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EX-ANTE SIMULATIONS OF DIRECT AND INDIRECT EFFECTS OF WELFARE REFORMS

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This paper estimates an ex-ante structural model that incorporates behavioral labor responses to analyze the distributive impacts of a long proposed reform in Ecuador: the shift from regressive consumer gas subsidies to the progressive Human Development Bonus (HDB). Even the most radical reform options may not have the expected sizeable distributive gains. This is the case even after the targeting instrument, SelBen, substantially corrects the current targeting deficiencies of the HDB. Poverty reduction is maximized (reduing poverty by about five percentage points) when the targeting instrument redirects resources to households close to the pre-reform poverty line. Most of this estimated impact accrues from direct effects with a minimal contribution from indirect effects. Labor-driven indirect effects are multiple and complex, tending to cancel out one another.

1. INTRODUCTION

Conditional cash transfer programs (CCTs) are becoming an increasingly popular form of safety net in Latin America and elsewhere. Advocates claim that well-designed cash transfers bring together long-run investment in human capital with (gender-sensitive) short-term poverty alleviation and desirable behavioral patterns in beneficiaries (see Morley and Coady, 2003 and Das *et al.*, 2005 for reviews). CCTs have been subject to numerous impact evaluations, which have shown unambiguous success in increasing enrolment rates, improving preventive health care and raising household consumption.[1]

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[1]In Nicaragua, IFPRI (2002) estimates that the implementation of the Red de Protección Social (RPS) program increased secondary enrolment rates among girls by 22 percentage points, and by nine percentage points in Mexico (Schultz, 2004). Duryea and Morrison (2004) and Attanasio *et al.* (2006) report increases between five and nine percentage points in the probability of school attendance in Costa Rica and rural Colombia, respectively, as a result of their CCTs. In Mexico, labor among Progresa children aged 8 and 17 fell by 10 percentage points (Parker and Skoufias, 2000). Rawlings and Rubio (2003) report increases of at least 30 percentage points in the proportion of those under 3 years of age participating in growth and nutrition monitoring in Mexico and Nicaragua. Consumption of Progresa households in Mexico increased by 14 percent on average according to Hoddinot *et al.* (2000). In Brazil and Ecuador, Bourguignon *et al.* (2003) and Schady and Araujo (2006) concluded that conditionality—or the expectation of future conditionality, as in Ecuador—were critical to induce reductions in child labor and increases in school participation among beneficiaries vis-à-vis non-beneficiaries.

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In the face of the increasing evidence of benefits associated with behavior-conditioned programs, Ecuador has long been planning a reform of its single largest cash transfer program, the Human Development Bonus (HDB), in tandem with the elimination of gas subsidies. The HDB (initially known as *bono solidario*) was conceived as a temporary compensation to poor families in the midst of the economic crisis of the late 1990s. It has grown since as the largest cash transfer in the country, delivered to mothers of schoolchildren and the elderly, in households with incomes below a threshold (one million *sucres* a month in 1999). In contrast with CCTs programs in the region, HDB has yet to establish and exert its conditionalities, remaining as of today a cash transfer program. Nonetheless, there are two features that make this program still relevant from a CCT point of view. First, the current HDB results from the merging of two earlier programs, *bono solidario* and *beca escolar*. While *bono solidario* was a traditional cash transfer, *beca escolar* required school participation by children of benefiting households. Second, Ecuadorian policy-makers stressed from the onset the importance of school enrolment to receive benefits from the HDB. A widely diffused marketing strategy consisting of television spots explicitly indicated the co-responsibility of parents regarding their children's schooling and health status. Schady and Araujo (2006) report that these expectations by beneficiaries had a positive impact in the reduction of child labor and the increase of school enrolment in Ecuador.

This paper develops an ex-ante structural behavioral model simulating the distributive impact of such a substantial reform involving HDB and gas subsidies. This exercise adds to very few studies addressing the welfare consequences of social programs inducing behavioral change in developing countries before reforms take place. In contrast to those previous studies, labor behavioral responses of adults rather than child labor responses are now estimated. Labor is no longer modeled exclusively as a discrete decision, incorporating instead an additional continuous dimension. Formal and informal responses are modeled separately, as well as male and female behavior. Different behavioral responses are allowed for each alternative reform scenario simulated, having tested that such a flexible specification is adequate.

Simulations conclude that the distributive consequences of HDB reforms are limited, even when resources are substantively increased and better targeted. This conclusion is relevant given the ongoing efforts to improve the targeting of the program and the successive governments' attempts to turn the HDB into an instrument to smooth consumption shocks to the poor. Thus, the objective of the HDB is not the reduction of poverty itself but, rather, becoming a *de facto* social protection mechanism for the poor in Ecuador. Two studies have found similar results in Ecuador and Brazil regarding the limited impact of potential social transfer reforms. Cuesta *et al.* (2004) concluded that the failure of the labor-based qualifying criteria for HDB to discriminate low from middle-income households would limit the distributive gains from a prospective HDB reform in Ecuador. In Brazil, Bourguignon *et al.* (2003) argue that perverse indirect effects in the form of increasing child labor explain a very modest distributive impact of increasing transfers or lowering the qualifying income threshold. In contrast, this paper argues that even the increased capacity to identify the very poor and the moderately poor and a substantive increase in transfers may not be sufficient to render large distributive gains. Labor-driven behavioral effects are multiple and complex, tending to

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cancel out one another: for instance, reforms may generate simultaneously labor incentives from the elimination of a subsidy and disincentives to work from increases in the transfer of other subsidies. As direct effects dominate in the case of Ecuador, the reduction of poverty will be maximized to the extent that the increased HDB transfers are geared towards households closer to the pre-reform poverty line.

The paper is structured as follows. Section 2 discusses the estimating strategy for direct and indirect (or behavioral) distributive impacts following changes in the transfer of incomes to the household. Section 3 describes the characteristics of key social programs in Ecuador and the role of the SelBen index in their targeting. Section 4 summarizes the reform scenarios being considered for HDB and gas subsidies and the sources of data for the analysis. Section 5 presents and discusses the econometric and simulation results, while Section 6 summarizes the main findings of the paper.

2. Estimation of the Direct and Indirect Effects of Social Transfers

The emergence of CCTs has spurred numerous impact evaluations accounting for their induced behavioral changes among beneficiaries. Experimental and quasi-experimental impact evaluation techniques compare the effects of a program across beneficiaries vis-à-vis non-beneficiaries.[2] New evaluations on human capital and poverty impacts build up from the behavioral benefit incidence literature that typically estimates the distributive (marginal and average) benefits of existing social programs or their scaling.[3] Such evaluations[4] can be divided into ex-ante and ex-post behavioral studies, depending on the stage of the program cycle when impacts are evaluated. In the case of prospective reforms that are not already in place, ex-ante simulations are the only feasible ones to assess distributive impacts. Those simulations are rare, however. They require an additional number of assumptions about the way agents choose among different alternatives that are not already established (Bourguignon and Ferreira, 2003). In contrast, ex-post evaluations typically observe the difference between individuals confronted to or concerned with the reforms and individuals who are not (Bourguignon and Spadaro, 2006). Ex-ante simulations may also take different approaches. General equilibrium models incorporating behavior—either static or dynamic—have been long criticized for their sensitivity to modeling assumptions (see Cogneau *et al.*, 2003 for a discussion in the context of poverty reduction). Alternative partial-equilibrium behavioral micro-simulations are rarely used in the analysis of social programs in developing countries, although frequently in tax-benefit models in

[2]Experimental and quasi-experimental impact evaluation techniques differ in the way that control and treatment groups are formed: randomized before the implementation of the program in the experimental approach, while somehow "matched" after the implementation of the program in the quasi-experimental case.

[3]Van de Walle (1995, 2002, 2003), Jalan and Ravallion (2003), and Lanjow and Ravallion (1999) are examples of the use of both static and panel-based benefit incidence analysis across developing countries. Although a few studies such as Van de Walle (2002) use panel data, it is more likely that behavioral analyses use cross-section data. This is the case in this study for Ecuador. As cross-section studies do not account for dynamic effects or medium to long run effects, the estimated effects in cross-section studies should be interpreted as short-term or immediate impacts of the reform.

[4]Typically, impact studies—both accounting and behavioral based exercises—assume neither administrative nor delivery costs. They also assume identical valuations and consumption possibilities across households.

