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SIMULATING PROGRESSIVE SOCIAL TRANSFERS: GAS SUBSIDIES AND SOLIDARITY BONDS IN ECUADOR

José Cuesta
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ABSTRACT

After two decades of neglect, social expending has become a cornerstone in the current fight against poverty in Ecuador. Ecuador is presently considering the elimination of regressive gas subsidies and the shift of these resources into pro-poor targeted Solidarity Bonds. Great distributive gains are expected from this reform. There are, however, a number of considerations that may prevent this policy shift from obtaining substantial poverty and equality gains. Despite their regressivity, implicit gas subsidies still represent a considerable proportion of total household consumption among poor households. Also, solidarity bonds siphon off a substantial share of their total benefits to middle income groups.

This paper estimates the redistributive consequences of policy reforms on gas subsidies and solidarity bonds in Ecuador.[a] A simulation methodology estimates both direct and indirect (labour-driven) distributive effects of four alternative scenarios: (i) total elimination of gas subsidies; (ii) selective elimination of gas subsidies among non-poor households; (iii) total elimination of gas subsidies and shift of resources to solidarity bonds targeted to the poor; (iv) selective elimination of gas subsidies and shift of resources to solidarity bonds targeted to the poor.

Estimates confirm that the redistributive gains from these reforms are rather small both for poverty and inequality. Incentives to work following the elimination of subsidies compensate – or even outdo – immediate poverty rises. Also, the elimination of gas subsidies without further expansion of subsidy bonds will unambiguously increase poverty in Ecuador between one and one and a half percent points.

[a] José Cuesta (Institute of Social Studies, The Netherlands), Juan Ponce and Mauricio León (Secretariá Técnica del Frente Social, Ecuador). Authors are grateful to Grecia Marrufo, Rob Vos and Steve Younger for comments and suggestions on earlier drafts. Participants at seminars in the Inter-American Development Bank in Quito and the Institute of Social Studies in The Hague provided helpful and stimulating comments. Usual disclaimers apply.

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1 INTRODUCTION

Ecuador suffers from a malaise all too familiar across Latin America: unrelenting poverty and poor economic performance. In a desperate attempt to stabilize its economy and overcome a dramatic financial crisis, Ecuador has probably gone beyond any other country in the region dollarising its economy by surprise in 2000. This determination has not been paralleled on the social expenditure front, however. Social expenditure at the end of the Nineties remained below early Eighties levels in real terms and among the lowest on per capita basis across Latin America (Vos et al. 2003a). Following a timid recovery in real terms of social expenditure since 2000, the new Gutierrez administration has declared the combat of poverty as main policy priority. A higher profile of social expenditures has become a key element of this reduction strategy.

As a result, two social transfers – the subsidy to the consumption of residential gas and the solidarity bond – have moved to the forefront of policy-making debate in Ecuador. Gas consumption related subsidies are not strictly targeted to poor households. Instead, households benefit from the implicit subsidy to the extent that they consume this source of energy. According to the latest available 1999 Living Standard Measuring Survey (*Encuesta de Condiciones de Vida* in its Spanish translation), 80% of Ecuadorian households perceived this subsidy. In 1999 the total implicit subsidy amounted to over a 1% of that year's GDP. The Solidarity Bond (*Bono Solidario* in Spanish) was introduced in 1998 with the explicit task of compensating for the social costs of the 1998-9 crisis. This subsidy reached 1.3 million Ecuadorian households in 1999, that is, 45% of all households in the country (Leon et al. 2001). This scheme amounted to a 1% of GDP. Solidarity bonds are targeted to mothers with under-18s family claims; the elder; and the disable; pertaining to poor households. In practice, the real value of bonds has declined from their original US$15.1 and US$ 7.6 to the US$ 11.5 and US$ 7 for mothers and the elder/ disable, respectively, in 2001 (Leon et al. 2001). Solidarity bonds have been also accused of serious targeting problems. In fact, both gas subsidies and solidarity bond represent a very similar proportion of poor households' consumption: 6% and 7% of the final consumption of the poorest quintile of the distribution of households, respectively.

In any case, the current government is outspoken on the need to introduce progressive features to the gas subsidy scheme and is even considering a complete

elimination of the gas subsidy. No proposal has been concretised so far, though. However, the elimination of gas subsidies has gained support among current policy-makers in Ecuador. Also, the indigenous movement has unambiguously demanded its elimination arguing substantial distributive gains for poor households.

It does not, however, seem likely that substantial changes in the implicit gas subsidy may automatically lead to sizeable distributive gains in Ecuador. First, the elimination of gas subsidies would mean a significant loss of resources for the poorest households in Ecuador. Secondly, Ecuador traditionally champions severe leaking ('E-mistake') in its targeting transfers. Vos et al. (2002a) show that a third of solidarity bonds benefits went to middle and high income groups in 1999.[1]

This paper explores *ex ante* the impact that the elimination or targeting of the gas subsidy would have on the incidence of income poverty and inequality in Ecuador. The evaluation of these distributive impacts estimates both direct effects as well as indirect effects of simulated reforms. The latter refer to labour (dis)incentives transmitted by the loss (reception) of social transfers across household members. As a result, short term immediate distributive effects are completed with behavioural changes caused by social transfer reforms, a dimension typically ignored in this sort of studies (Walle 1995a). Simulations comprise four alternative scenarios which are either fiscally neutral or deficit reducing: (i) a complete elimination of gas subsidies; (ii) the elimination of gas subsidies to non-poor households; (iii) the complete elimination of gas subsidies and the shift of resources towards solidarity bonds effectively targeted to poor households; and finally, (iv) the elimination of gas subsidies to non-poor households and their shift to solidarity bonds targeted to the poor.

2 IMPLICIT GAS SUBSIDIES AND SOLIDARITY BONDS IN ECUADOR

Volatility mainly driven by economic and electoral cycles and the preference for expanding assistance transfers in detriment of social investment have both marked the

[1] Middle income households refer in the present study to the two intermediate quintiles of the per capita household income distribution. High income households pertain to the top quintile of that distribution.

last two decades of social policy making in Ecuador. As a result, per capita social expenditure in Ecuador fares among the lowest in Latin America and has declined since the Eighties in real terms. At US$ 142 per capita social expenditure remained below the per capita level in the early Eighties and well below the US$ 542 Latin American average (CEPAL, 2001). Unsurprisingly, targeted assistance programs have at best 'only partially' protected the most vulnerable groups throughout the Nineties (Vos et al. 2003b: 30). It is only after 2000 that the decline in social public expenditure has fallen short of the decline in overall public expenditure. Vos et al. (2003b) interprets this evidence as a sign of the new priority assigned to social expenditure in the post-dollarisation era.

Weak progressivity characterises overall social spending in Ecuador. Vos et al. (2003a) argue that the household distribution of social benefits in 1999 was more progressive than household consumption. See Table 1. However, this is hardly meritorious given the highly unequal distribution of household consumption in Ecuador.

TABLE 1
Household distribution of Gas subsidies and solidarity bonds

Deciles	Gas subsidy	Solidarity bond	Social transfers	Per capita gas consumption	Per capita consumption
Bottom 10%	3%	12%	6%	6%	2%
2	5%	13%	8%	9%	3%
3	7%	14%	8%	10%	4%
4	8%	12%	9%	10%	5%
5	9%	13%	9%	11%	6%
6	10%	13%	11%	11%	7%
7	12%	8%	11%	11%	9%
8	13%	8%	12%	10%	11%
9	16%	4%	13%	10%	16%
Top 10%	17%	1%	14%	10%	37%

Source: INEC, ECV 1999, Vos et al. 2003a.
Note: Deciles defined along the distribution of per capita household total consumption.

