IMPLICATIONS OF HOUSEHOLD SAVING ON POVERTY

Maros Ivanic

Department of Agricultural Eonomics
Purdue University
West Lafayette, Indiana, USA

ABSTRACT

The commonly observed difference between household income and expenditure appears increasingly important in the poverty reduction debate. Previous studies that explored poverty reduction using household survey data have struggled with significant discrepancies between household income and expenditure but they have left them at most only arbitrarily reconciled. However, because this difference is more significant for the poorest households, ignoring it has placed a significant strain on the credibility of the poverty results without fully understanding the differences between income and expenditure of the poorest households.

To address the problem of the difference between household income and expenditure, this paper proposes explaining this difference as household saving determined within the household demand system. It justifies this inclusion of savings in households demand structures based on empirical and theoretical grounds. Following the work of Hertel *et al.* (2004), this paper performs a multilateral trade liberalization in an adjusted GTAP model to explore the implications of such a treatment of savings on the poverty results.

The paper finds that household saving greatly affects the very poorest households that rely on selling their own assets as a coping strategy. Even though their ability to dissave, in general, acts positively on the poorest households that are able to afford the basic consumption, a falling price of capital goods greatly reduces their wellbeing through placing more strain on their asset reduction. The paper also finds that the price of capital goods has opposing effects on the poor and the rich, thus potentially increasing the size of the poverty gap when rising, and decreasing it when falling.

1. INTRODUCTION

Poverty research continues to be an important part of the exploration efforts in applied economics on both global and local scale. Because poverty is basically an empirical issue that needs to be addressed using real world data, it has necessitated the need for modeling tools to investigate this issue. Among other models, the inexpensive and globally consistent GTAP model has been a natural vehicle for this kind of research. Though this behavior has been more or less successfully built into previous single country CGE models, a few issues remain unsettled, most notably the issue of linking household income and consumption through household savings. This issue is of great importance because the phenomenon of dissaving is often observed among the poorest households, with additional ramifications for households' consumption and wellbeing.

There are several ways of dealing with household savings. The most common examples in literature however employ the simple assumption of Chan *et al.* (1999) that household income and expenditure are equal, thus avoiding the issue of savings altogether. This tendency to ignore the difference between expenditure and income is probably fueled by the fact that both income and expenditure data are expensive, resulting in many researchers choosing to accept them both as identical. The World Bank Development Report also follows the suit by publishing its inequality measures based on income and expenditure in a single table. Other authors have also chosen to assume the equality of income and expenditure for modeling reasons where the link between these two is unclear and thus is assumed away. This is the case of the work of Hertel *et al.* (2004).

Despite some benefits, the assumption of income being equal to expenditure is significantly flawed and should be dismissed. It goes fundamentally against the observed data that show that for the majority of households income is different from expenditure in a systematic way where the poorest household dissave and richest households save. Also this simplification has disastrous implications on modeling the household demand, because allowing expenditure to go to zero — as zero income is commonly observed in household surveys — is incompatible with a subsistence-based demand system, such as is the case of the LES or AIDADS demand systems. Moreover the distributions of income and expenditure are hardly equal — the income distribution is much wider than the distribution of expenditure.

With the goal of shedding more light on the issue of household savings, this paper bridges household income and expenditure data by introducing savings in a consistent demand system. The demand system of choice is the "An Implicit Direct Additive System" by Rimmer and Powell (1992) as this system is capable of non-monotonic consumption shares across income and thus is very suitable for the consumption side of poverty analysis (Hertel *et al.*, 2004). Even though this system is generally estimated with consumption goods (Reimer and Hertel, 2003), the previous treatment of AIDADS' close relative, LES system, has shown that the introduction of savings is possible. In introducing savings into the AIDADS system, the chapter closely follows the method of Lluch (1973) who introduces savings into LES by solving an intertemporal utility maximization problem and the method of Howe (1975) who further shows that this methodologically rigorous treatment of savings is identical to savings being considered as just another consumption good in a static optimization problem.

Similarly to the treatment of Harrison *et al.* (2002) and Hertel *et al.* (2004), this paper uses a micro-based version of the GTAP model that retains its full, global CGE capacity and - in addition to that - integrates sound microeconomic modules for multiple countries. Based on the work of Hertel *et al.* (2004), these micro modules incorporate samples of households divided into relevant groups stratified by income source. The stratification is aimed at improving the model's ability to address poverty issues for different types of households. Each household's behavior is modeled separately, replacing the original regional private household agent with a set of households. The households' endowments are determined exogenously by the observed household survey data. The preferences of the households are AIDADS with the parameters estimated econometrically in other studies (Hertel *et al.*, 2004). Saving and transfers are explicitly modeled by separating private savings out of the current regional savings and determining them endogenously by each household. The framework is general enough to permit dis-saving by the poorest households, as is often observed in the survey data.

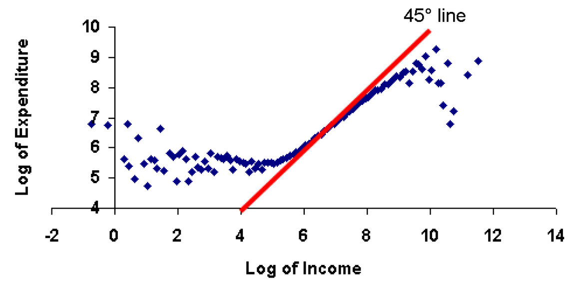

Fig. 1. A scatter-plot of household income and expenditure in Indonesia and the 45 degree line. Each point represents the average expenditure of a cluster of households with similar income.