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developed countries—see Creedy and Duncan (2002) and Bourguignon and Spadaro (2006) for reviews. Bourguignon and Spadaro (2006) report that these models are also subject to limitations, such as their specificity to the policy evaluated and the corresponding micro-data and the difficulties of testing the underlying assumptions to the structural model upon which behavior is modeled.

Among the few ex-ante behavioral micro-simulations in developing countries, Bourguignon *et al.* (2003) and Cuesta *et al.* (2004) analyze social transfer reforms. Other social micro-simulations in developing countries such as Cogneau and Grimm (2004) or Cuesta (2006), among others, simulate the distributive impact of AIDS and intra-household discrimination, respectively. Bourguignon and Ferreira (2003) argue that, in addition to the technical limitations mentioned above, the rare use of behavioral micro-simulations to analyze social transfers is a consequence of typically small-sized transfer programs and the difficulty of disentangling informal and formal labor related behavior.

This study adds to the behavioral modeling literature in developing countries, and remedies the shortcomings found in the only two previous studies using a behavioral ex-ante approach to study welfare program reforms. This study differs from Bourguignon *et al.* (2003) and Cuesta *et al.* (2004) in that behavior is structurally modeled and allowed for different responses to different reform alternatives (a flexibility which is formally tested, as seen below). In contrast with Bourguignon *et al.* (2003), labor decisions refer to all working-aged household members, not only to child labor. The model also separates informal and formal responses as well as male and female decisions. Both discrete and continuous dimensions of labor (that is, participation and working hours) are included in the model.

The simplest structural modeling of labor draws from extensions to the classic consumer demand theory that incorporates interrelations among household members. Becker (1965) and Ashenfelter and Heckman (1974) are pioneering works in a large series of studies. Consumer demand models maximize household utility accruing from consumption and leisure among its members. This utility is subject to budget and time restrictions and non-negative consumption and leisure levels. The solution of this maximization problem provides the optimal labor effort (as total available time minus optimal leisure) of each household member. The optimal allocation depends on the level of hourly earnings from labor, other non-labor household incomes, and the allocation mechanism operating within the household. Under the common preference and income pooling hypotheses all individual incomes end up in a common fund that the household head distributes according to each household member's needs. In its simplest format, this intra-household allocation rule distributes all household incomes on a *per capita* basis.[5]

[5]Social scientists studying gender relations have long contested the assumption of a unitary household with common preferences and income-pooling (see Pahl, 1989; Chiappori, 1992; Jejeebhoy, 1995). An increasing intra-household allocation literature has convincingly shown that the unitary rule does not typically hold, although it has not been equally successful in demonstrating alternative mechanisms of collective behavior within the household. Furthermore, non-unitary models are believed to have strong redistributive impacts. A recent simulation study in Chile (Cuesta, 2006) reports dire impacts on poverty incidence (up to five additional percentage points) if the allocation of resources within households follows discriminatory rules. The lack of information in the household surveys in Ecuador prevents simulation of such alternative allocations in this study. However, inasmuch as intra-household discrimination exists, distributive effects estimated by the unitary rule underestimate the true impact.

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Following the standard unitary household allocation set up as an extension of the classical Ashenfelter and Heckman (1974) model using a Stone–Geary specification, household members maximize their identical preferences subject to the *total* household consumption and the total household budget constraint. In addition to assumptions on common preference and income pooling, individuals are assumed to be altruistic, that is, the consumption of other members enters each member's individual utility (Chiappori, 1988). The resulting optimization problem of the household becomes:

$$\max_{C,L_i} \prod_i U_i = (C-\chi)^{\alpha_i}(L_i-\mu_i)^{\beta_i},\ \alpha_i+\beta_i \geq 1 \tag{1}$$

$$\text{s.t. } X = Lw + C \tag{2}$$

$$X = Tw + N \tag{3}$$

$$L_i \leq T \tag{4}$$

$$L_i + H_i = T \tag{5}$$

$$C, L_i > 0 \tag{6}$$

$$(C-\chi) \geq 0 \tag{7}$$

$$(L_i-\mu_i) \geq 0 \tag{8}$$

$$\sum_i L_i = L \tag{9}$$

$$\sum_i C_i = C \tag{10}$$

where U_i stands for each household member's individual utility; $\Pi_i\ U_i$, the aggregated household utility; C, total household consumption; C_i, the consumption of the i-th household member; L, total leisure time of the household; L_i, the time that each household member devotes to leisure; μ_i, the minimum leisure acceptable for the i-th household member; H_i, individual working hours; χ, the minimum level of consumption acceptable for the household; w_i, hourly labor earnings; X, total household income; T, the maximum available time (i.e. 24 hours daily); and N, the non-labor household income, which in the Ecuadorian case refers to gas subsidies, HDB and other non-labor incomes, such as self-consumption, social transfers, retirement incomes, rents and financial incomes.

Solving the Kuhn–Tucker conditions associated with the Lagrangian of the above maximization problem provides the first order condition, which indicates the equilibrium relationship between individual consumption, leisure, and work

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effort. The resulting equilibrium defines an optimal wage, the reservation price, w_i^r, that is fundamental in determining participation in the labor market. The reservation wage is the unitary labor income at which the individual is indifferent between working or not working. In that case, $C = N$, and $T = L$, so working hours equal 0. In other cases, participation takes place (i.e. $\pi = 1$) if the individual's wage exceeds his or her reservation wage. Otherwise, the individual chooses not to participate (i.e. $\pi = 0$). Interestingly, the decision to participate is determined by individual wages, non-labor incomes (in which HDB in Ecuador is substantive, as seen below), and factors that will shape consumption and leisure levels, such as personal and household characteristics. A generalized expression (that is, without imposing a priori conditions on their shape) of these theoretical links, equation (11), is estimated econometrically. Given the discrete nature of the participation variable, π_i, a discrete choice estimating technique is used.

As for working hours, the first order condition of the maximization problem and the budgetary constraints, equations (2) and (3) determine optimal consumption (C^*) and leisure levels (L_i^*). The optimal labor supply, H_i, is then obtained from $H_i = T - L_i^*$. Conditional to participation, work effort is linked with unitary labor incomes, non-labor incomes and factors that affect the valuation of leisure, as it was the case with participation. These links are modeled in equation (12). Given the continuous nature of the working hours variable, H_i, an ordinary least square (OLS) technique is used to predict its behavior.

Interestingly, the inclusion of observed labor earnings in the estimation of participation and (i.e. conditional to participation) working hours causes selectivity bias (i.e. unobserved wages of those not working), endogeneity (unobserved wages are not randomly distributed across the sample, but are expectedly correlated with unobserved and omitted variables) and measurement error biases (Heckman, 1979). Heckman (1979) develops an estimation technique that corrects for such biases in the calculation of wages, known as the Heckman Sample Selection Correction model (*heckman*). Those corrected hourly wages, $\hat{w}_i$, are then included as explanatory variables for labor supply decisions. An additional variable, the *Mills Ratio* (λ_i), is also included in the participation and working hour models to correct for the probability that the wage of an individual is not observed in the sample. The resulting participation and working hour models to estimate become:

$$\pi_i = \gamma_0 + \gamma_1 \ln\hat{w}_i + \gamma_2[\ln\hat{w}_i]^2 + \sum_j \gamma_j \ln N_{ji} + \sum_m \gamma_m Z_{mi} + \varepsilon_{\pi i} \tag{11}$$

$$\ln H_i = \eta_0 + \eta_1 \ln\hat{w}_i + \eta_2[\ln\hat{w}_i]^2 + \sum_j \eta_j \ln N_{ji} + \sum_m \eta_m Z_{mi} + \eta_{m+1}\lambda_i + \varepsilon_{Hi} \tag{12}$$

Labor decisions are also estimated separately for males and females, following well-known results in the labor supply literature (Killingsworth and Heckman, 1986). A multinomial logit (MN) models the participation decision (π_i in equa-

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tion (11)) according to three outcomes: no participation, participation in informal occupations, and participation in formal occupations. Conditional to participation (and having previously corrected for sample selection), an OLS will model work effort for informal and formal sectors, separately.