Consequently, weakly progressivity social transfers are not effective poverty reducing instruments. The richest 20% of households (according to per capita household consumption) received almost the same amount of social benefits than the poorest 40%.[2]

[2] According to Vos et al. (2003a) estimates, the richest 20% of households receive 27.7% of total social expenditure while the poorest 40% of households receive 30.1% of total social expenditures.

Furthermore, 30% of total social benefits transferred to Ecuadorian households came from gas subsidies, whilst only 10% of social benefits to households accrued from the allegedly progressive and pro-poor solidarity bonds.

The poorest decile of the per capita household consumption distribution received from solidarity bonds a higher percentage of social transfers than from gas subsidies. See table 2 below. The average transfer from the gas subsidy exceeded the average solidarity bond transfer among the remaining deciles of the household distribution. This implies that many poor households received larger transfers from a regressive social scheme than from a scheme purposefully targeted to them. Consequently, the elimination of gas subsidies without further compensation to the poorest (40% of) households would certainly imply a substantial loss of their consumption capacity.

Nonetheless, the significant amounts effectively transferred through gas subsidies suggest a considerable redistributive potential if effectively targeted. So far, gas subsidies are proportional to the household consumption of gas and lack any discriminatory or progressive mechanism. At present, the 15-kilo gas cylinder is sold at US$ 1.6 while its cost amounts to US$ 5.4. Differential and progressive prices by consumption brackets or consumption ceilings are relatively simple tools to improve the progressivity of gas subsidies. Given that the richest 20% of the distribution of households consume 20% of total residential gas and the poorest 40% some 35%, the subsidy clearly turns out regressive and not pro-poor. Vos et al. (2003a) estimates that the poorest 40% of the distribution of households captures only 23% of total gas benefits while the top 20% a third of total benefits.

Solidarity bonds were instead conceived as a monetary compensation to the elder, the disable and to mothers in poor households with family claims (under-18s) not affiliated to the Ecuadorian Institute of Social Security, failing to perceive labour incomes over a million *sucre* in 1999 or any regular labour earning (i.e., fixed term contract).[3] The scheme transferred in 1999 some US$ 160 million or a 1% of GDP, with individual monthly transfers of US$ 7 to the elder and disable and US$ 11.5 to poor mothers.[4]

[3] Current US$ 40.
[4] León et al. (2001)

TABLE 2
Social transfers as shares (%) on total household consumption (1999)

	Gas subsidy	Fuel subsidy	Schooling breakfast	Free food	Solidarity Bond	Public expenditure on primary education	Public expenditure on secondary education	Public expenditure on public tertiary education	Public expenditure on private tertiary education	IESS health care	SSC health care	Military health care	MSP health care	Per capita social expenditure
10% más pobre	5.3%	0.0%	2.2%	0.2%	8.6%	11.8%	3.8%	0.2%	0.0%	0.8%	0.5%	0.0%	4.2%	37.6%
2	6.7%	0.0%	1.5%	0.2%	6.1%	5.4%	4.2%	1.8%	0.0%	1.3%	0.2%	0.0%	2.5%	29.8%
3	6.4%	0.0%	0.7%	0.2%	5.0%	3.9%	3.8%	1.2%	0.1%	0.5%	0.2%	0.0%	1.7%	23.8%
4	6.1%	0.0%	0.2%	0.0%	3.3%	2.8%	3.1%	3.7%	0.0%	1.2%	0.2%	0.1%	2.5%	23.3%
5	5.9%	0.0%	0.4%	0.3%	2.7%	2.0%	3.0%	1.4%	0.2%	2.1%	0.1%	0.1%	1.6%	19.8%
6	5.7%	0.1%	0.0%	0.1%	2.3%	1.4%	2.3%	3.1%	0.2%	1.6%	0.1%	0.4%	1.2%	18.5%
7	5.1%	0.1%	0.5%	0.1%	1.2%	1.0%	1.7%	2.7%	0.3%	1.3%	0.1%	0.1%	1.1%	15.4%
8	4.4%	0.1%	0.2%	0.0%	0.9%	0.5%	1.3%	2.5%	0.4%	1.2%	0.1%	0.1%	0.9%	12.8%
9	4.0%	0.2%	0.0%	0.0%	0.3%	0.3%	0.8%	2.4%	0.5%	1.5%	0.0%	0.0%	0.4%	10.4%
10% más rico	1.8%	0.4%	0.0%	0.0%	0.0%	0.1%	0.1%	1.0%	0.4%	0.8%	0.0%	0.1%	0.1%	4.8%
Total	3.9%	0.2%	0.2%	0.1%	1.3%	1.1%	1.3%	1.9%	0.3%	1.2%	0.1%	0.1%	0.8%	12.4%

Source: Vos et al (2003a) from ECV 1999
Note: Deciles of total household consumption.
IESS, Ecuadorian Institute of Social Security
SSC, Rural Social Security
MSP, Health Ministry

Leon et al. (2001) and Vos et al. (2003a) argue convincingly that despite its progressivity, solidarity bonds present serious targeting pitfalls. Monthly earnings of a million 1999 *sucre* or fixed term contracts are inefficient criteria to discriminate low income from middle income households. In fact, only 40% of the active labour force reported labour monthly earnings above a million sucre and only 16% reported to work under a fixed term contract in 1999. As a result, some 42% of the benefits from the program go to middle income households, that is, households pertaining to the fifth to eighth richest decile of the distribution of households. The share of gas subsidies captured by these middle income households is strikingly similar: 45%. See Table 1. In other words, despite solidarity bonds attempt to target poor households and gas subsidies are not a targeting scheme, both transferred very similar benefits to middle income households. The distributive features of gas subsidies and solidarity bonds as well as the current policy debate call for the estimation of the potential distributive consequences of a number of possible reforms. Simulations are described in table 3. These simulations include fiscally neutral reforms as well as reform scenarios leading to net fiscal savings. Reforms that would imply fiscal expansion are not considered given the delicate fiscal situation of Ecuador. For simulation purposes,

TABLE 3
Simulations of gas subsidy and solidarity bond (1999)

	Gas subsidy			Solidarity bond		
Scenario	Amount transferred	Structure	Average transfer to benefited household	Amount transferred	Structure	Average transfer to benefited household
Baseline	$160 Mill.	Original	$ 7.2	$ 164 Mill.	Original	$ 17.7
Sim. 1. Elimination of gas subsidy	0	Scrapped	0	$ 164 Mill.	Original	$ 17.7
Sim. 2. Elimination of gas subsidy to non-poor households	$ 81 Mill.	Baseline poor households[1]	$ 5.1	$ 164 Mill.	Original	$ 17.7
Sim. 3. Elimination of gas subsidies and funds shifted to solidarity bonds targeted to poor households	0	Scrapped	0	$ 324 Mill.	Original	$ 20.4
Sim. 4. Elimination of gas subsidies to non-poor households and funds shifted to solidarity bonds targeted to poor households.	$ 81 Mill.	Baseline poor households	$ 5.1	$ 243 Mill.	Baseline poor households	$ 15.3

[1] Baseline poor households are those with a per capita income below the individual poverty line at US $ 42 monthly. This is the cost of the basic consumption basket officially estimated from the ECV 1999.

successful targeting implies that transfers reach purported beneficiaries, that is, poor households. It is worth noting that better targeting may well lead to a reduction of the average benefit accruing to the poor, if increasing beneficiaries exceed proportionally increased benefits. Furthermore, simulations also assume that targeting is costless. The estimated impacts must be therefore interpreted as a maximum of potential redistributive benefits.

