulatory environment discouraged foreign participation, resulting in an annual average net FDI flow of less than 1 percent of gross domestic product (GDP) from 1950 to 1985. These policies have been dramatically reversed in recent years, beginning in 1986 with the initiation of a debt-to-equity conversion scheme and the exemption of small to medium levels of investment from government approval for foreign majority participation. Beginning in 1987 majority FDI participation in specified sectors was permitted on a case-by-case basis. On May 19, 1989, President Carlos Salinas de Gortari announced a major shift in Mexican policy toward foreign investment, stating:

We are a mature country with the judicial, intellectual, and economic capacity to assimilate the largest flow of foreign investment. On behalf of all Mexicans, we will institute new regulations to encourage the types of foreign investment that support our economic policy objectives without compromising our sovereignty and freedom of action.

Major changes in the foreign investment regulations soon followed. Under the new regulations, majority investment in nonrestricted sectors meeting all of the following six criteria is eligible to receive automatic approval:

1. The investment is less than Mex\$250 billion (in 1989 pesos) (about US\$100 million)
2. The capital originates from outside Mexico
3. The project is located outside the country's three major industrial cities (Mexico City, Monterey, and Guadalajara)
4. The foreign exchange cost is spread evenly over three years
5. The investment provides permanent jobs and training
6. The project uses technologies satisfying existing environmental regulations.

Furthermore limited access to the Mexican stock market is permitted through special trust funds. Temporary access to some sectors normally reserved for Mexican citizens is allowed under 20-year trusts for investment in Mexican companies with high export potential or in financial distress. Thirty-year trust funds provide access to otherwise restricted geographical zones, such as coastal and border areas. New regulations stipulate automatic approval of an application on which the National Foreign Investment Commission fails to reach a decision within 45 days of the initial submission.

It is clear that whatever the demand for FDI in Mexico has been in the postwar period, the supply of available opportunities for FDI has been severely limited until recently. Thus it will be important to control for this in the analysis. If demand was always limited by these regulations in a binding way, there would be no interesting story to tell about taxation. Data on FDI flows indicate a positive correlation between the flows and after-tax rates of return in FDI and therefore suggest that these limitations were not always binding, so that tax influences on demand did play a role in the volume of FDI into Mexico.

The instability of the Mexican economy also poses analytical problems. High inflation rates (114 percent in 1987) and nominal interest rates (92 percent in 1987) have dramatic consequences for the calculations of effective tax rates on new investment. The standard assumption used in such calculations—that current values for inflation, interest rates, tax rates, and tax depreciation rates will persist in the future—are unlikely to be accurate, but reasonable alternative assumptions about expectations are not obvious. This problem suggests that some measure of the average rate of taxation (taxes paid divided by a measure of economic income) may be a more accurate measure of the tax system's disincentives than an analytically constructed marginal tax rate.

Mexico taxes nonresidents under the territorial rule so that only income originating from Mexican sources is taxed. Mexico is a member of the Latin America Integration Association, which is designed to provide preferential treatment to member countries in matters of trade and taxation. Mexico has not yet concluded any comprehensive treaty on avoiding double taxation or tax sparing with any other country.

One important change in the tax code concerned the treatment of income of subsidiaries and branches of foreign companies. Until 1989 establishing a subsidiary rather than a branch office in Mexico was a tax-preferred alternative,

since the retained earnings of a subsidiary of a foreign corporation were exempt from taxation, with dividends taxed upon distribution to a parent. All income of a branch office, however, was taxed upon accrual. Following changes in the Mexican tax code in 1989, the different treatment of subsidiary and branch income was eliminated. The major features of the taxation of income earned in Mexico by foreigners, as revised in 1989, are summarized in appendix A.

III. SOME THEORY AND THE EMPIRICAL MODEL

The modern theoretical literature has, for the most part, concluded that the demand for FDI is primarily an issue of industrial organization. Dunning (1985, pp. 6–7) argued that foreign investment by firms is more likely if the firms possess ownership-specific advantages relative to host country firms in sourcing markets, find it profitable to use these advantages themselves rather than to lease them to host country firms, and find it profitable to utilize their ownership-specific advantages in the host country rather than at home. A large body of empirical literature (see Dunning 1985) has tested this theory of international production, usually referred to as the “eclectic” theory. Much of this research has been cross-sectional, relating the extent of foreign investment in a given sector to characteristics of the sector that represent ownership-specific and location-specific advantages. Studies of the effects of taxation on FDI have generally taken the view that firms must weigh the benefits of foreign investment against the tax consequences of carrying out FDI. We hypothesize that the tax systems of both Mexico and the firm’s home country affect not only the incentives to invest but also the best way to finance a given level of FDI.

Mexico asserts the right to tax income originating within its borders, including income generated by multinationals. The effective tax rate on this income depends in a complicated way on the statutory tax rate on corporate income, on the extent of tax credits granted, and on the definition of the tax base, including the system of depreciation and the way in which gross income and deductions are allocated between Mexican source and foreign source. There are two approaches to measuring the effective tax rate on new investment. In the analytical approach pioneered by Hall and Jorgenson (1967), the level of pre-tax return required for a stylized investment to yield a given after-tax return is calculated. The wedge between the pre-tax and the after-tax rates of return is a measure of the tax-related disincentive to invest. This procedure requires details on the tax code, rate of inflation, economic depreciation rates, and the proportion and costs of debt and equity finance. Thus the effective tax rate on FDI from equity transfers and retained earnings would be different.

The alternative approach is to calculate the ratio of taxes paid in a given year to a measure of income that is independent of the definition of taxable income. This approach may capture some of the features of the tax law that are left out of the analytical approach and also may more accurately capture some features that are present in the analytical models but are inadequately represented by the

stylized assumptions that must be made to calculate marginal effective tax rates. As argued above, because of the extreme volatility of the Mexican inflation rate, such an average tax rate may be more appropriate.

The multinational's country of residence may also tax the income that is generated in Mexico. This is not, however, true of all countries, some of which, notably France and the Netherlands, operate a territorial system for active (in other words, nonportfolio) income earned abroad. Under a territorial system the home country levies no tax of its own on the foreign source income. Under the worldwide system of taxation, used by the United States, Canada, United Kingdom, and Japan among other countries, the home country asserts the right to tax the multinational's income regardless of where it is generated. In order to avoid two tiers of taxation, these countries offer their multinationals a limited credit against domestic tax liability for certain taxes paid to foreign governments. The credit is generally limited to the tax liability that the foreign source income would incur if home country tax rules were applied. Finally, in most cases the tax liability (and credit) on subsidiaries' foreign source income is deferred until dividends are repatriated to the parent company, but the foreign source income of branch operations is taxable upon accrual.

Let τ_m be the effective rate of tax on new investment imposed by the Mexican tax system. For a multinational from a country using the territorial system, τ_m is also the total tax burden imposed. For a multinational from a country with a worldwide system of taxation, the home country's taxation must also be considered. The old view of this extra level of taxation is given by $\max[\alpha(t_u - \tau_m), 0]$, where t_u is the tax rate of the home country and α is a value between zero and one that reflects the benefits of being able to defer the tax liability on subsidiaries' foreign source income until the earnings are repatriated. Note that t_u is generally closer to a statutory rate than an effective tax rate on investment, since the home country tax base for foreign source income generally does not allow such things as accelerated depreciation and investment tax credits that affect taxable income from domestic operations. In cases in which earnings are never repatriated (α is equal to zero) or when the firm is in an excess credit position ($\tau_m > t_u$), so that taxes paid to the host country generate foreign tax credits that may be used to completely offset the tax that would otherwise be due upon repatriation, the home country tax is irrelevant. An opposite extreme case occurs when α is equal to one, implying that the tax liability of the multinational in the host country can be fully offset by tax credits in the home country.

The new view of the total tax burden on FDI, expounded by Hartman (1984, 1985), distinguishes between debt and equity financing. If investment is financed by the retained earnings of the foreign subsidiary, then the tax rate in the home country is irrelevant, so that the total tax burden is τ_m , and any taxes due upon repatriation to the home country are irrelevant to the investment decision. The tax rate in the home country would be relevant for multinationals that are contemplating a transfer of funds to a foreign subsidiary, so that the total tax burden on FDI in this case is $\tau_m + \alpha(t_u - \tau_m)$.

Scholes and Wolfson (1989) have suggested that the ownership of a given stock of domestic capital will depend on the relative tax rate paid by alternative owners. This implies that, in the contest for ownership of Mexican capital, foreign owners are more likely to be successful the lower the ratio $[\tau_m + \alpha(t_u - \tau_m)]/\tau_m$. (This of course applies only if the home country operates a worldwide system of taxation.) The surprising implication of this analysis is that, as long as α is greater than zero and t_u exceeds τ_m , an increase in τ_m , the tax rate in Mexico, will increase foreign ownership of Mexican capital, because, although an increase in τ_m is fully borne by potential Mexican owners, its effect on foreign owners is partly offset by foreign tax credits. Thus the relative tax burden on foreign owners from countries with worldwide tax systems is reduced. Of course, to the extent that τ_m reduces the incentive to undertake investment in Mexico, both domestically and foreign-owned investment will decline. The overall impact on FDI thus depends on the relative strength of the Scholes-Wolfson ownership effect and the volume effect. Furthermore the ownership effect applies only to investment from countries with a worldwide tax system and only to the extent that tax rates in the home country exceed those in Mexico, so that additional taxes paid to the Mexican government do in fact generate additional foreign tax credits.

The foregoing discussion suggests that a general empirical model of the impact of taxation on FDI in Mexico has the following form:

$$(1) \quad FDI_s = f_s [\tau_m; L(t_u - \tau_m), X]$$

where X is a vector of nontax factors that affect FDI, the subscript s refers to the source of investment financing, and L is an (inverse) index of the credit status of the excess investing countries. The presumption is that the greater the extent of excess credit status, the smaller the effect of the home country's tax rate. For empirical estimation equation 1 is specified as follows:

$$(2a) \quad FDI_T = a_0 + a_1\tau_m + a_2(t_u - \tau_m) + a_3 \cdot L \cdot (t_u - \tau_m) + a_4X + u_T$$

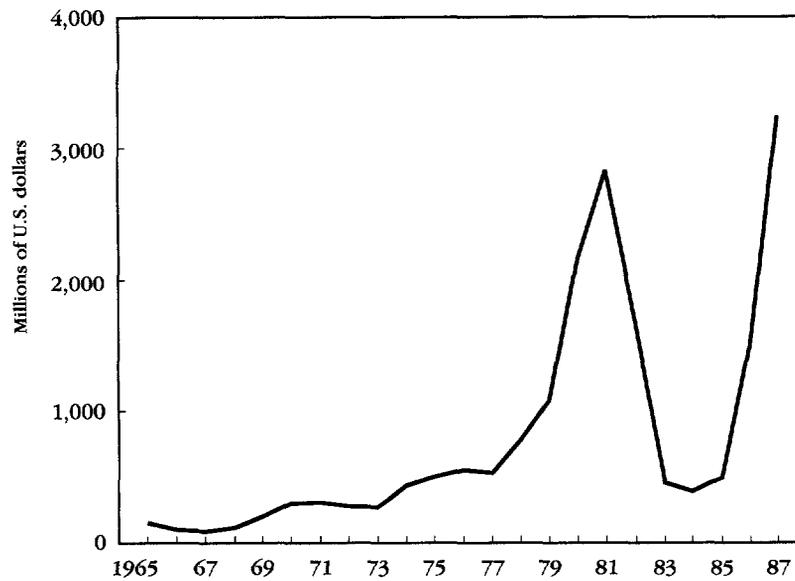
$$(2b) \quad FDI_R = b_0 + b_1\tau_m + b_2(t_u - \tau_m) + b_3 \cdot L \cdot (t_u - \tau_m) + b_4X + u_R$$

where the subscript T denotes FDI financed by transfers of funds, and the subscript R denotes FDI financed by retained earnings.

IV. THE DATA AND ESTIMATION

Aggregate data on stocks and flows of FDI and other relevant variables for 1965–85 have been assembled from a variety of sources. A few key variables utilized in the study are described here, and details of variable construction are given in appendix B.

Data on FDI levels come primarily from the Banco de Mexico, which provides substantial details on the financial flows of firms with foreign capital, including the amount of transfers and reinvested earnings and a breakdown of FDI by

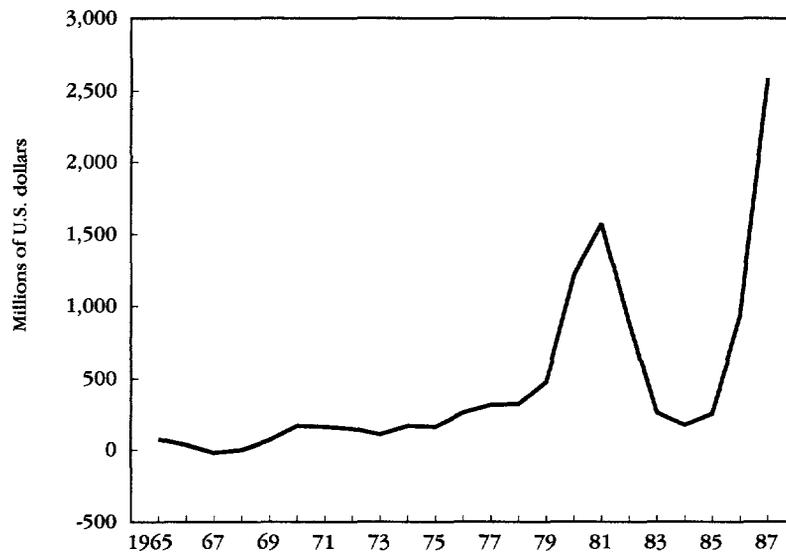
Figure 1. *Foreign Direct Investment in Mexico, 1965-87*

Source: Banco de Mexico (various issues).

economic sector and the country of origin. Figure 1 shows FDI from 1965 to 1987. From 1965 to 1977 FDI slowly but steadily increased. The beginning of the oil boom in the late 1970s led to dramatic increases in FDI, which peaked in 1981 at US\$2.8 billion. The end of the oil boom in 1982 coincided with a sharp drop in FDI. FDI accelerated again in 1986, when debt-equity conversion schemes were initiated and small to medium-size FDI was exempted from the government control and approval process. Figures 2 and 3 show details of FDI financed by transfers and retained earnings, respectively, during 1965 to 1987. Both types of FDI follow the same broad trends, but transfers become the dominant source of financing in the mid- to late 1980s.

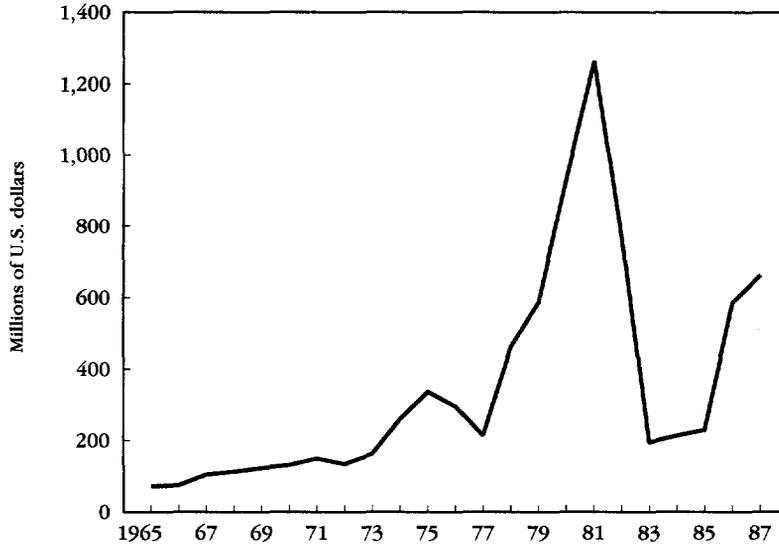
Several tax concepts are computed as measures of tax disincentives, beginning with the simple Mexican (t_m) and U.S. (t_u) statutory tax rates. Four alternate measures of the tax disincentive to new investment in Mexico—three marginal and one average measure—are also developed (see appendix B for details). A historical series on the marginal effective tax rate on new aggregate investment in Mexico (τ_m) is computed using the standard Auerbach-Hall-Jorgenson methodology, and a comparable series for the United States is obtained from Auerbach and Hines (1988). Then marginal effective tax rates for transfers and for retained earnings are calculated. The marginal effective tax rate measures are conceptually attractive, but, as discussed above, a highly inflationary environment with financing constraints diminishes their usefulness. Therefore, an aver-

Figure 2. Foreign Direct Investment in Mexico Financed by Transfer of Funds from Parent Company, 1965-87



Source: Banco de Mexico (various issues).

Figure 3. Foreign Direct Investment in Mexico Financed by Retained Earnings of Multinationals, 1965-87



Source: Banco de Mexico (various issues).

age effective tax rate measure based on corporate tax liability per dollar of value added is calculated for Mexico (T_m) and the United States (T_u). The choice of this particular formulation of the average effective tax rate is based primarily on the completeness of the data series for this measure.

The index of the excess foreign tax credit position of investing multinationals (L) is calculated as the ratio of aggregate foreign tax credit claimed to foreign tax credits available to U.S. multinationals investing in Mexico. Because U.S. investment has accounted for about two-thirds of Mexican FDI in the period studied, it is a reasonable indicator of the excess credit status of investing countries generally. The closer this index is to zero, the more likely it is that the typical U.S. multinational is in an excess credit position. At the extreme where this index is equal to one, all available foreign tax credits are immediately claimed, implying that the multinationals are in an excess limit (deficit of credit) position. A major limitation of this measure is that data are available for only five years; values for the remaining years are interpolated. Longer time series data are available on an alternate, but conceptually less satisfactory, measure: the credit status of all U.S. multinationals, whether investing in Mexico or not. Because there are some firms with no Mexican investment in this sample, use of this latter measure in the analyses of reinvested earnings would be subject to caveats.

A useful measure of country risk factors can be derived from the annual country credit ratings published by the Business International Corporation and the *Institutional Investor*. These credit ratings are based on a composite index of political, commercial, and monetary factors. In order to obtain this index for the entire sample period for Mexico, the Business International Corporation index for 1965 to 1979 is spliced with the *Institutional Investor* index for 1979 to 1987.

Black market exchange rate premia are used as an index of regulation in Mexico. Exchange rate premia in Mexico correlate well with the past history of regulation and, therefore, serve as a reasonable proxy of the regulatory environment. This is, however, not a fully satisfactory measure of regulations, because it may simply be capturing the effects of import restrictions. To capture the effects of protective trade barriers on inward investment, effective tariff rates are calculated using data on import duties and the value of imports from various Mexican government publications.

A wide array of variables is available to implement the empirical models specified in equations 2a and 2b. The modeler must choose among several alternate measures of tax disincentives, two alternate measures of multinationals' excess credit status, and a host of nontax factors, including quantitative restrictions, unemployment rates in the host and home countries, and exchange rate and price movements.

The biggest dilemma in model estimation is presented by the choices available for the tax rate variable. Economic theory does not provide much guidance in this respect beyond a preference toward marginal tax rates, so final variables are

selected primarily on the basis of model selection tests. Mexican data show a great deal of variability during 1977 to 1987 because of oil booms and busts. An intercept dummy variable with a value of one for the oil boom-bust period and zero otherwise is used in various regressions, but it is found to be insignificant and is, therefore, dropped from further analysis. The economic environment associated with oil boom and bust cycles is well captured by credit ratings, and therefore it is possible to isolate tax effects from the effects associated with a general deterioration or amelioration of economic activity. Furthermore the marginal effective tax rate incorporates the rate of return to FDI and therefore captures the variability of profits over time.

As a first step in model specification the Lagrange multiplier test is used to screen regressors. Subsequently, several alternate models are formulated, and standard model selection tests were conducted to pick the "best" model. These tests take the general form of the residual sum of squares multiplied by a penalty factor. The penalty factor varies directly with the number of estimated parameters, so that an increase in model complexity would reduce the residual sum of squares but raise the penalty. Two of the better regressions based on these tests are presented in table 1. Only regressions incorporating the aggregate marginal effective tax rate are presented here, because this formulation allows us to test the two alternative views on tax sensitivity of FDI in a simple and transparent manner. Results from regressions incorporating the marginal effective tax rate on transfers and retained earnings are close to this simple formulation.

FDI from transfers are very sensitive to the Mexican marginal effective tax rate. The estimated coefficient on τ_m implies a startlingly high elasticity of -6.25 of FDI transfers with respect to the marginal effective tax rate when evaluated at the mean values over the period; a more reasonable elasticity of -0.79 is obtained when evaluated at 1987 values. Since the elasticity of marginal effective tax rates with respect to the Mexican statutory tax rate is only -0.2 , the elasticity of FDI transfers with respect to changes in Mexican statutory tax rates is -1.24 at mean values and -0.16 at 1987 values. The large difference in elasticities calculated at mean and 1987 values results from the increased magnitude of FDI in Mexico in recent years; what would have been a very large change in FDI in previous years represents a much smaller change in relative magnitude in recent years. This same fact implies that the behavior of FDI in recent years is critical to the estimation results. For example, if the equation for FDI transfers is estimated excluding the years 1985 through 1987, the large negative coefficient on τ_m disappears. This suggests that future research should focus on whether the recent surge in FDI transfers and decline in τ_m are in fact causally related or coincidental.

The tax differential variable $t_u - \tau_m$ and the composite variable on the credit status of multinationals $L(t_u - \tau_m)$ have signs consistent with expectations but are not statistically significant. However, the coefficients imply that for the extreme excess limit case ($L = 1$), it is approximately true that the t_u , but not τ_m , provides a disincentive to investment; in general, though, the tax rates in both

Table 1. *Estimated Foreign Direct Investment Equations for Mexico, 1965–87*

<i>Independent variable</i>	<i>Dependent variable</i>	
	<i>FDI financed by transfers</i>	<i>FDI financed by retained earnings</i>
Marginal effective tax rate in Mexico (τ_m)	- 6,766.7 (-2.4)	- 2,593.7 (-2.9)
U.S. statutory tax rate minus Mexican tax rate ($t_u - \tau_m$)	- 3,994.5 (-0.8)	- 6,687.5 (-2.7)
Excess credit status of multinationals $L(t_u - \tau_m)$	- 3,012.1 (-0.6)	5,166.0 (2.5)
Country credit rating (CRM)	34.6 (3.8)	17.1 (3.0)
Index of regulations (REGU)	- 394.6 (-1.6)	- 340.0 (-1.9)
Effective tariff rate (MDM)	2,507.9 (1.1)	- 1,573.9 (-0.9)
Constant	2,341.1 (1.7)	3,415.6 (5.1)
Summary statistics		
\bar{R}^2	0.89	0.69
Log likelihood	- 157.7	- 146.9

Note: *t*-statistics are in parentheses.

Source: Estimation results based on equations 2a and 2b.

the home and host countries mattered. The empirical results weakly suggest that the regulatory environment in Mexico discourages foreign investment, while protective trade barriers have a positive effect on FDI.

The estimated equation for FDI from retained earnings indicates that such FDI is sensitive to the Mexican marginal effective tax rate, to differences in Mexican and U.S. taxes, to the credit position of the multinationals, and to Mexico's credit ratings and regulations. The elasticity of reinvested earnings with respect to τ_m is -1.5 ; the elasticity with respect to the Mexican statutory tax rate is -0.56 and with respect to the differences in Mexican and U.S. taxes is -2.8 (all calculated at 1987 values). A change in the credit status of multinationals toward excess credit positively influenced their decisions to reinvest rather than to repatriate their earnings, with an estimated elasticity of 1.9 at 1987 values. These results are qualitatively robust even if the 1985–87 data are eliminated.

In various formulations of the models the marginal effective tax rate variable shows a great deal of consistency as a determinant of transfers and retained earnings. Estimated coefficients of average tax rate and statutory tax rate variables, however, are very sensitive to model specification. This instability of coefficients is partly attributable to a degree of collinearity among a subset of variables. An unexplained aspect of this instability is that the coefficient estimates for regressions on retained earnings are less robust than those for transfers. Thus the conclusions reached in the following sections merely represent our

best judgments based on available imperfect data. It is conceivable that different conclusions could be reached if a better set of data was used.

Overall the results are consistent with the old view that the source of financing is not critical to the tax sensitivity of FDI and suggest that the tax regimes in both the host and home countries matter for FDI in Mexico. However, because of the difficulty in accurately measuring effective tax rates and the sensitivity of the results to alternative forms of the tax rate variables, these results concerning tax sensitivity must be interpreted with great caution. In addition to taxation, the regulatory framework and the overall economic and political climate in the country appear to influence FDI transfers and reinvestments in Mexico.