The data used for the model consist of the original GTAP data base that has been reconciled with the available household survey data, and the sample of households including the information on the household savings and transfers. In this paper, the microeconomic data are available for fourteen regions. Most of the parameters used in the new model come from the original GTAP parameters, with the exception of the AIDADS parameters, which come from independent studies on consumer demand.

2. INCLUSION OF SAVINGS IN HOUSEHOLD DEMAND

Treatment of savings is an important issue in reconciling household income and expenditure reported by various household surveys. In general, the household survey data suggest that household income is different from expenditure. Because the level of this discrepancy appears to be positively correlated with household income, it suggests that this difference representing household savings, as typically would expect savings to be the greatest for the richest households that put aside a substantial level of their income. Similarly, it is plausible to observe that savings tend to drop with falling income and eventually become negative for the poorest households that instead of setting aside some of their income sell their assets to support their consumption. This pattern is observed in Figure 1 that plots the averages of household consumption and incomes by household income in Indonesia.

Figure 1 makes it clear that consumption and income appear in monotonic relationship not dissimilar to the one between the demand expenditures and income. This observation greatly supports the idea of including savings along with the consumption goods into the household demand system based on household income. Similar efforts to support such inclusion on theoretical grounds have already been exercised by Howe (1975) who showed that inclusion of savings into the LES demand system under some restrictions results in an identical demand system of Lluch (1973) obtained by solving the LES system as an intertemporal utility maximization problem with deferred consumption, or savings.

2.1. Including saving into the LES system

Howe (1975) shows that his LES system with savings is identical to the system of Lluch (1973) only if the subsistence level of savings equals zero. Under such conditions, his system yields the level of savings S as a fixed portion β_s of income z

$$s = \beta_s z, \tag{1}$$

which is identical to the solution of Lluch's dynamic optimization problem of discounted utility maximization with infinite horizon.

Such a restrictive formulation of savings is, however, not very consistent with the data shown in Figure 1. Saving rates obviously vary with income level. Also, this formulation does not permit negative levels of savings, so important for the poor households.

The general expenditure demand under the LES system is

$$x_i = \gamma_i p_i + \beta_i \left[Y - \sum_j \gamma_j p_j \right] \tag{2}$$

If savings are to reach negative values, it is necessary that the general LES expenditure formulation for saving include a negative intercept, $\gamma_i p_i$, interpreted in the LES framework as the subsistence expenditure level. This interpretation remains valid for the notion of saving as well, meaning that this is the minimum possible level of saving (or maximum level of dissaving). Because this value is attained at the minimum level of income (zero), it would make sense if the maximum level of dissaving equal the subsistence level of expenditure for the rest of the goods, or

$$-\gamma_s p_s = \sum_{j \neq s} \gamma_j p_j. \tag{3}$$

Such a treatment would then not only permit negative saving, but it would also make zero an admissible value for income in the demand system.

Surprisingly, establishing an adapted LES system that would have these properties is possible with just a minor conceptual change to the LES demand system where the total income is thought of to consist of two components: observed current income y and the portion of the household assets that can be used to purchase the subsistence level of consumption, called *subsistence reserve* r, so that

$$z = y + r. \tag{4}$$

In this system a household with zero observed income will spend its subsistence reserve and will therefore appear to have a positive income ($z = r$) under the original LES system.

Splitting income into current income and subsistence reserve produces a new LES system (NLES) based on current income y instead of real income z, where the level of savings s is determined as

$$s = -r + \beta_s y, \tag{5}$$

thus permitting negative savings for household with income y lower than the cost of subsistence r, making this demand system fit far better the observed data in Figure 1.

A very useful property of any NLES demand system is that there exists a regular LES system that yields identical demand expenditures for each expenditure in both systems. In other words, if we consider an NLES demand system of n goods and saving with the expenditure demands $x_i^N(y)$ for each level of income y, there always exists another, parallel, LES system of n goods with expenditure demands $x_i^L(e)$ for each expenditure level e with the property that these demands are identical for the corresponding levels of income and expenditure. Correspondence between income and expenditure means the following:

$$e = y - x_s^N(y) = \sum_{i=1}^{n} x_i^N(y). \tag{6}$$

The existence of parallel LES and NLES demand systems is a strong analytical argument for linking expenditure and income through saving. It also means that an existing LES demand system on expenditure may be expanded to cover income with the addition of saving and without disturbing the original consumption shares at any income (expenditure) level.

	Estimate	Standard error
β_s (MPS)	0.3	0.06
$\gamma_s p_s$(subsistence reserve)	-148.54	1007.3

Table 1. OLS estimates of the LES saving parameters of the income and consumption data in Indonesia.

