Ex Ante Evaluation of Policy Reforms Using Behavioral Models

François Bourguignon and Francisco H.G. Ferreira

The tools for incidence analysis of taxation and public spending reviewed in the previous chapters are fundamentally ex post. Given some tax or public expenditure, these tools show (a) who pays the tax or receives the benefits provided through public spending; (b) how much everyone pays or receives, in accounting terms; (c) how much everyone receives when taking into account behavioral responses to taxes or the free delivery of public services; and (d) what the indirect effects of public programs are. This sort of ex post analysis sheds valuable light on the actual distribution of a tax or public expenditure and thus improves policymakers’ ability to judge whether individual spending items are “worth their cost” or whether a reform of the instrument under analysis should be considered.

Ex post analyses have one significant limitation, however. Only existing taxes or public programs may be analyzed in this way. This chapter turns to techniques designed to shed light on the potential distributional impacts of policies or policy designs that do not currently exist, but that might exist in the future. Suppose ex post analysis of an existing program pointed to the necessity of reforming it. Suppose further that several alternative designs—rather than a single one—are suggested for the reform. The government might
find it helpful to have some estimate of how much each alternative reform would cost and of which households would be affected, and by how much, under each alternative. If pure experimentation on actual live subjects (such as people or communities of people) of all possible reform designs is not possible or would take too much time, no actual data would be available to evaluate these hypothetical reforms directly. Some counterfactual must be generated, showing how each household in a sample survey would fare depending on the reform being undertaken and how much the reform would cost. Since households respond to policy changes by changing their own actions, this counterfactual must rely on some representation of household behavior.

Essentially, ex ante analysis is what if analysis. What if some features of the tax system or public spending were modified? How would the modification change the situation for individual households from their initial situation, or status quo? As the introduction to this part of the volume explained, ex ante analysis is marginal because it is meant to capture differences between the proposed reform(s) and the status quo. And it is almost necessarily behavioral, because of the need to generate counterfactuals that take agent responses into account.¹

Like ex post analysis, ex ante policy evaluation that is concerned with distributional or poverty outcomes generally relies on household surveys. However, ex ante evaluation requires an additional and preliminary use of the household survey data. Whereas the secret of good ex post impact evaluation is to identify which actual samples should be compared, ex ante analysis requires the simulation of a counterfactual sample, which should represent the population characteristics of interest, as they would be under the counterfactual policy in question. To achieve that, some model is required that transforms the actual sample into the counterfactual one. At its simplest, this model may be a simple arithmetic representation of the incidence of a tax or benefit, without simulating any policy response by the agents (that is, assuming that all relevant elasticities are zero).

If a simple arithmetic representation seems inadequate because, say, one believes that the policy change may have important price or income effects on consumption or labor-supply behavior, then a behavioral model would be needed. Such a model may be obtained in one of two basic ways: through the estimation of a structural econometric model on the cross-section of households provided by the household survey; or through the calibration of a model with a given structure so as to make it consistent with what is observed in the survey.

The archetypal example of ex ante analysis of this kind is a tax-benefit model with labor-supply response, such as those commonly
estimated for industrial countries. Changes in the tax-benefit system in these models have two general effects. First, tax or benefit changes modify the disposable income of households with an unchanged labor supply. Second, through this income effect as well as through the price effects induced by changes in the after-tax price of labor, they also modify labor-supply decisions. The quantitative extent of these effects—and their net impact—is determined through a behavioral model that is generally estimated econometrically across households observed in the status quo.

There are many models of this type in industrial countries. By contrast, not much has been done along these lines in developing countries, except perhaps for a few examples of the pure accounting microsimulation approach. One reason may be that the cash element of the redistribution system is not usually important enough to modify labor supply significantly and to warrant this kind of analysis. It may also be that estimating structural econometric models of labor supply is made complex because of the informality of a large part of the labor market. Nevertheless, the growing importance of cash transfers and the increasing concern for distributional issues is generating greater need for this kind of analysis. In addition, there are dimensions of household behavior other than labor supply that matter from a welfare point of view and that may be affected by transfers and other public policies. Demand for schooling or health care are some examples.

In this chapter we first present the basic workhorse structural model used for ex ante evaluation of policy reforms: the tax-benefit model with labor-supply response. We use this model to illustrate the sequence of steps needed to build a model, generate the counterfactual distribution, and compare it with the actual in order to simulate and evaluate the reform. We then introduce discrete choice occupational or labor-supply models to show how a change in the model can be used to expand the set of policies that can be analyzed. This methodology is then applied to the simulation of a targeted conditional cash transfer in a developing country to illustrate the final steps of the ex ante evaluation approach. Extensions and limitations are considered in the last section of the chapter.