3 METHODOLOGY

3.1 Structure of simulations

Proposed simulations aim at evaluating the potential distributive consequences of alternative policy-making scenarios incorporating household members' behavioural responses. Poverty and distributive impacts estimated in these simulations outdo a mere arithmetic exercise. Instead, household member behaviour is modelled. This modelling is confined to labour decisions among working age household members. Other household decisions relevant to the generation of incomes, and ultimately poverty and distribution, such as the allocation of off-labour market time, savings and investment decisions are not included. This is mainly due to lack of relevant information in the available income and expenditure surveys in Ecuador. There are, however, reasons to believe that the modelling of labour behaviour is sufficiently relevant for distributive purposes, especially among poor households in Ecuador.[5]

Table 4 below shows the entire estimating procedure. As a first step, poverty and inequality baseline indicators are estimated from the 1999 ECV survey. Secondly, distributive direct impacts of social transfer reforms described in table 3 are estimated. This estimation assumes first that there is no behavioural change among beneficiaries or among non-beneficiaries. The extensions to the classic consumer demand theory show, however, that non labour incomes may have disincentive effects on the individual as well as on other household members. Consequently, a third step consists of estimating indirect or behavioural effects on the labour supply of each working-age household member caused by the simulated changes in gas subsidies and solidarity

[5] On the one hand, saving and investment decisions are only relevant to high income households. On the other hand, the variable of labour incomes includes all sources of income related to labour activities regardless of where they were generated. Furthermore, ECV 1999 reports that self-consumption represents roughly 5% of total household consumption.

bonds received by the household that member belongs to. These effects will separately capture variations in the probability to participate in labour earning activities, and conditional to this participation, the number of working hours dedicated to labour activities. It is worth noting that simulations assume that households behave according to unitary allocation rules, for which bargaining considerations are not further explored.

Simulations compute then a theoretical distribution of labour incomes across the entire sample of working age individuals, either if they report to be engaged in labour earning activities or not. Labour supply is considered a discontinuous function. Thus, the decision to engage in labour earning activities is separated from the number of working hours provided to these activities, if any. The indirect or behavioural effects credited to gas subsidies and solidarity bonds reforms are computed as changes on the probability to participate in labour activities and, conditional to that participation, on the amount of working hours.

Fourthly, the estimated changes on participation and working hours are translated into monetary terms, that is, are expressed as changes on baseline individual labour incomes. Reforms may alter the original participation status of individuals. In cases of a shift into participation, each working hour provided is valued at the average imputed labour earning per hour in the baseline scenario. Similarly, working hour changes among individuals who keep participating in labour activities are valued at the baseline average hourly labour earnings reported by that individual in the ECV 1999 income survey.

Fifthly, new distributions of household incomes are constructed for each scenario simulated after including their direct changes in social incomes and indirect changes in labour incomes. The final step consists of calculating poverty and inequality indicators from the new household income distributions. Differentials between baseline indicators and indicators resulting from each simulated scenario become the overall distributive impact credited to each reform. Aggregated impacts are further disaggregated according to socioeconomic, demographic and geographic characteristics of households.

TABLE 4
Steps in the simulation of distributive impacts from gas subsidies and solidarity bond reforms in Ecuador

Simulation Procedure	Observations and Assumptions
[1] Calculation of poverty and inequality indicators from the baseline distribution of household incomes.	The observed distribution of total incomes (labour, financial and social) constitutes the baseline scenario.
[2] Estimation of direct effects from each simulated reform on gas subsidies and solidarity bonds.	The increase, decrease or elimination of gas subsidies and/or solidarity bonds across households is first assumed not to alter household members' behaviour.
[3] Estimation of the indirect effects from each simulated reform on gas subsidies and solidarity bonds.	1) The increase, decrease or elimination of gas subsidies and/or solidarity bonds may now possibly alter household members' behaviour 2) Household social transfers are divided across household members on per capita basis. 3) Labour supply is a discontinuous function composed of participation, and conditional to participation, working hours. 4) Determinants of participation and working hours are the same although their impacts on each decision may differ. 5) There are no reasons – nor conclusive evidence – indicating that the impacts on labour decisions must be identical for males and females.
[4] Monetary valuation of indirect effects from gas subsidies and solidarity bonds reforms.	Each working hour increased as a result of a simulated reform is valued as the average hourly labour earnings if the individual originally participated in the labour market or by the average imputed hourly labour earnings if the individual did not originally participated in the labour market.
[5] Construction of resulting household income distributions following gas subsidies and solidarity bond reforms.	Direct and indirect effects are quantified in monetary terms across individuals. These individual effects are then aggregated at the household level adding up these effects across household members.
[6] Re-calculation of poverty and inequality indicators from new household income distributions.	Poverty and inequality indicators are calculated along the resulting new distributions of household incomes after direct and indirect effects are included. The differential between new and baseline indicators is the overall distributive impact of a simulated reform.

3.2 Estimation of the direct and indirect effects from social transfers

Direct distributive effects on household incomes result from the addition or subtraction of social benefits according to simulated reforms. In addition, the monetary nature of solidarity bonds and gas subsidies further simplifies these computations, avoiding traditional problems prevailing in the valuation of in-kind transfers (Walle 1995b). There persist, however, some considerations in the valuation of monetary transfers. First, benefits transferred to households are equated to the fiscal cost incurred by the government. This valuation assumes no administrative or delivery cost. It does also assume identical valuations among Ecuadorian households. Neither of these assumptions is entirely realistic, of course. In particular, assuming that a dollar transferred through gas subsidies or through solidarity bonds brings the

same utility among households strongly implies uniform preferences and uniform consumption possibilities. Hence, the estimated outcomes from these simulations should be interpreted as potential or maximum benefits expected from lack of preference and/or consumption constraints.

Regarding *indirect effects* from social transfers, their simplest modelling draws from the extensions to the classic consumer demand theory (Deaton & Mulbauer 1980) incorporating household members' interrelations—pioneered in Becker (1965) or Ashenfelter & Heckman (1974). Consumer demand theory maximises household utility accruing from consumption and leisure. This utility is subject to budget and time restrictions and non-negative consumption and leisure levels. The solution of this maximisation problem provides the optimal labour time (total available time minus optimal leisure time) for each household member. The optimal allocation depends on the level of hourly labour earnings, other non labour household incomes as well as the allocation mechanism operating within the household. Under the common preference and income pooling hypotheses all individual incomes end up in a common household 'fund' that the household head distributes according to each household member's needs.[6] In its simplest format, this intrahousehold allocation rule distributes among household members all incomes generated by, or socially transferred to, the household on per capita basis.

Following the unitary allocation set up in Cuesta (2001) the optimal household allocation results from the individual maximisation problem of each household member as follows:

$$\max_{C,L_i} \; U = (C_i - \chi_i)^{\alpha_i} (L_i - \lambda_i)^{\beta_i} \qquad ,\alpha + \beta \geq 1 \qquad 1$$

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

$$X = Tw + N \qquad 3$$

$$L_i \leq T \qquad 4$$

$$L_i + H_i = T \qquad 5$$

[6] See Deaton & Mulbauer (1980) as classic reference.

$$C, L_i > 0 \qquad 6$$

$$(C - \chi) \geq 0 \qquad 7$$

$$(L_i - \lambda_i) \geq 0 \qquad 8$$

$$\sum_i L_i = L \qquad 9$$

$$\sum_i C_i = C \qquad 10$$

where C_i stands for consumption of the i-th individual of the household; L_i stands for the time that each household member devotes to leisure; H_i stands for individual working hours; χ_i is the minimum individual consumption; λ_i is the minimum leisure consumption by the i-th individual; w_i is hourly labour earnings; X is the total household income; T is the maximum available time (24 daily hours); N is the non labour household income, which in the Ecuadorian case refer to gas subsidies, solidarity bonds and other non-labour incomes (such as self-consumption, social transfers, retirement incomes, rents and financial incomes).

First order conditions provide the optimal relations for individual participation (π_i) and conditional to participation, his or her optimal provision of working hours (H_i). These conditions are as follows:

$$\pi_i = 1 \quad if \quad w_i - \frac{\beta_i}{\alpha_i} \frac{(N_i + N_j) - \chi_i}{T - \lambda_i} > 0 \qquad 11$$

$$\pi_i = 0 \quad otherwise$$

These conditions show that not only individual non-labour incomes but also other household members' incomes may have a disincentive effect on each individual's labour supply.