The relationship between the parameters of NLES and its parallel LES system is surprisingly simple. The subsistence levels of each consumption good, γ, remain the same in both systems. The subsistence level of saving in the NLES system is equal to $\gamma_s p_s = -\sum_i \gamma_i b_i$. The marginal consumption shares, β, change more substantially according to the following formula

$$\beta_i^L = \frac{\beta_i^N}{1-\beta_s^N} \tag{7}$$

where β_i^N and β_i^L represent the marginal consumption shares for good i in the NLES and LES systems, respectively, and β_s represents the marginal propensity to save.

2.2. Estimation of marginal propensity to save and subsistence reserve in LES

Using the household survey data for Indonesia (Indonesia, 1993), it is possible to estimate both the marginal propensity to save (β_s) and the subsistence reserve $(\gamma_s p_s)$ from the expenditure equation 2 for saving:

$$x_s = \gamma_s p_s + \beta_s \left[Y - \sum_j \gamma_j p_j \right] \tag{8}$$

If we assume that equation 3 holds, equation 8 may be rewritten as

$$x_s = \gamma_s p_s + \beta_s Y. \tag{9}$$

Equation 9 may be estimated on the available income and saving data directly. The ordinary least square estimates with standard errors are shown in Table 1.

The estimated value of the marginal propensity to save of 0.3 appears to be the same as the value often assumed in macroeconomics literature. Moreover it appears fairly significant as with some 95% probability its value lies between 0.18 and 0.42, all fairly plausible values.

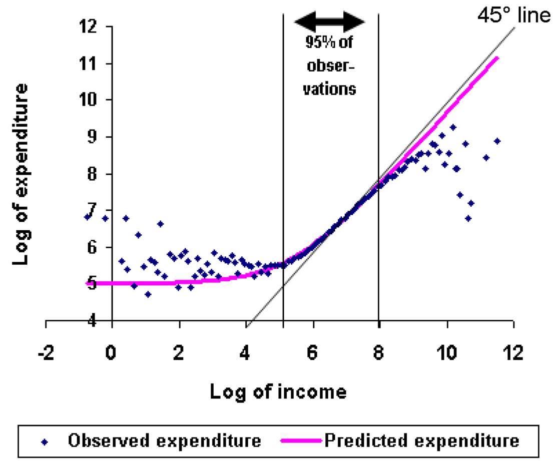

Fig. 2. Scatter-plot of the observed and estimated expenditure for the mean income of the observed clusters of households in Indonesia..

The value of the subsistence reserve is found as expected negative, however not too significant. As the subsistence reserve level is determined by the less numerous observations of the poorest households with higher variance, its value is not easily anchored. Nevertheless, the negative estimate is greatly supportive of the inclusion of saving in the LES system.

2.3. Including saving into the AIDADS system

Because linking income and expenditure through savings in two parallel LES systems is so simple, it would be very useful if a similar treatment were possible under more general demand systems, such as the AIDADS system, which generalizes the LES system. The bad news is that at present, it appears that no similarly simple analytical transformation of an income-based AIDADS system to an expenditure-based AIDADS is possible so that both systems would yield identical expenditure demands at parallel income and expenditure. In other words, a removal of one good from the AIDADS system renders the remaining demand structure non-AIDADS.

Nevertheless, the distortions between parallel AIDADS systems are quite small in practice. I document this by performing the transformation of a sample AIDADS system in the same way as proposed for the LES system. The parameter values chosen for this exercise are in Table 2. These parameters were used to draw the distribution of consumption shares under the income-based AIDADS system. The parallel

	α	β	γ
Food	0.375	0.075	5
Manufact	0.150	0.225	2
Services	0.225	0.450	3
Save	0.250	0.250	-10

Table 2. Parameter values in the sample AIDADS exercise.

expenditure-based AIDADS system parameters (with asterisk) were specified as:

$$\alpha_i^* = \frac{\alpha_i}{1-\alpha_s} \tag{10}$$

$$\beta_i^* = \frac{\beta_i}{1-\beta_s} \tag{11}$$

$$\gamma_i^* = \gamma_i \tag{12}$$

where index i denotes the set of consumption goods and index s the saving good.

Expenditure levels and consumption shares were calculated first for a range of incomes y in the income-based AIDADS system. These are shown in Figure 3. Similarly, consumption shares were calculated for these expenditure levels in the parallel expenditure-based AIDADS system and are shown in Figure 4. Comparison of these two figures shows *no noticeable difference* between them, suggesting that in empirical work, the AIDADS system also permits a simple link between expenditure and income after savings have been included as another good.

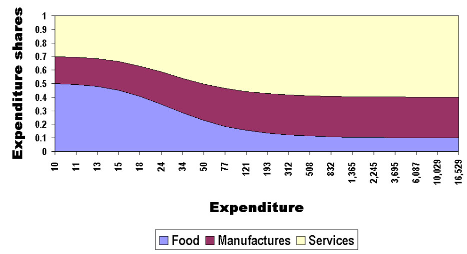

Fig. 4. Expenditure shares for expenditures associated with the income in Figure 3.

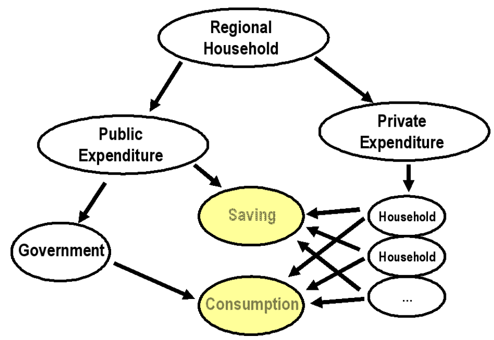

Fig. 5. Structure of regional household expenditure.