V. POLICY IMPLICATIONS

Our analysis suggests that FDI in Mexico shows a great deal of sensitivity to the Mexican tax regime. If this conclusion stands up in further investigations, it implies that Mexico must aim for tax rates closer to—but neither higher nor lower than—the U.S. rates. Higher rates would discourage investment, while lower rates would allow a transfer of revenue from Mexico to the U.S. Treasury through the operation of U.S. foreign tax credit provisions. However, the U.S. Tax Reform Act of 1986 has pushed more U.S. multinationals into excess credit status, thus increasing the likely disincentive effects of Mexican taxation of FDI and reducing the possibility that reductions in Mexican tax rates will simply transfer revenues to the United States. This implies that, for U.S. multinationals that operate globally, a tax rate below that of the United States may be appropriate (Slemrod forthcoming).

Mexico has already implemented tax reforms making the tax regime competitive with the United States and Canada. Furthermore effective taxes on reinvestments in Mexico are lower than that on repatriations, which provides incentives for increasing retained earnings. However, the 2 percent assets tax begun in 1989 may, because of its partial noncredibility against U.S. tax liabilities, discourage a potential investor. This tax could be replaced by an alternative minimum tax with an adjusted base that would include tax preferences as part of taxable income. Such a tax could function the same way as the assets tax but would be fully creditable against U.S. tax liabilities. Because the tax changes introduced in 1989 do not contain any special disincentives for foreign investment, perhaps public policy attention in Mexico should focus on accelerating the process of deregulation of FDI that has already been initiated.

APPENDIX A. TAXATION OF FOREIGN INVESTMENT INCOME IN MEXICO

The corporate income tax base is now indexed. Taxable profits (defined as gross receipts minus costs, business expenses, dividends corresponding to previous periods of earnings, and net losses carried forward from other periods) are

subject to tax at a rate of 35 percent (the rate was 42 percent before 1987). Depreciation deductions are indexed or, alternatively, the present value of depreciation calculated at a discount rate of 7.5 percent may be deducted fully in all regions except major metropolitan areas and in all sectors except for the automobile industry. In major metropolitan areas only 60 percent of the present value of depreciation can be deducted in the first year, with the remaining 40 percent subjected to capital consumption allowances over time. An assets tax of 2 percent of the average value of total assets of business enterprises is levied but may be credited to income tax liability. Dividends may no longer be deducted by the corporation distributing them or included in the gross income of the recipient. The withholding tax on dividend distributions varies from 0 to 40 percent, depending on whether they are paid from accumulated earnings already taxed—the “net tax profit account”—or from previously untaxed other sources and the tax regime faced by the recipient.

Effective in 1991 the withholding tax rate on interest income paid to nonresidents is 35 percent, and on payments for technical assistance, transfer of technology, and fees (including royalties for patents when licensed in connection with the rendering of technical assistance) the withholding rate is 21 percent. Payments for the use of other royalties, such as for the licensing of trademarks or trade names, or patents without the rendering of technical assistance, are taxed at 40 percent. Goods in bonded warehouses are subject to a 3 percent tax either on the value on which import duties are assessed or on the declared value, whichever is greater. All businesses in Mexico are obliged to share 10 percent of their profits with employees. Employers are obliged to contribute 11 percent of workers' weekly wages to social security coverage, 1 percent of wages to children's nurseries, and 5 to 167 percent of wages to an occupational risk fund. In addition employers contribute 5 percent of wages to the National Housing Fund and 1 percent of wages to support education. The general 15 percent value added tax is applicable to all transactions concluded in the border and free zones.

Effective in 1991 immediate full expensing of the present value of capital consumption allowances calculated using a 7.5 percent discount rate will be available to all investors, in nonmetropolitan areas only, regardless of the resident status. Incentives in the form of investments and employment tax credit certificates for priority industries and special regions are available to Mexican residents only. The inbond assembly industries established in border areas may be completely owned and operated by foreigners, provided Mexicans are hired to process the imported raw materials using imported equipment and the processed goods are exported back to the country of origin. Table A-1 compares taxation of business income in Mexico and the major source countries for foreign investment (the United States and Canada). It shows that the Mexican tax system is fully competitive with the tax regime in the home countries of foreign investors. Mexico has also moved some distance toward adopting a full cash flow taxation in the future.

Table A-1. *Taxation of Business Income in Mexico, the United States, and Canada*

	Mexico (1991)	United States (1990)	Canada (1990)
Corporate income tax rate: general ^a	35 + 3.9 = 38.9	34 + 6 = 40	28 + 15 = 43
Withholding taxes: rates			
Interest	35	30	28
Dividends	0-40	30	25
Technology transfer fees	21	30	25
Royalties	40	30	25
Indexation of deductions	Full	No	No
Loss carry forward	5	15	7
Loss carry backward	0	3	3
Minimum/alternative minimum tax	2% assets tax	20% on taxable income inclusive of tax preferences	0.175% on capital in excess of \$10 million creditable against 3% surtax on corporate profits
Capital gains taxation			
Coverage	Full	Full	2/3
Indexation	Full	No	No
Rate	35	34	28
Dividends deduction	No	Yes	Yes
Full expensing of investment	No	No	No
Investment tax credits	Regional and priority sectors	Energy investment, rehabilitation of real estate, targeted job credit	Regional and research and development

a. In Mexico the profit-sharing rate and, in the United States and Canada, the average provincial or state tax rates are added to the basic federal rate.

Source: Ugarte (1988); Price Waterhouse (1988, 1989); Mancera Hermanos (1989); International Bureau of Fiscal Documentation (1988); and Gil-Diaz (1989).

APPENDIX B. DATA DEFINITIONS

Index of excess credit status (L). These data are obtained from the U.S. Commerce Department (various issues). The index is calculated as follows:

$$L = \frac{A}{B + C - D + E}$$

where

A = foreign tax credit claimed

B = foreign taxes paid or accrued

C = foreign taxes deemed paid

D = deductions for certain foreign taxes

E = taxes carried over.

Marginal effective tax rates. The following formulation developed by Auerbach (1990) is used in calculating marginal effective tax rates.

$$\tau = \frac{[(r + \delta)(1 - \Gamma)/(1 - t) - \delta] - s}{(r + \delta)(1 - \Gamma)/(1 - t) - \delta}$$

where

τ = effective corporate tax rate

r = weighted average cost of capital

δ = capital depreciation rate (assumed value)

Γ = present value of investment credits and depreciation deductions (based on a sample of 23 firms reported in Schwartzman [1987])

t = corporate tax rate (Mexico)

s = rate of return to supplier of funds (calculated based on data from IMF [various issues]).

Marginal effective tax rate for transfers (τ_t). This term utilizes the following expression for the weighted average cost of capital (r).

$$r = b \frac{[i_u (1 - t_u^p) - (\pi_u - \pi_m - \text{XRRC})]}{1 - t_{max}} + (1 - b) \left[\frac{\mu}{1 - \phi} \right] \left[1 - \frac{t_{min}}{1 - t_u} \right]$$

where

b = fraction financed by debt

μ = real discount rate for equity

t_u^p = U.S. personal tax rate

i_u = U.S. nominal interest rate

π_u = U.S. inflation rate

π_m = Mexican inflation rate

XRRC = rate of Mexican pesos depreciation against the dollar

t_{max} = higher of U.S. personal income tax rate and the Mexican withholding tax on interest payments

t_{min} = lower of Mexican and U.S. corporate tax rates

ϕ = effective tax rate on real equity return.

Retained earnings.

$$r = \frac{\mu}{1 - \phi} \text{ is utilized in the effective tax rate formula.}$$

Regulations (REGU). Exchange rate premia is used as a proxy for regulation. It is defined as:

$$\text{REGU} = \frac{\text{XRM} - \text{XRN}}{\text{XRN}}$$

where

XRM = market exchange rate

XRN = official exchange rate.

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Prospects for Agricultural Land Taxation in Developing Countries

Jonathan Skinner

Countries that collect tax revenue from the agricultural sector through export taxes, marketing boards, and overvalued domestic currencies are often loath to abandon these distorting policies because of the consequent revenue loss. One potential alternative is to replace these distortionary taxes with a land tax, which would not depress output prices or discourage foreign exchange earnings and which could be, in theory, a highly progressive tax. The advantages and disadvantages of a land tax are examined theoretically and using the specific experiences of Bangladesh, Argentina, and Uruguay. It is concluded that the land tax is not necessarily more efficient than other types of taxes; the Achilles Heel of land taxation is administration; progressive tax rates based on land holdings are nearly impossible to administer; land taxes have been ineffective at promoting nonrevenue goals; political support by farmers is necessary to implement the tax; and the most promising prospects for a moderate land tax system are in financing local, rather than central, government expenditures.

Many developing countries use a combination of export taxes, marketing boards, and overvalued domestic currencies to raise revenue from the agricultural sector. The effective rates of taxation on selected exports during 1980–84, for example, were 50 percent for wheat in Argentina, 34 percent for rice in Thailand, and 36 percent for cotton in Egypt (Krueger, Schiff, and Valdés 1988). Although these explicit and implicit taxes are highly inefficient, they do provide a substantial amount of government revenue. In 1977 the agricultural sector in Argentina accounted for just 15 percent of gross domestic product (GDP) but contributed 40 percent of total central government tax revenue (Trapido 1988). Despite the demonstrated benefits of reducing tax-induced distor-

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tions, most countries facing budgetary pressures are unwilling or unable to forgo the tax revenue.

One apparent solution to this problem is to replace currently used taxes with a tax on agricultural land. Such a tax causes no distortion of farm produce prices and can potentially raise significant revenue. In 18th century India the land tax accounted for more than two-thirds of all government revenue collected; in the first part of the 20th century it was still responsible for more than one-third of government revenue (Bird 1974, p. 35). Moreover progressive land taxes, in which rates rise with total land holdings, can theoretically ensure that wealthier farmers with extensive land holdings bear most of the tax burden. Given the prospect of raising revenue in an efficient and equitable way, shouldn't central governments be encouraged to adopt a land tax?

The presumed theoretical superiority of land taxation over other forms of taxation has been addressed in recent papers by Hoff (1991) and Skinner (1991). This article provides a broader perspective on the prospects for agricultural land taxation. Historical trends in the use of land taxes are examined, the theoretical literature on the efficiency of land taxes versus export and commodity taxes is reviewed, the effectiveness of the land tax in achieving non-revenue objectives is considered, and recent experience with land taxation in Bangladesh, Argentina, and Uruguay is discussed. The article concludes with summary observations on the feasibility of, and conditions necessary for, replacing export, income, or commodity taxes with land taxes.

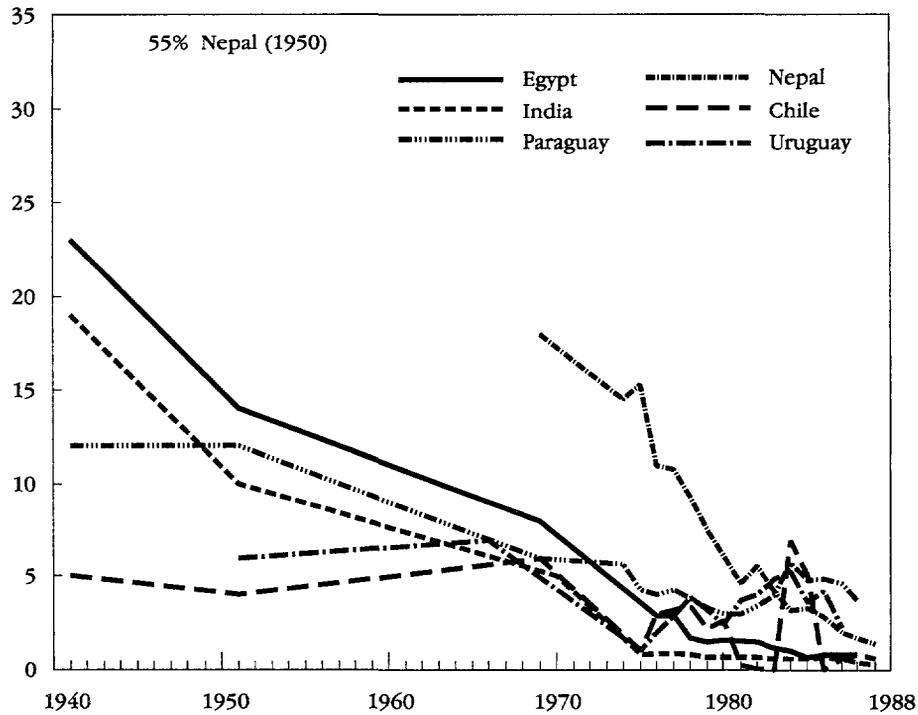
I. HISTORICAL PATTERNS OF LAND TAX USE

Agricultural land taxation has a long history matched only by the history of resentment on the part of taxpaying farmers. Most governments shifted to less contentious sources of revenue, such as indirect taxes on domestic and international trade, at the earliest opportunity (Bird 1974, ch. 6).

Figure 1 illustrates the declining importance of agricultural land taxation as a source of central government revenue for six countries between 1940 and 1988. The importance of land taxation decreased most sharply in Nepal, where the land tax accounted for 55 percent of central government revenue following World War II but less than 2 percent in 1988; the importance of land taxation also declined drastically in Egypt and India. The decline of the land tax in India during the 20th century continues a trend begun in the 19th century: land tax revenue as a fraction of total revenue fell from 69 percent in 1793/94, to 36 percent in 1891/92, to 16 percent in 1938/39 (Bird 1974, p. 133), and to less than 1 percent currently. Local land tax revenue for Indian states also receded from 13 percent of total state tax revenue in 1951/52 to only 2 percent in 1978/9 (Titus 1984, pp. 53–54).

Other countries have had similar experiences with land tax revenue. The agricultural land tax in Taiwan fell from 2.7 percent of central government revenue in 1975 to 0.3 percent in 1984 (Riew 1987). The land tax in Turkey was

Figure 1. *Land Tax Revenue as a Percentage of Total Tax Revenue in Six Countries, 1940-88*



Note: Land taxes are defined as property taxes less corporate property taxes on financial and capital transactions. This classification includes urban taxes.

Source: Pre-1970 data, Bird (1974) pp.34-35. Post-1970 data, IMF (1984, 1989).

hobbled by lagging tax assessments in the mid-20th century, so that although the market value of land increased 50-fold between 1936 and 1960, land tax revenue rose less than threefold (Bird 1974, p. 68). The property tax on agricultural land in Indonesia has recently benefited from improved assessment and collection methods, but the effective rate on land value is just 0.1 percent. Although Chile and Uruguay have enjoyed some success with a federally administered land tax, these countries are exceptions to the overall trend. Currently, it is rare for more than 3 or 4 percent of total government revenue to be raised through land taxes.

Part of the land tax decline depicted in Figure 1 could be due to factors other than an absolute decline in the use of land taxation. If the share of agricultural GDP is declining over time (as one might expect in a developing economy), then a fall in the share of land taxes to total taxes should be expected. But the ratio of land tax to total tax has fallen over time, even after adjusting for the decline in

the share of agricultural production.¹ The fact that land tax revenue is such a small fraction of total revenue implies that doubling or tripling land tax rates would have little impact on revenue. To boost land tax revenue to a significant fraction of total central government revenue would require a radical restructuring of current land tax systems.

II. THEORETICAL ASPECTS OF LAND TAXATION

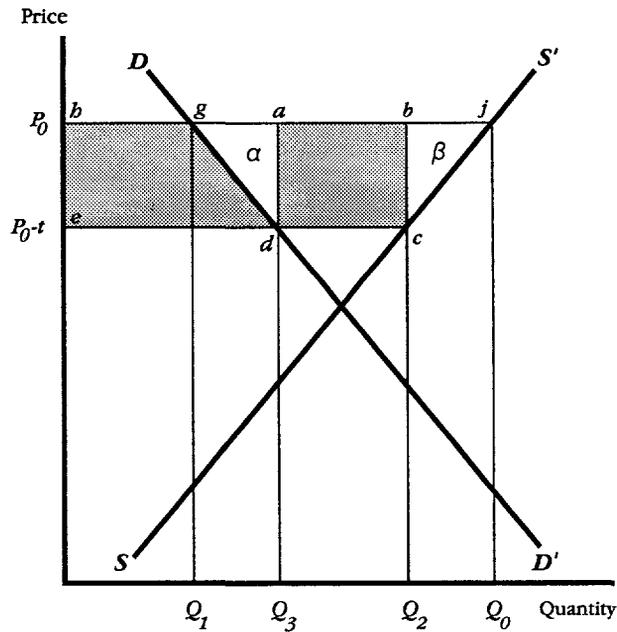
Nearly all taxes cause efficiency losses. Export taxes, for example, discourage domestic production, reduce foreign exchange earnings, and encourage domestic overconsumption of the taxed good. Income taxes may reduce labor supply, investment, and saving. The question of concern here is whether the land tax is necessarily more efficient than these alternative taxes.

Income taxes are not generally a viable option for taxing agriculture in developing countries because of unreliable farm records and home consumption of output. Tax authorities sometimes rely on presumptive income taxes based on an objective measure of farm productivity. Since land area and quality are the best indicators of farm productivity, the presumptive income tax becomes a de facto land tax (Bird 1974). Therefore in the theoretical section below the land tax is compared with an export tax. Export taxes (whether explicit or implicit) are most commonly used to raise revenue from the agricultural sector.

The effect of an export tax on domestic production and consumption of the agricultural good is shown in figure 2, in which the domestic demand curve, including both rural and urban consumers, is given by DD' and the domestic supply curve is given by SS' . Suppose that the country enjoys no monopoly power in world markets so that the world price of the commodity is fixed at P_0 . Without the tax, producers receive P_0 and produce Q_0 . The domestic quantity demanded is Q_1 , so exports are $Q_0 - Q_1$. When a specific export tax is imposed, the world price remains at P_0 , so that the price received by domestic producers declines by the full amount of the per unit tax, t . Domestic output falls to Q_2 , domestic consumption rises to Q_3 , and exports shrink to $Q_2 - Q_3$. The loss to producers from the export tax is the entire area $hjce$. Part of this loss, the shaded area $abcd$, is transferred to the government in the form of tax revenue and another part, the shaded area $hgde$, is transferred to domestic consumers in the form of lower prices and increased supplies available to the domestic market. By driving the domestic price below the world price, the tax also produces a deadweight loss equal to the area of the two triangles labeled α and β . The triangle β is the traditional production efficiency loss; the low net price to suppliers causes them to produce less than they would have without the tax. The

1. Adjusting the revenue share of land taxation by the ratio of GDP to agriculture value added corrects for the secular decline in the agricultural share of GDP. Because historical data are sparse, all of GDP was assumed to be from agriculture in earlier years. Even with this extreme assumption, the corrected ratio showed a strong decline in all countries except Chile, Paraguay, and Uruguay.

Figure 2. *Economic Effects of an Export Tax*



triangle α is the consumption efficiency loss; consumers respond to the lower domestic price by overconsuming relative to the good's value on the world market.

In contrast, a land tax assessed on the site value of the land (the intrinsic economic value of the land excluding improvements) causes no distortions because the site value cannot be altered or reduced by the producer. The producers therefore behave just as they did without taxes: they receive P_0 , produce Q_0 , sell Q_1 domestically, and export $Q_0 - Q_1$. Some proponents of the land tax even claim that the tax will increase supply (shift the supply curve rightward) as landowners, burdened with cash tax payments, are forced to use their land more efficiently. Such a shift of the supply curve would increase output and spur exports further. The deadweight losses α and β are not incurred, making the land tax a more efficient source of tax revenue. Because of its nondistorting nature the land tax enjoys a distinguished theoretical pedigree dating back to Henry George and David Ricardo.

Replacing an export tax with a land tax would affect more than farmers' incentive to produce. Because export taxes depress domestic as well as export prices of agricultural commodities, they are a very efficient way to transfer income from the rural to the urban sector (Trapido 1988). Because the replacement of an export tax with a land tax will increase domestic prices, farmers

should prefer the land tax, whereas urban consumers should prefer the export tax.

Up to this point the analysis has assumed perfect certainty. When farm income is uncertain because of unforeseen yield or price fluctuations, the comparison between land taxation and export or commodity taxation changes. As Hoff (1991) has carefully shown, a fixed-rate land tax may be less desirable to farmers than an export tax because the land tax must be paid regardless of actual yields and prices. Land taxes thus increase the variance of net income. To the extent that governments have better access to credit markets than farmers, the export tax can serve a risk-pooling function (Newbery and Stiglitz 1981).

The empirical importance of risk pooling through export taxation in developing countries is not well established, but, even in a model incorporating uncertainty, land taxes may dominate export taxes. Numerical calculations suggest that the degree of output uncertainty must be high for even risk-averse farmers to prefer export taxes over land taxes (Skinner 1991). Deaton (1990) has argued persuasively that farmers are able to partially insure against bad harvests by precautionary saving so that the importance of risk pooling is reduced. In addition Hoff (1991) has shown that if risk-sharing institutions are imperfect, a combination of land taxation and commodity taxation dominates either tax in isolation. In Uruguay a land tax and a variable export tax are used in tandem, with appropriate adjustments in both taxes when world beef prices are low (Jarvis and del Rosario Medero 1988).

Orthodox economic theory showing that the land tax is more efficient than export or commodity taxes ignores administrative costs. A simple model developed by Skinner (1991) illustrates that administrative costs may be a relevant factor in choosing between land and export taxation. Under export taxation a farmer with more productive land will produce more output and pay more in taxes, all other things being equal, than a farmer with average quality land. Although export taxes may be avoided by smuggling goods past regulated shipping centers, harsh penalties for smuggling will induce a high degree of compliance even if the rate of detection is low.

Under a tax based on land quality, however, farmers have a strong incentive to misrepresent the productivity of their land. There is no "true" value of land, and reasonable people may differ over its inherent productivity or value, particularly when agricultural land markets are thin or when inflation is rampant. Assessing large penalties on taxpayers who incorrectly report low market land values could be viewed as confiscatory and patently unfair. To ensure equitable assessments, then, tax administrators must visit and evaluate individual plots of land. But such plot-by-plot surveying may lead to large numbers of appeals by landowners; Strasma and others (1987) suggest that just a 5 percent appeals rate can effectively shut down most land tax administration systems. Property assessment costs—the social cost of transferring resources from the taxpayer to the government—are an efficiency loss. Hence the land tax may be less efficient than the export tax once administrative costs are added in (Slemrod 1990).

If administering the land tax is so difficult, then why was it so important as a

source of revenue in the 19th century? One reason is that alternatives such as income or trade taxes were not then capable of raising large sums of money because of low levels of trade and manufacturing. Also there may have been less concern in the 19th century with horizontal and vertical equity in tax collection. Countries may no longer be willing to exert the force necessary to stifle the “strenuous resistance and even uprisings” (Yamamura 1986) by farmers reacting to heavy land taxes.

Up to this point it has been assumed that the land tax is a pure site value tax on the implicit value of the land excluding all improvements. But as all tax administrators learn, one must give up “the quest for the Holy Grail of the ‘true’ value of land; there is no such thing . . .” (Bird 1974, p. 238). In practice, tax authorities typically choose one of three methods to assess the tax: an *in rem* (property) tax based on land area, a tax based on the net income or market value of the land, or a tax based on objective measures, such as soil quality, distance from market, and other factors, which are proxies for presumptive income or productivity.

Tax based on land area. An *in rem* tax based solely on land area is the easiest to administer. There is no need to assess land quality, so the cadastral requirements are minimal and tax authorities need not establish detailed ownership records. If cadastral records are incomplete and rates are low, farmers often prefer to pay the land tax, since it may help to establish ownership or title. The disadvantage of the tax based on land area is that the tax burden as a fraction of land value is largest on the least productive land and is smallest on the most productive land. If poorer farmers own less productive land, then the *in rem* tax is regressive, whereas the export or commodity tax tends to be progressive to the extent that poorer farmers consume more of their own output. Furthermore the revenue potential of an *in rem* tax is limited by the maximum acceptable burden on the least productive land. Because of these problems the *in rem* tax must remain a limited way to raise central government revenue.

Tax based on the net income or market value of land. A tax on the land’s market value or net income includes improvements as well as the site value of the land, thereby partially shifting the tax to owners of capital and distorting incentives to improve the land.² Efficiency considerations are ignored here, and the focus instead is on the administrative difficulties of determining market value. One approach is to allow self-assessment of land value, but without penalties for underassessment such a method rarely yields much revenue. As one official commented concerning the self-assessment program in Colombia:

. . . property owners’ statements were—and are—highly undependable. Their memories are notoriously bad, both as to what they own and how much of it they own. And their modesty with respect to the value—for tax

2. For a debate on the neutrality of site value taxation, see Bentick (1979), Mills (1981), Tideman (1982), and Turnball (1987). For a good theoretical discussion of land taxation and shifting, see Bruekner (1986).

purposes—of their own property is simply incredible. (Morgan 1967 quoted in Bird 1974, p. 84.)