Among their potential determinants, participation and working hour functions include non-labor incomes (N_{ji} in equations (11) and (12)). Non-labor incomes are further disaggregated in four categories: HDB for females, HDB for the elderly, gas subsidies, and the remaining non-labor incomes of the household. This separation constitutes an implicit test for the uniformity of labor effects among categories of social transfers. Previous evidence rejects such uniformity in the Ecuadorian case. Cuesta *et al.* (2003) report significantly negative participation elasticities of universal transfers; significantly negative participation and working hour elasticities of consumption-related subsidies; and insignificant participation and working hour elasticities of targeted transfers. These patterns are believed to reflect differences in qualifying criteria, the co-finance structure of public social services, age of beneficiaries and household size. Finally, the reduced-form equations include a number of exogenous variables, Z_m, that include personal and household characteristics as well as, for the working hour case, informality and the Mills Ratio (or participation correction factor).

3. Social Transfers in Ecuador and the SelBen Targeting Mechanism

The Human Development Bonus (HDB) and gas subsidies have lately attracted increased attention in Ecuador, a country whose social expenditure *per capita* remains among the lowest in Latin America (CEPAL, 2004). These two programs constitute the largest transfers in the country, accounting for 1 percent and 2.4 percent of GDP, respectively, in 1999. These programs are also significant contributors to household welfare, representing 1.3 percent and 3.9 percent of total household consumption *per capita*, respectively. Gas prices in Ecuador had been subsidized since the discovery of oil in the country in the early 1970s. The HDB scheme—then called *bono solidario* or "solidarity bonus"—was introduced in 1998 as a temporary monetary compensation for the liberalization of gas prices that year. The elimination of the subsidy was short-lived, however: fixed gas prices were reintroduced in 1999 and have been maintained ever since. A 15-kg gas cylinder cost US$1.6 in 1999 while its real price was estimated at US$5.4 (León *et al.*, 2001). The *bono solidario*, far from disappearing, became a central social protection mechanism for the poor in the recurrent periods of crisis since 1999, to the point of being widely perceived now as a permanent transfer. These *bonos solidarios* compensated the elderly, the disabled, and mothers in poor households with dependants (under-18s) who were not affiliated to the Ecuadorian Institute of Social Security. To qualify for benefits, households must earn less than a million *sucres* per month (US$95 in 1999) from labor, or fail to have regular labor earnings (i.e. a fixed term contract). In 2000, the unitary benefit was increased and the program name changed to HDB. In 2003, some US$150 million was transferred through HDB to almost 1.28 million beneficia-

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TABLE 1

DISTRIBUTION OF BENEFITS ACCORDING TO THE SELBEN INDEX

Household Consumption *per capita*, Quintiles	[1] Gas, Initial Distribution (%)	[2] Gas, "SelBen-Poor" Distribution (%)	[3] HDB, Initial Distribution (%)	[4] HDB "SelBen-Poor" Distribution (%)
1 (poorest)	8.4	21.3	27.1	30.5
2	14.1	31.5	27.8	28.9
3	20.5	26.3	25.4	22.6
4	24.6	15.8	11.7	13.4
5	32.4	5.1	4.0	4.6
Total	100	100	100	100

Note: The cut-off point determining the "SelBen-poor" allocation of benefits is 51.9.
Source: SIISE (2000) and authors' estimates.

ries.[6] In 2004, the program was reformulated to become a CCT, merging the *bono solidario* with *beca escolar*. The latter was introduced at the end of the 1990s. It transferred US$5 per month per child (up to two children per household) conditional to school enrolment and assistance of at least 90 percent of school days. The "new" HDB was then advertised as a CCT and television spots were aired indicating the co-responsibility of parents towards the health and education status of their children as a counterpart for benefit reception. However, conditionalities have been never detailed, enforced nor monitored. Although reasons for that failure to develop conditionalities are unclear, delays in the application of the means-test instrument, the SelBen index, left the selection of beneficiaries a first-come first-served exercise (Schady and Araujo, 2006). Also, the widely accepted current view of the HDB as a permanent transfer would hamper the effective use of possible conditionalities towards graduation of the HDB and updating its roster of beneficiaries.

The distribution of benefits from HDB and gas subsidies varies significantly, HDB being better targeted. Vos *et al.* (2003) show that the poorest 40 percent of households capture only 22.5 percent of total gas benefits compared with some 54.9 percent of HDB benefit. However, households in the intermediate region of the distribution of consumption capture a very similar share of benefits from each program: 45.1 percent of total gas benefits accrue to the middle income groups, while 37.1 percent of total HDB benefits end up in those same households (see Table 1, columns 1 and 3). Cuesta *et al.* (2004) argue that the substantial benefits accruing from HDB to middle income groups are the result of weak qualifying criteria. Only 40 percent of the active labor force self-reported monthly earnings of over a million *sucres*, and only 16 percent reported having a fixed-term contract in 1999.

The widely-acknowledged targeting deficiencies of the HDB have stirred up a strong demand for its reform. Those urging targeting improvements have also

[6]According to official figures by SIISE, the *bono solidario* benefited some 1,279,576 individuals in June 1999 (SIISE, 2000). In December 2003, according to SIISE figures, there were 1,324,019 HDB beneficiaries; by June 2004, this figure had declined to 1,090,306 after the introduction of SelBen targeting. This decrease in the number of beneficiaries is attributed to improved targeting, but also the impossibility of computing the SelBen index among all HDB beneficiaries. Special registration committees at the local (*parroquia*) level have been formed to amend this situation.

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TABLE 2
DISTRIBUTION OF SELBEN INDEX AND HOUSEHOLD CONSUMPTION

Household Consumption *per capita*, Quintiles	SelBen Distribution, Quintiles (% of beneficiaries)				
	1 (poorest)	2	3	4	5
1 (poorest)	91.32	34.90	0.04	0	0
2	8.34	57.65	37.46	1.16	0
3	0.35	7.06	57.74	30.90	0
4	0	0.40	4.75	65.10	16.53
5	0	0	0	2.84	83.47
Total	100	100	100	100	100

Note: Cut-off points determining the quintiles of the SelBen index are, respectively, 35.1; 42.3; 49.3; 58.4.
Source: SIISE (2000) and authors' estimates.

advocated an increase in resources for the HDB program resulting from the elimination of gas consumption subsidies. The household-based targeting index, SelBen, was created in 2000 partly for this purpose. SelBen is a comprehensive index of household living conditions weighting 27 variables reported in the latest *Encuesta de Condiciones de Vida* (ECV; see INEC, 1999). Variables refer to the education, health, and social protection conditions of the household head, spouse and other members; household demographic composition and geographic location; and households' access to basic public services and consumer durable goods. Using principal component analysis, the correlation of each of these variables with the first factorial component determines the individual weight of each variable in the composite index. The resulting index is normalized into a 0 to 100 point scale, where 0 demonstrates maximum vulnerability and the highest priority for the targeting of social benefits. A cut-off point of 51.9 in the SelBen 100-point scale separates two categories of households: the poor (households below the cutting-off point) from the non-poor (above that point) or, more importantly, households that will benefit from social programs from those that will not. A second cut-off point at 43.3 in the 100-point scale discriminates between the poor and the very poor. Table 2 shows the distribution of the SelBen index in terms of household consumption.

Table 2 shows that SelBen efficiently identifies beneficiaries among the poorest household consumption quintiles using the living conditions ECV 1999. The bottom quintile of the SelBen index (up to a cutting-off point of 35.1) reportedly contains 91 percent of the poorest quintile of the household consumption *per capita* distribution. However, the targeting efficiency of the SelBen index decreases rapidly when other quintiles of the SelBen index are used. The proportion of beneficiaries captured by the two bottom quintiles of the SelBen index distribution (i.e. up to 42.3 in the scale) is 92 percent, that is, only an additional 1 percent of those captured by the bottom quintile of the SelBen index. However, less than 35 percent of the beneficiaries belong to the poorest quintile of household consumption *per capita*. When other quintiles of the SelBen distribution are used for targeting purposes, beneficiaries do not belong to the poorest quintile of household consumption *per capita*, compromising targeting efficiency.