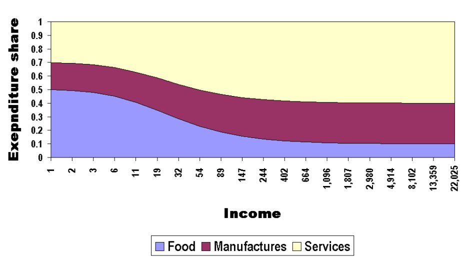

Fig. 3. Expenditure shares for given incomes.

3. GTAP MODEL WITH ENDOGENOUS HOUSEHOLD SAVING

The model used in this paper is derived from the standard version 6 GTAP model. It contains 23 regions and each region is represented by a single reginal household that only determines the split of regional income for private and public expenditure. Similarly to the treatment of Hertel *et al.* (2004), private and public spending changes at an equal rate, meaning that the shares of private and public expenditures are kept fixed in the model.

The model consists of 31 production commodities used in producing six consumption commodities. Similarly to the model used by Hertel *et al.* (2004), the demand for consumption in each region is now AIDADS. Instead of a single agent representing the private household, however, the model used in this paper is modified to include 120 income-differentiated households per region. All households share the same preferences within a country described by a set of AIDADS parameters. Figure 5 shows the basic structure of the regional household expenditure under this treatment.

Based on the household survey data, each household's income level and structure are determined by its share of the region's five primary factors (agricultural profits, non-agricultural profits, skilled and unskilled labor and natural resources). Beside income derived from production factors, transfers appear to be a significant source of household income according to the household survey data. To implement this

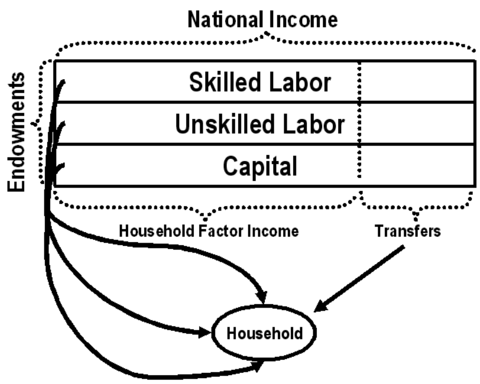

Fig. 6. Structure of regional household income.

phenomenon, the model introduces transfers through a tax on national income that is delivered to the households again according to the survey data. Because the data were insufficient to separate out public and private transfers, they were both lumped together and assumed to be public, financed by a tax on primary factors. Additionally, the total burden of the tax is assumed to be shared equally among each primary factor, reflecting the lack of additional data on specific factor taxation in the household surveys. Figure 6 illustrates this treatment of the transfer tax in the model.

4. EFFECT OF SAVING INCLUSION ON POVERTY ANALYSIS

To evaluate the importance of the assumption of household saving and dissaving, I have performed two experiments of global multilateral trade liberalization in the GTAP model, generally following the data and method of Hertel *et al.* (2004): the data were a version 5 GTAP data reconciled with household survey data for fourteen developing countries following Ivanic (2004). The method was based on finding the poverty level of utility and counting the poverty headcount change in seven income-specialized strata [1].

The main difference between my approach and that of Hertel *et al.* (2004) consisted of my inclusion of all income-differentiated households in the general equilibrium model itself by breaking the private household into 140 private households, twenty households per each stratum. This was necessary in order to observe not only the primary effect of household saving decisions on household income, but also its effect on the economy as a whole.

Most of the demand system used in this paper is based on the work of Hertel *et al.* (2004) who estimated the α and β parameters based on household survey income data. Because this estimation did not yield plausible subsistence quantities, these were adopted from the work of Hertel *et al.* (2000) that estimated the AIDADS system on expenditure data.

To evaluate the effect of household saving assumption on poverty, two trade liberalization simulations were run. In the first simulation, Simulation S, household savings were inserted into each region's AIDADS demand structures to create parallel income-based AIDADS demand systems. The income of each household was taken from the household survey income data. The contrasting simulation, Simulation NS, was run without the savings on the original demand system, where each household's original expenditure was determined as the expenditure yielded by the parallel income-based demand system at household's income level. Starting with the parallel income and expenditure levels, both simulations were assured to yield the same original expenditure shares. All of the difference between the two policy simulations was represented by the different treatment of household savings.

The treatment of other countries for which the household survey data were not available was identical under both scenarios to minimize additional distortion to the results.

4.1. Change in consumer and factor prices

The main results for these two scenarios are in Tables 5 and 6. Observing the first column of the tables, it is apparent that real income increased by almost the same rate in both simulations. This is an expected result as the only change in the model came in the demand structure, changes in which should only shift consumption within these countries, without affecting production efficiency or global production.