Conditional to individual participation, the optimal level of working hours for each individual is derived as a reaction curve to other household members' working

decisions. Let 'i' be a household member and 'j' the remaining members, their optimal working hour functions can be expressed as:

$$H_i = \alpha_i (T - \lambda_i) - \frac{\beta_i}{w_i}[H_j w_j + N_i + N_j - \chi_i] \qquad 12$$

$$H_j = \alpha_j (T - \lambda_j) - \frac{\beta_j}{w_j}[H_i w_i + N_i + N_j - \chi_j] \qquad 13$$

Hence, individual working hours result from a simultaneous decision of each household member given other members' decisions. Crucially, this household model shows once again that incomes generated by an individual do not have an isolated impact on that individual. In so far as individual incomes can be distributed among other household members, individual labour and social incomes may have indirect effects on other members.

The emerging literature on intrahousehold bargaining shows that allocation rules strongly determine the optimal allocation of time and labour.[7] Unfortunately, the empiric evidence presented in this literature is not conclusive on the actual form that bargaining processes take, if any. Labour supply studies report, in fact, a wide range of labour elasticities depending on samples considered and specifications used (Mroz 1987). Wage elasticities on married females' participation stretch from 0.49 to 0.99 in studies conducted for Chile, Holland, Mexico, Sweden and United Kingdom.[8] Male wage elasticities for working hours range from -0.5 and 0.08 and from -0.3 to 0.91 for females. Triest (1990) reports for a US sample of working age married females wage elasticities of 1.2, 0.97, 0.86, 0.27, 0.26, and 0.03 depending on the specification used.

Likewise, the indirect effects of household non labour incomes widely vary. In Ecuador, Cuesta et al. (2003) estimates indirect effects of social programs ranging from -0.06 to 0.01 with respect to participation and between -0.04 and 0.001 with respect to working hours. That study also argues against a continuous labour supply function in Ecuador. Once an individual decides to participate, he or she will likely

[7] See: Chiappori (1997) for a comprehensive review of bargaining literature.
[8] See: Hausman (1986), Killingsworth & Heckman (1986), Pencavel (1986), Triest (1990) for studies on female participation, and Layard et al (1980), Hausman & Ruud (1984), Hausman (1985), Joshi (1986), Blomquist & Hansson-Brusewitz (1990), Licona (1997) or Cuesta (2001) for analyses on male and female working hour decisions.

(over 80%) work between 30 and 40 weekly hours. This finding supports Heckman (1993)'s call for a separate treatment of participation and working hour decisions.

There is a final aspect in the estimation of labour supply models. The inclusion of *observed* labour earnings in an Ordinary Least Square regression of working hours (conditional to participation) may lead to selection, endogeneity and measurement error biases. Heckman (1976) or Killingsworth (1983) argue that selection biases arise from the fact that hourly labour incomes are not observed across those who do not work. Endogeneity is caused by the fact that this failure to participate is not a random event but is associated with unobserved individual or market characteristics not randomly distributed. Finally, measurement errors result from imprecise reporting of labour earnings and effort.

Two techniques developed originally by Tobin (1958) and Heckman (1976, 1979) correct for these biases. Given that the first set of techniques introduces additional restrictions (Mroz 1987, and Killingsworth 1983), the model considered in this study follows the second set of techniques based on full information maximum likelihood.[9] Hence, it is first defined a *heckman* function that re-estimates the distribution of individual hourly labour earnings correcting for selection bias. The new corrected hourly labour earnings are later on included as a determinant to participation and working hour decisions. See table 5. In the unique study of labour supply in Ecuador using the Heckman correction technique, Cuesta et al. (2003) shows that individual schooling years, age, square age and household location determine both the probability of observing individual labour earnings and their level. In contrast, the gender of the individual determines his/her level of labour earnings. Having a partner determines only the probability of observing labour incomes but not their level. Number of children in the household does not determine the probability of observing labour incomes, although this may be the result of counteracting effects from the children composition of the household.

Once hourly labour earnings have been corrected for, a *Probit* model and Ordinary Least Squares (OLS) regression estimate participation and conditional working hour functions, respectively. Both estimating models use the same set of determinants. The separation of both labour decisions permits the magnitude of these

[9] Killingsworth (1983: 145) shows that *Tobit* technique imposes identical magnitudes for the coefficient of determinants of participation and working hours, while Heckman techniques does not.

determinants to vary, though. Both participation and working hour specifications include (corrected) hourly labour earnings, their square (in what constitutes an implicit test for backward bending behaviour, or negative substitution effects from hourly labour earnings). Non labour incomes are also included in the labour functions, disaggregated into four categories: solidarity bonds for females, solidarity bonds for the elder, gas subsidies and the remaining non labour incomes of the household. The separation of these categories implies an implicit test on the uniformity of indirect effects among social transfer categories. In a previous study, Cuesta et al (2003) finds no uniform indirect effects of social transfers in Ecuador. That study reports significantly negative elasticities on participation from universal transfers; significantly negative elasticities on participation and working hours from consumption-related subsidies; and no significant labour elasticities from targeted transfers.[10]

TABLE 5
Estimation of indirect effects from social transfers

Estimation Technique	Sample	Specification
Heckman FIML for hourly labour earnings	All individuals in baseline survey, either working or not.	Log w(1-t) = f(Z) Prob(w>0) = f(Z,X)
Probit for the participation function	Working males and females separately.	Prob(H>0)=f($\hat{w}(1-t), \hat{w}(1-t)^2, B, G, R, Z, X$)
Ordinary Least Squares Regression for working hours conditional to participation	Working males and females separately.	LogH = f($\hat{w}(1-t), \hat{w}(1-t)^2, \lambda, B, G, R, Z, X$)

Note: N indicates non labour household incomes consisting of solidarity bond (B), gas subsidies (G), and the remaining social incomes accruing from retirement, rents and financial sources (R); Z represents exogenous variables that affects the observation of labour incomes but not their level. This set of exogenous variables is also expected to determine participation and working hour decisions. In addition, *w(1-t)* stands for hourly labour earnings net of taxes; $\hat{w}(1-t)$ hourly labour earnings corrected for selection bias, λ_i is the Mills Ratio for the 'i'-th individual with respect to his/her probability of observing labour earnings in the baseline scenario.

4 DATA

This study uses data from the latest available income and expenditure household survey in Ecuador, the Living Standard Measurement Survey 1999 (*Encuesta de Condiciones de Vida*, ECV, in Spanish) collected by the Ecuadorian Institute of Statistics and Census (INEC). Data were collected in three-month waves

[10] Cuesta et al. (2003) relates these differentials qualifying criteria, co-finance structure of public social services, age of beneficiaries and household size among others.

throughout 1999 using a stratified and multi-phase survey design. The national sample consists of 25,980 observations representing 5,824 households.

As a LSMS type survey the ECV 1999 details individual access to social programs including solidarity bonds as well as public education and health services. It also includes public subsidies implicit in the consumption of gas, electricity and fuel. The surveys also provides information on living conditions of Ecuadorian households, their income and consumption levels, the participation of their members in labour markets, as well as other demographic, geographic and socioeconomic characteristics. Table 6 summarises the main socioeconomic characteristics of Ecuadorian households in 1999.