The Basic Model: Accounting for Labor-Supply Responses to Changes in Taxes

This section outlines the logical sequence a practitioner should follow when using ex ante evaluation tools to simulate alternative outcomes for a policy or program reform. To make the approach as concrete as possible, we base the discussion on a model of labor
supply decisions that are made when the budget constraints facing individuals may be nonlinear because of taxes and transfers. The basic reference is the first model of this type, proposed by Hausman (1980). We break down the approach into five steps: definition of the problem; identification of the required data; specification of the model; model estimation; and policy simulation.

**Step 1: Identify a well-defined, tractable policy reform question.**

For example, determine the likely effect of an increase in income taxes or in benefits on the distribution of incomes, and on the government's budget. The simulation approach has often been used to address fiscal questions of this type because actual tax experiments (such as the application of different tax rates to comparable population subgroups) are generally difficult to justify politically. Additionally, a model that simulated such tax changes without taking agents' responses into account would be likely to generate wrong revenue predictions.

**Step 2: Find a data set that contains reliable information on the variables that need to be included in the model.**

In this case, one would need a household or labor force survey, with information on earnings and hours of work for a representative cross-section of the population of interest. Additionally, one would ideally need information on which taxes each individual pays, and at what rates. If the best available surveys do not contain this information, then one would need a clear description of the tax rules to make assumptions (such as 100 percent compliance) about how those rules apply over the sample.

**Step 3: Write the simplest economic model that contains enough structure to capture the mechanisms that are likely to affect the agent responses to the policy under consideration.**

In this case, the logical economic structure is that of the textbook utility-maximizing consumer. An economic agent with characteristics $z$ chooses a volume of consumption, $c$, and a labor supply, $L$, so as to maximize the agent's preferences represented by the utility function $u(\cdot)$ under a budget constraint that incorporates the tax-benefit system. The important point is that the taxes under consideration enter explicitly into the budget constraint, so that any changes in the parameters of the tax system will affect the consumer’s optimal choices. This model is written in a general form below, so that other tax or transfer changes can also be considered:
(6.1) \[ \text{Max } u(c, L; z; \beta, \varepsilon) \text{ subject to } \]
\[ c \leq y_0 + wL + NT(wL, L, y_0; z; \gamma), \quad L \geq 0 \]

In the budget constraint, \( y_0 \) stands for (exogenous) nonlabor income, \( w \) for the wage rate and \( NT( ) \) for the net transfer defined by the tax-benefit schedule. Taxes and benefits depend on the characteristics of the agent, his nonlabor income and his labor income, \( wL \). Taxes and benefits may also depend directly on the quantity of labor being supplied, as in workfare programs. \( \gamma \) stands for the parameters of the tax-benefit system such as the various tax rates, means-testing of benefits, and the like. Likewise, \( \beta \) and \( \varepsilon \) are coefficients that parameterize preferences. The solution of that program yields the following labor-supply function:

\[ L = F(w, y_0; z; \beta, \varepsilon; \gamma) \]

This function is nonlinear. In particular, it may be equal to zero for some subset of the space of its arguments. The set of restrictions on the vector \( \gamma \) that ensures that \( L > 0 \) is known as a participation condition.

**Step 4: Estimate the model.**

Suppose now that a sample of agents (indexed by \( i \)) are observed in some household survey containing reliable information on \( L, w, y_0 \), and \( z \). The problem is now to estimate the function \( F( ) \) above or, equivalently, the preference parameters, \( \beta \) and \( \varepsilon \), since all the other variables or tax-benefit parameters are actually observed. To do so, it is assumed that the set of coefficients \( \beta \) is common to all agents, whereas \( \varepsilon \) is idiosyncratic. It is not observed, but some assumptions can be made on its statistical distribution in the sample. This leads to the following econometric specification:

(6.2) \[ L_i = F(z_i, w_i, y_{0i}; \beta, \varepsilon_i; \gamma) \]

where \( \varepsilon_i \) plays the usual role of the random term in standard regressions.

Estimation proceeds as in standard models, minimizing the role of the idiosyncratic preference term in explaining cross-sectional differences in labor supply. This leads to a set of estimates \( \hat{\beta} \) for the common preference parameters and \( \hat{\varepsilon}_i \) for the idiosyncratic preference terms. By definition of the latter, it is true for each observation in the sample that

\[ L_i = F(z_i, w_i, y_{0i}; \hat{\beta}, \hat{\varepsilon}_i; \gamma) \]

While the estimation process just described is conceptually simple, its implementation in practice is generally not so straightforward.
That is because of the nonlinearity of the budget constraint and its possible nonconvexity due to the tax-benefit schedule, $NT(\cdot)$, and corner solutions at $L = 0$. Functional forms must be chosen for preferences, which may introduce some arbitrariness in the procedure. Finally, it may be feared that imposing full economic rationality and a functional form for preferences severely restricts the estimates that are obtained. There has been a debate on this point ever since this model first appeared in the literature. We return to this estimation problem later, where we suggest a simple and robust alternative, the cost of which is discreteness.