The next four columns show the changes in the real prices of the main consumption categories: food, manufactures, services and — in the case of Simulation S — savings. The difference in demand structures between the two simulations has clearly translated into different demands for these commodities and the resulting price changes. Nevertheless, the demand systems appear very similar as the commodity price changes are very similar, without changing the sign in a single case. The price of food always increases, while the price of manufactures always decreases. The price of services generally increases with a few exceptions. In the case of Simulation S, the price of savings generally falls, again with a few exceptions.

[1]These strata are: agricultural, non-agricultural, rural labor, urban labor, transfer, rural diverse, urban diverse

Even though differences in consumption goods prices are rather small, these differences have a much stronger impact on the returns to the factors in each country due to the magnification effect occurring in the GTAP model. Because food, manufactures and services have very different factor intensities, small changes in their prices result in much greater changes in returns to the factors they used most intensively. This is indeed true as shown by the rest of the columns in the tables that show the changes to real returns to the primary factors. They change much more profoundly, many times changing the signs, between the simulations.

4.2. Change in overall poverty

The price results of both simulations were used to estimate the changes in the headcount of poverty in each of the fourteen focus countries by evaluating the changes to each household's income and consumption. Following the method of Hertel *et al.* (2004), the poverty level of utility [2] was established for each region. Then each household's change in utility was evaluated to establish whether its poverty status has changed following each simulation. These results, shown in Table 3, suggest that the differences in poverty changes due to different assumptions on household saving are rather modest in most cases. Brazil is the most notable exception where resulting poverty is much higher under Simulation NS.

	Simulation	
	S	NS
Bangladesh	0.3	-0.1
Brazil	-3.0	30.7
Chile	-4.0	-4.0
Colombia	-1.0	-1.5
Indonesia	1.2	3.5
Malawi	-1.2	-1.9
Mexico	0.7	0.9
Peru	-4.4	-0.6
Philippines	-1.6	0.0
Thailand	-15.7	-16.4
Uganda	-0.4	-0.3
Venezuela	0.4	0.4
Vietnam	-7.0	-6.1
Zambia	-14.5	-12.1

Table 3. Overall percent changes of poverty headcount in the fourteen focus countries.

[2]Poverty is thus defined in terms of utility derived from the poverty level of income. Because this utility level is invariant to changes in commodity prices, it serves as a useful measure of poverty in simulations.

4.3. Changes in stratum poverty

Even though in all but one case overall poverty level does not change differently between the two simulations, it is possible that its structure changes more profoundly. Because overall poverty is determined as the weighted average of poverty in the seven strata, it is possible that while their average does not change much, the individual strata may experience larger perturbations. In order to ascertain that this structure of poverty does not change between the simulations, Figure 7 plots poverty changes in each stratum for the fourteen countries. The coordinates of each point in the figure represent the change in poverty following two simulations, where the value on the x-axis (y-axis) represents the change following Simulation NS (Simulation S). The 45 degree line in the figure shows the points where both values are identical and this is the region where most of the points lie, meaning that for most strata, poverty change does not differ much between the two simulations. Two exceptions, however, stand out: the transfer and rural labor strata in Brazil (labeled as Br/Tr and Br/LR). While under Simulation S poverty among the transfer specialized households hardly changes, under Simulation NS it increases almost by 250 percent. Similarly, poverty among the rural labor specialized households increases by 52 percent under Simulation NS, while it only increases by 2 percent in Simulation S. These two significant differences in poverty impacts explain the big difference in total poverty change in Brazil as the transfer and rural labor households represent a significant portion of the total poverty in Brazil.

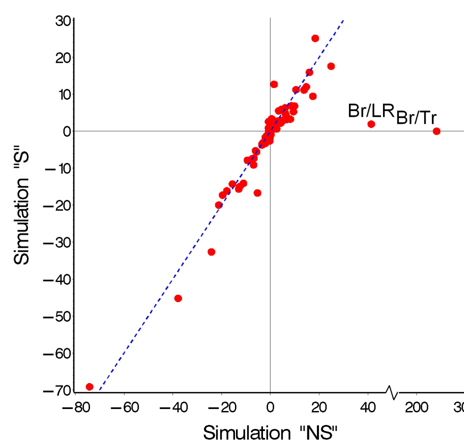

Fig. 7. Stratum poverty changes under both simulations. The outliers are: Br/Tr=Brazilian transfer stratum, Br/LR Brazilian rural labor stratum.

Even though poverty in this paper is defined through the poverty level of utility, the utility is nevertheless intimately attached to the level of household income through the basic economic theory. Therefore, household income distribution enters as a determining factor in the evaluation of policy simulation on poverty. Its role is especially important in explaining the vast differences in poverty between the two simulations in the case of Brazil. The particular flatness of income distribution for some strata is documented in Figures 8 and 9 that plot the original and updated household income and expenditure distributions with the respective national poverty levels of income and expenditure for the transfer stratum. The points on the x-axis represent the population of the transfer stratum in Brazil, ordered by income from the left to the right. Only the first 40% of the population is shown in order to focus on the poor households in the stratum. The solid horizontal line (Poverty0) in each figure shows the level of income necessary to provide utility above the poverty level. Also shown as a solid line (Income0) is the actual income of each household, increasing from the left to the right. The point of intersection A determines the actual poverty level in the Brazilian transfer stratum, which is approximately 5%. Following the simulation, the utility level of poverty shifts into the level depicted by the broken horizontal line (Poverty1). Also the income level of each household changes and this is captured by the other broken line (Income1). The new point of intersection B determines the new poverty level following the simulation.