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This begs two questions, one regarding targeting effectiveness, the other, poverty reduction effectiveness: How much would targeting have been improved if HDB and gas subsidies had been allocated using the SelBen index? How much reduction of poverty should be expected to happen following such a reallocation based on the SelBen index? If the poor cutting-off point of 51.9 in the 100-point scale were used to identify beneficiaries, the resulting distribution of gas subsidies would improve considerably (see Table 1, columns 2 and 3). However, little distributive benefit should be expected from a SelBen-based reallocation of HDB. As the cut-off point of 51.9 falls within the next-to-top quintile of the SelBen distribution, it will only be effective in identifying beneficiaries within the upper part of the household consumption distribution. It is in that region of the distribution that beneficiaries of the gas subsidies abound and beneficiaries of HDB are scarce. Interestingly, even though SelBen may potentially increase targeting efficiency (that is, identify beneficiaries belonging to low income groups), its use will not systematically produce large redistributive gains (that is, take these households out of poverty or alleviate much their poverty gap). This seems to confirm the conclusion of Coady and Skoufias (2004) that the shift from universal to targeted subsidies in Mexico increased targeting efficiency without sizeable redistributive gains, even when poverty reduction was not their main objective. Similar results are also found in Brazil. Bourguignon *et al.* (2003) show that even though school attendance would increase significantly from raising transfers and making them age-progressive, the impact on poverty would be very limited (little more than one percentage point). The authors argue that high initial inequalities and adverse distributive effects from increasing child labor are to blame.

4. Simulation Scenarios of Social Transfer Reforms

Concrete proposals for social reforms have not yet been laid out in Ecuador. Consequently, this paper considers the reform of gas subsidies and HDB using several possible scenarios. Table 3 describes these scenarios: in the first, the elimination of gas subsidies is not compensated; in the second, gas subsidies are shifted to the HDB, maintaining the current qualifying criteria for beneficiaries; in the third, gas subsidies are shifted into HDB, which in turn is reassigned to households classified as poor by the SelBen index (i.e. beneficiaries do not exceed a cut-off point of 51.9 in the 100 point scale). The other two scenarios reassign the shifted resources from gas subsidies to HDB targeted to the extreme and moderate poor, respectively. The first scenario is resource-saving; the other four are fiscally neutral. Thus, the redistributive consequences of the simulated reforms are solely the result of a better use of available resources.

A second consideration refers to a trade-off between unitary benefits and the number of beneficiaries from the simulated reforms. The increase of aggregated HDB resources may not increase unitary HDB benefits if the increase in the number of beneficiaries from better targeting is sufficiently large. This is true in the case of shifting gas subsidies using the SelBen index to identify beneficiaries (vis-à-vis a shifting of gas subsidies with the current targeting). The simulations also assume costless targeting and no substantive substitution effects among

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TABLE 3

SIMULATED REFORMS OF GAS SUBSIDIES AND HDB

Scenario	Gas Subsidies			Human Development Bonuses		
	Amount Transferred	Structure	Monthly Average Household Transfer To Beneficiary	Amount Transferred	Structure	Monthly Average Household Transfer To Beneficiary
Baseline	$279 million	Original	$12.88	$117 million	Original	$15.42
Simulation 1. Elimination of gas subsidies	0	Scrapped	0	$396 million	Original	$15.42
Simulation 2. Elimination of gas subsidies and funds shifted to HDB with current targeting	0	Scrapped	0	$396 million	Original	$23.73
Simulation 3. Elimination of gas subsidies and funds shifted to HDB with SelBen-based targeting	0	Scrapped	0	$396 million	SelBen "poor"	$22.90
Simulation 4. Elimination of gas subsidies and funds shifted to HDB with SelBen-based targeting towards the extreme poor	0	Scrapped	0	$396 million	SelBen "extreme poor"	$22.90
Simulation 5. Elimination of gas subsidies and funds shifted to HDB with SelBen-based targeting towards the moderate poor	0	Scrapped	0	$396 million	SelBen "moderate poor"	$22.90

Note: Baseline poor households are those with *per capita* incomes below the individual poverty line officially estimated at US$95 monthly in 1999. This is the cost of the basic consumption basket officially established in 1999.

Source: Author's estimates from INEC (1999) and Cuesta *et al.* (2004).

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energy sources in the short-run. Energy substitution at the residential level may not take place in the short-run if it implies costly investments to the users; technological or economic reasons constrain the supply of alternative sources of energy; the government fails to incentive the switch to other sources. These three conditions concur in Ecuador.[7]

The simulations are constructed in six steps. First, baseline poverty indicators are estimated using the ECV 1999 survey (INEC, 1999) compiled by the Ecuadorian Institute of Statistics and Census (INEC, 1999). Data were collected in three-month waves throughout 1999 using a stratified and multi-phase survey design. The national sample consisted of 25,980 individuals belonging to 5,824 households. As a Living Standard Measurement Survey type, the ECV 1999 provides information on individual access to social programs, including HDB, as well as public education and health services. It also reports consumption of gas, electricity and fuel, from which their implicit subsidies can be estimated. The survey also provides information on living conditions, income and consumption levels among households. The ECV 1999 specifies labor participation and working hours of household members and other demographic and geographic characteristics of households. Table 4 summarizes key descriptives of Ecuadorian households.

A second step in the simulations consists of working out the direct effects of the reforms across the entire distribution of households, that is, also including those households without initial beneficiaries of the programs. The simulated changes in gas subsidies and HDB are incorporated into new distributions of household incomes, and poverty indicators are re-estimated. The resulting differences with the baseline poverty indicators constitute the direct distributive effects of reforms. Thirdly, labor supply responses induced by changes in gas subsidies and HDB are estimated separately for males and females, participation and working hour decisions, and informal and formal occupations. In the absence of any indication of alternative intra-household behavior in Ecuador, households are also assumed to behave according to unitary allocation rules.

Disaggregated labor supply responses are re-estimated in each scenario. This allows for structural changes (if any) in labor decisions following social reforms to be taken into account. The small number of responses in the ECV concerning secondary jobs prevented a further exploration of specific effects from primary versus secondary jobs. In any case, the underlying assumption of the present supply model is that desired labor supply meets labor demand. In other words, labor market rigidities do not cause a substantial difference between desired work

[7]Although there are no studies specific to Ecuador, a study in Honduras found that low-income groups were not ready to substitute the current source of energy for cooking following an increase of its price because the purchase of a stove operated by other sources represented a sizeable investment for the household (see González and Cuesta, 2003). Similarly, Keener and Banerjee (2006) report that only 4 percent of consumers interviewed in Ghana would substitute electricity for other energy sources vis-à-vis 72 percent who would reduce consumption if subsidies were eliminated. Also, there are no plans in Ecuador to increase its electrical generation capacity by the construction of new hydro- or thermo-electrical plants, and the use of solar thermal systems for water heating uses remains marginal (FEDEMA, 1999). As for economic arguments, diesel, electricity and gasoline have all observed annual increases in their real prices of between 2.5 and 6.6 percent throughout the 1990s, while prices of gas and oil went down between 4 and 2 percent annually (Falconí, 2002). Finally, one should not overlook the dire political consequences of eliminating gas subsidies in Ecuador, even if further compensation were to be offered.

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TABLE 4

SOCIOECONOMIC CHARACTERISTICS OF ECUADORIAN HOUSEHOLDS, 1999

	Male Headed	Female Headed	All Households
Number of households, by household head	1,907,804	480,089	2,387,893
Average size of household, by household head	4.6	3.7	4.5
Average schooling years of household head	7.6	6.7	7.4
Total household consumption[1]	2,819,000	2,390,000	2,730,000
Per capita consumption[1]	719,000	823,000	740,000
Average gas consumption per household (monthly gas cylinders)	1.45	1.40	1.45
Average gas subsidies per household[1]	131,000	126,000	130,000
Average HDB benefits per household[1]	89,000	128,0800	97,000
Average other non-labor incomes of the household[1]	180,000	182,000	175,000
Total household incomes[1]	2,580,000	1,950,000	2,460,000
Participation rate (14+)	89.2%	65.2%	76.9%
Participation in informal market (14+)	56.1%	56.0%	56.1%
Weekly working hours (14+)	43.0	33.8	39.2

Note: [1]Consumption and incomes are expressed in monthly 1999 *sucres* unless otherwise indicated. 1999 annual average exchange rate, 10527 *sucres* per US$. Informality is defined according to occupation and working conditions. Informal workers are wage-earners, non-professional self-employers and employers in workplaces with less than six employees, both in agricultural and non-agricultural activities and domestic service employees with or without salaries. Household non-labor benefits are reported as national averages for beneficiaries and non-beneficiaries.

Source: INEC (1999).

effort and observed work effort. Large informal sectors such as that in Ecuador are consistent with the idea of flexible occupations, where individuals can achieve the desired number of work hours.