**Step 5: Simulate the policy reform using the empirical estimate of the model.**

It is now possible to simulate alternative tax-benefit systems, which simply requires modifying the set of parameters $\gamma$. In the absence of general equilibrium effects, the change in labor supply due to moving to the set of parameters $\gamma^s$ is given by

$$L_i^s - L_i = F(z_i, w_i, y_0; \hat{\beta}, \hat{\varepsilon}_i; \gamma^s) - F(z_i, w_i, y_0; \hat{\beta}, \hat{\varepsilon}_i; \gamma)$$

The change in the disposable income may also be computed for every agent. It is given by

$$C_i^s - C_i = w_i(L_i^s - L_i) + NT(y_0, w_i L_i^s, y_0, z_i; \gamma^s) - NT(y_0, w_i L_i, y_0, z_i; \gamma)$$

At this point one may also derive changes in any measure of individual welfare, and construct from each of them a full counterfactual distribution over the sample.

**Discrete Models of Labor Supply or Occupational Choice**

We now return to the caveat made in the last paragraph of step 4, where we noted the main weakness of the approach outlined here so far. That is, despite its conceptual simplicity, estimation of the nonlinear (but piecewise continuous) labor-supply function is generally complex, often involving maximization of nontrivial likelihood functions and requiring the specification of possibly arbitrary utility functional forms.

It turns out that simpler and less restrictive specifications may be used that considerably reduce this problem. In particular, specifications used in recent work consider labor supply as a discrete variable that may take only a few alternative values; these specifications evaluate the utility of the agent for each of these values and the corresponding disposable income given by the budget constraint. If this
discreteness is not seen as too costly in terms of the reliability of the policy simulation under consideration, it can buy a great deal of simplicity in estimation.

As before, the behavioral rule is simply that agents choose the value that leads to the highest level of utility. However, the utility function may now be specified in a very general way. In particular, its parameters may be allowed to vary with the various quantities of labor that may be supplied, with no restriction being imposed on these coefficients. Such a representation is therefore as close as possible to what is revealed by the data.

Formally, a specification that generalizes what is most often found in the recent tax and labor-supply literature is the following:

\[
L_j = D_j \text{ if } U_j = f(z_j; \epsilon; w_j; c_j; \beta_j; \epsilon_j) \geq U_k = f(z_k; \epsilon; w_k; c_k; \beta_k; \epsilon_k) \text{ for all } k \neq j
\]

where \(D_j\) is the duration of work in the \(j\)th alternative, \(U_j\) the utility associated with that alternative, and \(c_j\) the disposable income given by the following budget constraint:

\[
c_j = y_0 + wL + NT(wD, D, y_0; z_i; \gamma)
\]

When the function \(f(\ )\) is linear with respect to its common preference parameters and when the idiosyncratic terms are assumed to be identically and independently distributed with a double exponential distribution, this model is the standard multinomial logit. It may also be noted that it encompasses the initial model 6.1. It is sufficient to make the following substitution:

\[
f(z_j; \epsilon; w_j; c_j; \beta_j; \epsilon_j) = u(c_j; D_j; z_j; \beta, \epsilon_j)
\]

This specification, which involves restrictions across the various labor-supply alternatives, is actually the one that is most often used.

Even under this more general form, one might be tempted to argue that the preceding specification is still too restrictive, because it relies on some utility-maximizing assumption. It turns out that ex ante incidence analysis or policy evaluation cannot dispense with such a basic assumption. The ex ante nature of the analysis requires that some assumption be made about the way agents choose between different alternatives. Given that, assuming that agents maximize some criterion defined in a different way for each alternative is not really that restrictive. It also should be clear that if no restriction is imposed across alternatives, then the utility-maximizing assumption is compatible with the most flexible representation of the way in which labor-supply choices observed in a survey are related to individual characteristics, including the wage rate and the disposable income defined by the tax-benefit system, \(NT(\ )\).
The fact that model 6.3 can be interpreted as representing utility-maximizing behavior is to some extent secondary, although this interpretation permits implementing counterfactual simulations in a simple way. More important is that this model fits the data as closely as possible. Interestingly enough, the only restriction affecting that objective is the assumption that the income effect in each alternative—that is, the $c_i$ argument in $f(\cdot)$—depends on disposable income as given by the budget constraint that incorporates the tax-benefit schedule, $NT(\cdot)$. The economic structure of this model thus lies essentially in the income effect. If it were not for that property, it would simply be a reduced-form model aimed at fitting the data as well as possible.