TABLE 6
Socioeconomic characteristics of Ecuadorian Households (1999)

	MALE	FEMALE	TOTAL
Number of households headed by (gender)	1,907,804	480,089	2,387,893
Average size of household headed by (gender)	4.6	3.7	4.5
Average schooling years of household head	7.6	6.74	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
Gas consumption (monthly cylinders)	1.45	1.40	1.45
Household gas subsidies[1]	131,000	126,000	130,000
Household solidarity bond[1]	89,000	128,0800	97,000
Other non labour incomes[1]	180,000	182,000	175,000
Household total incomes[1]	2,580,000	1,950,000	2,460,000
Participation rate (14+)	89.2%	65.2%	76.9%
Weekly working hours (14+)	43.0	33.8	39.2
% self-employed and unpaid workers	38.8%	61.5%	48.2%

Note: ECV 1999
[1] Consumption and incomes are expressed in monthly 1999 sucre unless otherwise indicated.

5 ESTIMATING DISTRIBUTIVE EFFECTS

5.1 Sample selection corrected hourly labour earnings

Table 7 presents the estimated function for hourly labour earnings net of taxes – and social security contributions – having corrected for selection bias, endogeneity and measurement errors through the Heckman estimation technique.[11]

TABLE 7
Hourly labour earnings net of taxes corrected by selection bias

	Hourly labour incomes, log.		Probability of observing labour incomes	
	Coef.	Std. Error	Coef.	Std. Error
Schooling years	0.0891 **	0.0033	0.0278 **	0.0031
Age	0.0511 **	0.0050	0.1695 **	0.0035
Age square	-0.0005 **	0.00006	-0.0017 **	0.00004
Gender	0.4227 **	0.0298	0.9629 **	0.0251
Urban dummy	0.2478 **	0.0316	-0.0019	0.0267
Marriage dummy			-0.1158 **	0.0302
Number of children			0.0017	0.0081
Constant	6.1635 **	0.1114	-3.7130 **	0.0611
Wald Chi2(5)	1641.36 **	Prob>Chi2 = 0		
Wald independence test (H_o: ρ=0), Chi2(1)	4.44 *	Prob>chi2 = 0.0350		

Note: Number of observations: 25980, Censored: 16132; Non-censored: 9848. The independence of the two equations is accepted at a confidence interval of 95%. (**) indicates that a coefficient is significantly different from 0 at a 99% confidence; (*) significantly different from 0 at 95%; and ( ) indicates that is not significantly different from 0 for intervals of confidence higher than 95%.

Corrected hourly labour earnings depend on individual schooling years (with an annual return close to 9%), age (in a non-linear fashion), gender (some 42% gap in favour of males), and the geographic location (a quarter higher in urban locations) of the household to which the individual belongs. These variables also shape the probability of observing labour incomes in the original household sample except for geographical location. Thus, urbanity does not bear statistical significance on the probability of observing labour earnings despite affecting their level. Marital status, in turn, affects that probability but not the level of labour earnings: being married or living with a partner reduces the individual probability of engaging in labour earningactivities. The number of children living in the household does not turn out a

[11] Labour earnings in the ECV 1999 are reported net of tax deductions. This facilitates the comparison of labour earnings across formal and informal labourers.

significant determinant of individual labour earnings, neither on the probability of receiving them nor on their level. This is likely a consequence of counteracting effects from children of different ages. While younger children typically demand care from older household members, elder children may well take care of their younger siblings and other household members. In any case, these results confirm the sign and magnitudes of hourly labour incomes net of taxes estimated in Cuesta et al. (2003).

5.2 Estimating labour supply functions

Participation and conditional working hours separate estimates show that this specification adequately suits the Ecuadorian labour market. Elasticities are typically higher in the participation function than in the conditional working hour function. This result is in line with Heckman (1993)'s argument that effects 'at the margin' of the labour decision (i.e., whether to participate or not) are larger than effects over the decision to provide certain number of working hours. In other words, once an individual decides to supply labour, the possibility of working a number of weekly hours very different from the average is limited. Estimates also confirm that labour elasticities differ by gender, supporting the strategy of separating male and female labour supplies.

Appendix 1 reports labour supply estimates by gender in detail. Appendix 2 presents estimates of a labour supply model that does not correct for selection bias. The comparison with the corrected model shows that coefficients in the uncorrected and corrected model are fairly robust. This robustness indicates that selection bias appears not to be substantive. This should not be surprising given the high proportion of Ecuadorians engaged in labour activities, as table 6 shows above. In any case, the corrected model shows a high predictive capacity both for participation and working hour functions and by gender. See table 8 below.

The number of younger children (0-9's) increases the probability of participation and longer working hours across male adults although increases only female participation. In contrast, the number of elder children (10-14's) does not affect significantly labour supplies among adult household members either by gender or by labour decision. While younger children pose greater demands on adult household members, elder children may well compensate greater demands with care to other household members.

Household location in urban and rural areas brings a distinctive effect on male and female labour decisions. Controlling for other factors, males participate more in other cities than in Quito. However, there are no significant differences with respect to their working hours by location. Females, in contrast, do not exhibit substantial differences in participation among urban cities although their working hours differ by location. Thus, cities other than Quito systematically lower female working hours. These results confirm that male labour supply is less sensitive than female supply on the one hand, and that there are differences of labour opportunities for females depending on location, on the other.

Household head's characteristics and partner's characteristics also have different impacts on the participation and weekly working hours of non household years affect significant and negatively the participation of other male and female household members.[12] This negative relation is three times higher for females than for males, though. In contrast, household head's or partner's schooling does not affect significantly other household members' working hours.

Higher – corrected – hourly labour earnings increase the probability of participation both of males and females. However, this effect is twice as large for females than for males as table 8 shows. The effect that corrected hourly labour earnings have on male and female working hours is similar in magnitude although opposite in sign: negative for males and positive for females. Underlying these estimated effects, though, there is a critical assumption that individuals voluntarily increase labour supplies at their will. In other words, there are no substantial labour restrictions that prevent labour demand from meeting desired labour supplies. This assumption may be strong for Ecuador as argued in Cuesta et al. (2003). However, the large size of self-employment and informal labour in Ecuador (48% of active labour force) provides some support for relatively flexible labour supplies.

Specific to household non labour incomes, table 8 highlights three main features regardless of the specification used. First, the effects of each type of

[12] Partner's characteristics used in the estimations refer to age and schooling. Their labour earnings were deliberately excluded in order to avoid potential simultaneity between other household members' incomes and labour supply decisions of an individual.

non labour income differ within and between labour decisions.[13] Secondly, participation and working hour elasticities of non labour incomes do not have systematically substantial effects on labour decisions.[14] These results confirm similar findings for Ecuador reported in Cuesta et al. (2003). Finally, labour effects of non labour incomes also vary by gender.

TABLE 8
Labour supply for working age (14+) individuals in Ecuador

	JOINT		MALE		FEMALE	
	Participation	Working hours	Participation	Working hours	Participation	Working hours
Gas subsidies	-0.0769**	-0.0342**	-0.0258**	-0.0052	-0.1106**	-0.0596**
Solidarity bond, mothers	0.0058	-0.0226**	0.0042	-0.0052	-0.0043	-0.0461**
Solidarity bond, elder	0.0021	-0.0052**	0.0000	-0.0051*	-0.0046	-0.0056
Other non-labour household incomes	-0.0015	-0.0017	-0.0002	-0.0037*	-0.0049*	0.0028
Corrected hourly labour earnings	1.1335**	-0.0175	0.6032**	-0.6216**	1.5684**	0.6081*
	Participation probability – working hours average:					
Observed	0.7694	33.4	0.8921	38.8	0.6516	27.4
Predicted	0.8214	32.6	0.9375	38.7	0.6600	26.5

(**) indicates that a coefficient is significantly different from 0 at a 99% confidence; (*) significantly different from 0 at 95%; and ( ) indicates that is not significantly different from 0 for intervals of confidence higher than 95%.

In concrete, implicit gas subsidies show a pattern close to the classic labour supply predictions. These subsidies have significantly negative effects on participation and these effects are larger than on working hours. Also, gas subsidies have larger effects on the labour supply of females, confirming once again a higher sensitivity of female supply to labour market and household conditions. In turn,

[13] Tests on the difference of elasticities are available upon request to the authors. It is believed that specification problems can cause the observed differences in elasticities as factors related to technology, access to alternative energy sources, socioeconomic status, geographical location, education, labour incomes and other incomes are all directly or implicitly taken into account. Estimates from several specifications – with and without sample selection bias correction – confirmed robustness of coefficients.

