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Automatic Stabilization and Fiscal Policy

Some Quantitative Implications for Latin America and the Caribbean

Emilio Espino
Martin Gonzalez-Rozada

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Ana Corbacho, acorbacho@iadb.org

Abstract[1]

This paper provides an estimation of the size of income and demand automatic stabilizers in a representative sample of LAC countries. We found that when a negative unemployment shock hits the economy, the size of income and demand automatic stabilizers coefficients is much smaller than the size of these coefficients in Europe and the United States. This evidence suggests that there is room for policies that can enlarge the absorbtion by these coefficients as a way to contribute to macroeconomic stability in LAC countries. We analyze four policies affecting the income stabilization coefficient and two others affecting directly the demand stabilization coefficient. The main results of the paper suggest that changing the minimum tax exemption and its progressiveness using the tax structure of middle-income countries outside the LAC region is the best option to enlarge the size of the income and demand stabilization coefficients and in this way to reduce the need of discretionary fiscal policies in the region.

JEL Classification: E32, E63, H2, H31

Keywords: Income and demand automatic stabilizers, fiscal policy, economic cycle, microsimulations.

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1 Introduction

This paper presents new empirical evidence of how automatic stabilizers contribute to macroeconomic stability in Latin America and the Caribbean (LAC) countries. Using a methodology based on previous work by Dolls, Fuest and Peichl (2010) and a behavioral micro-simulation approach, we measure the size and effectiveness of automatic stabilizers in LAC countries. We find that income and demand automatic stabilization coefficients are much lower in LAC countries than in developed countries, suggesting that revenue and expenditure items that adjust automatically to cyclical changes in the economy can be enlarged to reduce output volatility in the region. Towards this end, we analyze the impact of different policy instruments to enlarge the size of the automatic stabilizers in LAC countries and, in turn, to reduce the need for discretional fiscal interventions in the region. By analyzing the positive aspects of fiscal policies, that is, given taxes and expenditures, it is possible to evaluate their impact on stabilizing the economy; the results in this paper should contribute to the growing policy discussion about the importance of the fiscal policy over the business cycle in LAC countries.

An important objective of the tax policies is to contribute to macroeconomic stability. The standard role of fiscal policy in macroeconomic management comes from discretionary fiscal interventions and automatic stabilizers. Much of the literature trying to understand the cyclical behavior of fiscal revenues in LAC countries has focused on discretionary fiscal interventions, stressing the fact that these interventions are largely procyclical (see Gavin, Michael and Roberto Perotti (1997), Talvi, Ernesto and Carlos A. Vegh (2005), Avendano, Rolando, Helmut Reisen, and Javier Santiso (2008) and IMF (2009) among others). Discretionary fiscal policy has two main shortcomings: it suffers from implementation lags, and it is not automatically reversed when the economic cycle improves, giving rise to a potential deficit bias and fiscal sustainability concerns (Baunsgaard and Symansky, 2009). These shortcomings gave rise to a growing consensus that fiscal policy should be primarily left to automatic stabilization (Andersen (2005)). Fiscal stabilizers that adjust automatically to cyclical changes in the economy provide a reversal of any fiscal expansion. However, the extent to which automatic stabilization can mitigate output fluctuations and provide demand stabilization depends essentially on the tax and transfer systems since it is through these that a given income shock transmits into a change in disposable income, linking current disposable income to the demand for goods and services (Dolls, Fuest and Peichl (2010)).

The main contributions of this paper shed light on the importance of automatic stabilizers as a way to diminish the need of discretionary fiscal interventions to reduce output volatility, and on some alternative tax reforms that can lead to enlarge the magnitude and composition of automatic stabilization in LAC countries. First, we estimate the size of automatic stabilizers when a shock increases the unemployment rate by 5 percent and when a negative shock induce 5 per-

cent of the formal employment population to transit towards informality. In these exercises we find that automatic income and demand stabilization coefficients in LAC countries are small when compared with Europe and the United States, suggesting that there is room to enlarge the size of these automatic stabilizers in the region. Second, we study several tax reform channels through which the government can enlarge the size of the automatic stabilizers in order to mitigate output fluctuations; that is, to perform countercyclical fiscal policy without the use of a discretionary fiscal intervention. We find that changing the minimum tax exempt and its progressiveness using the tax structure of middle-income countries outside the LAC region is the best option to enlarge the size of the income and demand stabilization coefficients and in this way to reduce the need of discretionary fiscal policies in the region.