Figures 8 and 9 show that in this stratum a huge portion of households are concentrated right around the poverty level of income. This accumulation is apparently caused by the level of transfer payments provided by the Brazilian government coincidentally chosen close to $1 per person per day. As a result of this flatness in the income distribution very slight changes in the poverty level of utility as well as income can lead to very different changes in poverty, because roughly 30% of the population of this stratum earn a very similar amount of income.

The consequence of such an income distribution is that it makes the poverty change particularly sensitive to the change in the welfare for these households. As we can see in Figure 8, a greater increase in consumer prices under no-saving scenario causes a huge portion of these households to fall into poverty (poverty rises from 5% to 17%), determined at the intersection of updated household expenditure and poverty level of expenditure. Under the saving scenario, however, consumer prices of staples rise a little less, meaning that the same utility can be obtained for a lower cost, resulting in many fewer households falling into poverty.

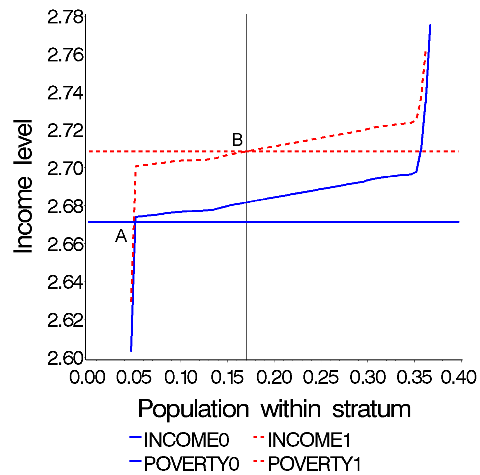

Fig. 8. Original (income0) and post-simulation (income1) income levels for the transfer stratum in Brazil and the national levels of poverty income (poverty0, poverty1) under Simulation NS.

4.4. Effects on poverty gaps

It seems that introducing saving to the demand structures in the GTAP model does not result in many significant changes in poverty among strata. However, despite this apparent similarity in poverty head counts, the effect of introduced household savings could nevertheless have a varying impact on the households. This is because of the differences in the spending patterns among the households with different income levels. While the expenditure on consumption goods is strictly positive for all households under both demand systems, savings is not. While the poor households dissave, the rich ones save. This means that the effect of the savings price has an opposite effect on these households. When the price of savings goes down — as is the case for many of the countries — the poor, who sell their assets to survive will be hurt more, because they have to sell larger quantities. On the other hand, the rich gain because they are able to acquire more assets for less money.

In this model, just as in the standard GTAP model, we assume, for simplicity, that all commodities have a single price throughout the region. Thus even though the rich probably consume more quality and more expensive food, this fact is not captured in the model. Similarly, the same assumption is applied to the notion of the price of saving. Because it may not be clear what the assumption of a single saving price implies in the model, we may spend a few words describing

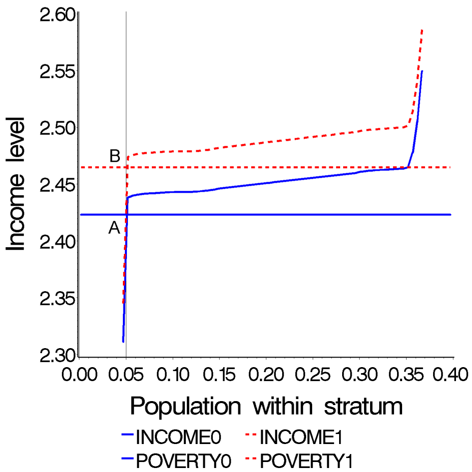

Fig. 9. Original (income0) and post-simulation (income1) income levels for the transfer stratum in Brazil and the national levels of poverty income (poverty0, poverty1) under Simulation S.

what is meant by it and how its definition affects the conclusions stated above. In the GTAP model, price of saving is determined by the cost of the capital goods, suggesting that the nature of saving is to add to capital. In that respect it is plausible that this is the price of saving that the rich face as they save. The price of saving for the poor, however, may be different as their dissaving includes jewelry, estate and perhaps even consumption goods. Even though many of these items may be bought by the richer households as saving assets, the structure of saving among the rich and the poor is probably very different and the notion of a single price of saving faced by all comes under suspicion.

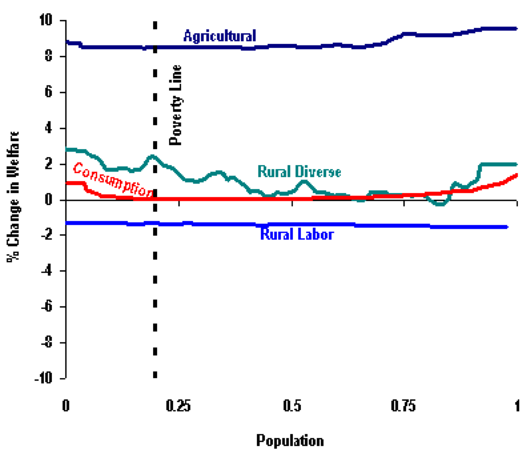

Fig. 10. Income and consumption effects for selected strata in Colombia under Simulation NS.