Fourthly, the estimated changes in participation and working hours in each scenario are translated into monetary terms, that is, they are expressed as changes in the original labor earnings of household members. This translation is not straightforward, as reforms may alter the original participation status of individuals. In cases of induced participation (from no participation), each working hour provided is valued at the average hourly labor earnings imputed in the baseline scenario. Changes in working hours among individuals who continue to participate in labor activities are valued at the baseline average hourly labor earnings reported by the ECV 1999 survey.

Fifthly, new distributions of household incomes are constructed for each scenario, after including direct changes of social incomes and indirect changes of labor incomes.[8] Finally, poverty indicators are re-estimated along the new distributions of household incomes. The differential between baseline indicators and indicators obtained in each scenario constitutes the overall distributive impact

[8]Household income based measures of poverty are chosen to estimate distributive impacts instead of consumption measures because they avoid additional assumptions on how the monetary value of the labor decisions is converted into consumption decisions, and how these decisions change across different types of households. It would be very difficult to assess how the loss of gas subsidies will affect consumption behavior and ultimately consumption-based poverty measures. Household surveys in Ecuador do not report consumption or prices, just total expenditures on gas. Besides, energy consumption behavior may not change substantively if energy sources are not easily to substitute (that is, require costly installation costs, for example).

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TABLE 5

Sample Selection Corrected Hourly Labor Earnings for Individuals 14+

	Hourly Labor Incomes, Log		Probability of Observing Labor Incomes	
	Coef.	Std. Error	Coef.	Std. Error
Schooling years	0.0919	0.0034	0.0113	0.0031
Age	0.0620	0.0048	0.1333	0.0042
Age square	–0.0007	0.0001	–0.0015	0.0001
Gender (being a female)	–0.7726	0.0349	–1.0408	0.0251
Ethnicity (being indigenous)	–0.3941	0.0630		
Marriage			–0.0697	0.0294
Residence (rural as reference)				
Dummy for Quito	0.5898	0.0467	0.1094	0.0454
Dummy for Guayaquil	0.1644	0.0501	0.2751	0.0402
Dummy for other cities	0.0579	0.0370	0.2361	0.0315
Location (Highlands as reference)				
Dummy for Coast			–0.0912	0.0302
Household size			–0.0321	0.0053
Household universal social transfers (×1,000,000)			–0.158	0.0380
Constant	11.6588	0.0912	–1.6950	0.0857
Rho	0.0455*	0.0218		
Wald χ^2 (8)	2,203.32**			
Wald independence test (H_o: $\rho = 0$)	4.33*	Prob > χ^2 =	0.0374	

Note: Number of observations: 17071 censored: 7348; non-censored: 9723. The independence of the two equations is accepted at a confidence interval of 95 percent. (**) indicates that a coefficient is significantly different from 0 at a 99 percent confidence; (*) indicates that a coefficient is significantly different from 0 at 95 percent; and ( ) indicates that a coefficient is not significantly different from 0 in intervals of confidence higher than 95 percent. Labor earnings are net of taxes and social security contributions.

Source: Authors' estimates using ECV 1999 (INEC, 1999).

attributed to each reform. These impacts are then broken down into relative contributions from direct and indirect effects.

5. Simulating the Distributive Effects of Social Transfer Reforms Sample Selection Corrected Hourly Labor Earnings

Table 5 reports the regression results of hourly labor earnings—net of taxes and social security contributions—estimated by a sample selection correction *heckman* model. The independence test indicates that there is in effect a selection mechanism affecting work decisions, this effect being statistically significant at a 95 percent level of confidence. Corrected hourly labor earnings depend on individual schooling years, age, gender, ethnic group and household location. This selection follows standard practices in the literature (see Killingsworth and Heckman, 1986; Pencavel, 1986) and specifically applied to the Ecuadorian case in Cuesta *et al.* (2003). Estimates show an annual return to schooling of 9.2 percent; a non-linear relationship between age and hourly labor earnings (44 years of age being the turning point); a 53 percent hourly earnings gap to the detriment of females; and hourly earning gaps in favor of urban areas over rural areas, of nearly 6 percent in most cities, and as high as 80 percent in Quito. Other things being equal, ethnicity

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reduces hourly earnings by almost a third compared to non-indigenous rates. All these variables, with the exception of ethnicity, are also used to determine the selection function, that is, the individual probability of working. MacIsaac and Rama (1997) show that ethnicity in Ecuador affects working conditions more than access to work. In order to specify the selection function, other variables potentially affecting working decisions but not wages are also included: marital status, coastal location, household size and universal social transfers received by the household. They are all statistically significant and have the expected signs with respect to the probability of working.[9] In particular, being married or living with a partner decreases the probability of that individual working by almost 7 percent, while the presence of an additional member of the household decreases the probability by 3 percent. Also, receiving universal transfers reduces the probability of observing labor incomes in the household significantly (every US$10 monthly increase in universal benefits reduces the probability by 1.5 percent).

Labor Supply Functions

In Table 6, specification tests[10] confirm that the decision to participate in labor markets in Ecuador is appropriately described by a three-option choice: no participation, participation in informal occupations, and participation in formal occupations. This is to be expected from a country such as Ecuador, with a large informal market. Informal labor may well be a strategy used by Ecuadorians to increase their work effort to desired levels when this is not possible in formal markets. This explanation is consistent with the traditional view of informal work as a residual of better (but typically rationed) formal jobs, although recent observers question the usually involuntary character attributed to these activities. Maloney and Núnez (2003) argue that the informal self-employed (and, to some extent, the informal salaried) reflect voluntary optimal-decision preferences, institutional constraints and formal labor productivity in Latin America. Specific to Ecuador, MacIsaac and Rama (1997) argue that several features of the labor market confer much greater flexibility than its cumbersome regulation initially suggests.[11] More interestingly, they argue that after controlling for education and other socioeconomic and geographical characteristics, hourly earnings in the public sector are not, on average, significantly different from those in the informal sector (excluding agricultural work from the latter category). Specification tests also confirm that gender-specific labor functions are preferred specifications for describing labor supply in Ecuador. This follows the traditional practice in the labor supply literature, which has, since the early 1980s, customarily modeled labor decisions separately for males and females (Killingsworth,

[9]Universal transfers are by definition independent of household income levels, so there is no endogeneity between these incomes and labor decisions.

[10]Appendix 1 presents the estimated labor supply functions for *probit* participation functions with and without sample corrected wages, as well as OLS functions without gender disaggregation.

[11]Among such features, the authors emphasize the weak capacity of enforcing labor market regulations, especially minimum wages; the limited unionization of the labor force (less than 10 percent); the extended practice of adjusting downwards based earnings (up to 39 percent) to "compensate" for mandatory benefits; and the low levels of social security compliance (roughly 20 percent).

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TABLE 6

ESTIMATED LABOR SUPPLY MODELS FOR INDIVIDUALS AGED 14+

	Participation (Multinomial Logit)				Working Hours (OLS)			
	Male, Informal (1)	Male, Formal (2)	Female, Informal (3)	Female, Formal (4)	Male, Informal (5)	Male, Formal (6)	Female, Informal (7)	Female, Formal (8)
Prime age male, head	2.251	2.381			0.092	0.203		
	(0.304)**	(0.301)**			(0.038)*	(0.025)**		
Prime age female, head			0.814	0.925			0.280	0.260
			(0.237)**	(0.230)**			(0.090)**	(0.063)**
Prime aged male, no head	0.616	0.615			0.010	0.118		
	(0.132)**	(0.136)**			(0.037)	(0.030)**		
Prime aged female, no head			0.150	0.066			0.113	0.024
			(0.082)	(0.086)			(0.050)*	(0.045)
Household size	0.012	–0.021	0.002	–0.017	0.015	0.015	–0.004	0.017
	(0.025)	(0.026)	(0.015)	(0.016)	(0.006)**	(0.005)**	(0.009	(0.008)*
Dummy for Quito	–1.861	–1.106	–1.008	–0.273	–0.166	0.086	–0.108	0.062
	(0.224)**	(0.231)**	(0.152)**	(0.161)	(0.083)*	(0.039)*	(0.088)	(0.066)
Dummy for Guayaquil	–0.974	–0.688	0.039	0.401	–0.015	–0.011	0.209	0.273
	(0.187)**	(0.197)**	(0.114)	(0.123)**	(0.057)	(0.034)	(0.090)*	(0.074)**
Dummy for other cities	–0.482	–0.063	–0.034	0.268	–0.041	–0.032	–0.021	–0.006
	(0.158)**	(0.168)	(0.094)	(0.108)*	(0.033)	(0.027)	(0.048)	(0.051)
Dummy for Coast	–0.229	0.084	–0.991	–0.658	–0.102	0.001	–0.461	–0.385
	(0.151)	(0.159)	(0.093)**	(0.106)**	(0.035)**	(0.025)	(0.057)**	(0.050)**
Log sample corrected wage	0.209	0.972	0.056	0.737	–0.065	–0.084**	–0.047	0.152
	(0.108)*	(0.114)**	(0.073)	(0.083)**	(0.039)	(0.025)	(0.047)	(0.045)**
Household gas subsidies	–5.379	–2.071	–2.994	0.411	–0.423	0.245	0.262	–0.113
	(0.751)**	(0.800)**	(0.538)**	(0.574)	(0.234)	(0.150)	(0.20)	(0.259)
Household HDB, mothers	2.196	1.051	1.073	–1.274	0.087	–0.112	–0.435	–1.142
	(0.882)**	(0.943)	(0.504)*	(0.592)	(0.215)	(0.143)	(0.325)	(0.283)**