The problem with self-assessment is that there is often little or no penalty for “modesty.” Accurate self-assessment may be encouraged by allowing the government or private individuals to bid on the disputed land; the taxpayer may then either sell the land for the bid price or pay the tax on the bid price (Strasma and others 1987). In equilibrium, all taxpayers will truthfully report the market value of their land. The disadvantage of such a technique is the potential for abuse or extortion (Bird 1974). For example, larger farmers can either buy out smaller farmers or force them to pay higher land taxes if they refuse to sell their land. Even if these bids are not actually carried out, they can be used as threats.

The other way to enforce market value taxation is to assess each plot of land using a cadastral survey and then to reassess the land periodically. This approach entails the substantial costs—before any revenue is collected—of conducting cadastral surveys; in Brazil the average cost per parcel was \$220, or about \$7 per hectare (Strasma and others 1987). It is estimated that the survey costs of a five-year cadastral revision cycle in Bangladesh would exceed the additional revenue collected (Skinner 1987). This method is also particularly vulnerable to inflation. In late 1986 the assessment on one plot of land in Bangladesh was fixed at its 1922 nominal rate! In theory it should be straightforward to index the tax rate to avoid the problem entirely, but in practice few tax authorities use indexing for land taxation. In part inflation may reflect real price shocks such as oil price increases. But politicians may also be loath to increase nominal tax rates and may choose to rely instead on ad valorem trade, income, and property transfer taxes that are buoyant with respect to inflation.

Tax based on objective measures. A land tax assessment that relies on objective features of the land, such as distance from the market, soil quality, and irrigation facilities, provides a crude measure of the income potential of the land. It is not a pure site value tax, because capital improvements such as irrigation increase tax assessments. In many respects this type of tax holds the greatest promise for future tax revenue. There is no need to rely on market assessments, and the tax can be adjusted for inflation by increasing the tax rate on the (constant) quality index of the land. Furthermore this type of tax can distinguish between as many or as few types of land as can be handled by tax administrators. For example, one could assess land tax based only on distance from the market or on objective measures of soil quality. For developing countries the administrative prospects for such objective grading of land are brighter than market-based approaches.

III. NONREVENUE OBJECTIVES OF LAND TAXATION

Land taxation has often been viewed as a way to encourage a number of nonrevenue development objectives. One such nonrevenue objective is encouraging productive efficiency. That is, given output and input prices, it is thought

that the land tax would encourage farmers to seek the most productive use of their land, perhaps even prodding large absentee landlords to sell “unproductive” land to small farmers. It is not clear at a theoretical level why a land tax should encourage more productive use of land, unless it is tied to a reduction in export taxation (which would increase domestic output prices). By definition an efficient tax should not affect land use decisions. However, it is possible that a sufficiently large land tax could spur landowners to work harder (an income effect) or to break away from reliance on traditional methods of production and seek new and more efficient methods (Leibenstein 1978).

The Meiji period in Japan has been cited as one illustration of how land taxation has improved agricultural productivity. Several researchers have suggested that after the imposition of a 25 percent tax on gross income during the latter part of the 19th century, farmers increased agricultural investments and sought to market their produce (Yamamura 1986). That is, the necessity of making cash payments to the government motivated farmers to work harder and more efficiently. One potential shortcoming of this explanatory link between land taxes and productivity is that other factors, such as improved regional markets and land reform, could have provided the incentive for improved agricultural investment. Furthermore the income effect of land taxation can cut both ways. Lindauer and Singh (1979) suggested that the heavy Indian land tax at the turn of the century may have reduced farmers’ productivity and nutrition by cutting into consumption or may have forced peasants to borrow money during bad harvests. Subsequent defaults by small farmers increased the landless population and concentrated holdings among large landowners. In this case the income effects of land taxation discouraged productivity goals.

Land taxes are also sometimes believed to encourage efficient land use by discouraging speculation in idle land. Again the theory behind this belief is weak. Imposition of the tax reduces the market price of land, but, once speculators have suffered this one-time loss, their future expected profits from holding land are unchanged. To see this, suppose that the land tax reduces land prices by 20 percent and that land today is held in expectation that land prices will be higher next year. Because the tax reduces both the current and future land price by 20 percent, the rate of change in land prices is independent of whether the land tax is imposed or not (also see Tideman 1990). Land taxation would only effectively discourage speculation if it burst a speculative “bubble” in land prices.

A third nonrevenue objective of land taxation is to encourage land reform. Taxing large farm holdings at progressive rates could force their breakup into several smaller farms. Efforts to encourage land reform through this channel in Colombia and other countries have generally been unsuccessful for two reasons. First, commonly administered land tax rates have been neither large enough nor progressive enough to affect land use. In one study of Colombia, L. Harlan Davis concluded that:

Because of low rates, the tax burden is a relatively small percentage of income and this fact . . . means that there is little opportunity for the

nonfiscal effects to operate . . . particularly . . . among the larger farmers, where the tax burden is lightest (Strasma and others 1987, p. 41).

Second, land taxation is politically unpopular because neither large nor small farmers like increased tax rates. At least the benefits of direct land reform are obvious to landless peasants (Bird 1974, pp. 262–67, and Strasma and others 1987).

More recently, land taxation has been proposed to promote the environmentally sound use of land. For example, land taxes could be assessed on environmentally harmful conversions of Amazon rain forests to cattle ranches, which would resemble a Pigouvian tax on the external effects of environmental degradation. Binswanger (1989) presents evidence that the existing land tax in Brazil actually encourages the destruction of the Brazilian rain forest because forest land is considered to be “unused” and as a consequence is subject to a higher tax rate. Even if the design of the land tax were to discourage deforestation in Brazil, the incentive is likely to be minimal given existing tax rates. Binswanger reports that for land plots above a minimum size, the statutory land tax rate in Brazil is 3.5 percent of the unimproved value of the land, with a reduction of up to 90 percent in tax liability, depending on land use. A more important factor in encouraging deforestation is the exemption of most agricultural profits from corporate and individual taxes in Brazil.

A land tax may still be able to affect environmental quality indirectly, by tying tax proceeds to a particular expenditure program. This “valorization” or earmarking of taxes may provide the most effective means for local self-financing of projects that combat deforestation, pollution, and erosion of waterways.

IV. CASE STUDIES: BANGLADESH, ARGENTINA, AND URUGUAY

The experience of Bangladesh, Argentina, and Uruguay illustrates some of the advantages and disadvantages of the land tax described above.

Agricultural Taxation in Bangladesh

This section draws on Skinner (1987), Alm and Schroeder (1985), and World Bank data. In 1959–60 direct agricultural land taxes in Bangladesh (then East Pakistan) comprised 66.2 percent of all direct taxes and 19.8 percent of total central government tax revenue. Following independence small landowners with less than 8.25 acres were exempted from land taxes, but, because of the resulting fall in tax revenues, the government implemented the Land Development Tax (LDT) in 1976. The LDT consisted of a flat rate on commercial and residential areas, with a two-tier system for agricultural land: Tk3 (\$0.09 in 1989 US dollars) per acre for holdings under 8.25 acres and a marginal rate of Tk15 (\$0.45) per acre for holdings above 8.25 acres, with a minimum tax payment of Tk1 per land owner.

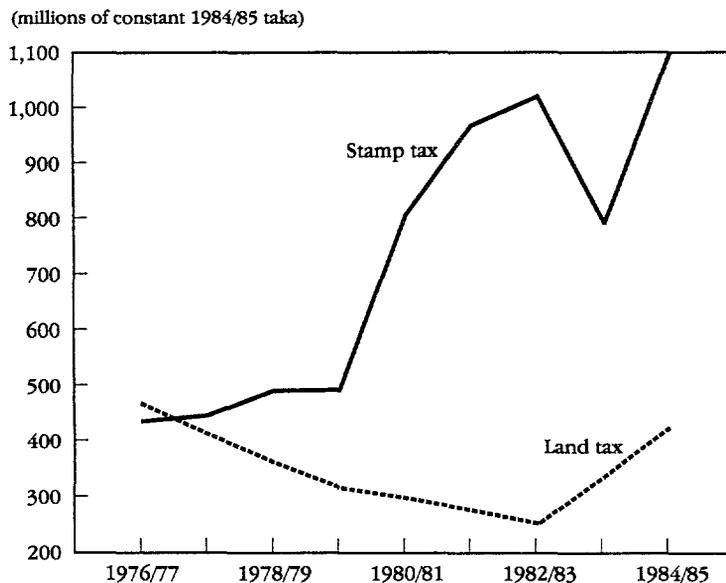
The commercial and residential rates were increased in 1980 and 1982, and in 1982 the agricultural rates were made sharply progressive, with nominal rates

ranging from Tk3 per acre to a marginal rate of Tk145 (\$4.35) per acre for land holdings larger than 25 acres. Following the 1982 adjustments, the industrial and commercial rates imposed on land near police stations (located in the cities of Dhaka, Khulna, and Chittagong) were 69 times higher than the maximum rate on agricultural land.

Total real revenue collected between 1976/77 and 1984/85, in 1984/85 prices, is shown in figure 3. Despite the substantial rate increases during the 1980s, inflation eroded the value of revenue collected, and only in 1985/86 did real tax collections regain the levels collected during 1976/77. LDT revenue also diminished relative to the aggregate tax revenue of the central government, and by 1987 the LDT accounted for only 0.2 percent of agricultural value added. Although some countries have simply replaced land taxes with indirect methods of raising revenue, such as overvalued domestic currencies and marketing boards, the Bangladesh government during the mid-1980s did not place such implicit taxes on the agricultural sector (Hossain, Rahman, and Akash 1985; World Bank data).

The difficulty of maintaining revenue from a nonindexed *in rem* land tax in the face of inflation contrasts with the ease of revenue collection for the Bangladesh nonjudicial stamp tax. In 1986 the stamp tax was assessed on property transfers at a progressive rate between 6 and 18 percent of the declared value of the property. As shown in figure 3, in 1976/77 revenue collection from the two

Figure 3. Revenue from Land and Stamp Taxes in Bangladesh, 1976/77-1984/85



Source: World Bank data.

taxes were nearly identical, but by 1986 the stamp tax collected more than twice as much revenue. Property transfer taxes may be inefficient because they discourage the sale of property, but they are relatively easy to administer, and, because nominal property values rise with inflation, stamp tax revenue has been resilient to inflation in Bangladesh.

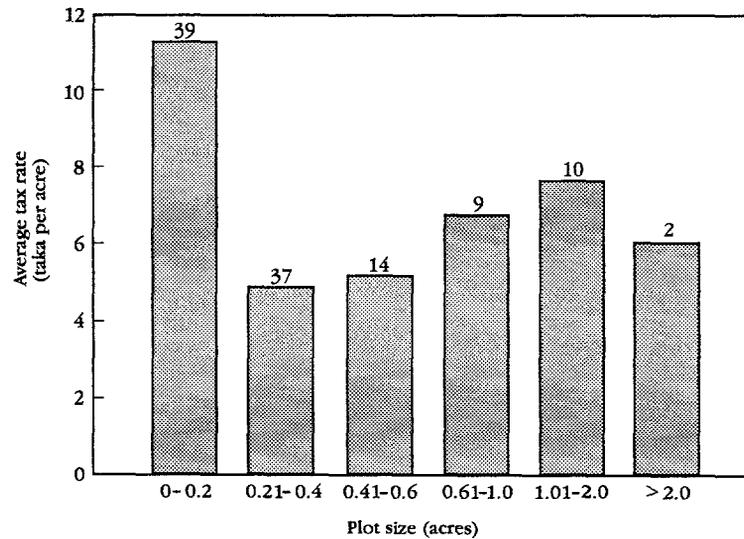
The 1982 revisions of the LDT made the tax substantially more progressive, with the ratio of the highest to the lowest marginal rate increasing from 5 (15:3) to nearly 50 (145:3). Given the substantial concentration of wealth in land holdings (Rahman 1982), the assessment on the wealthiest 1 percent of the population was calculated to be 55 percent of the total (projected) tax revenue of Tk453 million, or \$13.6 million (World Bank data). This combined with the actual tax collections in 1985/86 of Tk485 million might suggest that the LDT is a highly progressive and effective tax. However, aggregate LDT revenue includes commercial and residential sectors, which, as noted above, are taxed at much higher rates than the agricultural sector. To measure the independent contribution of agricultural land taxes to LDT revenue, a survey of tax records was conducted in the Tangail and (rural) Dhaka districts.

In both tax offices the records of plot ownership and location dated from the early 1960s and were based on cadastral surveys from 1914. The most striking characteristics of the sampled records were the small average plot size and the high fraction of plots subject only to the Tk3 rate per acre (or the minimum Tk1 payment). Figure 4 shows the average tax rate by plot size and the corresponding number of plots. Sixty-eight percent of the sampled plots were smaller than 0.4 acres, and only 2 out of 111 plots were larger than 2 acres. Based on this sample, it seems clear that although some effort was made to assess progressive tax rates above the basic rate of Tk3 per acre, actual tax collections do not reflect the legislated degree of progressivity. Much of this lack of progressivity is due to the minimum Tk1 payment, which results in the smallest plots of land being assessed the highest average tax rates. But the degree of progressivity for the larger plots is still very slight.

The failure of the LDT as a progressive tax may result from the fragmented land holdings of larger farmers. According to the 1977 Agricultural Census, for example, 44 percent of large farmers reported owning 20 or more separate plots. Even among small farmers owning less than 1 hectare (2.47 acres) of land, 43 percent reported ownership of more than 6 plots. But aside from the very smallest plots of land subject to the Tk1 minimum, there was no agricultural plot of land in the sample subject to an average tax rate of more than Tk28 per acre.

There appeared to be substantial difficulty in matching plots of land to individual owners. The tax collector may have knowledge of local land ownership, but, given the large size of districts and land ownership outside of a single district, the collector may find it difficult to identify all the land held by a single owner. To complicate matters further, many plots are registered to long-dead owners (because of slow updating of records) or to multiple siblings or cousins

Figure 4. *Land Tax Rates per Acre by Plot Size in Rural Bangladesh, 1986*



Note: Numbers above the bars denote the number of plots in each size category.
Source: World Bank data and the author's unpublished data.

who have shared in a common inheritance. It appears that, in practice, many of the actual tax assessments were based on "discussion and imagination."

Even after adjusting for possible regional differences in the distribution of plot sizes (Miller and Wozny 1985), agricultural revenue cannot have accounted for more than two-thirds of total LDT revenue. It seems likely that much of the increasing LDT revenue collection in the mid-1980s resulted from collections in urban and commercial districts, and not in agricultural areas. Real tax rates for urban and commercial areas have risen in real terms between 1976 and 1986. Although Dhaka paid 5 percent of total LDT revenue in 1984/85, it accounted for 17 percent of the increase between 1984/85 and 1986/87.

The cost of administration must be subtracted from revenue to determine net revenue to the government. In 1985/86 administrative costs were 66 percent of tax collections, so only 34 percent of LDT revenue was available for central government use. The local tax office does provide valuable services, such as maintaining land records and providing land tax receipts, which are often viewed as informal land titles. Still the average administrative cost per taka of LDT revenue collected exceeds that for other taxes in Bangladesh by a factor of seven. In sum, the LDT on agricultural land is best thought of as a filing fee for annual ownership records, since it provides little revenue for central government operations.

Land Taxation in Argentina

Whereas the land tax in Bangladesh is a dim memory of what it once was, the federal land tax in Argentina remains a dream of what it might be. As Trapido (1988) has discussed in his excellent survey, the intellectual basis for the land tax dates to the early 1960s, when it was viewed as a publicly palatable step toward land reform. The first federal government land tax, implemented in 1969 under the regime of General Onganía, imposed a flat tax of 1.6 percent of the market value of agricultural land. Despite public opposition, land tax collections averaged 24 percent of total agricultural taxes (or two-thirds of export tax revenue) during the few remaining years of the regime (Trapido 1988, p. 52). In successive administrations the land tax was converted to an agricultural income tax, and tax revenue lagged.

In 1986 a new land tax was proposed to replace the agricultural income tax. The land tax was viewed as preferable to an export tax because it would not depress output prices and would ensure a more stable supply of revenue to the government. Although the legislation introducing the land tax referred to the desirability of decreasing the export tax, this reduction was not explicitly linked to passage of the land tax. Furthermore the land tax revenue was designed not simply to replace revenue, which would be foregone if the export tax were eliminated (area *abcd* in figure 2), but to mop up the entire surplus from farmers (area *hbce* in figure 2), leaving them without surplus gains. Believing that the land tax would be added to an already heavy export tax, farmers opposed the land tax, and farming organizations worked to prevent legislative approval of the bill.

The vehement protests against the land tax should be understood in light of the historical tax bias against agriculture and, in particular, the large share of tax revenue contributed by the agricultural sector (Sturzenegger 1988; Trapido 1988). Furthermore the proposed land tax came on top of already quite heavy provincial land taxes. One study estimated local tax rates on net income from land at 10 percent for farmers in the Pergamino region (Trapido 1988, p. 45). A local land tax of this magnitude ensures stiff farmer opposition to a second layer of taxation imposed by the federal government.

An important lesson from the experience with the land tax in Argentina is that imposing a new land tax is a risky investment. The administrative apparatus of land taxation, including cadastral surveys and assessor training, must be put in place before a single austral can be collected. The tax can be thought of as a project with an up-front cost (for Argentina perhaps \$6 million) and with a risky future return. For Argentina thus far the investment has not been successful; no revenue has yet been raised under the 1986 land tax proposal.

Land Taxation in Uruguay

Uruguay has enjoyed a more positive experience with land taxation. The land tax was first proposed in the 1960s by a group of cattle ranchers, who understood that, since only one-third of the country's beef output was exported, an

equal-revenue land tax to replace the export tax would shift the terms of trade to favor producers. With the support of the World Bank, the tax was implemented in 1967, accompanied by a reduction in the export tax.

The land tax was originally a presumptive gross income tax based on an index of land quality measured in terms of its potential to produce beef and wool. The tax liability was the product of the land productivity index and an annual adjustment reflecting the output and prices of the baseline land yield. Costs of implementing cadastral and land record surveys were likely eased by the fact that more than half of Uruguay's agricultural land is in farms of more than 1,000 hectares (World Bank data).

A serious crisis occurred in 1974 when beef prices fell dramatically but land taxes based on productivity in 1973 came due. The total direct tax bill for 1973 (including a capital levy and social security taxes) was 43 percent of gross agricultural income in 1974, the year in which the tax was collected. Since net income (even before direct taxes) was negative in 1974, the land tax contributed to an already serious liquidity crisis for cattle ranchers. The ranchers argued successfully that the land tax should be based on net rather than gross income, which resulted in a new tax assessed on net imputed income. Neither the presumptive gross income tax nor the net imputed income tax relied directly on individual farmers' records of costs. During the 1980s the government attempted to move toward a tax based on the accounting records of individual ranchers, but this effort has not been entirely successful in increasing revenues. As an internal Bank study notes:

The primary problem with the IRA (net income) tax is that it requires a reasonably sophisticated set of records, especially regarding inputs costs, which most Uruguayan farms and ranches cannot currently meet. It seems that such record keeping might be feasible over a period of years, but that the shift to IRA could not be applied on most farms without a significant decline in government revenue. Tax evasion is already a substantial problem in Uruguay.

Nevertheless the land tax contributes a substantial fraction of total taxes collected from the agricultural sector. Between 1977 and 1981 the land tax raised 31 percent of total agricultural tax revenue, and, although that percentage fell during the early 1980s, it had rebounded to 27 percent in 1986 (World Bank data).

The government did not eliminate the export tax entirely. Instead the export tax was often used to moderate the domestic price of beef during periods of high international beef prices. The export tax was used most heavily during the price boom of the early 1970s and later in 1977 and 1984. During downturns in beef prices the export tax was reduced or even removed. In contrast, the land tax collected a relatively stable fraction of agricultural product in the 1970s, although even this tax was removed during years of very poor beef prices (1982–83).

The land tax has provided a relatively steady source of revenue from the

agricultural sector. Although Uruguay has stated its intention to phase out the export tax, it is a likely candidate to stabilize domestic beef prices should world prices rise in the future.

V. WHAT ARE THE LESSONS FOR TAX REFORM?

Although one must be careful in drawing conclusions about the feasibility of land taxation from the historical experiences of a limited number of countries, a few lessons are suggested here.

The Land Tax Is Not Necessarily More Efficient Than Other Types of Taxes

At a theoretical level the land tax suffers from two general drawbacks. First, because the farmer is required to pay a given tax liability in each year, the land tax does not pool risk. The export tax, however, reduces the variance of annual net income so that risk averse farmers may prefer the export tax to the land tax (Hoff 1991). Although the increased risk to farmer income associated with land taxation may not be a fatal shortcoming (Deaton 1990; Skinner 1991), it does throw doubt on the theoretical supremacy of the land tax.

Second, the land tax may be costly to administer. On pure efficiency grounds it doesn't matter whether \$1 is lost to society because of traditional inefficiency triangles or because an extra \$1 is spent on administrative expenses. The higher cost of enforcing the land tax must be taken into account in comparing the overall efficiency of both tax systems. The question of which tax is preferred on efficiency grounds is ultimately an empirical one that has not been entirely resolved.

The Achilles Heel of Land Taxation Is the Problem of Administration

The theoretical tax base for land taxation is the net income or intrinsic value of the land, but determining land value is problematic. As was shown in Colombia, self-assessment is not particularly effective, since farmers have a strong incentive to underassess their land. There is indeed an incentive to evade any kind of tax. What makes land tax evasion more troublesome is that the true value of land cannot be precisely known. Even if each plot is assessed by trained officials, landowner appeals and the inflationary erosion of the assessment over time can quickly attenuate the revenue potential of a land tax.

Another option is to base the tax on objective measures such as land area and quality. A tax based simply on land area is easy to administer, but the tax is likely to be regressive if wealthier landowners own higher-quality land. Evidence from Latin America, and in particular Uruguay, suggests that land taxation based on crude measures of quality have been more satisfactory at collecting revenue than taxes based on market valuations and represent the most promising avenue for collecting land tax revenue.

Progressive Tax Rates Based on Land Holdings Are Difficult to Administer

Most cadastral surveys are good at identifying land area, soil quality, and the owner of record. But the Bangladesh experience with attempting to link land records to trace ownership across parcels (and across regional districts) suggests that assessing progressive tax rates is difficult. Even if the tax administration could link land ownership records, taxpayers could still avoid the progressive rates by dividing land among family or business associates or by creating a twisted paper trail of ownership records. A small amount of tax evasion can result in large revenue losses under a progressive tax system. In Bangladesh, for example, splitting a 24-acre lot into three equal parts reduces land taxes owed by two-thirds. Evasion and incomplete land records often lead to quite disappointing revenue collection under a progressive tax system.

Land Taxes Have Not Proved Effective in Attaining Nonrevenue Goals

Development experts in the past held great hopes for land taxation to effect desirable nonrevenue goals. It was viewed as a means to encourage more productive use of land and to prompt "voluntary" land reform. However, it has not been successful in achieving these objectives. First, the theoretical underpinnings for why the land tax should promote such objectives is weak. Second, and more important, land taxes rarely have had sufficiently sharp teeth to affect land use decisions. More recently, land taxation has been proposed to encourage environmentally sound land management. Although it seems clear that the World Bank should discourage taxes that encourage environmentally unsound land management, land taxation at its current low rates is unlikely to have more than a marginal effect on improving land use. A better use of land taxation for environmental purposes would be to use the revenue thus collected for local environmental expenditures.

Political Support for the Land Tax Is a Necessary Precondition for Its Success

This may appear to be a tautology, but its fundamental truth is often overlooked. The contrast between the success of the land tax in Uruguay and its failure in Argentina is instructive. The land tax in Uruguay at least partially replaced export taxes in response to political pressure from the ranchers themselves, whereas Argentine farmers viewed the land tax as yet another attempt by urban political powers to extract resources from the agricultural sector. The 1986 Argentine tax reform might have enjoyed more success had farmers believed that the increase in land taxes would be accompanied by a reduction in export taxes.

The Best Potential for Land Taxation Is in Financing Local Governments

Although agricultural land taxation may provide only a trivial fraction of central government revenue, it often accounts for a large portion of local government revenue. For example, in many districts in Indonesia 60 to 70 percent

of discretionary local revenue is provided by the land tax, despite its low rate of only 0.1 percent of assessed value. The lower revenue requirements of local governments allow the land tax to take the form of *in rem* taxes based solely on area or based on crude measures of land quality. As noted above, although these types of taxes cannot raise large amounts of revenue in an equitable way, they have the great advantage of being relatively easy to administer.

Another lesson from country experiences with land taxation is that to succeed, there must be some political sentiment in its favor. It is likely that a local land tax with proceeds used for local betterment or valorization projects would enjoy greater acceptance (or at least lessen smoldering resentment) than a central government tax used to finance projects in far-away cities. The wide acceptance of land taxation for local governments in many different countries (and particularly in Latin America) suggests that the brightest future for agricultural land taxation is not to replace central government export taxes but to provide a resilient source of financing for local government expenditures.