In effect, the restriction that the income effect must be proportional to disposable income seems to be a minimal assumption to ensure that this representation of cross-sectional differences in labor-supply behavior may at the same time represent a rational choice among various labor-supply alternatives. After all, within this framework, the simulated effect on individual labor supply of a reform of the tax-benefit system, $NT(\cdot)$, is estimated on the basis of the cross-sectional disposable income effect in the status quo.

The role of idiosyncratic terms, $\hat{\varepsilon}_i$ or $\hat{\varepsilon}_{ij}$, in the whole approach should not be downplayed. They represent the unobserved heterogeneity of agents’ labor-supply behavior. Thus, they are responsible for some of the heterogeneity in responses to a reform of taxes and benefits. It can be seen in equation 6.3 that agents who are otherwise identical might react differently to a change in disposable incomes, even though these changes are the same for all of them. It is enough that the idiosyncratic terms, $\hat{\varepsilon}_i$, be sufficiently different among them.

Estimates of the idiosyncratic terms result directly from the econometric estimation of the common preference parameters $\hat{\beta}$ or $\hat{\beta}_j$. Note, however, that it is possible to use a “calibration” rather than an estimation approach. With the former, some of the coefficients $\hat{\beta}$ or $\hat{\beta}_j$ would not be estimated but given arbitrary values deemed reasonable by the analyst. Then, as in the standard estimation procedure, estimates of the idiosyncratic terms would be obtained by requiring that predicted choices, under the status quo, and actual choices coincide.

Before closing this section, it is important to emphasize that there is some ambiguity about who the “agents” behind the labor-supply model 6.1 should be. Traditionally, the literature considers individuals, even though the welfare implications of the analysis concern households. Extending the model to households requires considering simultaneously the labor-supply decision of all household members of working age, a factor that makes the analysis more complex.
Applications of the preceding model are numerous in industrial countries. Surveys are given in Blundell and MaCurdy (1999) and in Creedy and Duncan (2002). The discrete approach underlined above is best illustrated by Van Soest (1995), Hoynes (1996), or Keane and Moffitt (1998). A nice application of this approach for predicting the likely effect of the introduction of the Working Families Tax Credit in the United Kingdom is Blundell and others (2000).

A Developing Country Application: Cash Transfers, Demand for Schooling, and Labor Supply

The preceding framework has not very often been applied to developing countries, for a number of reasons. First, direct transfers to households, whether positive or negative, have usually been less important in developing countries. Second, the functioning of the labor market may make the concept of labor supply somewhat artificial or insufficient in several instances. In particular, the distinction between formal and informal employment is important, with the former often being rationed and the latter often leading to an imprecise observation of income and income effects. Both limitations apply more strongly to the poorest segment of society.

Nevertheless, the broad issue of agent response to policy changes—which motivated the preceding models—is becoming increasingly relevant in the developing world, as both tax and transfer systems develop. For instance, it was observed in South Africa that the payment of lump-sum pensions to elderly people without other resources was accompanied by changes in the labor supply of the households they belonged to (Bertrand, Mullainathan, and Miller 2002). As a result, the change in monetary income in poor households differed from what had been expected. The amplitude of this phenomenon might be measured either through ex post “differences in differences” techniques of the type discussed in chapter 5, or by ex ante models of the type shown here. Of course, the ex ante approach could be useful, say, in designing reforms to the existing minimum pension system.

Progresa in Mexico, Bolsa Escola in Brazil, and similar conditional cash transfer programs in several other countries offer a second example of the ex ante evaluation approach. This section provides a summary presentation of an ex ante evaluation of the effects of Bolsa Escola in Brazil and of potential changes in the format of that program. This evaluation may be seen as an extension or a variation of the framework discussed in the previous section. The discussion is based on Bourguignon, Ferreira, and Leite (2002), where the exercise is described and analyzed in greater detail.
The Bolsa Escola program consists of transfers to households whose incomes per capita are below R$90—approximately US$30—a month, provided that all children in the household ages 6 to 15 are enrolled in a public school, and that their individual attendance rates do not fall below 85 percent in any given month. The monthly transfer is equal to R$15 per child going to school, up to a maximum of R$45 per household. This program may be considered as a conditional cash transfer program because it combines cash transfers based on a means-test with some additional conditionality, that is, having children of school age actually attending school.