Table 6 continued on next page

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TABLE 6 (*continued*)

	Participation (Multinomial Logit)				Working Hours (OLS)			
	Male, Informal (1)	Male, Formal (2)	Female, Informal (3)	Female, Formal (4)	Male, Informal (5)	Male, Formal (6)	Female, Informal (7)	Female, Formal (8)
Household HDB, elder	–0.208	–5.165	1.513	0.644	–0.962	–1.192	–0.981	–0.071
	(2.183)	(2.469)*	(1.565)	(1.775)	(0.746)	(0.559)*	(0.703)	(0.821)
Household other transfers	–0.005	–0.009	–0.078	–0.043	–0.000	–0.010	0.017	0.029
	(0.078)	(0.082)	(0.037)*	(0.036)	(0.024)	(0.008)	(0.020)	(0.021)
Mills Ratio					–0.748	–0.724	–0.251	–0.055
					(0.091)**	(0.072)**	(0.069)**	(0.084)
Constant	–0.434	–11.739**	0.445	–9.197	6.247	6.368	5.672**	2.874
	(1.407)	(1.477)	(0.888)	(1.016)**	(0.521)**	(0.348)**	(0.606)	(0.610)**
No. observations	5,305		6,590		2,550	4,531	2,159	3,032
Wald χ^2	576.31		551.66					
F (r, n)					10.19**	19.54**	8.75**	13.50**
R^2	0.0978		0.0569		0.0935	0.0892	0.0718	0.0841
Log. P-likelihood	–4,556.30		–6,759.16					
Hausman Specification Test	H_0: difference between probit and logit not systematic $\chi^2(14) = 21.73$; $P > \chi^2 = 0.084$ H_0 is accepted, Independence of irrelevant alternatives accepted.				H_0: difference in coefficients not systematic by gender $\chi^2(12) = 259.32$; $P > \chi^2 = 0.0$ H_0 rejected, gender specifications accepted			

Note: Standard errors in parentheses. (**) indicates that a coefficient is significantly different from 0 at a 99 percent confidence; (*) indicates that a coefficient is significantly different from 0 at 95 percent; and ( ) indicates that a coefficient is not significantly different from 0 in intervals of confidence higher than 95 percent.

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1983). In Ecuador, MacIsaac and Rama (1997) also suggest the existence of gender and ethnic gaps in the hourly earnings of otherwise identical workers.[12]

Estimated participation coefficients have the predicted signs. Age, gender and household position affect the decisions to participate in both formal and informal occupations. Higher responsibilities associated with age and household position increase the probability of participation, and this effect is between two and three times higher for males than females. Non-participating males are most likely to be found in urban areas, with insignificant differences between highlands and coastal locations.

Labor inactivity seems to be rarely affordable. Females find more formal opportunities in urban areas, except in Quito. There and in coastal locations, females appear to find less formal opportunities. As expected, corrected labor earnings per hour increase participation by type of occupation and gender. Wage coefficients on participation are larger in formal than informal sectors, among both males and females. This is unsurprising given the typically more diverse composition of labor earnings among informal workers.

Participation coefficients vary among categories of social transfers. This interesting result has already been documented for Ecuador (Cuesta *et al.*, 2003), and in other studies in Latin America and elsewhere (Coady *et al.*, 2004). In the Ecuadorian context, gas subsidies typically have a negative effect on participation. This effect is two to three times higher than the positive effect from HDB. Increasing gas subsidies provokes a dominant income effect, which is unsurprising for a subsidy tied to household welfare levels. In contrast, a higher HDB reflects larger vulnerabilities for the household, and a coping strategy consisting of increased labor participation. These vulnerabilities may be caused either by original low-income levels or by larger numbers of children and the elderly, as these two factors constitute qualifying criteria for HDB. This would also explain why household size has no significant effect, on its own, on participation decisions: HDB captures the size effect. Interestingly, HDB for the elderly does not have a significant impact on individual participation decisions, since receipt of that subsidy simultaneously increases household needs, and the probability that other household members participate in household production activities. Similarly, the distinctive single effects of universal, consumption-linked and targeted social transfers aggregated in "other household transfers" may well cancel one another out. The estimated coefficient in this study supports previous evidence for Ecuador, reported in Cuesta *et al.* (2003), of a complex distribution of contradictory impacts from different social transfer categories. As a result, distributive impacts from labor-driven decisions are expected to be small in magnitude.

As for working hours, responsibilities shaped by age, position and gender increase the supply of working hours. Corrected unitary earnings per hour affect the working hour decisions only of formal workers. These effects have different signs: negative for males, positive for females. These results fall in the wide range of effects from social transfers in working hours reported in the labor supply

[12]Such gaps amount to 33 percent and 15 percent, respectively, for the whole sample of workers. These gaps are smaller than those estimated in this study. The MacIsaac and Rama study, however, does not correct for sample correction bias. Also, its earning functions fail to control for household socioeconomic characteristics such as household size or other non-labor income sources.

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literature. Signs and magnitudes depend on the specification used and the degree of self-selection (Mroz, 1987), with a safe interval of working hour elasticities between –2.0 and 2.0 (Pencavel, 1986; Licona, 1997). In Ecuador, Cuesta *et al.* (2003) report elasticities of –0.55 for aggregate social expenditures on working hours. Increases in household size lead systematically to increases in working hours, also an indication that it is through this labor dimension that households react to greater household needs. Coastal location reduces working hours, which is probably explained by the devastation in the form of floods caused by the climatic phenomenon of "El Niño" during 1997 and 1998.[13] Urban location seems to reduce the number of hours worked by males compared with rural areas, but this effect is mixed in the case of female working hours. Furthermore, social transfers do not seem to have a significant effect on working hour decisions. All coefficients are found to be statistically insignificant, with the exceptions of HDB of mothers in female formal work and HDB of the elderly in male formal work. This could be associated with higher demands on individuals' time in the household when HDB claims increase. In contrast, gas subsidies have no impact on working hour decisions. This evidence for Ecuador reinforces the traditional empirical finding that labor decisions at the margin are more responsive to non-labor incomes (Heckman, 1993). In Ecuador, too, once an individual decides to participate and reaches a desired level of work effort, minimal working hour variations are to be expected.

Distributive Effects of Gas Subsidies and HDB

In the only previous study simulating the distributive impacts of social policy reforms in Ecuador (Cuesta *et al.*, 2004), a main caveat was the imposition of an invariable behavioral labor model. However, substantive changes in subsidies (even when the aggregated effects are fiscally neutral or resource-saving) and in beneficiaries may well induce structural labor changes. Consequently, the estimates presented in the previous section constitute the baseline behavioral labor model while participation and working hour functions are re-estimated specifically for each scenario. Table 7 reports the estimated changes in the labor decisions of each simulated scenario by sector and gender with respect to the baseline labor model. Changes statistically different would justify a flexible model of adaptable behavior to alternative scenarios. Tests for the statistical significance of these changes are also reported in Table 7.

Changes in labor decisions (with respect to the baseline) resulting from the simulated reforms are mostly significant in statistical terms but inconsequential in magnitude. Participation effects of gas subsidies and HDB reforms are larger than effects on working hours for the first two simulations, while the reverse is true for the SelBen-based targeting simulation. In that simulation, occupation rather than gender determines the size and sign of indirect effects. The result is also indicative of differences in labor coping strategies between formal and informal workers.