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Taxation of Financial Assets in Developing Countries

Christophe Chamley

In developing countries most of the financial assets are deposits at commercial banks. This article focuses on the implicit taxation of financial assets through seigniorage, reserve requirements, lending targets, and interest ceilings combined with inflation. The impact of taxation on financial deepening increases significantly with the tax rate, as shown by cross-sectional and time series data for selected countries in Sub-Saharan Africa and Southeast Asia. The problem of measuring revenue is examined, and the efficiency cost of taxation is analyzed in a Harberger framework. Although taxes on financial assets have a low administrative cost, the excess burden caused by the misallocation of resources is probably a much higher fraction of revenues than that of other taxes.

The role of financial institutions and credit markets in economic development has been recognized since the well-known studies of Shaw (1973) and McKinnon (1973). Most financial assets in the formal markets of developing countries are deposits at financial institutions. These deposits constitute a large potential tax base that could be taxed at low administrative cost. When the revenue of taxes on financial assets is significant, implicit taxes dwarf explicit taxes. This article considers the effect of implicit taxation through seigniorage, reserve requirements, lending targets, and interest ceilings combined with inflation. The last instrument has often been overlooked, but in some cases, such as Nigeria in the early 1980s, the combination of interest rate ceilings and inflation has generated more than a third of implicit revenue by lowering the cost of government borrowing.

Although the same general economic principles will be at work everywhere, the effects of financial taxation will depend on the stage of a country's development. Financial liberalization will have different effects in the Republic of Korea and Ghana, for example. The empirical material is drawn mainly from countries in Sub-Saharan Africa. Some data on Southeast Asian countries that have experienced financial liberalization is also used. Primary studies on those topics include Chamley and Hussain (1989) and Chamley and Honohan (1990).

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In this article the tax base and the fiscal instruments are introduced first. The impact of implicit taxes on the rate of return and the level of financial assets is analyzed empirically, and the issue of revenue measurement is discussed. The results are then used to estimate the efficiency cost of taxation.

I. THE TAX BASE AND FISCAL INSTRUMENTS

The menu of financial assets in many developing economies is limited to currency, demand and time deposits, and in some cases deposits at specialized institutions such as merchant banks or savings institutions. Stock markets are embryonic even in the most developed of these countries, as in Nigeria, where trading is thin and price quotes on some of the main stocks remain unchanged for weeks. Government bonds, which could provide the best risk guarantee and liquidity, are not owned by individuals; financial institutions hold most of the government debt outside of the central bank. Therefore in many low- to middle-income countries, and especially in Sub-Saharan Africa, the main base for financial taxation is the extended definition of money, M2.

The fiscal instruments can be divided into two groups: explicit and implicit taxes. Explicit taxes include taxes on loans, interest income, and, in some rare cases, value added taxes. They are defined by stable statutory rates, which are subject to revision, but not more frequently than other items in the tax code. Statutory rates differ from effective rates mainly because of a lack of indexation for inflation. Even so, the average values of the effective rates are in general small, and their variance is dwarfed by that of implicit taxes. In African countries explicit taxes are found mainly where the tax structure is left over from French rule, namely in Morocco, Tunisia, and the countries of the two CFA zones. Such taxes are also found in the Philippines, but they are insignificant in the rest of Asia.

Implicit taxes provide a ready source of government revenue, especially in time of crisis. By definition these taxes do not appear in standard national accounts as tax revenue. Their effective rates are difficult to compute, highly variable, and often unpredictable. Implicit taxes have been very large at times, with annual revenue exceeding 100 percent of the tax base in some cases (for example, Ghana in 1983). Because of the size and variability of implicit taxes and because the impact of financial taxation is evident only when tax rates are high, only the implicit instruments are considered here. The conclusions are applicable, however, to the analysis of explicit taxes on financial assets.

The first implicit tax instrument used is the issuance of currency, or seigniorage. The introduction of new currency debases the money that is already in circulation, and the resulting inflation is a tax on the currency. This tax cannot be separated from the taxes on the institutions of financial intermediation because these institutions provide assets that are close substitutes for the currency. An essential characteristic of this tax is that it operates through a capital loss on the existing currency. Since cash revenue to the government and capital loss to the private sector are not identical, measuring tax revenue becomes a complex

matter, as explained below. It is not always clear whether governments deliberately use seigniorage or inflation to raise revenue. Poterba and Rotemberg (1990) cast doubt on this hypothesis for a set of developed countries. However, the countries they considered have low inflation rates and efficient administrative structures for collecting explicit taxes. In developing countries the small size of the formal sector (with a labor force that may be less than 5 percent of the population), the weak administration of explicit taxes, and the magnitude of potential revenue from implicit taxation make seigniorage an operational instrument.

Reserve requirements, the second implicit instrument, are equivalent to a tax on deposits when reserves earn a rate below that offered by the market. It is sometimes argued that reserve requirements crowd funds out of the markets for private credits. This is correct, but the government could invest the proceeds of the reserves in investment projects earning a return and distribute the earnings to depositors. Required reserves are therefore viewed as an implicit tax with a rate that is equal to the difference between the market rate and the rate paid on the forced borrowings. The only caveat is that by altering requirements on forced borrowings, the government can temporarily generate a cash flow that substantially exceeds the implicit tax due to the difference in the interest rates. Such a policy, however, does not affect the present value of implicit tax revenue.

Lending targets for preferred sectors are an instrument that typically applies to the agricultural sector and are similar to earmarked reserve requirements. In this way they are equivalent to a tax on deposits that subsidizes borrowers with preferential rates.

The last instrument, interest rate ceilings with inflation, has often been overlooked, although it has been one of the most important taxes on financial institutions. It was used in Nigeria before 1986 when all loans were subject to interest ceilings of less than 12 percent (while the inflation rate exceeded 30 percent). Some lending targets for specific sectors with lower rates also had to be met. Given the ceilings on the private loans and the inherent riskiness of these loans, government bonds providing a nominal rate of 9 or 10 percent were very competitive. It is therefore not surprising that their fraction in banks' portfolios was well in excess of the liquidity requirements (in some cases more than 60 percent).

Consider the stylized case of a regime with zero values for interest rates on loans and deposits and a high rate of inflation. In this regime financial institutions (assuming there are no operating costs) will happily buy government bonds that pay a rate of return equal to zero since their risk is less than that of private bonds. Although banks are not forced to hold government bonds, the government is able to borrow "competitively" at no interest all the resources of the financial system, if necessary. This policy is equivalent to a 100 percent reserve requirement and illustrates how the economic effects of different fiscal instruments may be identical, thus complicating the analysis and measurement of revenue.

Ceilings on interest rates may more often be caused by inertia than by policy

design. In the regular course of events ceilings are put in place because of general concern about credit markets (as in Sub-Saharan Africa), usury laws (as in Thailand), and other factors. In normal times the ceilings may be binding, but their effect is relatively small. When a fiscal crisis occurs, however, inflation increases, and, if the ceilings are not altered, their impact becomes significant. The ceilings are then useful for government finances, but unfortunately they also result in subsidization of private loans, thus creating many opportunities for rent seeking. In general, therefore, they impose a greater burden on depositors per unit of government revenue generated than do taxes on deposits or reserve requirements.

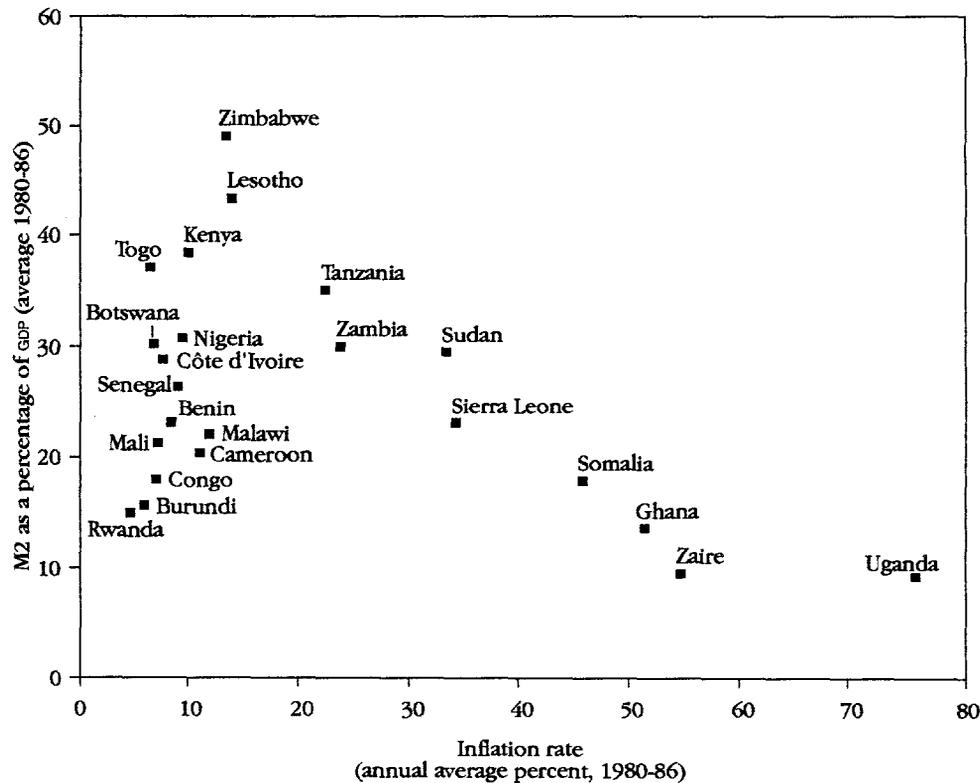
II. IMPACT OF TAXATION ON FINANCIAL DEEPENING

Financial institutions are by definition extremely highly leveraged: deposits represent more than 90 percent of their liabilities. Some of the incidence of taxes and regulations obviously falls on the equity of the banks and affects its rate of return, but most of the effective taxation on financial institutions falls on deposits.

In some countries interest ceilings, reserve or lending requirements, and inflation have had a large impact on the real rate of return of financial assets. Sub-Saharan countries, in which currency, demand, and time deposits are the main financial assets, constitute a somewhat homogeneous region (with respect to other countries), which makes cross-section comparisons interesting. The cross-sectional data are expected to show how financial deepening, as measured by the ratio of M2 to gross domestic product (GDP), is affected by an inflationary environment. The degree of financial deepening depends on the expected real rate of return on financial assets, which is affected by financial taxation. The data do not allow for a model that would yield reliable estimates of the real rate of return for all countries, so we have used instead either the average inflation rate or the real rate of return on deposits. The two methods yield similar values in figures 1 and 2 because nominal interest rates were fixed for most of the sample. These data are represented in figure 1 for 23 countries in Sub-Saharan Africa. The missing countries are Burkina Faso, Chad, Ethiopia, Liberia, Madagascar, and Niger.

Figure 1 presents a striking pattern: countries can be divided in two groups, non-CFA and CFA. CFA countries belong to one of the two currency zones with a fixed parity with the French franc (a constant nominal exchange rate since 1953) and specific constraints on monetary policy. The non-CFA countries exhibit an inverse relation between inflation and financial deepening, except for Rwanda, Burundi, and Malawi, which have both low inflation and low financial deepening. This apparent anomaly may be explained by differences in urbanization rates. Whereas the urbanization rates for the other countries are 17 to 30 percent (except for Uganda, with 7 percent [World Bank 1988]), those for these three countries are 2, 2, and 5 percent, respectively. The relatively small urban

Figure 1. *Financial Deepening and Inflation in 23 Countries in Sub-Saharan Africa, 1980-86 Averages*

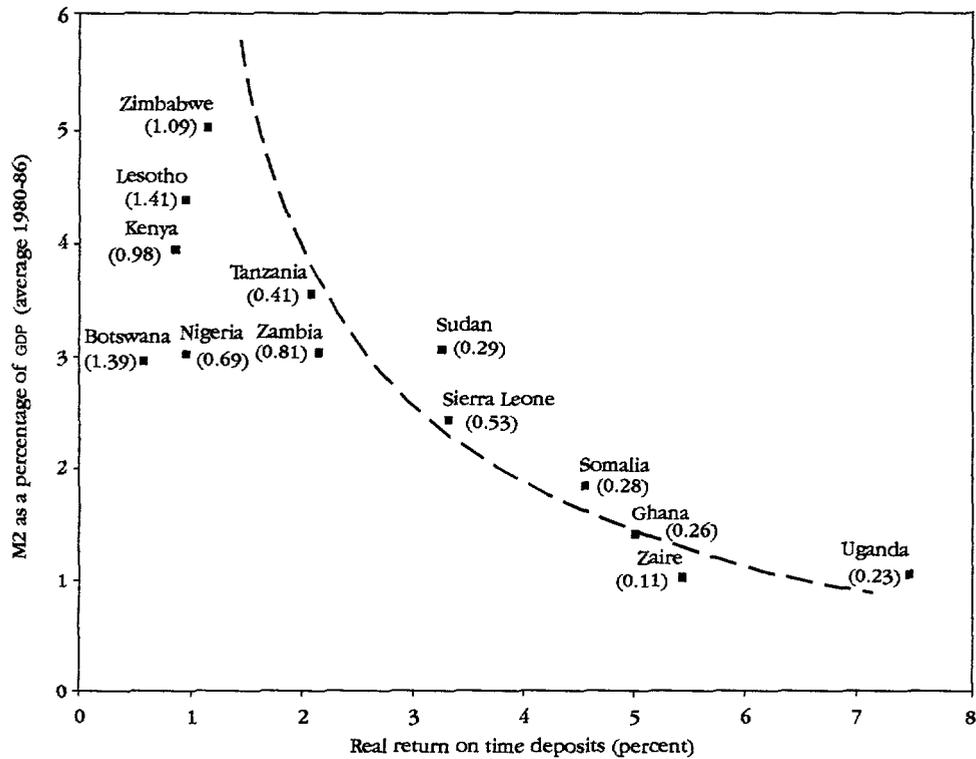


Source: World Bank data.

populations in Rwanda, Burundi, and Malawi would lead one to expect less financial deepening, even with low inflation.

The second group, composed of CFA countries, has experienced low inflation on average because of the institutional restraints on the creation of money, but their degree of financial deepening is generally less than in the non-CFA countries with low inflation. The exception is Togo, with an index of financial deepening 10 percentage points greater than any of the other CFA countries; this difference is probably due to the inflow of funds from neighboring Ghana, where inflation exceeded 100 percent at the same time. The differences in financial deepening between CFA and non-CFA countries cannot be attributed to urbanization rates because these are about the same in both groups. It is possible that, under the special regime of the CFA zone, agents use institutions in France and other European countries for intermediation. Quite remarkably, the low level of deposits in CFA countries is compensated for by large loans from the central bank to commercial banks, so that the level of loans by commercial banks to the

Figure 2. *Financial Deepening and Inflation in 13 Non-CFA Countries in Sub-Saharan Africa, 1980-86 Averages*



Note: The numbers in parentheses are average ratios $[(M2-M1)/M1]$ for 1980-86. The dashed line is the locus of combinations of inflation and M2 yielding tax revenue equal to 6 percent of GDP. The real return on time deposits (X axis) is the difference between the nominal rate and the inflation rate.

Source: World Bank data.

private sector is not much below that in many non-CFA countries. A careful examination of this issue is beyond the scope of this article.

The data are repeated in figure 2 for the subsample of non-CFA countries. The relationship between inflation and the level of financial deepening is weak when the inflation rate is moderate, that is, less than 20 percent on average, as in Botswana, Kenya, Lesotho, and Nigeria. The inverse relation between inflation and assets is strong when the inflation rate ranges from 30 to 60 percent (on average). The ratio of quasi-money (time deposits) to money (demand deposits plus currency outside banks), $(M2 - M1) / M1$ is also reported for each country in the diagram. At higher rates of inflation the taxation of financial assets has a strong negative impact on the level of quasi-money, which is used as a means of savings. The ratio of time deposits to money is relatively high for countries with low inflation (in Kenya and Zimbabwe ratios are near 100 percent) and low in

the countries with high inflation (in Ghana, Zaire, and Uganda they are less than 30 percent).

Because financial deepening is inversely related to inflation, an increase in inflation from a moderate to a high level may not generate a significant increase in revenue. The measurement of these revenues is a complex issue that will be addressed in the next section, but we suggest as an approximation here the product of the base and the inflation rate, minus a correction for the cost of handling the accounts (which is fixed, arbitrarily, and inconsequentially at 5 percent of deposits). The locus of points at which revenues are equal to 6 percent of GDP is represented by the curve in figure 2. It fits the data for the countries with high inflation rather well, which suggests that these governments did not enjoy increased revenue from increased inflation. This fit is not a strong proof that high inflation does not bring more revenue, but it does indicate that the increase in revenue is not large. On average an increase in the permanent inflation rate from 30 to 60 percent does not generate much higher levels of revenue. It is quite possible, however, that very high inflation rates can generate large revenues for short periods of time.

The weak relationship between inflation and financial deepening when the inflation rate is less than 30 percent also appears to be verified in time series data for particular Sub-Saharan countries. Consider, first, the countries that have experienced higher levels of taxation on financial assets, such as Somalia and Zaire. One would expect to find the most significant impact of taxation on financial intermediation and on financial deepening in these countries.

Estimating the demand for financial assets using ordinary least squares with lagged dependent variables generates an estimate of the long-term interest elasticity that is much overstated. We therefore use an error correction model (Engle and Granger 1987) composed of two equations:

$$(1) \quad \log(M/P)_t = C_1 + \alpha\pi_t + \beta \log y_t + e_t$$

$$(2) \quad D\log(M/P)_t = C_2 + aD\log y_t + b_0D\pi_t + b_1D\pi_{t-1} \\ + cD\log(M/P)_{t-1} + \delta e + \epsilon,$$

where M is the financial asset, P is the consumer price index (CPI), y is real GDP, π is the inflation rate, and D is the first difference operator, so that, for example, $D\log(M/P)_t = \log(M/P)_t - \log(M/P)_{t-1}$.

Equation 1 parameterizes the long-run equilibrium relation between the demand for money and the inflation rate. The parameter α is the long-run semi-elasticity of the demand for money and will be used later to compute the efficiency cost of taxation. Equation 2 determines the adjustment of money demand in the short run. The inclusion of the error term from equation 1, e , as an explanatory variable in equation 2 is tantamount to imposing long-run equilibrium on the system, while still allowing short-run deviations from equilibrium. The coefficient on e , δ , is interpreted as the percentage of the gap between the long-run demand for money and the actual demand for money that is closed in

one period. (Thus the name "error correction" model.) The financial asset was chosen to be M2, and the estimation period is 1972–86.

Table 1 presents results of the estimation for Somalia and Zaire. Interest rates on time deposits were more or less constant for the periods of estimation, so the inflation rate is a good proxy for the (ex post) tax rate on financial assets. For both of these high-inflation countries there is an inverse relation between the level of M2 and inflation ($\alpha < 0$) and a significant inverse relation between changes in M2 and changes in inflation ($b_0 < 0$). Ghana is another country that experienced very high taxes on financial assets (more than 100 percent a year), but time series estimations of the demand for money turned out to be unstable. This may be explained by the dramatic changes in policy (and political) regimes during the period studied and by two episodes of demonetizations, which had an additional impact on the demand for money that cannot be easily captured by standard equations. A more in-depth analysis is presented by Tsikata (1990).

The Sub-Saharan countries that experienced moderate inflation rates on average include Kenya, Nigeria, Tanzania, and Zambia. There was no significant inverse relation between the demand for financial assets in these countries and inflation or the opportunity cost of deposits. The case of Nigeria is perhaps the most surprising because it is one of the most developed countries in Sub-Saharan Africa, and the menu of financial assets there extends beyond M2 to include deposits at merchant banks and an embryonic stock market. The real rate of return on deposits was subject to large fluctuations from 1980 to 1985 and

Table 1. *Estimation of Demand for Financial Assets: Somalia and Zaire*

Equation and variable	Estimated value for coefficient	
	Somalia	Zaire
<i>Long-run equilibrium equation</i>		
Inflation rate	-0.52 (1.85)	-0.53 (1.68)
<i>Adjustment equation</i>		
Real GDP	0.66 (2.09)	
Inflation rate	-0.47 (2.34)	-0.46 (2.6)
Inflation rate in previous period	0.54 (2.28)	
Financial asset ^a	0.88 (3.2)	0.23 (0.83)
Gap in the demand for money ^b	-0.49 (2.6)	-0.35 (1.84)
R ²	0.62	0.58

Note: *t*-statistics in parentheses. When an exogenous variable was not significant, it was omitted from the specification.

a. Deflated by the consumer price index.

b. The percentage of the gap between the long-run demand for money and the actual demand for money, which is closed in one period.

Source: Author's calculations.

reached values on the order of -50 percent a year. Although these values would have significant effects in many other countries, they did not have a measurable impact on the level of deposits in Nigeria.

The time series and the cross-sectional data lead to similar conclusions. Moderate inflation rates have an impact on the level of deposits that is difficult to detect. This effect is clearly identifiable when inflation rates exceed an average value of 50 percent for an extended period. The low demand elasticities may result from limited substitution possibilities between assets. The main assets for substitution are durable goods and foreign exchange, and trading in these assets may entail fixed costs that limit the extent of substitution when the inflation rate is moderate.

III. MEASUREMENT OF IMPLICIT TAX REVENUE

The revenue from taxation of financial assets is difficult to measure because of the complexity of the instruments. Conceptually, revenue is the product of the assets taxes and the tax rate. Such a simple computation is just not feasible, however, when the main instruments of taxation are only implicitly defined. Four problems arise in measuring the revenue of implicit financial taxation: to define the position of "no taxation," to reconcile the cash flows to the government and the burden on individuals, to determine the impact of expectations on inflation, and to account for the revenues in economies in which financial institutions absorb some of the government debt. The first three appear in economies with or without financial intermediation.

These issues can be illustrated by looking at the simple case of an economy without financial intermediation and with a constant inflation rate. Assume first that the price level is stable and that the economy is growing. Seigniorage, as defined as the revenue from money creation, is positive because currency is issued at the same rate as the real growth rate. Are these revenues taxes? It seems that the answer is "no" since there is no "tax" on money. Friedman (1969) has argued, however, that money should pay a return as capital, if the government could finance this policy through lump-sum taxation. (The proposition can be extended in an economy with distortionary taxation [Chamley 1985].) If we follow this definition of the "no tax" position, the tax wedge on money should be defined as the sum of the inflation rate and the real rate of return on capital. When the growth rate of the economy is lower than the real rate of return, which is required in the long run for efficiency, this tax wedge is smaller than the rate of money creation. This definition implies, therefore, that the implicit tax on money is greater than the level of seigniorage.

Such issues are not of quantitative importance in this article. The difference between the growth rate and the real rate of return on capital is small, on the order of a few percentage points a year, and is certainly negligible compared with the inflation rates in many developing countries. We will therefore assume here that the tax wedge on the currency is equal to the sum of the inflation rate

and the real growth rate. In steady state, tax revenue is equal to the seigniorage revenue, that is, the revenue that is generated by creating money.

Unfortunately, the assumption of a steady state is almost always irrelevant, and, when it is relaxed, serious difficulties arise. The main problem here is that the revenue is generated by the flow of the creation of money, whereas the tax burden is induced by a capital loss on the existing assets. In a stationary world these quantities would be identical; revenue flows and capital losses are also roughly identical on average when the economy fluctuates around a steady state. However, this identity does not provide information on the amount of revenue that can be generated in a given year. Furthermore expectations about future policies affect the current value of the inflation rate. As Sargent and Wallace (1981) have shown, reducing the rate of growth of money can accelerate the inflation rate.

Two methods can be used to measure seigniorage and can be extended to the taxation of financial assets. In the first method, which we call the rate-of-return method, the tax on financial assets is computed by multiplying the implicit tax wedge on the assets by the stocks. Consider first the case of taxes on currency (seigniorage). The wedge between the imputed and the actual rate of return defines the effective (ex post) tax rate, and revenues are defined by the product of this rate and the amount of currency in circulation. Because of anticipation effects, however, this measure does not give an accurate evaluation of effective government revenues in a given year. Moreover some of the variations in the asset prices may be exogenous to government policies. In addition the data are often available only on an annual basis. Fluctuations of the inflation rate during the year thus introduce additional errors in revenue calculations. For these reasons this method is not used to compute seigniorage revenue (Fischer 1982). The same problems arise when the method is used to measure the revenue from taxes on other financial assets, such as deposits at commercial banks.