The rest of the paper is organized as follows. Section 2 describes the theoretical setting that we use as a framework to develop and to interpret the two shocks used to measure the size of automatic stabilizers. Section 3 presents the empirical strategy we use to estimate the size of automatic stabilizers in LAC countries and the possibilities to enlarge them. Section 4 describes the data we use and Section 5 presents the main results. Finally, Section 6 concludes.

2 Automatic Stabilizers: A Theoretical Framework

Here we analyze the implications of exogenous shocks on disposable income, given a system of taxes and transfers, and then on the behavior of consumption in the presence of borrowing constraints. We begin by presenting a standard model without borrowing constraints and examining the implications on the dynamics of consumption. Next, we impose exogenous quantity constraints on net indebtedness in each period.

2.1 Taxes, subsidies and individual income

Individual i is subject to idiosyncratic income shocks, $s_{i,t} \in S_t = \{1, 2, 3\}$ at date t. We assume that $\{s_t\}$ follows a **finite state first-order stationary Markov process**. Transition probabilities are denoted by $\pi(s, s') > 0$ for $s, s' \in \{1, 2, 3\}$. Denote $s^t = (s_0, ..., s_t)$ as a partial history of events. State 1 is employment at formal sector, state 2 is unemployment and state 3 is employment at informal sector. The degree of persistency of these shocks will play a key role to discipline the exercises below.

Market income for individual i is computed as

$$y_i^M = r_i + q_i + k_i + h_i + o_i \tag{1}$$

where, r_i are earnings, q_i business income, k_i capital income, p_i property income, and o_i other income for individual i. Agent i's disposable income at date t

$$y_i(s_{i,t}) = (1 - p_i(s_{i,t}))\, y_i^M(s_{i,t}) - (1 - \tau_i(s_{i,t})) \max\left\{(1 - p_i(s_{i,t}))\, y_i^M(s_{i,t}) - d_i(s_{i,t}), 0\right\} + b_i(s_{i,t})$$

where τ_i denotes direct income taxes, p_i denotes employee social insurance contributions, d_i denotes deductibles, b_i denotes social cash benefits and y_i^M denotes gross market income.

We analyze the impact of automatic stabilizers role played by $(\tau, p, d, b) \equiv (\tau_i, p_i, d_i, b_i)_{i=1}^N$ in two steps. First its role played to stabilize disposable income. Then, the stabilization of demand. Consider first the stabilization of disposable income. Our target is first to measure at the aggregate level how changes in gross market income, $\sum_{i=1}^N \triangle y_i^M$, maps into changes in aggregate disposable income, $\sum_{i=1}^N \triangle y_i$, given taxes-subsidies (τ, j, d, b). As in Dolls, Fuest and Peichl (2010) we refer to the measure of this effect as the *income stabilization coefficient (ISC)*, e^I, defined as

$$\left(\sum_{i=1}^N \triangle y_i\right) = \left(1 - e^I\right) \left(\sum_{i=1}^N \triangle y_i^M\right)$$

More precisely, we define $\triangle y_i = y_i(s_i') - y_i(s_i)$ and $\triangle y_i^M = y_i^M(s_i') - y_i^M(s_i)$ for all $s_i', s_i \in \{1, 2, 3\}$. Then

$$\begin{aligned}\left(\sum_{i=1}^N \triangle y_i\right) \;=\; & \left(\sum_{i=1}^N \triangle y_i^M\right) \left(\frac{\sum_{i=1}^N \triangle \left(1 - p_i(s_{i,t})\right) y_i^M(s_{i,t})}{\sum_{i=1}^N \triangle y_i^M} - \right. \\ & \left. \frac{\sum_{i=1}^N \triangle \left(1 - \tau_i(s_{i,t})\right) \max\left\{(1 - p_i(s_{i,t}))\, y_i^M(s_{i,t}) - d_i(s_{i,t}), 0\right\}}{\sum_{i=1}^N \triangle y_i^M} + \frac{\sum_{i=1}^N \triangle b_i(s_{i,t})}{\sum_{i=1}^N \triangle y_i^M} \right)\end{aligned}$$

and thus, in our setting, ISC dichotomizes into three components

$$\begin{aligned}\left(1 - e^I\right) \;=\; & \frac{\sum_{i=1}^N \triangle \left(1 - p_i(s_{i,t})\right) y_i^M(s_{i,t})}{\sum_{i=1}^N \triangle y_i^M} + \frac{\sum_{i=1}^N \triangle b_i(s_{i,t})}{\sum_{i=1}^N \triangle y_i^M} \\ & - \frac{\sum_{i=1}^N \triangle \left(1 - \tau_i(s_{i,t})\right) \max\left\{(1 - p_i(s_{i,t}))\, y_i^M(s_{i,t}) - d_i(s_{i,t}), 0\right\}}{\sum_{i=1}^N \triangle y_i^M}\end{aligned}$$

i.e., relative to a given change in market income: changes in income net of social contributions, changes in benefits and changes in disposable income.