Because the main occupational alternative to school is work, evaluation of the Bolsa Escola program really is a labor-supply problem similar to the one analyzed above. The discrete approach is used for each child aged 10 to 15, with the following three labor-supply alternatives, indexed by $k$: $k = 1$ if the child has some market earnings and does not go to school; $k = 2$ if the child has some earnings and goes to school; and finally $k = 3$ if the child does not work in the market but does go to school. Following equation 6.3, the utility of the household to which child $i$ belongs is specified

$$U_i^k = z_i \beta^k + \alpha^k (Y_i + y_i^k) + \epsilon_i^k$$

for $k = 1, 2, 3$. As before, $z_i$ stands for characteristics of both the child and the household; $Y_i$ is household income without the child’s earnings; $y_i^k$ is the income earned by the child in alternative $k$; and $\epsilon_i^k$ stands for idiosyncratic preferences.

The key variable for describing the conditional cash transfer program is clearly $y_i^k$, since transfers depend on income per capita in the household and on the schooling status of the child, which itself affects the child’s earnings. Under the status quo—before the program was launched—and in the household survey being used for estimation, this variable is defined as follows. In alternative 1, $y_i^k$ equals the observed market earnings of the child, $w_i$. In alternative 2, the child is assumed to work only a proportion $M$ of the time available when not going to school. The child’s observed earnings therefore are $Mw_i$ on average. In the third alternative, the child does not bring home any market earnings. But that does not prevent the child from contributing to domestic production. Assume this contribution to be, on average, some fixed proportion of the earnings obtained from market work by children with the same observable characteristics. Let $\Lambda w_i$ be the corresponding amount. A difference with model 6.3 is that $\Lambda$ is not observed.

Substituting the preceding values of $y$ into equation 6.4 leads to

$$U_i^k = z_i \beta^k + \alpha_k Y_i + \rho^k w_i + \epsilon_i^k$$
where $\rho^k$ is given by

$$
(6.6) \quad \rho^1 = \alpha_1, \rho^2 = \alpha_2 M, \rho^3 = \alpha_3 \Lambda
$$

Expression 6.5 is comparable to the discrete choice labor-supply model 6.3. It can be estimated by a multinomial logit model. A potential problem might be that this model allows estimating the coefficients corresponding to some alternative only as a deviation from those of some other alternative, which is taken as a reference. In this application, since the child’s earnings variable differs across alternatives, it is necessary to estimate all three $\alpha^k, k = 1, 2, 3$. In this case that is achieved through the restrictions given by equation 6.6, which allow the identification of the three coefficients $\alpha^k$ and $\Lambda$. It is those restrictions, and the fact that $M$ can be estimated (as a coefficient on a dummy variable for school attendance in an earnings equation for children with positive earnings) that permits estimating the whole model. See Bourguignon, Ferreira, and Leite (2002) for details.

Estimates $\hat{\beta}^k$, $\hat{\alpha}_k$, and $\hat{\epsilon}_k$ of the preferences may thus be obtained from the observation of adult and child incomes, various household and child attributes, and the demand for schooling and supply of child labor taken from a household survey conducted before the program began. Once these estimates have been obtained, the effect of Bolsa Escola on the decisions about children’s occupations is easy to simulate. The alternative with the highest utility is chosen, with the utility of each alternative being now given by:

$$
(6.7) \quad U_i^1 = Z_i \hat{\beta}^1 + \hat{\alpha}_1 Y_i + \hat{\alpha}_1 w_i + \hat{\epsilon}_i^1
$$

$$
U_i^2 = Z_i \hat{\beta}^2 + \hat{\alpha}_2 (Y_i + \gamma_1) + \hat{\alpha}_2 Mw_i + \hat{\epsilon}_i^2 \quad \text{if } Y_i + Mw_i \leq \gamma_2
$$

$$
U_i^2 = Z_i \hat{\beta}^2 + \hat{\alpha}_2 (Y_i + \gamma_1) + \hat{\alpha}_2 Mw_i + \hat{\epsilon}_i^2 \quad \text{if } Y_i + Mw_i > \gamma_2
$$

$$
U_i^3 = Z_i \hat{\beta}^3 + \hat{\alpha}_3 (Y_i + \gamma_1) + \hat{\alpha}_3 \Lambda w_i + \hat{\epsilon}_i^3 \quad \text{if } Y_i \leq \gamma_2
$$

$$
U_i^3 = Z_i \hat{\beta}^3 + \hat{\alpha}_3 (Y_i + \gamma_1) + \hat{\alpha}_3 \Lambda w_i + \hat{\epsilon}_i^3 \quad \text{if } Y_i > \gamma_2
$$

In this system, $\gamma_1$ and $\gamma_2$ stand for the parameters of the tax-benefit system being modeled. The former stands for the Bolsa Escola transfer for each child in school, and the latter is the means test. Together, these conditions incorporate the fact that Bolsa Escola can make the schooling alternatives 2 and 3 more attractive for poorer families. Moving from alternative 1 to 2 (respectively alternative 3) increases or reduces monetary income according to whether the transfer $\gamma_1$ is above or below $(1 - M) w_i$ (respectively $w_i$). In all cases, however, these moves potentially mean a higher future income for the child.