The second method used to measure seigniorage revenue is called the cash-flow method and computes the cash flow generated by expanding the monetary base. The cash flow thus generated can be written as

$$(3) \quad R = dM/P.$$

If the data on dM and P were available at every instant, it would be easy to compute the revenue. But the values of dM and P are reported only at discrete times. Moreover the price index available (often the CPI) may be inappropriate if it does not reflect the composition of government expenditures.

For this reason most people use a measure such as the one in Fischer (1982), where the amount of revenue is estimated by

$$(4) \quad R' = \Delta M/Y$$

where ΔM is the incremental change in the monetary base over a discrete period, and Y is the value of nominal GDP over the same period. The value of R' , which

is computed with nominal variables, measures the ratio of real income from money creation to the real value of GDP for the period. For most developing countries the minimum period for computing GDP is one year. This formula can be applied using standard national income data with no price index or deflator and is thus convenient. It gives an exact measure of real income when the velocity of money is constant and the rate of growth of money is constant during the period. When one of these two conditions is not satisfied, however, the formula leads to errors. When the inflation rate increases, the first method leads to gross overestimates. This is illustrated below in historical examples.

This method can also be used to measure the revenue from other implicit financial taxes. We have seen that reserve requirements are equivalent to a tax on demand and time deposits. To measure this revenue, these assets can simply be included in the base for the seigniorage revenue in equations 3 and 4. The combination of low ceilings on nominal interest rates, high inflation, and government borrowings has the same effect on government revenue (with an additional rationing on private credit markets). Should the expansion of the government debt then be included in ΔM ? This correction is not sufficient even when credits to the private sector finance the arrears of the government (as occurred in Nigeria). The expansion of M2 would be a better measure of nominal revenue when interest ceilings are near zero and inflation is high, but it is inappropriate when inflation is low, real interest rates are slightly below zero, and financial assets are growing because of a surge of the savings rate or financial deepening. The computation of revenue from interest ceilings and inflation is even more complicated when government debt pays a positive, but below market, rate of return.

These issues are ignored in most studies that compute seigniorage revenue. The evaluation of computation procedures depends on the policy background of the countries. For some countries that have only reserve requirements and that allow interest rates to be determined by the market, the standard measure is appropriate (subject to the errors mentioned above). In the countries of Sub-Saharan Africa and in others whose interest rates have been regulated in an inflationary environment, measurement problems cannot be ignored.

In table 2 the two previously described methods are applied to Ghana, Somalia, Zaire, and Zambia. In Ghana the first period of high financial taxation occurred in 1976 and 1977, with inflation rates of 56 and 116 percent, respectively. The revenue from the tax according to the rate-of-return method is equal to 10.7 and 16.9 percent of GDP for the same years. Using the cash-flow method and including the entire expansion of M2 in the cash flow (which is an upper bound on the revenue generated), revenues are 7.3 and 9.7 percent of GDP for these years. Furthermore these numbers may already be overestimates because the velocity of money increased during that period. The results of the two procedures can also be compared for the entire period, 1971 to 1987: the rate-of-return method yields an average amount of 6.8 percent of GDP compared with

the cash-flow method average of 4.8 percent. An accurate accounting would add to both results the revenue from the outright demonetizations that occurred in this period, but this omission affects both measurements equally.

The case of Somalia is somewhat similar. Inflation began to increase in 1979

Table 2. *Two Measurements of Tax Revenues from Implicit Financial Taxation in Ghana, Somalia, Zaire, and Zambia, 1971–86*
(percent)

Country and year	Inflation rate (based on CPI)	Implicit tax rate	M2/GDP	Revenues as a percentage of GDP	
				Rate-of-return method	Cash-flow method
<i>Ghana</i>					
1971	9.5	6.4	18.0	1.1	1.4
1972	10.0	6.7	20.2	1.3	6.2
1973	17.6	13.6	20.8	2.8	3.0
1974	18.1	14.0	19.2	2.7	4.0
1975	29.8	23.6	22.6	5.3	6.6
1976	56.0	42.6	25.1	10.7	7.3
1977	116.4	76.4	22.1	16.9	9.7
1978	73.1	53.1	19.4	10.3	9.4
1979	54.4	41.4	19.6	8.1	2.4
1980	50.0	38.3	16.2	6.2	4.2
1981	116.4	75.9	13.7	10.4	5.2
1982	22.2	17.5	15.5	2.7	2.8
1983	122.8	79.0	9.7	7.6	3.0
1984	39.6	31.0	9.7	3.0	3.8
1985	10.3	7.1	11.4	0.6	3.9
1986	24.5	18.7	11.3	2.1	4.0
Average	63.0	43.8	na	6.8	4.8
<i>Somalia</i>					
1971	-0.0	-0.0	18.9	-0.0	-3.0
1972	-2.0	-3.0	16.5	-0.0	4.5
1973	6.5	5.9	22.2	1.3	3.4
1974	18.2	16.3	23.5	3.8	5.8
1975	19.3	17.0	19.6	3.3	4.7
1976	14.1	12.5	22.1	2.7	3.7
1977	10.5	9.4	22.2	2.1	5.4
1978	9.9	8.9	22.8	2.0	6.2
1979	24.2	21.1	24.7	5.2	7.6
1980	58.8	45.9	27.8	12.8	4.8
1981	44.4	36.0	17.6	6.3	4.5
1982	23.6	19.8	16.3	3.2	2.1
1983	35.9	29.0	15.1	4.3	0.6
1984	91.1	63.7	9.9	6.3	2.1
1985	37.7	29.1	11.1	3.2	6.0
1986	35.7	26.8	12.3	3.3	3.1
Average	37.2	29.0	na	4.9	4.3

(24 percent), peaked in 1980 (59 percent), and was still high in 1981 (44 percent). The revenue computed with the rate-of-return method was equal to 5.2, 12.8, and 6.3 percent of GDP, respectively. For the same years the cash-flow method yields 7.6, 4.8, and 4.5 percent. In both Ghana and Somalia the first

Table 2. (continued)

Country and year	Inflation rate (based on CPI)	Implicit tax rate	M2/GDP	Revenues as a percentage of GDP	
				Rate- of-return method	Cash- flow method
<i>Zaire</i>					
1971	5.7	4.9	20.9	1.0	1.4
1972	15.7	13.9	22.0	3.0	4.1
1973	15.6	13.6	21.5	2.9	6.6
1974	27.4	23.2	23.8	5.5	6.4
1975	29.0	24.6	27.3	6.7	2.3
1976	80.6	59.1	22.8	13.5	7.1
1977	69.0	52.3	24.8	13.0	11.1
1978	48.4	39.1	28.0	10.9	11.7
1979	108.6	73.8	17.1	12.6	0.6
1980	42.0	34.5	14.9	5.1	7.0
1981	34.9	29.4	16.8	4.9	6.8
1982	36.2	30.2	20.9	6.3	10.6
1983	77.1	56.8	18.4	10.4	8.8
1984	52.2	41.5	16.2	6.7	5.1
1985	23.8	20.3	14.6	2.9	3.6
1986	44.4	35.9	15.4	5.5	6.8
Average	53.6	41.4	na	7.8	7.2
<i>Zambia</i>					
1971	6.0	4.3	28.5	1.2	-3.0
1972	5.0	3.4	24.4	0.8	1.3
1973	6.4	4.7	23.6	1.1	4.0
1974	8.0	6.2	22.5	1.4	1.2
1975	10.1	8.2	29.5	2.4	2.9
1976	18.7	15.4	29.4	4.5	6.3
1977	19.7	15.6	33.2	5.1	2.9
1978	16.3	12.6	29.7	3.7	-3.0
1979	9.6	6.6	27.6	1.8	6.5
1980	11.7	8.2	28.3	2.3	1.6
1981	13.9	10.5	27.0	2.8	1.3
1982	12.4	9.0	31.8	2.8	8.3
1983	19.6	14.7	33.0	4.8	2.3
1984	20.0	14.6	32.0	4.6	3.8
1985	37.4	25.1	26.9	6.7	3.7
1986	51.6	34.4	23.7	8.1	13.3
Average	21.2	15.1	na	4.3	4.0

Source: Author's calculations.

method overstates the variations in revenue. For 1971–87 in Somalia the two methods yield averages of 4.9 and 4.3 percent of GDP, respectively. However, the cash-flow method, which includes all of M2, may also overestimate revenue, as in the years before 1980, which was a period of financial deepening with relatively low taxation in Somalia. For those years revenues calculated using the first procedure are smaller than those calculated using the second, sometimes by four percentage points. These results can also be obtained in other cases (for example, Zaire in 1976), which indicates that in years of high inflation the first method, which is based on implicit tax rates, seriously overestimates the actual amount of revenue that accrues to the government. When the revenue from financial taxes is large, therefore, the cash-flow method is more reliable.

IV. EFFICIENCY COST OF TAXATION

The most important distortions caused by taxation and regulation of financial institutions concern the level of deposits and the allocation of available funds in credit markets. Although regulations do affect the efficiency of the operations of financial institutions, the variations in the banks' margins of operating costs (less than 5 percent of the deposits) are negligible with respect to the impact of taxation on the rate of return of deposits.

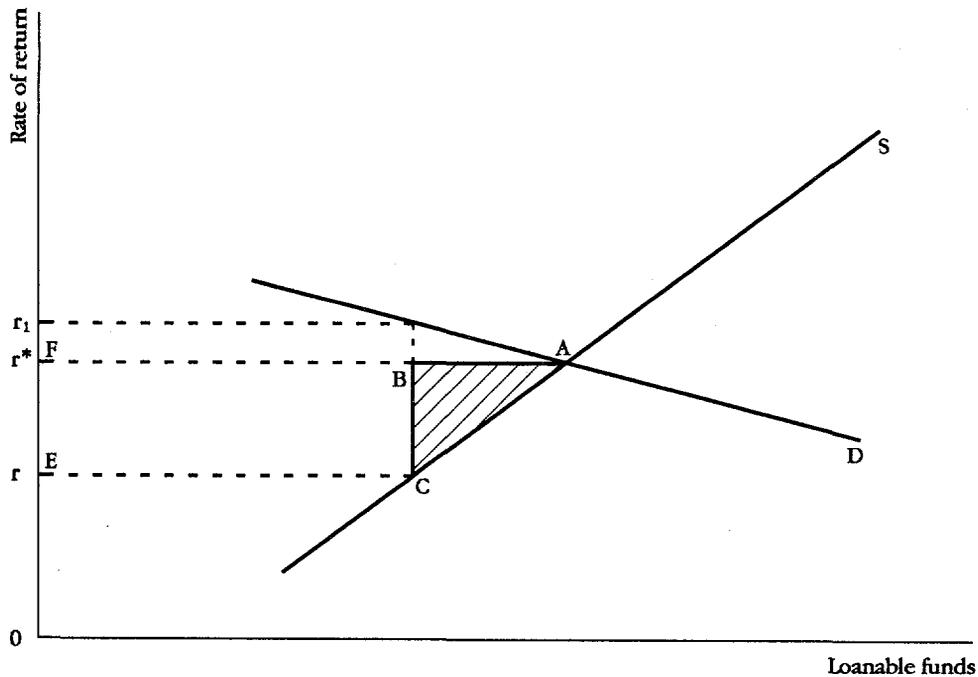
A comprehensive discussion of the efficiency cost of financial taxation should consider four types of distortion: the reduction of the level of financial assets in the formal sector and the substitution toward other markets (informal or foreign), distortions in the allocation of the available assets because of regulations such as interest ceilings, interactions between taxes and existing imperfections in the credit markets, and the impact on the level of savings and the intertemporal allocation of resources.

The first three kinds of distortion can be analyzed in a static framework with an exogenous level of capital that is either constant or increasing at a given rate. In many cases the first distortion is sufficient to show that the efficiency cost of financial taxation is high compared with the revenue collected and probably higher than the cost of standard taxes for many countries. The second and the third types of distortion can also generate high efficiency costs even when the first distortion is relatively small.

The fourth type of distortion is quite different because it operates through the impact on capital accumulation and the effect of capital accumulation on growth. The magnitude of this distortion is more controversial because it depends on the interest elasticity of savings and the properties of the growth model. Its analysis deserves separate consideration and is beyond the scope of this article.

Measurement

The demand for loans from the financial sector can be simply modeled as depending on the marginal productivity of capital. The supply of funds to the

Figure 3. *The Demand and Supply Schedules for Loanable Funds*

financial sector depends on the rate of return of deposits and on the opportunity cost of using the funds. Alternative uses may include foreign or informal capital markets. The impact of taxation on the level of savings will be neglected here so as to focus on the impact of taxation on the allocation of savings. The inclusion of savings effects would introduce additional efficiency costs (see also Chamley 1985). The rate of return on deposits is equal to the rate of return on the loans of financial institutions, net of operating costs. Assuming as a first approximation that the operating costs per unit of funds are constant, figure 3 shows the demand and supply schedules for loanable funds.

Taxes on financial assets introduce a wedge between the lending and the deposit rates. This wedge creates an efficiency cost that is measured by the area of the Harberger triangle. A nice property of the model is that computation of the efficiency cost requires information on only the elasticities of the demand and the supply of funds. No description of the alternative uses of funds (informal market or consumption) is necessary if there is no distortion in these markets. The existence of distortions may call for some policy intervention. However, the determination of a corrective policy should follow from the analysis of the distortion and its impact on the allocation of funds. This is clearly not the topic that is considered here. Informal markets may present some inefficiencies when compared with intermediation in the formal market. But informal markets

coexist with formal financial markets and present possibilities for economic substitution, because some of their inefficiencies are compensated for by their strengths. As an example, informal credit markets may offer less diversification of risk, but they do provide some special relation between lender and borrower that improves monitoring.

The application of the concept of excess burden in figure 3 also allows for interactions between the schedules of demand and supply: these schedules do not depend only on the rate of return, other things being equal. As the tax reduces the rate of return on deposits in the formal market, the substitution toward the informal sector increases the supply of funds in the informal sector, thereby reducing the equilibrium rate in that sector and thus reducing the demand for loans in the informal sector. Such an interaction decreases the slope of the demand schedule for loans in figure 3. The efficiency cost of the tax is measured by the observed changes of demand and supply that are induced by the tax.

A lower bound of the efficiency cost is approximated in figure 3 by the area of the triangle ABC, which is equal to

$$(5) \quad E = (1/2)(r^* - r)\Delta D$$

where r^* and r are the real rates of return on deposits with no tax and with a tax, respectively, and ΔD is the reduction of deposits that is induced by the tax. This expression is useful for two reasons: there is often little information on the interest elasticity of the demand for loans, and, in some important cases, this expression is likely to capture most of the efficiency cost. The amount of the underestimation is equal to

$$(6) \quad A = (1/2)(r_1 - r^*)\Delta D$$

where r_1 is the marginal productivity of investment when the tax is in place. When the effective tax wedge is large, the value of the real net interest rate r is negative and large in absolute terms, and the interest gap $r^* - r$ is probably much larger than the difference $r_1 - r^*$.

The measurement of the excess burden through the Harberger formula is of the second order with respect to the tax rate and therefore with respect to the amount of tax revenue. Because the average efficiency cost increases linearly with the tax rate, however, the value of the marginal cost increases with the tax wedge and may reach significant levels. Consider a small change of the net rate of return of financial assets, which has an impact dD on the level of the asset held. The marginal efficiency cost MEC is equal to

$$(7) \quad \text{MEC} = -(r^* - r)dD.$$

Revenue (implicit or explicit) is equal to $(r^* - r)D$, and the marginal change in revenues dR is equal to

$$(8) \quad dR = (r^* - r)dD - Ddr.$$

The approximate marginal efficiency cost per unit of additional revenue is simply the ratio of these two expressions:

$$(9) \quad \text{MEC} = \{(r^* - r)[D'(r)/D(r)]\} / \{1 - (r^* - r)[D'(r)/D(r)]\}.$$

The sign of D' is positive, so that, as expected, the marginal efficiency cost increases with the interest gap $r^* - r$ and with the response D' . When the demand for financial assets is of the form of equation 1, equation 9 becomes

$$(10) \quad \text{MEC} = \alpha / (1 - \alpha).$$

Empirical Estimates

The discussion in section II showed that when the level of taxation is low, it is difficult to observe an impact on the level of financial assets. If any effect exists, it is weak and is dwarfed by other determinants of financial deepening. When the tax rate is high, however, the effect on assets is strong and measurable. Using the empirical results of the previous section and equation 10, the marginal efficiency cost can be computed. These values are presented in table 3 for Somalia and Zaire. These numbers are complemented by others from a previous study on financial liberalization in Southeast Asia (Chamley and Hussain 1989).

The magnitude of the efficiency cost depends on the assumption about the inflation rate (which is reflected in the tax rate assumed in the first column). The values that are presented in table 3 are higher than those obtained by estimating the demand for money in industrial economies with high inflation (Cagan 1956).

From the cross-sectional data it appeared that there was hardly any revenue gain when the inflation rate ranged between 50 and 100 percent, which is the relevant interval for Somalia and Zaire. Indeed there is some reason to believe that the time series results underestimate the true elasticities in developing economies where a process of financial deepening is stopped by high inflation. In the

Table 3. *The Efficiency Cost of Taxation*
(percent)

<i>Country</i>	<i>Tax rate assumed</i>	<i>Marginal efficiency cost^a</i>
Somalia	60	0.43
Zaire	60	0.43
	100	1.00
	200	∞
Thailand	5 ^b	0.58
Indonesia	13 ^b	1.19

a. The marginal efficiency cost of taxation is in terms of marginal revenue.

b. This value is the difference between the average real rate before and after the liberalizations (Chamley and Hussain 1989). The value depends on the estimation of the demand for M2.

Source: Author's calculations.

Sub-Saharan countries with moderate and low inflation financial deepening has progressed gradually since the early 1970s. The development of the financial sector entails fixed costs that can be repaid only in a stable environment. In an environment of high taxes there is no growth of financial assets for savings, and currency in circulation is used mainly for transactions. This motive is less sensitive to the rate of return on money (ratios of currency to GDP are typically not very sensitive to inflation rates of 40 to 60 percent), so that one can expect time series estimates to show relatively low interest elasticities of the demand for money. The problem here is that models of linear equations such as equation 1 may be somewhat deficient for economies that undergo the structural changes associated with economic development. The values given in table 3 should thus be regarded as conservative estimates of the efficiency costs.

Interest Ceilings and Allocation in Credit Markets

Interest ceilings have two effects on credit markets: they discriminate against risky investment projects, and they induce rationing. The first effect occurs as soon as the interest ceiling falls below the market equilibrium rate. The second effect does not occur until the ceiling has dropped to some critical level.

Risky projects are discriminated against because the ceilings apply uniformly to all loans and do not allow for risk premia. The effect is similar to that of the corporate tax in the standard Harberger model, where a fixed amount of capital is allocated between two sectors. When this effect occurs, lenders allocate funds on the margin to the less risky sector (where the rate of return is equal to the ceiling). There is no general rationing, although some of the more risky sectors may be excluded completely. The implication of the Harberger model is that for small tax rates, the efficiency cost is only of the second order with respect to the implicit tax rate.

When the ceiling is sufficiently low or when all projects are identical, rationing may occur. This rationing creates rents and may lead to an inappropriate allocation of the available funds. The maximum efficiency cost of the rationing is thus represented by the area ACEFA in figure 3. In general information is inadequate to evaluate this cost more precisely. However, the cost is of the first order with respect to the implicit tax wedge. For small wedges, therefore, the efficiency cost of rationing is higher than the efficiency cost measured in table 3.

Imperfect Markets

The analysis in this section applied to an economy in which the alternative to holding money is to invest in activities without distortions, that is, in which the private rate of return is equal to the social rate of return. This assumption may not be valid in many cases, but a policy that addresses this issue must rest on a clear evaluation of the distortion. In many instances it will be difficult to arrive at an objective evaluation, but one important case provides additional insight into the empirical estimates of the efficiency cost of financial taxation. We have already noted that, for various reasons, capital markets in developing countries

are subject to imperfections in developing economies. As Shaw (1973) pointed out, a consequence of these imperfections is that investment goods (or any bulky item such as durable goods) cannot be purchased until cash balances have accumulated. This is especially true in an economy without credit, but, even when credit is available, the bank may finance only a fraction of the investment, and the rest will be financed by cash balances (see also Fry 1988).

Consider the problem of an investor who has no access to credit and has a positive cash flow that is saved in money to purchase a durable good. The real value of this flow is assumed to be constant. Assume for simplicity that in an initial environment there is no inflation and that the rate of return on the deposit is nil. Now suppose the inflation rate becomes positive. Inflation acts like a tax on the durable good and increases its effective cost. If the demand for durable goods is relatively inelastic, a positive inflation will push the average level of the cash balance up before the purchase.

This argument has two implications. First, it may explain some of the behavior of deposits in Sub-Saharan countries. In countries with temporary episodes of significant inflation (such as Nigeria or Zambia before 1986), there is no clear relation between the level of money holdings and inflation. Second, it shows that the values in table 3 probably underestimate the efficiency cost of financial taxation. The tax introduces other distortions in the allocation of durable, or even investment, goods that cannot be measured by the Harberger triangle of figure 3. This is particularly clear when the inflation tax causes the demand for durables to fall while the demand for deposit balances remains constant: although the reduction of the demand for durables is a distortion, this is not captured in the computation of MEC in table 3.

V. CONCLUSION: FINANCIAL TAXATION AND DEVELOPMENT

This article has shown that measuring the revenue from financial taxation is not a simple task. The efficiency cost of financial taxation is unambiguously large in terms of the revenue collected when the rate of taxation is more than 30 percent. Tax rates of less than 20 percent seem to have, in proportion to revenue, a much smaller effect on assets and efficiency cost. Similar conclusions have been obtained by Dornbusch and Reynoso (1989). And although it is difficult to detect the impact of small tax rates on the level of deposits at commercial banks, there may be other significant distortions even when the observed interest elasticity of financial assets is equal to zero.

Financial taxation also has an adverse impact on future expectations about taxation and thus affects the development of the financial system. These long-term effects cannot be measured very well by standard time series methods. A comparison of financial taxation in the Sub-Saharan countries indicates that the long-term effects may be significant, but this article is based primarily on data from countries that do not have a sophisticated financial system. As countries develop a larger menu of assets, the possibilities for substitution increase, and

the efficiency cost of financial taxation rises. This can be seen in the effect of financial liberalization in Indonesia and Thailand (Chamley and Hussain 1989), where an increase in the deposit rate of a few percentage points caused deposits to grow more than 20 to 50 percent. The efficiency cost of financial taxation thus depends on the stage of development.

The analysis of the efficiency costs was limited to a partial equilibrium framework. The extension to general equilibrium models with endogenous physical or human capital is an important topic for future research (see, for example, Greenwood and Jovanovic 1989 and Bencivenga and Smith 1991).

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Tax Incidence Analysis of Developing Countries: An Alternative View

Anwar Shah and John Whalley

Misleading conclusions can be drawn from studies of tax incidence that ignore the special features of developing countries. Incorporating these features can sometimes reverse the incidence pattern of taxes relative to what is often taken to be conventional wisdom. Even where patterns are not reversed, quantitative differences can be substantial. The "newer" views of incidence have implications for tax restructuring options being considered in several developing countries. The proposed restructuring may appear to lead only to a more regressive tax system because of improper incidence analysis.

All studies of the redistributive effects of taxes in developing countries calculate annual tax incidence on the basis of assumptions as to how different taxes are shifted onto consumers, producers, factor owners, and other groups (see, for example, Musgrave and others 1951; Gillespie 1980; Pechman and Okner 1974; Musgrave, Case, and Leonard 1974; Browning 1978). The five main kinds of taxes usually considered are income, corporate, sales and excise, property, and social security taxes. Each tax has side effects on sources (capital income, labor income, or transfers) or uses (savings and expenditure patterns by household) or both that reflect how the tax is assumed to be partially or fully borne. In the literature, the terms "shifting assumptions," "incidence assumptions," and "sources and uses side effects" all refer to the treatments adopted to allocate tax burdens and will be used interchangeably here.

I. TAX INCIDENCE ANALYSIS OF DEVELOPED COUNTRIES

The sources and uses side effects of taxes appearing in these incidence calculations reflect their allocation to the components of annual household budget

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constraints, written for simplicity as

$$(1) \quad C + S = K + L + Tr - PT$$

where C and S denote consumption and savings, respectively, and K , L , Tr , and PT are capital and labor income, transfers, and personal taxes. Sources side effects arise where the composition of income differs by income range. Of the three main income sources assumed to bear the burden of taxes, transfers are heavily concentrated in the lower tail of the income distribution, capital income is present in both the upper and lower tails (owing to the presence of retirees), and labor income is the closest to being proportional to income. Thus, the progressivity or regressivity of a tax depends on how the sources side effects are allocated. Uses side effects across households arise primarily where ratios of consumption to savings differ by household. Because a large percentage of household savings is concentrated in the top decile of income distribution, taxes such as sales and excise taxes, which are treated as borne by the consumers of taxed products, are regressive.