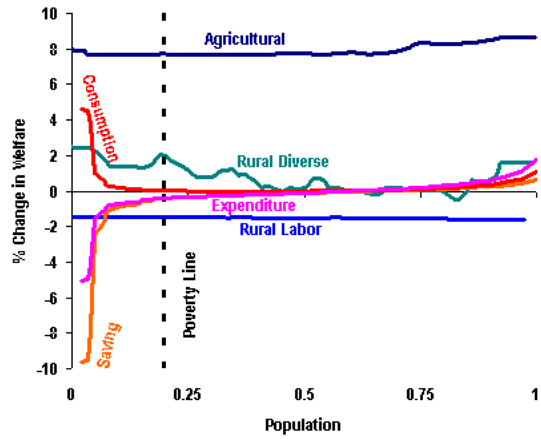

Fig. 11. Income and consumption effects for selected strata in Colombia under under Simulation S.

Assuming a single saving price, its effect on welfare is documented by Figures 10 and 11. These figures depict on y-axis the percent changes of income for three selected strata (agricultural, rural diverse and rural labor) along with the expenditure effects for the Colombia's population ordered by income on x-axis. The income effects are different for all strata as the composition of their incomes is different. The expenditure effect is, on the other hand, the same for all households on the same level of income, meaning that the consumption of a poor household is similar regardless of where its income came from. Figure 10 shows this expenditure effect for Simulation NS, where all of the expenditure effect is represented by the change in cost of consumption. Figure 11 shows the effects following Simulation S where households spend their income on consumption along with savings. The effects of both are depicted in the picture.

We see that the income effects are very similar between the two simulations, a result of the fact that the underlying income and factor incomes changed only slightly between the simulations. However, the expenditure effect appears vastly different especially for the poor where, under Simulation S, it is negative unlike in the other case where it was positive for all households. We see that the sharp drop in the consumption effect is caused by the introduction of savings whose welfare effect on households is extremely negative due to the drop of savings prices in Colombia.

The important point is that even though the overall poverty in Colombia does not change significantly between the simulations, the change of welfare among households is of a much different pattern. Due to the change in saving price, the poorest are affected in a far

	Poverty Gap		Head Count	
	Sim NS	Sim S	Sim NS	Sim S
Agricultural	-9.2	-5.3	-9.4	-7.9
Nonagricult.	1.2	1.7	1.3	1.3
Urban Labor	2.8	3.5	4.7	5.9
Rural Labor	2.5	3.2	1.9	2.5
Transfer	-0.1	0.8	0.2	0.4
Urban Div.	1.3	2.3	1.4	1.5
Rural Div.	-3.1	-1.0	-3.0	-3.1
Rural Total	-1.8	-0.2	-1.5	-1.0

Table 4. Comparison of headcount and poverty gap changes in the case of Colombia in two simulations.

more negative way. Because the overall poverty has not changed, such a variation of impacts means an increase of inequality and the poverty gap.

Table 4 shows the changes in poverty gaps and contrasts them to the changes in poverty headcount. When ignoring savings, both poverty gap and headcount change in a similar manner. With the assumption of household savings, however, the poverty gap measure shows smaller reduction in poverty in most cases among the strata in Colombia. The total results show even more apparently that the poverty gap results are much less favorable under Simulation S.

5. CONCLUSIONS

This paper proposed adding household saving into the general demand expenditure system. Based on the theoretical foundations for saving inclusion in the linear expenditure demand system (LES), it suggests a similar inclusion for the AIDADS demand system, a generalization of the LES. It explored the implications of such a saving inclusion on poverty by including it in the GTAP framework and estimating the effects of multilateral trade liberalization on poverty. By comparing the poverty results in a GTAP model with and without savings, it evaluated the implications of saving inclusion.

The main conclusion of this article is that adding savings brings about small aggregate changes in countries' income. The changes in the consumer prices are slightly higher as the consumption demand is affected due to the changes in the demand structure. These changes in consumer prices then bring about somewhat more significant changes in factor prices that change more substantially. Nevertheless, the observed changes in consumption and factor prices result only in minute change of poverty headcount for most of the investigated countries.

Despite small changes in poverty headcount, the paper finds that the price of saving has opposite effects on the welfare of the poorest and richest households and therefore it can greatly influence the level of the poverty gap. The explored case of Colombia shows that rising prices of savings tend to increase the poverty gap without changing the overall level of poverty.

References

Chan, N., Ghosh, M., and Whalley, J. (1999). Evaluation tax reform in vietnam using general equilibrium methods. *MIMAP*.

Harrison, G., Rutherford, T., Tarr, D., and Gurgel, A. (2002). Regional, unilateral and multilateral trade policies for growth and poverty reduction in brazil. *Presented at the 5th Annual Conference on Global Economic Analysis, Taipei*.

Hertel, T. W., Preckel, P. V., and Cranfield, J. A. (2000). Multilateral trade liberalization and poverty reduction. *Presented at the Conference Poverty and the International Economy, Stockholm, Sweden*.