This model was estimated on all children ages 10 to 15 in the Brazilian household survey sample PNAD 1999. The number of
children under age 10 involved in market activities and not enrolled in school was not sufficient to estimate the model. Results turned out to be quite consistent. In particular, the value of $M$ derived from the comparison of earnings among those working children who do not go to school and those who do go was found to be around 70 percent. Likewise, the coefficient measuring the market equivalent of the domestic production of children going to school but not active in the labor market, $\Lambda$, was found to be 75 percent. Finally, it turned out that, as in several other studies of the demand for schooling, the income effect, as measured by differences $\alpha^2 - \alpha^1$ and $\alpha^3 - \alpha^1$, is rather weak.

After estimating all the coefficients of the model and the idiosyncratic preference terms, $\hat{\epsilon}_{ik}$, the Bolsa Escola program and alternative formats of that program were simulated on each of the households in the PNAD survey. Focusing on all children between ages 10 and 15 led to a sample of 42,000 persons. However, only 26 percent of them passed the means test in Bolsa Escola and were thus potentially directly affected by the program.

Table 6.1 shows the effect of the Bolsa Escola program on the schooling of children ages 10–15 living in poor households, as simulated with the model sketched above. The table shows that the program is indeed quite effective in reducing the number of poor children who do not go to school. Their proportion in the population of poor children ages 10–15 falls from 8.9 percent without the program to 3.7 percent under the simulated program. Interestingly enough, the proportion of children who both go to school and have some activity in the labor market tends to increase, which suggests that the program has little effect on child labor when children are already going to school. Alternative specifications of the program scenarios have the expected effect on schooling. In particular, raising the amount of the transfer or making it age-progressive further reduces the proportion of children not going to school. However, making the program more generous by changing the level of the means test has very little effect. Another interesting finding is that the schooling conditionality is extremely important to achieving the objective of universal schooling. As shown by the last scenario, the income effect attributable to the cash transfer would have practically no effect on schooling without the conditionality of Bolsa Escola.

Table 6.2 shows the expected effect of the Bolsa Escola program on poverty, defined here for the whole population and on the basis of monetary income only. This effect turns out to be more muted. The poverty headcount goes down by only 1.3 percentage points, reflecting the moderate size of the program (shown in the last row of the table), the substantial inequality within the poor segment of
Table 6.1 Simulated Effect on Schooling and Working Status of Alternative Specifications of Conditional Cash Transfer Program

<table>
<thead>
<tr>
<th>Poor Households</th>
<th>All children ages 10–15</th>
<th>Original</th>
<th>Bolsa Escola program</th>
<th>Scenario 1</th>
<th>Scenario 2</th>
<th>Scenario 3</th>
<th>Scenario 4</th>
<th>Scenario 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not going to school</td>
<td>8.9</td>
<td>3.7</td>
<td>1.9</td>
<td>0.6</td>
<td>1.8</td>
<td>3.6</td>
<td>8.9</td>
<td></td>
</tr>
<tr>
<td>Going to school and working</td>
<td>23.1</td>
<td>24.7</td>
<td>25.1</td>
<td>25.4</td>
<td>25.2</td>
<td>24.9</td>
<td>23.0</td>
<td></td>
</tr>
<tr>
<td>Going to school and not working</td>
<td>68.1</td>
<td>71.6</td>
<td>72.9</td>
<td>74.0</td>
<td>73.0</td>
<td>71.4</td>
<td>68.2</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td></td>
</tr>
</tbody>
</table>

Note: Scenario 1: Transfer equal R$30, maximum per household R$90 and means test R$90. Scenario 2: Transfer equal R$60, maximum per household R$180 and means test R$90. Scenario 3: Different values for each age, no household ceiling and means test R$90. Scenario 4: Transfer equal R$15, maximum per household R$45 and means test R$120. Scenario 5: Bolsa Escola without conditionality.