To obtain incidence estimates for whole tax systems, separate incidence calculations by income range are made for each tax, and these are then summed across taxes, yielding an average total tax rate for each income range. The extent of redistribution through the tax system is evaluated by examining the pattern of average tax rates by income range. Although it is widely agreed that net redistribution considering both expenditures and taxes may be of more interest than tax incidence alone (see Chaudry-Shah 1989, Meerman 1979, and Selowsky 1979) and that lifetime rather than annual incidence calculations should form the basis for evaluating tax reform initiatives (Davies, St. Hilaire, and Whalley 1984), data limitations often prevent such evaluations. The major finding from conventional studies of incidence is that the tax system has little effect on income distribution.

There are agreements and differences in the key shifting assumptions used in the more significant incidence studies of developed countries (Pechmand and Okner 1974; Gillespie 1980; Browning and Johnson 1979). These studies agree that the individual income tax should be treated as being paid by income recipients and that it is progressive because of increasing average tax rates. The studies uniformly treat social security and related contributions as payroll taxes on labor and agree that, outside of the lower tail of the income distribution, such taxes are regressive because of the ceilings on contributions.

The major areas of disagreement center on the corporate, property, and sales and excise taxes. Corporate and property taxes are sometimes shifted "forward" to consumers, with regressive results, and sometimes shifted "backward" to recipients of capital income, in which case the taxes are progressive. Chaudry-Shah (1989) advocates empirical analysis of capitalized burdens of the local property tax as an alternative approach to the study of property tax incidence. This "capitalization" approach represents a major departure from the traditional

“reasonable assumptions” approaches to the study of the fiscal incidence of the local public sector.

The property taxes attributable to land are assumed to fall on capital income in general, or on landowners, or on capital owners, or half on capital income in general and half on factor income. Of these cases, land taxes on capital owners result in the most progressive incidence pattern; those that fall half on capital income and half on factor income are the least progressive. Three alternative assumptions are common for property taxes attributable to structures and improvements: to capital income in general, or to shelter and consumption, or half to capital income and half to factor income. Of these, the first case yields the most progressive incidence pattern and the second the most regressive.

Because of light taxation of widely held housing capital, corporate taxes are even more progressive if assumed to be borne by capital income specific to taxed industries rather than by capital income in general. In some studies, this motivates the allocation of corporate taxes to dividends rather than to all capital income.

Sales and excise taxes are regressive when they are assumed to be borne by consumers and progressive when they are assumed to be borne by recipients of factor incomes. Ballentine (1981), however, argues that because taxes that are shifted forward fall on capital goods as well as consumption goods, savers bear some of the burden of such taxes, thereby reducing the regressivity of the tax system calculated under assumptions of forward shifting.

II. EXISTING TAX INCIDENCE ANALYSES OF DEVELOPING COUNTRIES

Concerns over the equity of tax policies have motivated a number of tax incidence studies of developing countries, more typically of specific taxes rather than of the whole system. These studies generally employed the same shifting assumptions used in the conventional, Pechman-Okner (1974) type of incidence analysis of developed countries and did so in a relatively uncritical way. As a result, the conclusions of these studies with regard to incidence are similar to those found in analyses of developed countries. A small number of recent studies have examined tax incidence using general equilibrium techniques (Habito 1984; Bovenberg 1987; Chowdhury 1990), although the important nontax institutional features of developing countries stressed later in this article do not receive significant attention in this work. On a tax-by-tax basis, the main incidence themes emerging from this literature are as follows.

Sales and Excise Taxes

Most studies find a value added tax (VAT) of a uniform rate to be regressive, but note that this regressivity could be reduced by implementing differential rates for different commodities and a supplementary system of excise taxes on “luxury goods.” These incidence analyses usually assume full forward shifting, in

which the tax is allocated among income brackets by using consumption expenditure data. Some recent studies have used an input-output framework to take into account differential rates and exempt commodities (Ahmad and Stern 1988; Bird and Miller 1989a, 1989b) while continuing to assume (implicitly) full forward shifting. Sales taxes at the manufacturer and wholesale levels are also regressive. Full forward shifting is again generally assumed, even though in many developing countries producers and wholesalers typically apply a fixed percentage markup to prices, which prevents full forward shifting. Jeetun's (1978b) study of Pakistan, for example, finds only 35 percent forward shifting from increases in the sales tax at the manufacturer level.

Incidence analyses of excise taxes are typically based on an assumption of full forward shifting although available econometric evidence is once again at variance with this assumption. (Naqvi 1975 and Jeetun 1978b, for example, estimated the extent of forward shifting of excises in Pakistan at 48 percent and 31 percent, respectively.) A progressive incidence pattern is usually obtained for excises in the aggregate. A notable exception is taxes on tobacco and cheap liquor, which usually have a regressive incidence pattern (as in developed countries) because of relatively heavier consumption by the poor (McLure and Thirsk 1978; Cnossen 1977; Bird and Miller 1989b; Asher and Booth 1983). Some excises, such as motor fuel taxes, combine aspects of taxing luxury consumption (based on the ability-to-pay principle) and charges for the use of public services (benefit taxes). To the extent that these taxes serve as user charges, they should not be included in incidence analysis. Import duties are usually assumed to be fully forward shifted to consumers of imported goods, resulting in a regressive or proportional incidence (Jeetun 1978a). Most incidence studies of developing countries ignore the implications of quotas and import licensing for the shifting assumptions used.

When considered as a group, indirect taxes (general sales, excise, and import taxes) are almost universally assumed to be shifted forward to consumers of taxed commodities. With few exceptions (Radhu 1965), backward shifting and incomplete forward shifting have not received much attention. These taxes are found to have a U-shaped incidence pattern, with some regressivity in the lower income ranges for the urban and rural poor (because of general sales taxes and taxes on tobacco and cheap liquor), progressivity in the top income brackets (because of taxes on motor fuels, liquor, and other luxuries), and a flat incidence profile for the middle income groups (Foxley and others 1979; Jeetun 1978b; Malik and Saqib 1989).

Primary products dominate exports from many developing countries. For commodities where no single country or a small group of countries dominates the world market, little forward shifting of the tax to foreign buyers should occur. Most incidence studies, therefore, assume that export taxes are borne by the producer-exporter group, and, because this group is in the higher income range, export taxes are progressive. One recent study for Sri Lanka (Jayasundera 1986) also considered implicit subsidies to domestic consumers associated with

export taxes on tea and rubber and found that these implicit subsidies were distributed in a progressive fashion. The progressive incidence of export taxes may thus be reinforced by the redistributive effects of implicit subsidies.

Income and Property Taxes

Personal income taxes are assumed to fall on the individuals who pay them, and complications stemming from tax evasion are ignored. All incidence studies of developing countries thus show personal income taxes to be progressive. It is commonly assumed that 50 percent of the corporate income tax is shifted forward to consumers, and 50 percent is borne by owners of capital. Under this assumption, the usual incidence finding is a regressive incidence profile for the lowest income brackets, a nearly flat incidence profile for the middle groups, and a progressive incidence profile for the higher income groups.

Urban property taxes are found to be progressive in most studies of developing countries (McLure 1979; Linn 1980; Bahl and Linn, forthcoming; Holland and Follain 1985). For owner-occupied residential, commercial, and industrial properties, the usual shifting assumption is that the tax falls on capital owners with no forward shifting; this is the so-called "new view" of property tax incidence. For rental properties, varying degrees of forward shifting are assumed—a practice consistent with the "old view" of property tax incidence. In general, property taxes on owner-occupied properties are found to have a progressive incidence pattern, whereas taxes on rented properties are regressive. All available studies ignore tax capitalization effects, whereby the imposition of a property tax leads to a fall in the market value of the asset (Chaudry-Shah 1988, 1989). With tax capitalization effects included, a properly administered property tax is likely to be somewhat more progressive than it appears under traditional assumptions.

For taxes on agricultural land, the usual assumption is that such taxes fall on landowners. For subsistence agriculture, such taxes could induce an increase in marketable surplus, as the landowners must earn at least the cash equivalent of taxes in the marketplace. Such behavior would, however, dampen agricultural prices. Some studies (Qureshi 1987) imply that landowners therefore bear more than the burden of the tax because their producers' surplus is reduced as well. Because land ownership is generally concentrated in a few hands in most developing countries, a progressive incidence of such a tax is obtained under these assumptions.

Sectoral and Overall Tax Incidence

Although not emphasized in studies of developed countries, the sectoral incidence of taxes is frequently analyzed in studies of developing countries, either for rural-urban or agricultural-nonagricultural groupings. Such studies usually make assumptions about the fraction of tax passed between sectors. A recent study for Pakistan, for example, assumes that land taxes are borne solely by the agricultural sector while personal taxes and those on manufactured goods are

borne by the nonagricultural sector (Qureshi 1987). Import duties are allocated according to consumption patterns of taxable imports, and other indirect taxes are allocated by relative weights in consumption. Under these assumptions, the agricultural sector emerges as overtaxed relative to the nonagricultural sector. The same conclusion is also reached by Kazi (1984) for Pakistan, by Lipton (see Toye 1978) for India, and by Jayasundera (1986) for Sri Lanka. Opposite conclusions are reached in several studies on India (Mitra 1963; Gandhi 1966). Jayasundera (1986) examines relative tax burdens by income class in the modern (nonagricultural) and primary (agricultural) sectors in Sri Lanka, and concludes that individuals with low to lower-middle income are relatively heavily taxed in the primary sector compared with the modern sector.

Tax incidence studies of developing countries generally find the overall tax system to be broadly progressive, showing either a U-shaped (Malik and Saqib 1989 for Pakistan and McLure 1971 for Colombia) or a progressive (Jayasundera 1986 for Sri Lanka, Lovejoy 1963 for Jamaica, and Sahota 1969 for Brazil) incidence pattern. Exceptions to this include Wasylenko (1985) for Jamaica, who finds an inverted U-shaped incidence pattern for the overall tax system, implying that the tax system redistributes from the middle-income groups to the poor and the rich.

III. NONTAX POLICY ELEMENTS IN DEVELOPING COUNTRIES AND TAX INCIDENCE ANALYSIS

The mechanical application to developing countries of tax incidence analysis for developed countries has pitfalls. A wide network of policies surrounds tax systems in developing countries and must be taken into account in some way. Assumptions that are reasonable for developed countries may not be so for developing countries. The issue, then, is to determine what kinds of assumptions and analyses are appropriate for developing countries. Because developing countries are not homogenous, no single approach to tax incidence is applicable to all of them. It is still instructive, however, to discuss broad groups of developing countries and the implications of their tax systems for tax incidence analysis. Table 1 summarizes some of the key features that should be considered in tax incidence work for different types of developing countries. Nontax institutional features, such as informal or black markets, urban-rural migration, credit rationing, industry concentration, product market competition, price controls, import licensing regulations, exchange controls, and quantitative restrictions, cartels, and the extent of unionization may alter both shifting assumptions and conclusions of conventional incidence analysis of developed countries.

The External Sector

Many developing countries raise a significant portion of revenue from trade taxes. As discussed above, the assumption that import taxes are passed forward to consumers implies that these taxes are proportional or regressive. In most

Table 1. *Key Features for Tax Incidence Analysis for Different Types of Developing Countries*

Feature	Type of developing country in which feature is significant for tax incidence analysis			
	Low-income agrarian	Lower-middle income	Semi-industrial	Newly industrial
International trade taxes	X	X	X	
Limited coverage of income tax	X	X		
Social security and payroll taxes			X	
Sales taxes		X	X	X
Government ownership in the corporate sector	X	X	X	
Foreign ownership of capital			X	X
Widespread tax evasion		X	X	
Quantity and price interventions	X	X	X	
Widespread black markets	X	X	X	

developing countries, import taxes operate alongside import licensing restrictions, which act as quantity constraints on trade. In addition, foreign exchange may be rationed and may represent a binding restriction on trade (Clarete and Whalley 1986). Advance deposit schemes may also be imposed, under which importers are required to deposit foreign exchange in the central bank for a specified period of time before they are given permission to import. Such schemes are still common in Africa and can also be found in Latin American countries currently experiencing import compression, such as Argentina.

A binding restriction on imports is thus frequently a quantity constraint, with product prices in the domestic market determined by the severity of the quantity constraint. In such cases, tariffs do not affect domestic prices. Instead, tariffs transfer to the government rents that would have accrued to the owners of the rights of access to restricted imports, usually the recipients of import licenses or rationed foreign exchange. In such a regime, trade taxes largely become lump sum and have no flow-through effect on consumers in the form of higher prices (see Clarete and Whalley 1988). If, as would seem plausible, the recipients of importing privileges are predominately the wealthy, then trade taxes in developing countries can reasonably be argued to have progressive incidence effects, not the regressive or proportional effects that are usually reported.

The differences between using conventional shifting assumptions and alternative assumptions suggested by the discussion above are explored in table 2, which shows three kinds of incidence calculations of trade taxes, based on taxation and on household income and expenditure data for Pakistan for 1984–85. First, using traditional assumptions, trade taxes are allocated to consumption expenditures in general, resulting in a regressive incidence pattern similar to those in available studies (Malik and Saqib 1989). Second, when trade taxes are allocated to owners of capital income in general, reflecting the assumption that import licenses are received proportionally to capital income, incidence is prog-

Table 2. *Incidence of Trade Taxes in Pakistan under Alternative Allocation Assumptions*
(tax as a percentage of total income)

Annual household income (rupees)	Group subject to the tax burden		
	Consumers of traded products	Owners of capital income in general	High-income holders of import licenses
Under 7,200	7.8	4.0	n.a.
7,200–8,400	7.1	3.6	n.a.
8,400–9,600	7.0	3.6	n.a.
9,600–12,000	6.9	4.4	n.a.
12,000–18,000	6.8	5.1	n.a.
18,000–24,000	6.5	5.9	n.a.
24,000–30,000	6.3	5.9	n.a.
30,000–36,000	6.2	6.1	12.2
36,000–42,000	6.1	6.1	12.3
42,000–48,000	6.1	6.2	12.6
48,000–54,000	5.8	6.3	12.8
Above 54,000	5.1	7.0	14.0

n.a. Not applicable (see text).

Source: Calculations are for data from 1984–85, based on allocative series derived from Pakistan, Government of (1985) and taxation data from Pakistan, Government of (1988).

ressive. In Pakistan, access to the external sector is actually concentrated in only a few individuals belonging to the top income brackets. Accordingly, a third incidence calculation assumes that rents from licenses accrue only to the top five income brackets in proportion to their share of capital income. The resulting incidence pattern for trade taxes is dramatically progressive.

Price Controls and Black Markets

The widespread use in developing countries of price controls for many items subject to sales and excise taxes renders invalid the traditional (developed-country) incidence assumption of forward shifting onto consumers. If a tax is applied to a price-controlled item, the supplier may or may not be legally allowed to pass the tax forward. Thus, sales and excise taxes are either fully passed forward to consumers or fully shifted backward to recipients of factor incomes, depending upon how the law is written. The incidence outcome does not depend on supply and demand elasticities in markets for taxed products as it would in a typical developed country.

In most developing countries, black or parallel markets arise because of price controls and efforts to evade taxation. An important effect of a sales or excise tax, therefore, may be to change the relative size of black market activity to white market activity which can have important implications for incidence analysis. Mohammed and Whalley (1985) and Nguyen and Whalley (1989) highlight the equilibrium conditions linking black markets and white markets, and show how price changes in white markets, caused, for example, by a tax, reverberate onto black markets. The authors show that if there are penalties for

those caught transacting on black markets and endogenously determined search costs involved in transacting on white markets at the controlled prices (the larger the excess demand, the larger the search costs), buyers and sellers (assuming risk-neutral behavior) on both black and white markets must face the same effective prices in equilibrium (gross of search costs or net of expected penalties) on the two markets.¹

For simplicity, we assume black market penalties are imposed only on sellers. Thus, for buyers

$$(2) \quad P^B = \bar{P} + S$$

where P^B is the black market price, \bar{P} is the controlled price on official (white) markets, and S is the endogenously determined search cost faced by buyers on official markets.

For sellers

$$(3) \quad P^B - \gamma.K = \bar{P}$$

where γ is the endogenously determined probability per unit sale of being detected selling on black markets, and K is the penalty per unit sold. Mohammed and Whalley (1985) and Nguyen and Whalley (1989) both assume γ is an increasing function of the ratio of black market sales to official market sales. In this framework, changes in price controls affect black market prices, the length of queues on white markets, and the risk of detection for black market traders. Lowering price controls increases the ratio of P^B to \bar{P} and increases queuing or search costs on white markets. Stronger enforcement designed to curtail black markets (higher γ) increases search costs on white markets and can therefore decrease overall social welfare. A sales or excise tax that is passed forward will divert more activity to black markets, increase effective consumer prices (gross of queuing costs), and increase total penalties paid by black market traders. The tax will thus be borne by both the producers and the consumers in ways that are quite different from those deduced from conventional analysis.

The incidence of the tax will also depend upon whether buyers or sellers are liable for the tax. This approach is again different from conventional (developed-country) analysis, in which legal liability for taxes is seen as of no economic consequence. Assuming that black and official markets continue to coexist when a tax is introduced, if sellers on official markets are liable for the tax at rate t , the equilibrium condition for sellers across black and white markets changes:

$$(4) \quad P^B - \gamma K_o = \bar{P}(1 - t)$$

while equation 2 for buyers is unchanged. The effect of the tax is to divert sales to black markets, which lowers black market prices and increases the proba-

1. A referee has argued that rather than black and white markets facing the same effective price in equilibrium, there may be rents in the latter that accrue to the privileged consumers.

bility of detection. The lower black market prices from equation 2 reduce queuing and search costs on white markets. Consumers (buyers) thus benefit from the tax through lowered prices on the black market and reduced search costs on the white market. This implies that producers (sellers) more than fully bear the burden of the tax, which reflects the reduction in effective seller prices on black markets as well as on white markets.

However, if buyers on white markets are liable for the tax, the equilibrium condition in equation 2 changes to

$$(5) \quad P^B = \bar{P}(1 + t) + S$$

but equation 3 remains unchanged. In this case P^B will rise, which from equation 3 must produce an offsetting change in γ (the probability of detection). Sellers are no better off under the tax, and buyers (consumers) more than fully bear the burden of the tax through increased prices in black, as well as white, markets.

Thus, for sales and excise taxes in this case, with black market penalties borne fully by sellers, appropriate incidence assumptions depend upon the changes in black market activity induced by taxes. Because data are not readily available that allow a link to be made between black market activity and the personal distribution of income, it is not easy to take these effects into account in incidence calculations. Anecdotal evidence, however, indicates that the coverage of price controls and the size of black market activity in many countries is surprisingly large (see Pakistan, Government of, 1987; India, Government of, 1985; Chugh and Uppal 1986; Chopra 1985).

Tax Evasion

Another common feature of developing countries that is neglected in incidence studies is tax evasion. Given the degree of evasion found in many developing countries, the conventional assumption that income taxes are fully borne by the payer of the taxes is inappropriate. (For anecdotal evidence on the extent of tax evasion and bureaucratic corruption in developing countries see Gould and Amaro-Reyes 1983, Carino 1986, and Klitgaard 1988.)

In a simple model in which evasion involves bribery of officials, the bribe, B , is related to taxes owing, T , through the bribe rate, τ . In practice, as Gang and others (1989) suggest, the bribe rate will be endogenously determined, but for simplicity here it is assumed to be fixed, so that $B = \tau T$. An increase in tax rates will raise both T and B . If the bribe rate is high and tax compliance is low, the redistributive impacts of the bribe system will dominate the direct redistributive effects of the income tax. The relevant issue, then, is who receives the bribes.

One scenario is that, through a seniority system in public service, high officials with higher income and wealth receive a large portion (or the majority) of the bribes, along with professionals (accountants) who often act as "middlemen" in this process. Increasing the income tax can thus trigger redistribution from middle-class businessmen and others to wealthy elites, an entirely opposite conclusion to that obtained from applying conventional incidence analysis used for

developed countries to the income tax in developing countries. The extent of tax evasion and its links to rent transfers in particular countries are difficult to determine. To our knowledge, no tax incidence work taking these effects into account has been undertaken.

Rural-Urban Migration

A prominent feature of many developing countries over recent decades has been a rapid increase in rural to urban migration during the developmental phase, which has led to major concern over the effects of policy on migration. While there are several ways of modeling migration (Grosch 1986; Heady 1987; Heady and Mitra 1987), in a Harris-Todaro (1970) model, a rural-urban wage differential through urban unemployment yields an equilibrium condition with equal expected wages across the two sectors. Thus, $W^R = \rho \bar{W}^u$ where W^R is the rural wage rate, ρ is the probability of being employed in the urban sector, and \bar{W}^u is the downward rigid urban wage.

In many developing countries, income and payroll taxes apply de facto only to the modern sector, which can be equated with the urban sector. If the income tax operates as a tax on the urban sector only, increases in income taxes will affect migration patterns and therefore wages in the rural sector. The traditional (developed-country) incidence assumption concerning the income tax, namely, that taxpayers fully bear the burden of the tax out of the income they receive, is inappropriate in this framework (Imam and Whalley 1985). Part of the burden is shifted to rural workers who legally pay none of the tax but whose wages nonetheless fall in response to the tax. Similar issues arise with the incidence analysis of payroll taxes (Whalley and Ziderman 1989).

The potential importance of this effect can be illustrated by using data for Pakistan for 1984–85. In Pakistan only the urban sector is subject to a personal income tax. A graduated surcharge on gross revenue is imposed on the rural sector and acts as a pseudo-income tax, but with very minor consequences for revenue and incidence. In table 3, the traditional approach to the incidence of income taxes implies that these taxes are a progressive element in the overall tax structure in Pakistan.

The Harris-Todaro effect in incidence calculations is captured in two alternative calculations. Whether it is assumed that a significant proportion of the income tax is shifted from the urban to the rural sector in the form of reduced wages for rural households earning less than Rs24,000 a year (most potential migrants come from these income classes) or in the form of reduced rural wages overall, the incidence results change. The discrepancy between the taxation statistics and income tax payments data, as reported in the *Pakistan Household Income and Expenditure Survey 1984–85* (Pakistan, government of, 1985), serves as a proxy for the total income tax burden borne by the rural sector. Under either of these alternative assumptions, a regressive incidence pattern of the tax for the rural sector and an ambiguous pattern of tax incidence for Pakistan as a whole is obtained. Within the urban sector, the income tax remains progressive.

Table 3. Incidence of Personal Income Taxes in Pakistan under Alternative Approaches
(tax as a percentage of total income)

Annual household income (rupees)	Form of income tax shift to rural sector								
	No personal income tax in rural sector			Reduced wages for low-income rural households			Reduced rural wages overall		
	Urban	Rural	Total	Urban	Rural	Total	Urban	Rural	Total
Under 7,200	0	0	0	0	0.74	0.58	0	0.54	0.42
7,200–8,400	0	0	0	0	0.83	0.63	0	0.60	0.45
8,400–9,600	0	0	0	0	0.88	0.63	0	0.64	0.46
9,600–12,000	0	0	0	0	0.73	0.46	0	0.52	0.34
12,000–18,000	0.02	0	0.01	0.01	0.57	0.35	0.01	0.41	0.25
18,000–24,000	0.04	0	0.02	0.02	0.70	0.38	0.02	0.32	0.18
24,000–30,000	0.02	0	0.02	0.01	0.01	0.01	0.01	0.29	0.13
30,000–36,000	0.20	0	0.13	0.09	0.02	0.06	0.09	0.26	0.16
36,000–42,000	0.22	0	0.16	0.10	0.02	0.07	0.10	0.31	0.17
42,000–48,000	0.40	0	0.29	0.18	0.03	0.13	0.18	0.19	0.18
48,000–54,000	0.77	0	0.50	0.35	0.01	0.23	0.35	0.18	0.29
Above 54,000	1.33	0	1.04	0.61	0.11	0.47	0.61	0.13	0.48

Note: Calculations under “no personal income tax in rural sector” are based on actual tax collections by income class as reported in Pakistan, Government of (1985). All figures from this survey are adjusted to bring the total in line with data from Pakistan, Government of (1988). Income tax collections on household income derived from urban sources or from graduated surcharges on land revenue are effectively zero.

Source: Authors’ calculations based on 1984–85 data.

Credit Rationing and Foreign and State Ownership

The presence of credit rationing and foreign and state ownership affect the incidence assumptions appropriate for analysis of the corporate income tax. Credit rationing is a common element in the policy regimes of many developing countries (World Bank 1989). If firms are subject to credit rationing, the corporate tax will operate as if it were a tax on pure rent, much as trade taxes fall on holders of licenses if there are binding quotas. This differs from the trade tax case, however, as the tax will be borne from rents accruing to stockholders of firms as a result of their access to rationed credit.