Hertel, T. W., Ivanic, M., Preckel, P. V., and Cranfield, J. A. (2004). The earnings effects of multilateral trade liberalization: Implications for poverty. *World Bank Economic Review*.

Howe, H. (1975). Development of the extended linear expnediture system from simple saving assumptions. *European Economic Review*, **6**(3), 305–310.

Indonesia (1993). Susenas: Indonesia's socioeconomic survey.

Ivanic, M. (2004). Reconciliation of the gtap and household survey data. Technical report, Global Trade Analysis Project.

Lluch, C. (1973). The extended linear expenditure system. *European Economic Review*, **4**, 21–32.

Reimer, J. J. and Hertel, T. W. (2003). International cross section estimates of demand for use in the gtap model. *GTAP Working Paper 22*.

Rimmer, M. and Powell, A. (1992). An implicitly additive demand system. *Applied Economics*, **28**, 1613–1622.

			Relative spending effects							
	Real Income		Food		Manufactur		Services		Savings	
	S	NS	S	NS	S	NS	S	NS	S	NS
Bangl	0.3	0.4	0.9	0.9	-2.9	-3.1	1.1	1.7	0.2	N/A
Brazil	1	0.9	3.8	4.5	-2.2	-2.1	0.8	0.5	-2	N/A
Chile	0.2	0.1	5.3	6.2	-3.3	-3.3	0.5	0.4	-3	N/A
Colomb	0.3	0.3	2.7	2.6	-2.6	-2.4	0.5	0.5	-2	N/A
Indonesia	0.9	0.5	8.1	9.1	-7.7	-7.4	-2.3	-2.3	-3.3	N/A
Malawi	2.3	2.4	4.2	4.5	-3.6	-3.3	2.5	2.6	-6.7	N/A
Mexico	-0.4	-0.4	0.2	0.2	-1.1	-1	0.5	0.5	0.1	N/A
Peru	1.6	1.1	10.1	10.2	-5.5	-5.1	-1.3	-1.4	0.2	N/A
Philippines	0.3	0.2	3.7	4.4	-3.9	-3.7	-0.6	-0.7	-3.3	N/A
Thailand	2.9	3	8.2	8.8	-8	-8.2	3.4	3.6	-2.2	N/A
Uganda	0.3	0.3	0.7	0.9	-1	-1	0.3	0.1	-1.3	N/A
Venez	-0.1	-0.1	0.9	0.7	-1	-1	0.8	0.9	-1.4	N/A
Vietnam	10	10.4	12.9	13.8	-27.3	-29	11.7	15.3	2	N/A
Zambia	0.9	0.9	1.3	1.8	-2.5	-2.5	0.8	0.5	-5.8	N/A

Table 5. Income and spending effects of multilateral trade liberalization under two simulations.

	Relative earning effects													
	Agr. profits		Unskl. Labor		Skl. Labor		Non-ag profits		Nat. Resources		Depreciation		Transfers	
	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS
Bangl	0.8	0.4	-0.2	0.3	-0.6	-0.4	0.4	0.6	-2	-3.7	0.2	-0.4	0.3	0.4
Brazil	9.9	10.4	0.6	-0.1	0.2	-0.1	0	-0.3	-7.1	-6.5	-2	-2.6	1	0.9
Chile	13.3	13.8	0.4	-0.3	-1.3	-1.5	-1.1	-1.4	-0.2	0.8	-3	-3.3	0.2	0.1
Colomb	8.6	9.5	-0.7	-0.6	-1.1	-1	-1	-0.9	-1.2	-1.1	-2	-2.5	0.3	0.3
Indonesia	11	12.2	0.4	-0.4	-0.7	-1.5	-1.3	-2.1	-10.8	-11.7	-3.3	-5.1	0.9	0.5
Malawi	8.7	8.7	0.2	1	0	0.1	-1.7	-1.6	-0.2	0.2	-6.7	-9.7	2.3	2.4
Mexico	2.2	2.3	-0.6	-0.6	-0.8	-0.8	-0.5	-0.5	0.4	0.5	0.1	0.1	-0.4	-0.4
Peru	2	3.8	1.4	0.3	0.3	-0.3	1.5	0.7	-3.1	-2.8	0.2	-2	1.6	1.1
Philippines	8.6	9.2	0.6	0.2	-2	-2.3	-1.9	-2.1	-3.2	-3.5	-3.3	-3.6	0.3	0.2
Thailand	38.4	46.9	0.6	0.4	-1.5	-1.5	-0.8	-1.1	-7.4	-8.2	-2.2	-2.5	2.9	3
Uganda	-0.5	-0.6	1.2	0.2	0.9	0.6	1	0.8	-1.1	-1	-1.3	-2	0.3	0.3
Venez	3.6	4.1	-0.7	-0.7	-1.5	-1.4	-0.5	-0.5	0.6	0.9	-1.4	-1.7	-0.1	-0.1
Vietnam	21.2	17.9	16.2	12.3	10.3	8.5	5.5	3.5	-15.2	-26.2	2	-2.2	10	10.4
Zambia	0.6	1.5	-0.1	-0.4	-0.2	-0.4	0.3	0	-2.4	1.4	-5.8	-6.5	0.9	0.9

Table 6. Factor price impacts (% Change), of multilateral trade liberalization under two simulations.