[14] It could be still possible, nonetheless, that the small size of the elasticities underestimates the true impact in which social transfers constitute the only source of income for the household, requiring in that case estimations around kinks using Hausman (1986) technique. It was checked, however, that not a single household in the ECV 1999 sample reported solidarity bonds or gas subsidies as the only sources of incomes.

solidarity bonds do not have significant effects on the labour participation of both males and females. In contrast, mothers' solidarity bonds have a slightly negative effect on female working hour decisions while elder solidarity bonds have a negative effect on male working hours. These effects are rather small in magnitude, though. Doubling elder solidarity bonds among beneficiary households would reduce adult males' working hours by less than 1% or some 50 minutes per month. Doubling mothers solidarity bonds to beneficiary households would reduce female working hours by some 30 minutes per month.

Other household incomes – which include other social incomes as well as self-consumption, retirement, rents and financial incomes – do have a significant impact neither by gender nor by category of labour supply. This does not necessarily mean that each of the non labour income categories have insignificant effects on the labour supply, however. It is more likely that there exists a complex interplay of disincentive, neutral and incentive effects from the several categories of incomes aggregated. Cuesta et al. (2003) supports this presumption. Its more disaggregated estimation of social transfers effects shows disincentive effects (on participation) from universal programs, disincentive and neutral effects (on participation and working hours, respectively) from consumption linked subsidies, and neutral effects from targeted transfers.

5.3 Simulating the distributive consequences of gas subsidies and solidarity bonds reforms

The distributive effects of gas subsidies and solidarity bond reforms are expressed as changes in the incidence of monetary poverty and the degree of (per capita household) income inequality. Effects are also separated by origin, thus separating impacts from direct and indirect effects. [15] At a first glance, Table 9 shows that the focus on immediate direct effects of social policies may seriously mislead the evaluation of social reforms.

As expected, the complete elimination of gas subsidies (simulation 1) or its selective elimination across non-poor households (simulation 2) would initially

[15] Other poverty and income inequality indexes were also computed (P1, P2, and Theil, respectively). These are not reported here and are available upon request to the authors. In general, these indicators do not alter the sign or order of magnitude of the changes reported for the incidence of poverty and the Gini coefficient.

increase poverty incidence by more than three percent points. Despite poor households capture proportionally little of gas subsidies; they represent a considerable source of resources among poor households: approximately 6% of total household consumption as indicated in table 2 above. As a substantial share of gas subsidies accrues to non-poor households, the selective elimination of gas subsidies among non-poor households adds few additional distributive consequences to the complete elimination of the scheme. For this reason, the distributive impacts of simulations 1 and 2 are rather similar.

Considering only direct distributive effects of these reforms would have overestimated their impact on poverty. As table 8 shows, the elimination of social transfers increases labour participation of males and females (especially among the latter) as well as female working hours. This increase in labour supply partially compensates the negative distributive effect of losing household gas subsidies. In fact, increases in labour supply halve down to 1.6 (1.2) percent points the immediate direct effect of the (selective) elimination of gas subsidies.

Direct and indirect distributive effects also vary across simulations that combine gas subsidies and solidarity bonds. Re-orienting to poor households resources released from the total elimination of gas subsidies (simulation 3) reduces modestly poverty incidence by 0.4 percent points. However, there are substantial direct distributive effects underlying this modest poverty reduction. In spite of their targeting problems, solidarity bonds are capable of over-compensating the marked poverty increase that follows the elimination of gas subsidies.

Also, the distributive consequences of indirect effects are substantial. The final reduction of poverty goes from 0.4 to one percent point once indirect effects are factored in. The additional reduction in the incidence of poverty indicates that labour incentive effects from the elimination of gas subsidies exceed labour disincentives from the increase in solidarity bonds. This is not surprising given that gas subsidies produced larger behavioural responses (estimated as labour elasticities) than solidarity bonds. See table 8 above.

Simulation 4 shows even more starkly the relevance of indirect effects in distributive evaluations. The elimination of gas subsidies to non-poor households causes substantive work incentives across these households, raising the overall reduction of poverty from the initial 0.1 percent (from direct effects only) to 1.4 percent points. The scarce poverty reducing capacity of the direct effects of this

reform should not result surprising, though. In effect, the increase in the coverage of solidarity bonds after re-orienting gas subsidies exceeded the increase in resources shifted to the bond scheme. This situation led to a decline in the average transfer to solidarity bond beneficiaries from US$17.7 to US$15.3 monthly (see table 3).

TABLE 9
Effects on poverty incidence and income inequality of gas subsidies and solidarity bonds reforms

		Poverty incidence Base Line P_0=56.4 %		Per capita household income inequality Gini Coeff. Baseline = 0.546	
		Direct effects (percent points)	Direct and indirect effects (percent points)	Direct effects (percent points)	Direct and indirect effects (percent points)
		Reforms on gas subsidies			
Sim. 1	Elimination of gas subsidies	3.1	1.6	0.013	0.015
Sim. 2	Elimination of gas subsidies to non-poor households	3.0	1.2	-0.002	-0.005
		Combined reforms on gas subsidies and solidarity bonds			
Sim. 3	Elimination of gas subsidies and funds shifted to solidarity bond targeted to poor households	-0.4	-1.0	-0.033	-0.048
Sim. 4	Elimination of gas subsidies to non-poor households and funds shifted to solidarity bond targeted to poor households.	-0.1	-1.4	-0.033	-0.046

The disaggregation of distributive effects across categories of households confirms that combined reforms of gas subsidies and solidarity bonds would lead to reductions of poverty incidence. There are interesting particularities, though. According to Table 10, the elimination of gas subsidies (sim. 1) hits mostly urban, small and medium-sized households. Furthermore, households are specially vulnerable to this reform when their heads are relatively well educated (i.e., have at least secondary and/or tertiary education); are unemployed; or work as employees. In those cases the elimination of gas subsidies increases the incidence of poverty beyond the aggregate average. With the exception of households with unemployed heads, the baseline poverty incidence among those households was lower than the national

average. In other words, the elimination of gas subsidies affects mostly non-poor households as they consume more gas than poor households.

When the elimination of gas subsidies is targeted to non-poor households (sim. 2) neither female-headed nor rural households are especially vulnerable to this reform. This underlies the smaller consumption of gas in female-headed (and typically poorer) households and their higher dependence on solidarity bonds. Not surprisingly, female-headed households are those benefiting most from combined gas subsidy elimination accompanied by solidarity bond re-targeting (sim. 3 and 4). Also, rural households may be less dependent on gas subsidies as alternative sources of energy are available and preferred in rural areas (firewood, for example). In that case, the elimination of gas subsidies would affect rural households proportionally less than urban households.

In contrast, substantial poverty reductions are observed among categories of households with baseline poverty incidence higher than the average. That is the case, in effect, across large-sized households with six or more members. Such households have likely more family claims for the solidarity bond scheme and, as a result, would receive more benefits from a better targeting of these bonds. Likewise, households with self-employed heads and female heads would expectedly achieve larger poverty reductions than the aggregate average. The labour and gender characteristics of their heads would make these households qualify more likely for solidarity bonds.

Finally, poverty increases would also take place in households with low poverty incidence in the baseline, such as small and medium size households. As these households would typically have low family claims for the solidarity bonds, the better targeting of this scheme would not compensate much for the loss of resources that follow the elimination of gas subsidies.