A significant portion of the manufacturing sector in many countries is either foreign owned or has substantial foreign involvement. If a foreign tax credit applies under the domestic law of the source country (such as in the United States), a portion of the corporate tax may be borne by the treasury of the source country (Shah and Slemrod 1990). In this case both of the traditional polar assumptions of fully shifting the corporate tax back onto capital or forward onto consumers may be inappropriate. Finally, state ownership of the corporate sector implies that the portion of corporate tax revenue that is raised from state-owned enterprises represents an internal transfer of funds within the government, with no direct incidence effects.

Table 4 presents incidence analyses of the corporate tax in Pakistan for 1984–85 under alternative assumptions. The first three columns show incidence calculations using variants of traditional approaches used for developed countries; the corporate tax has a progressive incidence pattern if it is allocated to capital income but a proportional incidence pattern if a significant portion of the tax is

Table 4. *Incidence of Corporate Taxes in Pakistan under Alternative Approaches*

(tax as a percentage of total income)

<i>Annual household income (rupees)</i>	<i>Income category subject to the tax burden</i>			<i>Tax incidence excluding taxes paid by state and foreign enterprises</i>
	<i>Capital</i>	<i>Capital and consumption</i>	<i>Capital and labor</i>	
Under 7,200	1.18	1.71	1.56	0.85
7,200–8,400	1.06	1.55	1.64	0.77
8,400–9,600	1.04	1.53	1.70	0.76
9,600–12,000	1.26	1.62	1.69	0.91
12,000–18,000	1.46	1.70	1.69	1.06
18,000–24,000	1.70	1.79	1.68	1.24
24,000–30,000	1.68	1.76	1.69	1.22
30,000–36,000	1.75	1.78	1.68	1.28
36,000–42,000	1.77	1.78	1.66	1.29
42,000–48,000	1.81	1.79	1.65	1.32
48,000–54,000	1.89	1.76	1.63	1.34
Above 54,000	2.01	1.74	1.64	1.46

Source: Authors' calculations based on 1984–85 data.

allocated to either consumption or labor income. To account for the effect of foreign and government ownership, taxes paid by foreign and state enterprises are not allocated. In Pakistan, 22 percent of total corporate tax collections come from state-owned enterprises and another 5 percent come from foreign enterprises having access to some form of foreign tax credit against Pakistan's tax liabilities. The remaining 73 percent of total taxes are allocated to capital income in general, resulting in an overall progressive incidence of the corporate tax, but with lower effective tax rates than in the traditional analyses.

IV. CONCLUSIONS

The criticisms herein of existing tax incidence analyses of developing countries are wide ranging. Nontax policies relevant to tax systems in developing countries have not been taken into account in such work. Indeed, the underlying literature on tax incidence in developed countries, on which so much work on developing countries is based, is itself increasingly coming under challenge. Current views of incidence would likely be reversed or quantitative orders of magnitude substantially changed if more appropriate approaches were followed. In short, existing tax incidence studies of developing countries probably contain very little useful information.

At the same time, implementing the new approaches suggested here is not easy. New models of developing countries that accurately capture their special features are needed. The lack of appropriate data is a major (and, in some cases, possibly an insurmountable) problem, and no single uniform approach for all countries makes sense. Although this may seem to be an overly negative assessment, there are nonetheless more positive implications of this discussion that are worth emphasizing.

First, it seems clear that more explicit, rather than implicit, modeling would be helpful in future research (see Clarete and Whalley 1990). agonizing over forward or backward shifting for this or that tax may be less helpful than writing down an explicit model in which the full implications of assumptions can be traced through. We see this as an eventual move toward numerical, general equilibrium tax modeling, similar to that now being done for developed countries, but with the inclusion of features relevant to the developing country in question.

Second, even without new quantitative analysis, our discussion challenges the traditional approach to tax incidence questions—and, hence, lending decisions—relevant to World Bank operations in developing countries. Even though there are pitfalls with incidence analysis of developing countries and even though it may be impossible to state accurately the incidence of a particular tax, our analysis does shed new light on a whole series of questions about tax incidence in developing countries. These questions need to be understood in the institutionally richer framework that we suggest. It is the challenge to conventional thinking that our analysis implies, rather than the precise answers from

particular incidence calculations, that may prove more important for evaluating tax policy in developing countries in the longer run.

The importance of tax incidence analysis that incorporates features of developing countries can be illustrated by considering what one might term a stylized Bank-Fund package of tax reforms. Such a package would comprise four main components: a reduction of trade taxes and trade liberalization in general; an increased emphasis on production or consumption taxes, particularly the value added tax; a reduction of personal tax rates and a consolidation of the number of brackets; and a reduction in corporate tax rates and the granting of tax incentives to inward foreign investment.

A traditional analysis of the incidence effects of such a package would conclude that the overall impact of the package is regressive, which could lead to substantial problems in implementation. It seems to be equally defensible to suggest that the value added tax is a progressive, rather than a regressive, tax; that significant portions of the corporate tax in various countries are borne by foreign treasuries rather than by domestic capital; and that reductions in personal taxes can have substantially progressive incidence effects because of reductions in evasion and improved administration, ultimately reducing transfers to high-income groups through bribery and corruption. Thus, the incidence effects of the tax reform package could well be quite the opposite of that predicted by conventional wisdom.

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Applying Tax Policy Models in Country Economic Work: Bangladesh, China, and India

Henrik Dahl and Pradeep Mitra

Three examples from the World Bank's country economic work show how models can complement general principles in guiding the design of a tax reform package. The Bangladesh model highlights the sensitivity of judgments about desirable tax bases to assumptions about the labor market and substitutability in production. The China model quantifies the losses from recommending a single rate value added tax when prices are controlled and public capital is freely provided to state enterprises. The India model shows what fiscal adjustment is consistent with tariff reductions undertaken to promote an outward-oriented development strategy. Most of the costs of constructing tax policy models are related to the need to establish a consistent data set and to calibrate the model in a way that allows its behavior to be consistent with what good economic analysis would lead one to expect.

General guidelines are useful in designing the broad contours of a tax reform package. It is customary to recommend, for example, that the value added tax (VAT) form the mainstay of the indirect tax system, that corporate taxes cover a broad base and treat different sectors and alternative sources of investment finance neutrally, and that personal income have a small number of brackets and an exemption level that is high enough so as not to strain administrative capacity. Although a number of developing countries have undertaken fundamental tax reforms, it is more typical for governments to consider changing particular taxes and their rates as part of budget formulation or planning exercises. In these situations policymakers are interested in the impact of alternative proposals on government revenue and the circumstances of different socioeconomic groups. In such cases general guidelines alone are of limited use, and quantitative analysis is necessary.

This article reports on three tax policy models developed in the World Bank to analyze the impact of tax reform. The first model, used for Bangladesh, demonstrates how the relative attractiveness of different revenue-raising options de-

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depends on the functioning of labor markets and input substitution elasticities, matters about which conventional partial equilibrium incidence analysis makes strong assumptions. The second model, used for China, emphasizes the importance of taking a systemwide view of taxation in a decentralizing socialist economy, where the coexistence of administered and free market prices for the same commodities can make standard tax reform prescriptions most inappropriate. The third model, drawn from a study of India, examines the domestic tax adjustments needed to allow the government to maintain its real expenditures in the wake of import tariff reductions without any change in foreign borrowing. The costs of constructing and implementing quantitative frameworks of analysis as well as the value of the policy insights provided by them are discussed, and the principal findings are summarized.

I. BANGLADESH: THE ROLE OF ASSUMPTIONS ABOUT SHIFTING THE BURDEN OF TAXATION

This section highlights the influence of assumptions about shifting on the choice of sectors that should be additionally taxed to raise a given amount of revenue. The illustration here focuses on excise taxation, since Bangladesh, in attempting to reduce its dependence on trade taxes, has increasingly relied on the excise tax. This tax, which is levied *ex factory* on domestic goods and some services, now accounts for 97 percent of taxes on domestic production, and in recent years has accounted for 23 percent of all tax revenue. (For a similar analysis of other taxes in Bangladesh, see Dahl and Mitra 1989.)

As with any tax reform, a proposed change in excise taxation affects government revenue and the income of different socioeconomic groups. However, the direction and magnitude of these effects are often determined by assumptions made about shifting the burden of taxation. It is therefore important to examine the sensitivity of those effects and, even more important, the judgments about desirable directions of reform to the range of assumptions about shifting employed in the empirical literature. Thus it has been common in partial equilibrium analysis of tax incidence in developing countries to assume either full-forward shifting, in which commodity taxes are fully passed through to consumer prices, with producer prices constant (Ahmad and Stern 1984, 1987), or full-backward shifting, in which, for example, domestic commodity prices are anchored by world prices so that taxes are passed back, which compresses factor returns in the taxed sectors (Hughes 1986). The assumptions about shifting in the Bangladesh tax policy model presented here are more general and allow consideration of a central case that is intermediate between these polar cases.

In this model household preferences are represented by a linear expenditure system for 10 socioeconomic groups. In each urban and rural area labor supply is isoelastic in the real wage rate for all worker classes but one. The remaining class, informal workers in urban areas and landless workers in rural areas, is

considered residual. Workers in the residual class migrate freely into and out of other classes in the same geographic area, thus providing a pool of labor that adjusts to demands for other types of primary factors. As, for example, in Little and Mirrlees (1974), when demands for other classes of factors increase, the residual class accommodates this demand pressure, thus reducing the supply of rural landless or urban informal workers as appropriate; when demand for other factors decreases, the size of the residual class increases. It is assumed that migrating members of the residual household classes adopt the spending habits of their new class.

The primary factor inputs of each socioeconomic group are aggregated (using a constant elasticity of substitution function) into value added in each of 35 production sectors.¹ Output is a Cobb-Douglas aggregate of intermediate inputs and value added. These assumptions imply in general that a commodity tax increase would be partly shifted forward onto consumers of the commodity through increased prices and partly shifted backward onto factors employed in its production through depressed returns. The degree of shifting is endogenous and depends on, among other things, the relevant supply and demand elasticities for the commodity.

We use the model to determine the sensitivity of desirable reforms to the assumptions about shifting. This is calculated as the percentage increase in *ad valorem* excise taxation of a given sector that would increase total indirect tax revenue by 1 percent (or Tk230 million at 1984/85 prices), holding government expenditures fixed. The experiment is performed for every sector, and the revenue and distributional effects are summarized in a single measure that allows the sectors to be ranked according to the relative desirability of increased taxation on them. After changing the underlying elasticities of the model to reproduce the cases with full-forward and full-backward shifting, the revenue-cum-distributional summary measures and rankings are recalculated. The extent of changes in sectoral rankings from one case to the next indicates the sensitivity of desirable directions of reform to the assumptions about shifting.

As summarized in table 1, the tax rate increases needed to increase indirect tax revenue by 1 percent range from 0.18 percent if rice is the commodity on which taxes are raised, to 16.57 percent, if tea is the chosen commodity. Raising an additional Tk230 million in total revenue requires raising more than that amount from the sector in question. Although this need not always be true, it holds here because the direct and cascading-induced market price increases lead to a reduction in the level of economic activity and imports (and hence import tax receipts) that is not offset by government disposition of the additional tax revenue. Because the individual tax rate increases all raise the same amount of indirect tax revenue and government expenditures are unchanged, the govern-

1. Lack of data on capital in Bangladesh prevents the model from including sector-specific primary factors. Thus the wage rate actually refers to the price of value added.

Table 1. *The Macroeconomic Effects of Raising 1 Percent of Real Revenue from Excise Taxes on Different Commodities in Bangladesh*
(percent)

Taxed commodity	Increase in excise tax rate	Increase in			Customs duty and sales tax revenue	Distribution effect ^a
		Consumer prices	Trade deficit	Excise tax revenue		
Rice	0.18	-0.17	-0.39	3.31	-0.02	-
Wheat	2.73	-0.08	-0.37	3.31	-0.03	-
Jute	4.10	-0.95	-0.76	3.38	-0.05	-
Cotton	7.02	-0.14	-0.23	3.55	-0.13	?/-
Tea	16.57	-0.05	-0.11	3.27	-0.01	?/-
Other crops	0.61	-0.19	-0.40	3.37	-0.05	?/-
Livestock	1.84	-0.20	-0.41	3.32	-0.03	?/-
Fisheries	0.99	-0.17	-0.38	3.31	-0.03	?/-
Forestry	2.72	-0.06	-0.13	3.38	-0.06	0
Sugar	3.50	-0.09	-0.26	3.53	-0.12	0/-
Edible oil	2.82	-0.11	-0.36	3.41	-0.07	0/-
Tobacco	7.27	-0.10	-0.36	3.32	-0.03	0/-
Other food	3.14	-0.15	-0.37	3.35	-0.04	0/-
Cotton yarn	3.90	-0.24	-0.42	3.64	-0.17	0/-
Cloth	1.11	-0.10	-0.32	3.41	-0.07	0/-
Jute textiles	2.04	-0.01	-0.03	3.26	0.00	+
Paper	8.08	-0.16	-0.27	3.55	-0.13	0/-
Leather	2.91	-0.18	-0.33	3.31	-0.03	0/+
Fertilizer	2.98	-0.13	-0.38	3.33	-0.03	?
Pharmaceuticals and chemicals	2.28	-0.12	-0.32	3.54	-0.13	0/-
Cement	11.13	0.03	0.01	3.47	-0.10	+
Basic metals	1.85	0.01	0.01	3.73	-0.21	+
Metal products	1.20	-0.01	-0.05	3.30	-0.02	0
Wood and other industries	1.32	-0.06	-0.17	3.47	-0.10	0/-
Urban housebuilding	8.78	-0.01	-0.04	3.27	-0.01	0
Rural housebuilding	3.45	0.00	-0.01	3.26	0.00	0
Other construction	1.40	-0.01	-0.02	3.26	0.00	0
Petroleum	0.48	-0.13	-0.35	3.41	-0.07	0/-
Electricity and gas	3.32	-0.13	-0.20	3.39	-0.06	0/-
Transportation services	1.11	-0.19	-0.37	3.40	-0.06	0/-
Housing	2.14	-0.16	-0.36	3.30	-0.02	0/-
Health	6.51	-0.07	-0.26	3.31	-0.03	-
Education	3.29	-0.04	-0.12	3.27	-0.01	0
Public administration	1.35	-0.01	-0.02	3.27	-0.01	0
Trade and other	0.30	-0.20	-0.38	3.44	-0.08	-

a. A minus sign (-) indicates that the excise tax has a regressive impact on real per capita income distribution. A plus sign (+) indicates a progressive impact, a zero (0) indicates a neutral impact, and a question mark (?) indicates that the distributional impact is unclear. ?/- indicates a possibly negative impact, 0/- indicates a slightly negative impact, and 0/+ indicates a slightly positive impact.

Source: Authors' calculations.

ment drain on the economy is in all cases the same so that comparisons can be made across sectors. Thus, if the required increase of the excise tax rate is 1 percentage point in one sector and 10 percentage points in another, it is clear that revenue is more readily raised from the first sector. It need not be preferable to raise taxes in the first sector, however, because the welfare cost or distributional consequences may be undesirable.

The distributional impact of excise tax increases in selected sectors is shown in table 2, which reports the percentage change in per capita real income (income deflated by the consumer price index) by socioeconomic group. The socioeconomic groups are listed in order from poorest to richest based on income in 1984/85. The data on the distributional impact of excise tax increases are used to generate the last column in table 1. Thus a plus (+) indicates progressive impact, zero (0) indicates a neutral impact, and a minus (-) indicates regressive incidence. A question mark (?) signifies that the outcome is unclear.

Tables 1 and 2 show that several excise taxes feature desirable properties: they are effective at raising revenue (column 1 in table 1), have a minimally negative impact on the trade balance (column 3 in table 1), and may even exhibit progressive incidence (table 1, column 6, and table 2). This is true, most notably, of the basic metals sector. It is also interesting that while jute textiles is a satisfactory tax base, an additional tax on jute is strongly regressive. This is mainly because, in contrast with jute textiles, the jute industry is an intensive employer of the rural landless. Since increased taxes are partly shifted back onto factors of production, the landless bear a large burden of the tax.

Although the detail provided in tables 1 and 2 is useful in designing tax reform, a summary measure, which would capture the effects of increased taxation on both revenue and incidence, is necessary here. The loss caused to socioeconomic groups per unit of revenue raised provides a measure of the desirability of intensifying taxation on any particular sector. Of two sectors, the one with the lower (higher) loss per unit of revenue is a better (worse) candidate for taxation in the sense that, at the margin, a revenue-neutral switch in taxation from the worse to the better sector would improve welfare. The model is used to calculate the effect on welfare and on revenue of a marginal (strictly, infinitesimal) increase in the excise tax on each sector, taking into account the general equilibrium interactions of that change; the ratio of the welfare effect to the revenue effect yields the desired summary measure. This is the general equilibrium analog of the measure proposed by Ahmad and Stern (1984, 1987) in evaluating tax reform in the more partial context of full-forward shifting.

Welfare effects across socioeconomic groups are aggregated using the following social welfare function:

$$(1) \quad W = \sum_b N_b U_b^\nu / \nu$$

where N_b is the population of socioeconomic group b , U_b is the per capita utility

Table 2. *The Distributional Impact of Increased Excise Taxes on Different Commodities in Bangladesh, by Socioeconomic Group*
(percentage change in per capita real income)

Sector	Farmers						Rural		Urban	
	Rural landless	Small	Medium-size		Large	Largest	Informal sector	Formal sector	Informal sector	Formal sector
			Tenants	Owners						
Rice	-0.43	-0.08	-0.09	-0.10	-0.10	-0.11	-0.05	-0.04	0.22	0.02
Wheat	-0.36	-0.07	-0.08	-0.08	-0.08	-0.08	-0.05	-0.04	0.11	0.00
Jute	-0.88	-0.19	-0.15	-0.15	-0.14	-0.13	-0.01	-0.05	-0.04	0.05
Cotton	-0.25	-0.05	-0.07	-0.07	-0.07	-0.06	-0.05	-0.03	0.19	0.02
Tea	-0.11	-0.02	-0.03	-0.03	-0.03	-0.03	-0.02	-0.01	0.06	0.01
Tobacco	-0.44	-0.09	-0.11	-0.11	-0.11	-0.11	-0.06	-0.04	0.14	0.01
Cotton yarn	-0.42	-0.09	-0.12	-0.11	-0.11	-0.11	-0.09	-0.06	0.21	0.01
Jute textiles	-0.02	-0.01	-0.01	-0.01	-0.01	-0.01	-0.00	-0.00	0.01	0.00
Fertilizer	-0.35	-0.07	-0.10	-0.09	-0.09	-0.08	-0.08	-0.06	0.11	-0.02
Cement	0.00	0.00	0.00	0.00	-0.01	-0.01	0.00	-0.01	0.03	-0.01
Basic metals	-0.01	-0.00	-0.00	-0.00	0.00	0.00	0.00	-0.01	0.01	-0.02
Metal products	-0.05	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	0.01	-0.00
Urban housebuilding	-0.03	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	0.00	0.00
Rural housebuilding	-0.01	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	0.00	0.00
Other construction	-0.02	-0.00	-0.01	-0.00	-0.00	-0.00	-0.00	-0.00	0.01	0.00
Petroleum	-0.36	-0.07	-0.09	-0.08	-0.08	-0.08	-0.06	-0.04	0.17	0.01
Electricity and gas	-0.23	-0.05	-0.05	-0.05	-0.05	-0.04	-0.04	-0.03	0.11	0.02

Note: The distributional impact is the effect on real per capita income from raising government revenue by 1 percent from excise taxes on (different) commodities.
Source: Authors' calculations.

level of socioeconomic group h , and ν is the index of inequality aversion ($\nu \leq 1$).²

We choose as the central case a value of -5 for ν , which reflects a degree of inequality aversion greater than that used in many exercises. The reason, as argued in Dahl and Mitra (1989), is the following. Taxation is in practice administered at a level of classification that is significantly more disaggregated than that represented in this model or indeed in most applied general equilibrium models, where the degree of disaggregation is constrained by the availability of data. By taxing different goods that appear within the same sector in the model at different rates, it is possible to target selected households or income groups on the basis of differences in consumption and employment patterns more effectively than can be represented here. Thus, for example, the petroleum sector includes heavy fuels, light fuels, kerosene, and the like, but the distributional characteristics of the groups consuming each of those products are different. The need to tax all commodities making up a "model" sector at the same rate may be viewed as a tax restriction that imposes a constraint on the redistribution desired by even a moderately inequality-averse government (one with, say, $\nu = -1$). To correct for the fact that the conduct of tax policy has, in practice, more flexibility than may be represented in the model, the degree of inequality aversion is taken to be stronger than that expected to be characteristic of a government.

In order to compare the effects of different scenarios of shifting, the labor supply and factor substitution elasticities of the model are designated as the "central case," and those parameters are then varied to generate the polar cases of full-forward and full-backward shifting. In the "central case," in which taxes are shifted partly forward and partly backward, labor supply elasticities are 0.5 for all socioeconomic groups, and the uniform-across-sector elasticity of primary factor substitution in generating value added is 0.5. Although different sets of parameter values can be used to yield full-forward or full-backward shifting, the intent here is to choose parameters in ways that come closest to the important cases of full-forward and full-backward shifting recently produced by Ahmad and Stern (1984, 1987) and Hughes (1986), respectively. To that end, full-forward shifting obtains in the model when all elasticities of substitution between factors are set to zero and the labor supply elasticities by socioeconomic groups are set to infinity.³ These assumptions effectively allow the primary factors to be aggregated into a single factor, thus ensuring that no unit cost increases resulting from taxation may be shifted back onto factors. Full-

2. The utility function chosen to represent the linear expenditure system is

$$u_h = \prod_i (c_{ih} - \gamma_{ih})^{\beta_{ih}}$$

where c_{ih} is consumption of good i , γ_{ih} is subsistence consumption of good i , and β_{ih} is the marginal budget share of good i . The subscript h refers to a typical member of socioeconomic group h .

3. To achieve numerical stability, labor supply elasticities are set equal to 20.

Table 3. *Sectoral Rankings (by Welfare Cost to Revenue Ratio) for the Three Assumptions about Tax Shifting in Bangladesh*

Sector	Central case (part forward-, part backward-shifting)	Full-forward shifting	Full-backward shifting
Rice	10	2	14
Wheat	29	21	32
Jute	35	31	35
Cotton	21	25	21
Tea	12	17	12
Other crops	15	11	22
Livestock	24	15	30
Fisheries	7	1	10
Forestry	13	19	13
Sugar	22	24	20
Edible oil	28	29	28
Tobacco	33	34	34
Other food	26	26	19
Cotton yarn	34	35	33
Cloth	17	13	25
Jute textiles	6	7	6
Paper	23	27	16
Leather	27	30	26
Fertilizer	14	12	18
Pharmaceuticals and chemicals	25	28	23
Cement	1	6	1
Basic metals	3	8	3
Metal products	9	10	8
Wood and other industries	16	18	15
Urban housebuilding	8	9	7
Rural housebuilding	2	3	2
Other construction	4	4	4
Petroleum	20	16	24
Electricity and gas	19	22	17
Transportation services	32	23	29
Housing	30	32	31
Health	18	20	11
Education	11	14	9
Public administration	5	5	5
Trade and other	31	33	27

Note: Those sectors with the lowest values of the ratio of marginal welfare cost to revenue have the highest rank (1, 2, and so forth).

Source: Authors' calculations.

backward shifting is achieved by setting all labor supply elasticities to zero. This implies that the supply of labor is constant, so that changes in labor demand lead to changes in the real wage rate. Thus, when taxes are increased, factor demands decrease, which lowers the real wage rate.

Table 3 ranks sectors for the three sets of shifting assumptions such that those sectors with the lowest values of the ratio of marginal welfare cost to revenue

enjoy the highest rank (1, 2, and so forth). The ratios of welfare cost to revenue can be affected by the assumption made regarding the disposition of the revenue raised by the government through taxation. The figures reported here are calculated on the assumption that the government saves the additional revenue raised through taxation and uses it in part to retire foreign debt. An alternative assumption (Dahl and Mitra 1989)—that the government invests the extra revenue subject to the current account deficit in the balance of payments being fixed—causes little difference in the rankings.

It is apparent from table 3 that the rankings of sectors can vary depending on which assumptions about shifting are employed. Under all three assumptions, however, cotton yarn, jute, and tobacco are among the worst candidates for taxation. Desirable tax bases are rural housebuilding, other construction, public administration, and, except for the full-forward shifting case, cement. The housebuilding, construction, and cement sectors are linked together and serve investment needs that do not yield immediate welfare effects in the static model.