Sources: PNAD/IBGE 1999 and authors’ calculation.
Table 6.2 Simulated Distributional Effect of Alternative Specifications of the Conditional Cash Transfer Program

<table>
<thead>
<tr>
<th>Poverty measures</th>
<th>Original</th>
<th>Bolsa Escola program</th>
<th>Scenario 1</th>
<th>Scenario 2</th>
<th>Scenario 3</th>
<th>Scenario 4</th>
<th>Scenario 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poverty headcount</td>
<td>30.1</td>
<td>28.8</td>
<td>27.5</td>
<td>24.6</td>
<td>27.7</td>
<td>28.8</td>
<td>28.9</td>
</tr>
<tr>
<td>Poverty gap</td>
<td>13.2</td>
<td>11.9</td>
<td>10.8</td>
<td>8.8</td>
<td>10.9</td>
<td>11.9</td>
<td>12.0</td>
</tr>
<tr>
<td>Total square deviation from poverty line</td>
<td>7.9</td>
<td>6.8</td>
<td>5.9</td>
<td>4.6</td>
<td>6.0</td>
<td>6.8</td>
<td>6.8</td>
</tr>
<tr>
<td>Annual cost of the program (million Reals)</td>
<td>n.a.</td>
<td>2,076</td>
<td>4,201</td>
<td>8,487</td>
<td>3,905</td>
<td>2,549</td>
<td>2,009</td>
</tr>
</tbody>
</table>

Note: n.a. = Not applicable.
Scenario 1: Transfer equal R$30, maximum per household R$90 and means test R$90.
Scenario 2: Transfer equal R$60, maximum per household R$180 and means test R$90.
Scenario 3: Different values for each age, no household ceiling and means test R$90.
Scenario 4: Transfer equal R$15, maximum per household R$45 and means test R$120.
Scenario 5: Bolsa Escola without conditionality.

Sources: PNAD/IBGE 1999 and authors’ calculation.
the population, and the negative (child) labor-supply effect of the program. The comparison of the Bolsa Escola simulation with the results obtained under scenario 5—no conditionality—suggests that this last effect is small, however. Indeed, there is almost no difference in the poverty measures reported under the two scenarios. Other scenarios have the expected effect on poverty, with increases in transfer amounts being once again more potent than hikes in the level of the means test.

A much more detailed analysis than the results shown in these two tables is of course possible. Some additional detail is provided in Bourguignon, Ferreira, and Leite (2002). Because the main purpose of this chapter is to present and discuss the methodology of ex ante evaluation approaches to public redistribution programs, we go no further here. The few results presented above are sufficient to illustrate both the principles and the potential usefulness of the approach.

Despite the appeal of this methodology, few applications are available for developing countries. In most cases, applying it requires only a structural model of some dimension of household behavior that permits simulating a change in one or many policy parameters. Thus, models of demand for schooling along the lines of Gertler and Glewwe (1990) could be used to simulate the impact of several policies in the field of education, such as reducing the direct cost of schooling, providing school lunches, or changing the quality of schooling. For example, Younger (2002) uses this kind of approach to analyze the consequences of uniformly reducing the distance to school in rural Peru.

Conclusions, Extensions, and Limitations

A reliance on the multinomial logit model of discrete occupational choice (or labor supply) considerably facilitates the estimation of this kind of structural model, which can then be used to simulate the impact of policy or program reforms taking behavioral responses into account. Yet it is still probably true that starting such an exercise from scratch is not the easiest tool in this toolkit. It is therefore worth considering pure accounting ex ante marginal incidence techniques, at least as an initial step. Even this (much simpler) approach is not yet of generalized use, and one can plausibly argue that in many cases the first-order approximation generated by such a non-behavioral simulation might be informative in its own right; it may also serve as a learning stage before attempting the behavioral part of the model. A pure accounting approach to the evaluation of the Bolsa Escola program, assuming 100 percent enrollment in the program,
would have led to a poverty simulation that was a bit—but not massively—off the results obtained with the preceding simulation.

The most obvious field of application of the ex ante marginal incidence approach has to do with all the consequences of a change in the budget constraint faced by households, especially through all types of means-tested or conditional transfers. Behavioral features that are the most sensitive to income changes are the safest to study, because strong estimates for cross-sectional income effects are the most likely to translate into actual responses to a program that modifies the income of agents. Thus, labor supply and related behavior such as schooling at one end of the active life cycle and inactivity at the other end are the first candidates for behavioral analysis.

Ex ante simulations are less easy with other components of public finance because they generally involve price and quality dimensions that are very imperfectly observed. Public services financed through user fees are a case in point. If some health care facility is made available in a locality, then it is most likely that users will first be differentiated by income. If there is some cost recovery, then regular users will be those agents with an income above some threshold. Extending health care to poorer people could be done either by lowering cost recovery or by subsidizing low-income users on the basis of some permanent income criterion. Such systems are used in several countries—one example is the SISBEN system for health care in Colombia. Under the assumption of fixed price and quality, these systems could be studied with the same techniques discussed here. The problem is that quality and price are highly unlikely to stay fixed, and simulating the effects of variations in these two dimensions adds considerable complexity. Although some household surveys record visits to health centers, they do not record price and quality characteristics, or there may not be enough variation across households to estimate demand elasticities in any convincing way. The analysis may thus be only partial.