[13]Of the 105 municipalities (*cantones*) affected by El Niño between 1997 and 1998, around 80 were located along the coast. The population in the coastal provinces regarded as vulnerable to El Niño—5.6 million—represented 86 percent of the total vulnerable population (around 6.5 million) (Vos *et al.*, 2000).

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TABLE 7

ESTIMATED LABOR DECISION CHANGES IN EACH SIMULATED SCENARIO

	Female Participation			Male Participation			Working Hours (log)			
	No	Informal	Formal	No	Informal	Formal	Female Informal	Female Formal	Male Informal	Male Formal
Baseline	29.260	41.409	29.329	10.963	51.590	37.445	4.725	4.7599	5.0376	5.1538
Simulation 1 Elimination of gas subsidies	29.341	41.252	29.406	11.051	51.393	37.555	4.725	4.7599	5.0376	5.1537
Simulation 2 Elimination of gas subsidies and funds shifted to HDB with current targeting	29.346	41.259	29.393	11.045	51.400	37.553	4.725	4.7597	5.0373	5.1538
Simulation 3 Elimination of gas subsidies and funds shifted to HDB with SelBen-based targeting	29.320	41.315	29.363	10.910	51.531	37.557	4.729	4.7596	5.0417	5.1525
t test										
Base-Sim1 ≠ 0	−2.81**	2.60**	−2.24*	−2.03*	2.37**	−2.27*	1.04	1.87*	0.61	2.57*
Base-Sim2 ≠ 0	−2.97**	2.44**	−1.73*	−1.79*	2.28*	−2.11*	0.21	0.51	0.96	−0.13
Base-Sim3 ≠ 0	−1.87*	1.14	−0.59	0.74	0.48	−1.60	−1.69*	0.19	−2.96**	2.04*

Note: Standard errors in parentheses. (**) indicates that a coefficient is significantly different from 0 at a 99 percent confidence; (*) indicates that a coefficient is significantly different from 0 at 95 percent; and ( ) indicates that a coefficient is not significantly different from 0 in intervals of confidence higher than 95 percent.

Source: Authors' estimates using ECV 1999 (INEC, 1999).

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Although this is hardly surprising, it is relevant in the context of HDB targeting. If informal workers act differently to formal workers and are more able to conceal their incomes below qualifying criteria, then the efficiency of targeting directed towards them may diminish. As a result, the impact on poverty of shifting resources may well be lower than initially expected. Interestingly, SelBen-based reforms are less likely to affect labor participation. In stark contrast, simulations 1 and 2 have significant effects on participation categories: these simulated reforms raise participation in informal categories and decrease formal participation. Overall, both reforms provoke an aggregated increase in participation.

Both the differentiated adjustment of labor dimensions and the rather small magnitude of behavioral changes suggest relatively modest poverty impacts following these reforms. Table 8 confirms these expectations. The elimination of gas subsidies without further compensation from HDB (Simulation 1) increases the incidence of poverty by 2.45 percent. Increases in the other two poverty dimensions are similar. As expected, the elimination of a relevant resource for the household causes a sizeable increase in the incidence, depth and severity of poverty. Small indirect effects working in opposing directions also have a very modest effect on poverty dimensions: they only compensate some 6–7 percent of direct effects.

In Simulation 2, the resources available after the elimination of gas subsidies are transferred to the HDB scheme without further targeting improvements. The structure and number of beneficiaries are assumed to remain unchanged. As a result, the average household benefit increases. On average, this increase amounts to US$8.6 or 53 percent of the original reported household benefit (see Table 3). Given the initial targeting deficiencies of the HDB, a substantial proportion of the additional benefits will still accrue to households that were originally non-poor. The estimated total effect (including the effect from the elimination of gas subsidies) is an increase in poverty incidence by 1.71 percent. The average poverty gap and severity also increase in similar proportions (1.82 percent and 1.61 percent, respectively). However, the worsening of poverty is entirely driven by the initial elimination of gas subsidies. The marginal effect of increasing HDB benefits after the elimination of gas subsidies is a reduction of poverty by 0.7 percent (that is, from the increase of 2.45 percent in Simulation 1 to the estimated 1.71 percent in Simulation 2). Similarly, the marginal effect in terms of poverty gap is a reduction of 0.8 percent. Unsurprisingly, the insignificant or inconsequential indirect effects hardly counteract the direct effects on poverty in either this or the previous simulation. In fact, this is quite a robust finding among the simulated reforms. In Simulation 2, indirect effects compensate between 0 and 3 percent of direct effects on poverty.

Simulation 3 provides a somewhat different picture. This scenario simulates an improvement in HDB targeting and increasing resources after the elimination of gas subsidies. Total poverty incidence hardly changes with respect to the baseline scenario, which implies that the marginal effect of a SelBen-based retargeting of HDB is a sizeable reduction of poverty incidence by some 2.51 percent. More interestingly, the differential in poverty incidence between simulations 2 and 3 indicates the additional poverty reduction caused by improved targeting. This gain amounts to 1.77 percent. Poverty gap and severity gains from SelBen are even

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TABLE 8

DISTRIBUTIVE EFFECTS OF SOCIAL TRANSFER REFORMS

Baseline FGT(1) = 62.59 percent FGT(2) = 30.15 percent FGT(3) = 18.53 percent	Poverty Indicators after Policy Reforms, in Percent Points			Direct Effect of Social Transfers as Percent of Total Change			Labor-Related Indirect Effect of Social Transfers as Percent of Total Change		
	FGT1	FGT2	FGT3	FGT1	FGT2	FGT3	FGT1	FGT2	FGT3
Simulation 1 (Elimination of gas subsidies) FGT(1) = 65.05 FGT(2) = 32.75 FGT(3) = 20.86	2.45	2.60	2.33	105.7%	106.1%	106.8%	−5.7%	−6.1%	−6.8%
Simulation 2 (Elimination of gas subsidies and funds shifted to HDB with current targeting) FGT(1) = 64.31 FGT(2) = 31.97 FGT(3) = 20.14	1.71	1.82	1.61	103.5%	101.1%	100.6%	−3.5%	−1.1%	−0.1%
Simulation 3 (Elimination of gas subsidies and funds shifted to HDB with SelBen-based targeting) FGT(1) = 62.53 FGT(2) = 28.84 FGT(3) = 16.94	−0.06	−1.31	−1.58	98.5%	97.6%	98.9%	1.5%	2.4%	1.1%
Simulation 4 (Elimination of gas subsidies and funds shifted to HDB with SelBen-based targeting towards the extreme poor) FGT(0) = 63.042 FGT(1) = 28.470 FGT(2) = 16.901	0.44	−1.68	−1.63	117.1%	98.2%	98.9%	−17.1%	1.8%	1.1%
Simulation 5 (Elimination of gas subsidies and funds shifted to HDB with SelBen-based targeting towards the moderate poor) FGT(0) = 60.767 FGT(1) = 26.474 FGT(2) = 14.884	−1.83	−3.67	−3.64	96.4%	99.2%	99.6%	3.6%	0.8%	0.4%

Source: Authors' estimates using ECV 1999 (INEC, 1999).

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higher at 3.13 percent and 3.19 percent, respectively. Participation indirect effects in this simulation are again found to be much lower than direct effects. This is unsurprising given the composition of estimated labor reactions: positive for formal males' and females' working hours; negative for informal workers' working hours; and insignificant for participation. The aggregated indirect impact resulting from these mixed effects is a rather small effect reinforcing the direct impact on poverty (between 1.1 percent and 2.4 percent of the total estimated change in poverty dimensions).

Simulation 3 shows that the poverty gains from SelBen are sizeable. Could these gains be even larger if a different use of SelBen were attempted? Two additional simulations were conducted in order to answer this question. Simulation 4 uses the cutting-off point of the first quintile of the SelBen index distribution to assign the increased HDB benefits to households. The other simulation, Simulation 5, targets the increase of HDB benefits to households whose SelBen index lies between the very poor and the non-poor cutting-off points (i.e. between 43.3 and 51.9 in the 100-point scale of SelBen). Both scenarios show that reforms maximize the reduction of poverty when targeting effectively identifies those households (prior to the reform) closer to the poverty line. The estimated total poverty reduction of the SelBen moderate poor reform (Simulation 5) decreases the baseline poverty incidence by 1.83 percent. In terms of efficiency gains, the reduction of poverty incidence amounts to 5.8 percent with respect to increased HDB without further targeting improvements (Simulation 2). By contrast, the marginal gains of finessing the targeting of increased HDB to the poorest (Simulation 4) amount to only 1.2 percent and cannot fully compensate the overall poverty incidence increase that the elimination of gas subsidies causes on its own. Paradoxically, improving the targeting efficiency of social transfers through SelBen will maximize neither the reduction of poverty incidence nor other poverty dimensions. The larger improvement in the poverty gap indicator in Simulation 5 vis-à-vis that estimated in Simulation 4 suggests that targeting the increase of HDB benefits to the moderate poor pushes the new recipients of the transfer above the poverty line more easily than when benefits are targeted to the very poor.