A dramatic example of the impact of assumptions about shifting on rankings is provided by the rice sector. This sector employs a high share of landless workers, so that when taxes are shifted backward, incomes in this group, which is one of the poorest in the country, are very adversely affected. But this sector's ranking climbs to 2 under full-forward shifting. This is related to the fact that the supernumerary, or above-and-beyond-subsistence, use of rice in the linear expenditure system is not very progressive in relation to income and thus produces much smaller total distributional and income effects than if taxes are shifted backward. Another notable, although less striking, example is the basic metals sector, which becomes a better candidate for taxation the greater the degree of backward shifting. This occurs because the sector employs mainly higher-income classes, in particular, the urban formal sector. However, when taxes are shifted fully forward, the basic metals sector becomes less attractive, since the prices of many other sectors are affected, thus increasing the cost of living for other household groups, including the landless.

The sensitivity of sectoral rankings to assumptions about shifting can be summarized by Spearman rank correlation coefficients. The rank correlation coefficient is 0.79 between the cases of full-forward and full-backward shifting, which is rather low and indicates that judgments about desirable directions of tax reform can be quite sensitive to underlying assumptions about tax shifting. The correlation between the central case and either of the polar cases is, of course, considerably higher; for the central and full-forward shifting cases the correlation is 0.92, while for the central and full-backward shifting cases it is 0.94.

II. CHINA: TAX REFORM IN THE PRESENCE OF PRICE CONTROLS

As in many other countries the VAT is assuming increasing importance in China. The rates, however, are chosen on a product-by-product basis and are

designed to yield broadly the same revenue as the turnover tax, which the VAT replaced. Consequently, a large number of VAT rates coexist in China, ranging from 8 percent on steel to 45 percent on some household machinery and chemicals (World Bank 1990). In this situation tax analysts generally recommend unifying the VAT rate across all sectors that the tax administration is able to reach and setting the rate to generate the same revenue as before unification. To judge whether such advice would be appropriate for an economy such as China's, it is necessary to sketch the important features of the institutional framework within which the tax system is embedded.

First, economic reforms in China have led to the introduction of a dual pricing system that allows state enterprises to purchase part of their inputs and sell part of their output at market prices. Before selling output on the free market, however, state enterprises must first deliver their plan quota at controlled prices (known as state list prices). The inputs necessary to fulfill output targets may be purchased at controlled prices. It is estimated that the proportions of agricultural products, consumer goods, and intermediate goods not transacted at controlled prices in 1986 were 76, 53, and 40 percent, respectively (World Bank 1990). The system of price controls is an implicit subsidy to buyers, which is financed by an implicit tax on producers. Thus, for example, price controls on final goods subsidize final consumers at the expense of enterprises producing consumer goods, while price controls on intermediate goods boost profitability in these enterprises at the expense of those producing intermediate goods. An illustrative calculation suggests that price controls on nonagricultural final goods reduces the index of retail prices by about 7 percent (World Bank 1990). Since indirect taxes must operate within the overall framework of price controls, taxes and price controls must be viewed as an integrated system.

Second, before 1978 state enterprises received all funds for expansion from the state and, in return, remitted all profits to the state. Recognizing that this system greatly reduced any incentive to improve efficiency, reformers introduced "profit responsibility," which replaced profit remittances with enterprise income taxes. The enterprise was allowed to keep its after-tax profits and to divide them among three alternative uses: investment and research and development, a workers' welfare fund, and wage bonuses. Because controlled prices and free inherited capital stocks (the latter equivalent to nonremovable lump sum subsidies) could lead to highly unequal profitability for enterprises in different industries, commodity taxes were set at different rates for different industries.⁴ Part of the justification for using taxes to equalize profitability could be removed by setting controlled prices to just cover costs (including any taxes that might be desired for other reasons) and by revising them regularly to reflect changes in those costs. This would not, however, eliminate inequalities in profitability that result from differences in capital stocks provided by the state.

4. Originally the commodity taxes were the product tax and the business tax. These are both turnover taxes and are gradually being replaced by the VAT.

The coexistence of two sets of prices has significant implications for tax policy analysis. Taxes on controlled-price sales are borne by the enterprise and reduce profits, thereby reducing investment, payments into the workers' welfare fund, and bonuses. In contrast, taxes on free market sales can be partly passed on to consumers and affect only the enterprise through reduced demand for its output. Since taxes in the presence of price controls are used to affect profitability in this manner (see World Bank 1990 for estimates), unifying the VAT rate structure without price reform (and charging state enterprises for inherited capital stocks) would be premature.

A tax policy model based on Chinese data was used to explore the losses that would arise from unifying VAT rates in the presence of the dual price system (for a fuller exposition, see Heady and Mitra [forthcoming a]). The model distinguishes 24 production sectors and assumes that unequal profitability generates income inequality through differences in workers' bonuses caused by backward shifting of taxes on controlled-price sales. If, instead, unequal profitability had led either to lower investment or higher external borrowing in lieu of retained profits to finance investment, the eventual result would again have reduced workers' bonuses or welfare funds.

Table 4 demonstrates the welfare losses (measured in GDP equivalents) from imposing uniform taxes and from planning and the existence of free capital. The loss is measured as the percentage reduction in income that would have produced the same reduction in social welfare. The social welfare function used in the calculation is, as before,

$$(2) \quad W = \sum_b N_b U_b^\nu / \nu$$

where N_b is employment in industry b , U_b is the utility function of a worker in industry b , and ν is the index of inequality aversion ($\nu \leq 1$). The utility function is assumed to be Cobb-Douglas in order to calibrate the function from the available data, which report budget shares spent on each sector. We take $\nu = 0$,

Table 4. *Welfare Loss (in GDP Equivalents) from Uniform Taxation and from Planning and Free Capital in China*
(percentage change)

Cause of welfare loss	Extent of planning ^a (percent)				
	0	25	50	75	100
Imposing uniform taxes	0.0	1.4	4.7	9.1	14.8
Free capital	8.0	7.6	6.3	5.1	4.2

Note: Welfare loss is measured as the percentage reduction in income that would have produced the same reduction in social welfare. It is assumed that 90 percent of capital stock is provided free by the state.

a. Planned inputs and outputs as a percentage of their 1981 values, assuming that plan prices are the same as in 1981.

Source: Authors' calculations.

whence the above reduces to

$$(3) \quad W = \sum_b N_b \log U_b.$$

The first column gives the welfare loss when there is no planning. Although the existence of free capital introduces inequality in profit and bonus payments, the homothetic preferences imposed by assuming a Cobb-Douglas utility function prevent commodity taxation from playing a role in reducing such inequality. With an assumed inelastic labor supply, uniform taxes are (subject to a qualification noted in Heady and Mitra [forthcoming a]) optimal in this case. The second column presents the welfare loss when, for each sector, the planned inputs and outputs are equal to one-quarter of their 1981 values and plan prices are the same as in 1981. The remaining columns correspond to increasing the plan quantities, always as a uniform proportion of the 1981 inputs and outputs.

The first row of table 4 shows that the loss from uniform taxation increases rapidly with the extent of planning. This occurs because planning introduces inequality in profits and bonuses, a consequence that can be offset only by sacrificing uniform taxation, which preserves efficiency in the goods market. The losses from uniform taxation are large compared with losses computed in free market economies (see, for example, Ebrahimi and Heady 1988). Even the planning of only a quarter of output produces significant losses if taxes are uniform. The second row shows that the loss from planning and free capital, with no uniformity restriction on taxes, is reduced as the amount of planned output increases because controlled prices allow nonuniform taxes to offset the inequality caused by the free capital.

Although the losses from imposing uniformity are substantial, it would be inappropriate to recommend, for example, that any country adopt a VAT with many different rates, given the administrative cost of doing so and the attendant opportunities for tax fraud and rent seeking. Instead, these results should provide evidence that considerable welfare losses could occur if tax rates were equalized without substantial price reform and capital market reform. This result is reflected in the more institutionally oriented discussion in World Bank (1990). Without such reforms, a desirable change, explored in Heady and Mitra (forthcoming b), would be to divide goods into perhaps three groups, with a "low," "standard," and "high" rate of VAT to capture some of the gains of moving from uniform to sectorally differentiated taxation.

III. INDIA: REPLACING TARIFFS WITH TRADE-NEUTRAL TAXES

The move toward an outward-oriented development strategy requires lowering tariffs and abolishing quantitative restrictions on trade. However, many developing countries rely on tariffs to raise significant amounts of public revenue. The *World Development Report 1988* (World Bank 1988) estimates that

the contribution of import taxes to public revenue is more than 20 percent in Asia, Sub-Saharan Africa, and the Middle East and North Africa, compared with 2 percent in the industrial countries. Although converting quantitative restrictions into tariff equivalents would increase revenue, reducing tariffs would be expected to decrease revenue. Several kinds of fiscal adjustments would be required to offset the revenue consequences of tariff reductions in India, a country where import duties represented 63 percent of the value of imports in 1987/88.

As in many other countries, tariffs in India comprise a protective element (known as basic and auxiliary customs duties) and a purely revenue-raising element (known as the additional or countervailing customs duty, CVD) that matches the domestic excise tax. The CVD and the excise tax levied by the central government come under the modified value added tax. In 1987/88 protective customs duties accounted for 31 percent of central government revenue, while CVDs contributed 4 percent and domestic excises 44 percent of central government tax revenue. Reduction of customs duties would therefore have a significant impact on the public finances and would require offsetting policies, most likely increases in excise taxes and CVDs. To make the tax system more trade-neutral, it is important that the adjustment be made to both the excise tax as well as the CVD (Mitra forthcoming). Assessing the budgetary consequences of tariff reduction and estimating the magnitude of the required changes in excise taxes and CVDs requires a framework incorporating the appropriate economywide linkages. In addition the categories used in tariff reform analysis are sectorally disaggregated, so that it is necessary to ascertain how the economywide changes traced above would affect, for example, various subsectors within the manufacturing sector. These objectives are accomplished by implementing two models on a common (1987/88) data base (Mitra and Go forthcoming): a 72-sector disaggregated version, which makes simple assumptions regarding certain economywide relationships, and an aggregated 6-sector version, which makes more appropriate assumptions about those relationships and suggests what corrections ought therefore to be made to the results of the sectorally detailed analysis.

The Indian economy is characterized by a budget deficit of around 10 percent of GDP and a current account deficit of more than 3 percent of GDP. To determine the magnitude of the adjustments required to support tariff reform, we calculate the average increase in excise taxes and CVDs needed to allow the government to finance its expenditures without any change in the trade deficit, given an across-the-board reduction in protective customs duties.⁵

The calculation is accomplished in several stages. First, the required average increase in taxes is calculated in the 72-sector model under the assumption that real returns to factors are held constant at their 1987/88 values. Second, the

5. The increase in excise taxes is confined to the nonagricultural sector, because the contribution of agriculture to excise tax revenue is only 0.03 percent.

responsiveness of the required average increase in taxes to changes in the real factor prices is calculated, again in the 72-sector model. Third, the 6-sector model, with flexible real factor prices, is used to determine the impact of an across-the-board cut in protective tariffs on the real returns to labor and capital. Finally, the change in factor prices (step 3) is multiplied by the responsiveness to factor prices (step 2) to adjust the estimates in step 1.

An across-the-board reduction in protective customs duties has a negative effect on public revenue and, since government consumption is fixed in real terms, on public savings. However, given that around 60 percent of imports are inputs into the production process, a tariff reduction has a favorable effect on output, private sector income, and, hence, private savings. But since only a fraction of extra private sector income finds its way into private savings, the increase in the latter does not completely offset the decline in public savings. With a given trade deficit (foreign savings), total savings in the economy decline and, notwithstanding the fall in the price of investment goods induced by tariff reduction, are not sufficient to finance investment expenditures. Since with fixed expenditures the government saves all additional revenues it receives whereas the private sector saves only part of its additional income, domestic savings may be increased by transferring income to the public sector by increasing excise taxes and CVDS. With real returns to primary factors fixed, it is estimated in the 72-sector model that a 1 percent across-the-board cut in protective tariffs would call for a 0.48 percent increase in excise taxes and CVDS.

Excises and CVDS together accounted for 48 percent of central government revenue in 1987/88 or roughly one-and-a-half times as much as protective duties. Hence it would have been tempting to conclude that an approximately 0.67 percent increase in excise taxes and CVDS would be necessary to offset the impact of a 1 percent reduction in protective tariffs. This, however, takes no account of the fact that the fall in prices induced by the tariff cuts reduces the cost of government expenditure and hence requires a smaller increase in revenue.

By boosting aggregate demand, an increase in real factor prices has an expansionary impact on the private economy and a positive effect on income, consumption, and savings. Although this increases the value of fixed-investment expenditures, the rise in private savings is larger and, using the arguments developed above, requires a reduction in taxes to transfer income away from the government. The adjustment required in excise taxes and CVDS as a result of a 1 percent average increase in nonagricultural real wages and a 1 percent average increase in nonagricultural real returns to capital is calculated to be negative and equals -6.4 and -2 percent, respectively.

The aggregated model maps the 72 sectors into 6 sectors but allows factor prices to be determined endogenously. Labor is mobile across sectors and is supplied with an elasticity of 1.2, except, as in the Bangladesh model, for the residual labor classes in the rural and urban areas. Capital is sector specific, so that its rate of return is residually determined, an assumption polar to that made

in the 72-sector model. A reduction of protective tariffs is expansionary, so that the pull of domestic demand raises real factor prices. Since capital is supplied inelastically in each sector, its average real return is bid up to a greater extent than are the returns to labor. The aggregated model shows that a 1 percent across-the-board cut in protective tariffs has a negligible impact on non-agricultural real wages, while raising average nonagricultural real returns to capital by 0.09 percent.

The previous two sets of calculations may now be used to determine the correction required because of the assumption of constant real factor prices in the 72-sector model. The change in both sets of factor prices yielded by the 6-sector model as a result of a 1 percent across-the-board reduction in protective tariffs (step 3), multiplied by the responsiveness of the adjustment factor for excise taxes and CVDs to changes in those factor prices (step 2), shows that the latter adjustment factor falls by roughly 0.2 percent for a 1 percent reduction in protective tariffs. This should be subtracted from the figure of 0.48 percent arrived at in the 72-sector model with constant factor prices to yield 0.28 percent as the average adjustment factor.

The two models together show that, depending on the assumption that is made about the elasticity of supply of capital to each sector, the order of magnitude of the average upward adjustment to excises and CVDs varies from 0.28 to 0.48 percent in response to a 1 percent across-the-board cut in protective tariffs. To recapitulate, the tariff cut raises real factor returns; the greater the effect on factor prices, the smaller the gap between savings and investment that needs to be made up by increasing trade-neutral taxes.

IV. BENEFITS AND COSTS OF TAX POLICY MODELS

The models presented above can help to address a broad range of questions in a consistent way. The benefits of these models must of course be measured against the costs that are incurred in their construction.⁶ The costs of building and running a general equilibrium model for tax policy analysis may be assessed by considering the phases of a model's "life cycle." Although the phases are not disjointed, the following breakdown is convenient: selection of model structure, compilation of a raw data base, implementation of the model, generation of a consistent data base, calibration of the model, and experimentation with the model.

The formulation of the problem at hand determines the structure of the model in a straightforward way. For instance the evaluation of excise taxes requires a fairly disaggregated description of the production structure, whereas income tax analysis may call for closer attention to income generation, transfer incomes,

6. For a detailed account of how a model can be implemented, see Dahl (1989), which reviews the necessary steps in the context of a particular model.

and the determinants of factor supplies and demands. Studies of trade taxation naturally call for a detailed description of the external sector.

The structure of the model determines data requirements. A typical model uses statistics on production, factor employment and income, demand patterns, foreign trade, and government revenue and expenditure. The data come from diverse sources. National accounts, aggregate foreign trade statistics, and government revenues and expenditures are usually easily obtained, and an increasing number of countries have household expenditure surveys and input-output tables that can be updated using other information. Employment and income statistics are harder to obtain, especially when sectorally disaggregated information is needed. In particular it is normally not possible to find reliable estimates of land use and capital stocks, which then must be "guesstimated," for example, by postulating plausible capital-output ratios. Although it would clearly be desirable to collect time series of such data in order to obtain parameter estimates for use in a model, the most important pieces of information are generally available for (at most) only a few years.

Once a raw data base has been put together, the size and structure of the model to be implemented must be decided upon. This will typically represent a compromise between the desired level of sophistication as chosen in the first step above and the realities of data availability. Until just a few years ago model implementation was a major activity, requiring a great deal of knowledge of computer programming, data base organization, and solution algorithms. The advent of modeling languages has changed this significantly. Today it is a rather straightforward matter to translate formal mathematical relationships into computer statements. For instance the General Algebraic Modeling System (GAMS), in which all three models of this article have been implemented, allows the user to input a model into a computer in virtually the same way it would be written mathematically. A compact algebraic notation allows even models as large as the one used here for Bangladesh, which contains around 2,500 equations and variables, to be written in less than two pages. The modeling languages have, furthermore, made it possible to separate model formulation from the composition of a solution algorithm, so that the formulation may be altered without necessitating corresponding changes in several thousand lines of solver code. Finally, there are several prototypical models available today that may be used as a template to formulate new models. Although each model must focus on the specific issues that it is designed to illuminate, most models share accounting identities and equilibrium conditions, which may be taken from a prototypical model without much editing. These developments make it possible for the modeler to concentrate on the important task of describing behavior and the particular institutional structure of the economy.

The next step in building a general equilibrium model is to manipulate the raw data base to produce a set of data that is specific to the model and consistent with its framework. This is a major task. The raw data base will typically contain data scattered over various years. Sector and commodity groupings tend

to differ among the input-output table, the household expenditure survey, and foreign trade statistics. Different data sources often use different definitions for households and labor groups. These need to be reconciled to produce data for a base year (and preferably for several years) with common definitions of sectors, commodities, labor categories, households, and other entities identified by the model. Once data definitions have been made uniform, inconsistencies in the data must be resolved. For instance, supplies and demands may not match for a given sector, or the savings-investment identity may not hold. Since general equilibrium models must account for all flows in a consistent manner, the data must be adjusted to produce a balanced set of numbers. Although easily implementable algorithms are available for this purpose, they tend to give equal credibility to all data entries and are therefore too mechanical to produce sensible results. It is therefore essential that modelers identify the relatively more and less reliable parts of the data base so as to make reasonable adjustments.

With the model-specific data base in place, calibration can begin. The purpose of calibration is to produce a set of parameters for the model that will enable it to reproduce the base year and to track actual economic performance over several years. Although existing procedures allow for considerable automation, the time-consuming part of the exercise lies in choosing calibration assumptions appropriately, that is, in a way that allows the predictions of the model to be consistent with good economic analysis. Since general equilibrium models embody simultaneous interactions, the structure and properties of the model must be fully understood.

Running experiments with the model, once it has been sensibly calibrated, is not usually very difficult or time consuming, partly because existing modeling languages allow parameters and behavioral assumptions to be readily changed for counterfactual analysis. Equally important from the point of view of the experiments reported in this article, some modeling systems such as GAMS allow optimization of the model. This enables optimal policies to be calculated, as in the China model, and permits comparison of optimal policies with other alternatives, such as the uniform VAT. The optimization feature also makes it possible to find general equilibrium multipliers and elasticities. Even while solving a model with as many unknowns as equations, such as the Bangladesh and India models, and thus involving no optimization, the algorithm calculates shadow prices on all constraints in the model. One set of these constraints could be that excise tax rates are fixed at their current values. If the objective function provided to GAMS is the social welfare function, the shadow price on a tax constraint is interpreted as the welfare cost of changing that tax instrument, allowing for all other changes that would occur to preserve general equilibrium. These features have been extensively used in the experiments with the Bangladesh and India models.

The examples in this article indicate the benefits that may be derived from modeling exercises. First, they allow an extensive range of questions to be investigated. Examples provided here include detailed assessments of tax pro-

posals, the sensitivity of revenue and incidence analysis to assumptions about production structures and labor market specifications, the appropriate design of tax policy in the presence of dual pricing, and the coordinated reform of tariffs and indirect taxes. Second, the range of results available are a useful input into sectoral and project decisionmaking outside the immediate context of tax policy. Thus, for example, raising Tk1 of revenue in Bangladesh through excise taxation imposes an additional economic cost over and above the revenue raised of between Tk1 and Tk2, depending on the particular tax that is raised. This highlights the importance of paying special attention to fiscal consequences in the cost-benefit analysis of public investment projects. This, for example, would reduce the attractiveness of projects that have negative budgetary implications.

Thus although the costs of modeling exercises are high, the average fixed costs of constructing tax policy models are lowered, and the exercise rendered more cost-effective, if the models are used on a continuing basis for policy analysis rather than if they are singular exercises. Thus the Bangladesh model, in addition to being used for tax policy analysis in the World Bank's tax study, has been transferred, at the country's request, to its National Board of Revenue. The China model, in addition to being used for tax analysis, is being extended in an ongoing study on price reform, and the India model has been adapted for an investigation into related macro, fiscal, and exchange rate issues.

V. CONCLUSIONS

This article has described three applications of tax policy models developed by the World Bank during the course of its economic work on Bangladesh, China, and India. The Bangladesh model was used to highlight the role of assumptions about shifting tax burdens in influencing the relative attractiveness of different options for raising revenue. Judgments on desirable directions of tax reform based on revenue and incidence analysis were shown to be sensitive to the modeling of the degree of substitution among factors in production and the conditions prevailing in factor markets in the economy. This conclusion applies to comparisons between different model specifications that, far from being extreme, implicitly underpin the assumptions about shifting actually used in partial equilibrium empirical work. Given our uncertainty about the true values of some of the underlying elasticities, and therefore about the validity of different assumptions about shifting, models should be used to identify revenue-raising tax packages that are broadly satisfactory for plausible rather than polar values of the elasticities—an approach that was followed using the Bangladesh model in the World Bank's tax study of that country. Furthermore, the robustness of recommended packages to changes in assumptions about those elasticities should be examined whenever possible.

The China model was used to examine the desirability of recommending broad uniformity of tax rates for a large number of sectors with a dual price system. Given the practical difficulties of administering a highly differentiated

tax system, that exercise provided a measure of the desirability of reforming prices and instituting charges for free inherited capital in state enterprises. More generally, the exercise illuminated the importance of viewing the tax system and its reform in its institutional context.

The India model focused on aspects of the relationship between trade liberalization undertaken to reduce anti-export bias and tax reform, in particular, the need for increases in trade-neutral taxes to offset potential revenue losses arising from reduction of tariffs in an economy in which the tariffs make a substantial contribution to public revenue. Although the need for broadly based tax reform to accompany trade liberalization is seen as important (Mitra forthcoming), the modeling exercise, by keeping track of reform-induced changes in relative prices, can indicate the magnitude of the necessary fiscal adjustment. Moreover this approach also identifies the impact of those macroeconomic adjustments or manufacturing subsectors at a level of disaggregation that is useful for more microeconomic industrial analysis.

Finally, the costs of constructing tax policy models with respect to data requirements, computing demands, and judgments regarding model structure and calibration were reviewed. The two most important and time-consuming elements of model building arise from the need to generate a consistent data base and to calibrate the model. The former requires extensive knowledge of the strengths and weaknesses of the underlying data, while the latter requires a thorough understanding of the structure of the model. These costs must be weighed against the fact that the models are capable, as shown in this article, of addressing an extensive range of questions in a consistent and potentially replicable way. Moreover some of the results generated are useful in sectoral and project analysis that transcend the immediate context of tax policy. The costs of constructing tax policy models are seen as investments in tools that can be used on a continuing basis for many types of policy analysis.

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A RETROSPECTIVE ON
THE FIFTH ANNIVERSARY OF
THE WORLD BANK ECONOMIC REVIEW

Note from the Editor

This issue completes the fifth volume of *The World Bank Economic Review*. It is a good time to take stock and to thank all those who have contributed to the journal during the past five years: authors, referees, Editorial Board members, and—most important—our readers.

The *Review* is a professional journal for the dissemination of some of the most important output of the World Bank's research program. It publishes original and rigorous research that emphasizes empirical applications and policy relevance. The cumulative index of published articles that follows lists over a hundred items. But several times that number were submitted. All submissions to the journal are sent to three referees—two outside, and one inside, the World Bank—and the Editorial Board relies heavily on their professional judgement. A list of those who have refereed for the journal during the past five years is included to acknowledge, and to thank them for, their contribution.

The *Review* is edited more thoroughly than most academic journals, and authors are pressed to pay special attention to exposition. Thanks are due to our authors and our editors for their patience with this unusual effort to make economics research more accessible.

The journal now has more than 10,000 readers, the great majority of whom are in developing countries. As part of the Bank's commitment to disseminating research, the *Review* is available without charge to readers in developing countries and in the socialist economies in transition.

Many readers have written to us during the past five years. We are happy that you find the journal so useful and stimulating, and we thank you for your comments on the articles and your suggestions about how we can make the *Review* even better. Keep them coming!

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