The simulated reforms produce also limited distributive effects on income inequality, as table 9 shows. The complete elimination of gas subsidies would increase overall income inequality as the expected increase in individual labour supply among both poor and non poor household members rewards the latter with larger hourly earnings (sim. 1). The remaining simulations show that targeting social transfers in favour of poor households have favourable effects towards more income equality. These effects are rather limited in magnitude (sim. 2) if not accompanied by effective pro-poor targeting of solidarity bonds, though. In fact, combined reforms on gas subsidies and solidarity bonds reduce the income inequality indicator some 6% (sim. 4) and up to 9% (sim. 3) when indirect effects are also taken into consideration.

TABLE 10
Disaggregated effects of simulated reforms in the gas subsidy and solidarity bonds by categories of household

	Baseline	Sim. 1	Sim. 2	Sim. 3	Sim. 4
	(Poverty incidence, %)	(Change in the incidence of poverty, percent points change)			
		Household location			
Urban	45.0	2.1	1.8	-0.9	-1.5
Rural	68.1	1.0	0.4	-1.1	-1.2
		Household Size			
Up to 3	41.1	3.5	2.9	3.5	2.3
4-5	44.8	2.6	1.8	1.6	0.4
6 or more	63.1	0.8	0.5	-3.2	-2.9
		Household head characteristics			
Male	53.5	1.7	1.3	-0.8	-1.2
Female	59.0	1.2	1.0	-1.9	-2.4
Primary education	64.8	1.2	0.8	-1.5	-1.4
Secondary education	46.4	2.4	2.1	-0.3	-1.4
Tertiary education	20.8	2.2	1.9	0.0	-1.2
Inactive	66.7	1.6	1.4	-0.6	-0.4
Unemployed	72.3	3.1	4.3	3.8	2.4
Employed	47.8	2.2	1.7	0.1	-0.7
Employer	44.3	1.5	1.1	-0.2	-0.5
Employee	48.1	3.0	3.0	-1.1	-1.5
Self employed	64.5	1.3	0.5	-2.0	-2.7

6 CONCLUSIONS AND POLICY RECOMMENDATIONS

The prevailing argument that gas subsidies are highly regressive and solidarity bonds clearly pro-poor has led the new administration to consider the elimination of gas subsidies and a shift of these resources into solidarity bonds. Great distributive gains are expected of this reform. The present analysis, however, highlights some features questioning the distributive potential of reforms involving the elimination of gas subsidies. First, current qualifying criteria for solidarity bonds seem unsuited to discriminate low from middle income households. Any reform that fails to change current qualifying criteria for solidarity bonds is bound to siphon off substantial benefits into middle income groups. Lowering the household earnings threshold or

introducing progressive subsidising to gas consumption levels may bring redistributive improvements. More substantial changes involve linking the reception of solidarity bonds to education, nutrition or health programs. These conditional cash transfer schemes have proven rather effective in both poverty reduction and shifting behaviour in Mexico (*Progresa*) or Brazil (*Bolsa Escola*).[16]

Secondly, the elimination of gas subsidies without further compensating measures is bound to increase poverty incidence. This effect was estimated in some 1.6 percent points or 36,000 households. In spite of the regressivity of this subsidy, it transfers substantive resources equivalent to 6% of total consumption across poor households. This loss of resources would exceed the expected flow of household earnings resulting from labour incentives induced by the elimination of gas subsidies.

Fiscally neutral policies that combine total or partial elimination of gas subsidies with more effective targeting of solidarity bonds would simultaneously improve poverty and inequality records in Ecuador. The estimated distributive potential of these combined reforms would reach between one and one and a half percent points. Nonetheless, this potential distributive gain would lower had more realistic assumptions on targeting costs and labour mobility been considered. Improvements in the dispersion of incomes may reach some to 9% with respect to the baseline Gini coefficient.

Certainly, the present simulation exercise requires further refinement. Prospective developments should include additional simulation scenarios; valuation on the cost of reforms; and a more detailed map of distributive impacts by household categories. However, the conducted simulations cast five clear messages for the actual Ecuadorian social policy making debate. First, targeting transfers require qualifying criteria more effective in discriminating low and middle income households. Secondly, substantial reforms on gas subsidies and solidarity bonds would not bring substantial improvements in the distribution of incomes in Ecuador. In fact, great distributive gains following the elimination of current gas subsidies constitute a grossly misleading judgement. Thirdly, it is also misleading to evaluate social policies only through their direct effects. Fourthly, labour market rigidities may erode the distributive compensating role that labour incentives play following social expenditure cuts. Fifthly, the reduction of poverty incidence from social expending

[16] See: Coady et al. (2002) for a recent review of conditional cash transfers.

reforms may turn difficult to sustain over time. In the simulated reforms, less vulnerable groups – that typically consume more gas – are those bearing the brunt of benefiting most vulnerable groups. A social strategy that simultaneously improve the living conditions of the most vulnerable and worsen off conditions across the least vulnerable may be hard to politically sustain over time.

REFERENCES

Ashenfelter, O., & J.J. Heckman (1974) 'The estimation of incomes and substitution effects in a model of family labor supply' in: *Econometrica* 42 (1): 73-85.

Becker, G. (1965) 'A theory of allocation of time' in: *Economic Journal* 75: 493-517.

Blomquist, N.S. & U. Hansson-Brusewitz (1990) 'The effects of taxes on male and female labor supply in Sweden' in: *Journal of Human Resources* 25 (3): 317-57.

Coady, D., M. Grosh and J. Hoddinott (2002) The Targeting of Transfers in Developing Countries: Review of Experiences and Lessons. Social Safety Net Primer Series. Washington, DC: The World Bank.

Cuesta, J. (2001) *Social Transfers, the Household and the Distribution of Incomes in Chile.* PhD tesis, Oxford University.

Cuesta, J., M. León & J. Ponce (2003) Efectos Indirectos del Gasto Social Fiscal en la Generación de Ingresos en el Ecuador. En *Efectos del Gasto Social en la Generación de Ingresos del Ecuador* edited by R. Vos. Quito: SIISE-ISS.

Chiappori, P.A. (1997) "Collective" models of household behavior: the sharing rule approach. En *Intrahousehold resource allocation in developing countries: models, methods and policy* edited by L. Haddad, J. Hoddinott & H. Alderman. Baltimore: The Johns Hopkins University Press.

Deaton, A. & J. Muellbauer (1980) *Economics and consumer behavior*. Cambridge: Cambridge University Press.

Hausman, J.A. (1985) 'The Econometrics of Nonlinear Budget Sets' in: *Econometrica* 53 (6): 1255-82.

Hausman, J.A. (1986) Taxes and Labour Supply. En *Handbook of Economics*, vol. 1 edited by A. J. Auerbach and M. Feldstein. New York: North-Holland.

Hausman, J. A. and P. Ruud (1984) 'Family Labor Supply with Taxes' in: *American Economic Review* 74 (2): 242-48.

Heckman, J.J. (1993) 'What Has Been Learned about Labor Supply in the Past Twenty Years?' in: *American Economic Review* 83 (2): 116-21.

Heckman, J.J. (1979) Sample Selection Bias As a Specification Error. *Econometrica* 47(1): 153-62.

Heckman, J.J. (1976) 'The Common Structure of Statistical Models of Truncation, Sample Selection and Limited Variables And a Sample Estimator For Such Models' in: *Annals of Economic and Social Measurement* 5: 475-92.

Joshi, H. (1986) 'Participation in paid work: evidence from the Women and Unemployment Survey' in:*Unemployment, search and labour supply* edited by R.W. Blundell & I. Walker. Cambridge: Cambridge University Press.

Killingsworth, M. (1983) *Labour Supply*. Cambridge: Cambridge University Press.

Killingsworth, M. and J.J. Heckman (1986) 'Female labor supply: a survey' in: *Handbook of Labour Economics,* vol. 1 edited by O. Ashenfelter & R. Layard. New York: North-Holland.