Consumption responses to changes in prices through taxes or subsidies also face this problem of zero or unknown variation in prices within household surveys. From a welfare point of view, the demand response need not be known because, as a first approximation, the effect of a price change is simply the change in total expenditures that it causes at constant consumption behavior. Behavioral responses are important only to figure out the change in net tax receipts at the aggregate level. But then, aggregate demand analysis based on time series may be used for this. The same applies to changes in the prices of goods that are produced by households, that is, the price of the output of self-employed households or simply the wage rate of those employed in the formal labor market. Overall,
analysis of indirect taxes, including labor taxes, thus differs substantially from analysis of changes in direct taxes and transfers or in the supply of public services. The latter are more susceptible to ex ante evaluation—or marginal incidence analysis—than the former.

To conclude, we stress some of the limitations of the ex ante evaluation approach that have not been mentioned explicitly in this short presentation. First, this approach may be difficult to implement because it generally requires the estimation of an original behavioral model that fits the policy to be evaluated or designed, and of course the corresponding microeconomic data. It is thus unlikely that an analysis conducted in a given country for a particular policy can be applied without substantial modification to another country or another type of policy. The methodological investment behind this approach may thus be important. Therefore, preceding this approach with a pure accounting microsimulation based on simpler assumptions can be useful. Second, we emphasize the fact that the behavioral approach relies necessarily on a structural model that requires some minimal set of assumptions. In general, these assumptions are difficult to test. In the labor-supply model with a discrete choice representation, the basic assumption is that net disposable income, as given by the tax-benefit system, is what matters for occupational decisions. A reduced form model would say that the exogenous idiosyncratic determinants of the budget constraint are what matters. Econometrically, the difference may be tenuous, but the implications in terms of simulation are huge. For instance, the modeling of Bolsa Escola is based on the implicit assumption that income is pooled at the household level. That is not a given, and simulation results would be different if the model were specified otherwise.

Finally, the strongest hypothesis is that cross-sectional income effects, as estimated on the basis of a standard household survey, coincide with the income effects that will be produced by the program under study or reforms in it. In other words, income effects over time for a given agent should coincide with the effect of cross-sectional income differences. Here again, this is a hypothesis that is hard to test and yet rather essential for ex ante analysis. The only test we can think of would be to combine ex ante and ex post analysis. For instance, one could run some ex ante analysis on a Mexican household survey taken before the launching of Progresa and then compare those results with the results obtained for schooling and income in the ex post evaluations that have been made of that program. Combinations of ex ante and ex post evaluations—such as the studies undertaken by Todd and Wolpin (2002) and Attanasio, Meghir, and Santiago (2002)—are at the cutting edge of the applied microeconomics of development.
In the absence of such validation exercises, which are possible only in rather special circumstances, some uncertainty about the predictions generated by ex ante evaluations based on structural behavioral modeling is bound to remain. That being said, ex ante evaluation can be a valuable tool to visualize the distributional impact of alternative designs of policies that are likely to generate strong behavioral responses. A pure accounting approach to marginal incidence analysis is often a useful first step. But, because people do generally change their behavior when the policy environment around them changes, introducing behavior on an ex ante basis is ultimately desirable for simulating policy reform in most realms.

Notes

1. Pure accounting micro-simulation methods need not be totally discarded, at least as a first approximation. They may be useful to describe first-round effects on a sample of households, at least when previous evidence suggests that behavioral responses may be slow to come or have small effects. We return to this point in the last section of the chapter.

2. See Creedy and Duncan (2002).

3. See in particular Macurdy, Green, and Paarsch (1990). For a survey of empirical strategies suitable for estimating a nonlinear labor-supply function such as 6.2, see Blundell and MaCurdy (1999).

4. Assuming indeed a structural specification of the $NT(\cdot)$ function general enough for all reforms to be represented by a change in parameters $\gamma$.

5. They would be standard residuals with specification 6.2 and most likely pseudo residuals in the discrete formulation 6.3.

6. This is not true of coefficients $\beta^k$, but it may be seen from 6.7 that only the knowledge of differences of these coefficients across alternatives matters when determining the utility-maximizing alternative.

7. Note that the definition of poverty used here does not coincide with the means-test in *Bolsa Escola*.

8. Note that this issue is present in the demand for schooling problem too. Although public schools in Brazil do not charge user fees, the analysis described above implicitly assumes that quality is maintained constant everywhere. Effects of quality variations in the country are simply summarized by the idiosyncratic preference terms.

9. See chapter 1 in this volume.
References

The word processed describes informally reproduced works that may not be commonly available through library systems.