6. Conclusions

Ex-ante behavioral simulations are especially well suited for estimating the distributive effects of behavior-conditioning social reforms not yet implemented. This paper adds to the rare use of such ex-ante simulations of social transfer reforms in developing countries. A structural model of labor behavior is constructed separating decisions regarding formal and informal work, as well as between males and females. The model captures all working age household members' labor decisions and not only child labor. Simulations allow for different responses to different policy scenarios of the reform. As a result, the distributive effects of a reform can be quantified both in aggregate terms and separated by direct and indirect impacts. This approach is applied to the repeatedly announced—yet not implemented—HDB reform in Ecuador, usually tied to the elimination of gas subsidies. On paper, that kind of reform should shift transfers from regressive to progressive (and pro-poor) social schemes. However, the effects

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of such reforms have been shown to be disappointingly small without substantive improvements in the targeting of HDB. More interestingly, this study shows that even with targeting improvements through a means-test instrument, the SelBen index, the distributive impacts of gas subsidies and HDB reforms may fall short of expectations (even though the final objective of the HDB is not to reduce poverty itself).

Behavioral—indirect—effects may work in either the same or the opposite direction of direct effects, their net effect being an empirical question. In fact, there is a cumbersome pattern of labor behavioral responses to the simulated social transfer reforms. Reactions vary in terms of participation and working hour decisions. They also vary by informal and formal occupation, and by gender. Despite the complexity of these disaggregated labor effects, these indirect impacts are either insignificant or, if significant, rather small in magnitude. Estimated labor effects from the reforms could compensate up to 17 percent of their direct effects, although, typically, this compensation did not exceed 7 percent in the three poverty dimensions. Undesired disincentive labor effects are unlikely to appear even after radical program reforms.

Simulations show that the SelBen index can be used to dramatically improve the quality of targeting, that is, the proportion of benefited poor households. This is the case when the first quintile of the distribution of the SelBen index is used to discriminate beneficiaries from non-beneficiaries. However, reforms using SelBen may lead to rather disappointing poverty reduction results if the increased HDB is targeted exclusively to the extreme poor. In such cases, the use of SelBen is not sufficient to overcome the total increase in poverty that the elimination of gas subsidies initially causes. Poverty reduction is only maximized when the increased HDB is targeted to households close to the pre-reform poverty line.

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APPENDIX 1

ALTERNATIVE ESTIMATES OF LABOUR SUPPLY MODELS IN ECUADOR

	(A1) Participation Probit Without Sample Selection Correction	(A2) Participation Probit With Sample Selection Corrected Wages	(A3) Participation Multinomial Logit with Sample Selection Corrected Wages (No Participation as Reference)		(A4) Working Hours Without Sample Selection Correction	(A5) Working Hours With Sample Selection Correction	(A6) Working Hours With Sample Selection Correction	
Sample	Joint	Joint	Informal Labor	Formal Labor	Joint	Joint	Female	Male
Prime age male, head	1.973	1.549	2.533	2.560	0.133	0.234		0.165
	(0.102)	(0.105)	(0.293)	(0.292)	(0.017)	(0.021)		(0.021)
Prime age female, head	0.775	0.695	0.393	0.814	0.006	0.145	0.266	
	(0.100)	(0.102)	(0.235)	(0.223)	(0.040)	(0.045)	(0.051)	
Prime aged male, no head	0.905	0.507	0.919	0.746	0.063	0.105		0.077
	(0.046)	(0.048)	(0.121)	(0.126)	(0.021)	(0.022)		(0.023)
Prime aged female, no head	0.113	0.069	–0.253	–0.027	–0.111	–0.015	0.060	
	(0.031)	(0.032)	(0.066)	(0.070)	(0.022)	(0.027)	(0.033)	
Household size	0.021	0.016	0.011	–0.017	0.014	0.014	0.008	0.014
	(0.006)	(0.005)	(0.012)	(0.014)	(0.003)	(0.003)	(0.006)	(0.004)
Dummy for Quito	–0.333	–0.750	–1.482	–0.570	–0.175	–0.018	0.009	0.012
	(0.050)	(0.055)	(0.122)	(0.126)	(0.026)	(0.031)	(0.051)	(0.036)
Dummy for Guayaquil	0.098	–0.072	–0.293	0.119	–0.026	0.065	0.250	–0.009
	(0.041)	(0.042)	(0.091)	(0.098)	(0.024)	(0.028)	(0.057)	(0.029)
Dummy for other cities	0.056	0.011	–0.181	0.206	–0.037	–0.040	–0.014	–0.039
	(0.035)	(0.036)	(0.078)	(0.086)	(0.017)	(0.018)	(0.036)	(0.021)
Dummy for Coast	–0.418	–0.475	–0.824	–0.493	–0.192	–0.187	–0.419	–0.046
	(0.034)	(0.036)	(0.078)	(0.086)	(0.017)	(0.019)	(0.037)	(0.020)
Log sample corrected wage		0.497	0.357	0.873		0.007	0.071	–0.088
		(0.023)	(0.051)	(0.056)		(0.018)	(0.033)	(0.021)
Log sample wage					0.222			
					(0.009)			
Education	0.00003							
	(0.003)							
Household gas subsidies	–0.123	–1.863	–4.011	–0.308	–0.035	–0.092	–0.007	–0.023
	(0.028)	(0.195)	(0.423)	(0.455)	(0.014)	(0.109)	(0.193)	(0.127)

Appendix 1 continued on next page

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APPENDIX 1 (*continued*)

	(A1) Participation Probit Without Sample Selection Correction	(A2) Participation Probit With Sample Selection Corrected Wages	(A3) Participation Multinomial Logit with Sample Selection Corrected Wages (No Participation as Reference)		(A4) Working Hours Without Sample Selection Correction	(A5) Working Hours With Sample Selection Correction	(A6) Working Hours With Sample Selection Correction	
Household HDB, mothers	0.651	0.863	1.168	–0.685	0.034	–0.460	–0.899	–0.072
	(0.192)	(0.195)	(0.418)	(0.473)	(0.105)	(0.115)	(0.212)	(0.119)
Household HDB, elder	–0.635	0.902	2.034	–1.240	–0.140	–0.706	–0.471	–1.076
	(0.565)	(0.589)	(1.236)	(1.437)	(0.352)	(0.358)	(0.542)	(0.464)
Household other transfers	–0.008	–0.014	–0.067	–0.044	–0.001	–0.0003	0.025	–0.008
	(0.0139)	(0.013)	(0.032)	(0.034)	(0.010)	(0.007)	(0.015)	(0.007)
Dummy for informal						–0.041	0.006	–0.078
						(0.017)	(0.030)	(0.019)
Mills Ratio						–0.437	–0.148	–0.735
						(0.037)	(0.055)	(0.057)
Constant	0.609	–5.487	–2.904	–10.760	2.154	5.148	4.044	6.524
	(0.049)	(0.294)	(0.631)	(0.721)	(0.121)	(0.254)	(0.441)	(0.292)
N. Observ.	17,071	17,071	11,895		9,687	12,272	5,191	7,081
Wald χ^2	887.52	1,174.97	1,194.49					
F (r, n)					74.81	67.48	18.11	27.59
R^2	0.1252	0.1565	0.0887		0.2367	0.1109	0.0725	0.0911
Log. P-likelihood	–8,075.04	–7,786.72	–11,436.99					
Hausman Specification Test		H_0: difference between probit and logit not systematic $\chi^2(14) = 21.73$; $P > \chi^2 = 0.084$ H_0 is accepted, Independence of irrelevant alternatives accepted.					H_0: difference in coefficients not systematic by gender $\chi^2(12) = 259.32$; $P > \chi^2 = 0.0$ H_0 rejected, gender specifications accepted	

Source: Authors' estimates using ECV 1999 (INEC, 1999).

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