Layard, R., M. Barton & A. Zabalza (1980) 'Married Women´s Participation and Hours' in: *Economica* 47: 51-72.

León, M., R. Vos & W. Brborich (2001) *Son efectivos los programas de transferencias monetarias para combatir la pobreza.* Proyecto Evaluación de impacto del bono solidario en el Ecuador. Quito: SIISE-ISS

Licona, G. (1997) 'Oferta laboral familiar y desempleo en México. Los efectos de la pobreza' in: *El Trimestre Económico* 64 (4): 531-68.

Mroz, T.A. (1987) 'The sensitivity of an empirical model of married women's hours of work to economic and statistical assumptions' in: *Econometrica* 55 (4): 765-99.

Pencavel, J. (1986) 'Labour supply of men: a survey' in: *Handbook of Labor Economics* vol. 1 edited by O. Ashenfelter & R. Layard. New York: North-Holland.

Tobin, J (1958) 'Estimation of Relationships for Limited Dependent Variables' in: *Econometrica* vol. 20, pp. 512-53.

Triest, R.K. (1990) 'The effects of income taxation on labor supply in the United States' in: *Journal of Human Resources* 25 (2): 491-516.

Vos, R., M. León, J. Ponce, J. Cuesta & W. Brborich (2003a) Quién Se Beneficia del Gasto Social en Ecuador. En *Efectos del Gasto Social en la Generación de Ingresos del Ecuador* edited by R. Vos. Quito: SIISE-ISS.

Vos, R., M. León & R. Ramírez. 2003b. Política Social y Tendencias en el Gasto Social. En *Efectos del Gasto Social en la Generación de Ingresos del Ecuador* edited by R. Vos. Quito: SIISE-ISS.

Walle, D. van de (1995a) Introduction to *Public Spending and the Poor* edited by D. van de Walle & K. Nead. Baltimore: The Jonhs Hopkins University Press.

Walle, D. van de (1995b) 'The distribution of subsidies through public health services in Indonesia, 1978-87' in: *Public Spending and the Poor* edited by D. van de Walle & K. Nead. Baltimore: The Johns Hopkins University Press.

APPENDICES

Appendix 1

Labour supply in Ecuador (elasticities)

	JOINT		MALE		FEMALE	
	Participation	Working hours	Participation	Working hours	Participation	Working hours
Partner's age			0.0273**	-0.0365	0.0301*	-0.0054
Partner's schooling			-0.0475**	-0.0085	-0.0922*	-0.0338*
Male, household head, aged 18-45	0.0763**	0.0532**	0.0554**	0.0546**		
Female, non-household head, 18-45	-0.0014	-0.0114*			0.0978**	0.0489*
Female, household head, 18-45	0.0051**	0.0032*			0.0236**	0.0166**
Male, non household head, 18-45	0.0290**	0.0231**	0.0115**	0.0224**		
Number of 0-9 aged children in household	0.0237**	0.0082	0.0168**	0.0196**	0.0249*	-0.0154
Number of 10+ aged children in household	0.0067*	0.0042	-0.0011	0.0027	0.0119*	0.0066
Number of elderly in household	-0.0079**	0.0060	-0.0081**	0.0010	-0.0204**	0.0124
Guayaquil Dummy	-0.0004	-0.0157**	0.0072**	-0.0025	-0.0173**	-0.0336**
Provincial cities Dummy	0.0282**	-0.0133*	0.0143**	-0.0001	0.02388**	-0.0407**
Traditional cities Dummy	0.0096**	-0.0180**	0.0066**	-0.0037	0.0035	-0.0380**
Agrarian cities Dummy	0.0104**	-0.0396**	0.0203**	-0.0195*	-0.0366**	-0.0761**
Gas subsidy	-0.0769**	-0.0342**	-0.0258**	-0.0052	-0.1106**	-0.0596**
Solidarity Bond, Women	0.0058	-0.0226**	0.0042	-0.0052	-0.0043	-0.0461**
Solidarity Bond, Elderly	0.0021	-0.0052**	0.0000	-0.0051*	-0.0046	-0.0056
Other non labour household incomes	-0.0015	-0.0017	-0.0002	-0.0037*	-0.0049*	0.0028
Corrected hourly labour earnings	1.1335**	-0.0175	0.6032**	-0.6216**	1.5684**	0.6081*
Mills Ratio		-0.2190**		-0.2346**		-0.1194**
Observations	17166	12356	8383	7130	8783	5226
Wald-Chi^2(n) – F(n, m)	1038.68**	55.06**	438.67**	20.68**	460.68**	11.51**
Pseudo-R^2	0.1374	0.0961	0.1983	0.0835	0.0666	0.0495
Log-Likelihood	-7994.56		-2298.78		-5299.45	

Note: (**) indicates that a coefficient is significantly different from 0 at a 99% confidence; (*) significantly different from 0 at 95%; and ( ) indicates that is not significantly different from 0 for intervals of confidence higher than 95%.

Appendix 2

Labour supply in Ecuador without selection bias correction in Ecuador (elasticities)

	JOINT		MALE		FEMALE	
	Participation	Working hours	Participation	Working hours	Participation	Working hours
Partner's age			0.0140*	-0.0490*	-0.0230	-0.0210
Partner's schooling			-0.0260**	-0.0040	-0.0620**	-0.0290
Male, household head, aged 18-45	0.0720**	0.0640**	0.0366**	0.0550**		
Female, non household head, 18-45	-0.0013**	-0.0370**			0.0630**	0.0059
Female, household head, 18-45	0.0029**	0.0007			0.0160**	0.0110**
Male, non household head, 18-45	0.0348**	0.0320**	0.0120**	0.0340**		
Number of 0-9 aged children in household	0.0152**	0.0035	0.0122**	0.0180**	0.0150	-0.0220
Number of 10+ aged children inhousehold	0.0032	0.0026	-0.0007	0.0006	0.0068	0.0036
Number of elderly in household	-0.0012	0.0090*	-0.0047**	0.0024	0.0027	0.0240**
Guayaquil Dummy	-0.0007	-0.0147**	0.0060**	-0.0039	-0.0150*	-0.0330**
Provincial cities Dummy	0.0217**	-0.0155**	0.0120**	0.0000	0.0210*	-0.0420**
Traditional cities Dummy	0.0066**	-0.0180**	0.0052**	-0.0036	0.0016	-0.0380**
Agrarian cities Dummy	0.0000	-0.0400**	0.0130**	-0.0190**	-0.042**	-0.0770**
Gas subsidy	-0.0590**	-0.2660*	-0.0210**	-0.0061	-0.0940**	-0.0550**
Solidarity Bond, Women	0.0034	-0.0240**	0.0055*	-0.0058	-0.0070	-0.0480**
Solidarity Bond, Elderly	0.0012	-0.0055**	-0.0002	-0.0055*	0.0040	-0.0050
Other non labour household incomes	-0.0009	-0.0150	0.0002	-0.0035*	-0.0043*	0.0027
Schooling years	0.0009	0.0810	0.0033	-0.0320	0.0358	0.0450
Age	0.9480**	1.0200**	0.4870**	1.4400**	1.5660**	0.7500**
Square age	-0.4830**	-0.5010**	-0.2340**	-0.6620**	-0.8340**	- 0.4400**
Observations	17071	12273	8328	4273	8743	3318
Wald-Chi2(n) – F(n, m)	1327.38**	51.72**	564.64**	8.89**	500.19**	8.54**
Pseudo-R2	0.1635	0.0858	0.2576	0.0594	0.0851	0.0448
Log-Likelihood	-7722.35		-2119.03		-5174.59	

Note: (**) indicates that a coefficient is significantly different from 0 at a 99% confidence; (*) significantly different from 0 at 95%; and ( ) indicates that is not significantly different from 0 for intervals of confidence higher than 95%. 'n' indicates the number of estimating variables, and, m, the degrees of freedom in the F-test.