The ISC is a function of government policy variables (τ, j, d, b); i.e., $e^I \equiv e^I(\tau, j, d, b)$. Below we also analyze how changes in these variables controlled by the government can affect automatic stabilizers.

2.2 Stabilizing Consumption

In order to stabilize final demand and output, this effect on disposable income has to be transmitted into changes in consumption of goods and services.

2.2.1 An Economy without Borrowing Constraints

Suppose that agents are restricted to trade a noncontingent asset that pays one unit of consumption next period, independently of the realization of the state s_{t+1}; that is, a one-period risk free bond. Agent i's budget constraint reduces to

$$c_i(s^t) + q(s^t)a_i(s^t) = y_i(s^t) + a_i(s^{t-1}), \tag{2}$$

where $(q(s^t), a_i(s^t))$ denote the bond price and bond holdings at s^t, respectively.

To grasp the intuition, we study a partial equilibrium setting assuming away fluctuations in the price of the risk-free bond; that is

$$q(s^t) = q \equiv \frac{1}{1+r}, \tag{3}$$

for all s^t, where r is the (implicit) interest rate. Thus, we can impose a No-Ponzi scheme condition as follows

$$\begin{aligned} & \lim_{\tau\to\infty} E_t\left[\left(\frac{1}{1+r}\right)^{t+\tau} a_{t+\tau}\right] \\ = & \lim_{\tau\to\infty}\left(\sum_{s_{t+1}}...\sum_{s_{t+\tau}} \pi(s^t, s_{t+1}, ..., s_{t+\tau})\left(\frac{1}{1+r}\right)^{t+\tau} a_{t+\tau}\right) \geq 0. \end{aligned} \tag{4}$$

where $\left(\frac{1}{1+r}\right)^{t+\tau}$ is the implicit price of one unit of the consumption good delivered at date $t+\tau$.

At date t, write (2) as follows

$$a_i(s^{t-1}) = \left(c_i(s^t) - y_i(s^t)\right) + \frac{1}{1+r}\, a_i(s^t),$$

and note that for each s_{t+1} we have

$$a_i(s^t) = c_i(s^t, s_{t+1}) - y_i(s^t, s_{t+1}) + \frac{1}{1+r}\, a_i(s^t, s_{t+1}).$$

Multiply this expression by $\pi(s^t, s_{t+1})\frac{1}{1+r}$, add them up for all s_{t+1} and observe that

$$\frac{1}{1+r}\, a_i(s^t) = \frac{1}{1+r}\sum_{s_{t+1}} \pi(s^t, s_{t+1}) \left(c_i(s^t, s_{t+1}) - y_i(s^t, s_{t+1}) + \frac{1}{1+r}\, a_i(s^t, s_{t+1}) \right).$$

Denoting $x_{t+\tau}$ to any random variable with realization $x(s^t, s_{t+1}, ..., s_{t+\tau})$, proceed repeatedly as before, use (4) and take the limit to obtain

$$a_i(s^{t-1}) = \sum_{\tau=0}^{\infty} \left(\frac{1}{1+r} \right)^{\tau} E_t \left(c_{i,t+\tau} - y_{i,t+\tau} \right), \tag{5}$$

where E_t denotes the expectation conditional on s^t. Thus, individual financial wealth at date t equals the difference between expected discounted future streams of consumption and income.

Now we make two key additional assumptions. First, households have quadratic utility functions; that is,

$$u(c) = b_1 c - \frac{1}{2} b_2 c^2, \tag{6}$$

$b_1, b_2 > 0$. Secondly, the risk free interest rate equals the discount rate; that is, $\beta(1+r) = 1$.[2]

With these two additional assumptions, agent i's first order conditions imply

$$\left(b_1 - b_2 c_i(s^t) \right) \frac{1}{(1+r)} = \beta \sum_{s_{t+1}} \pi(s^t, s_{t+1}) (b_1 - b_2 c_i(s^t, s_{t+1})) \tag{7}$$

and thus

$$c_i(s^t) = E_t(c_{i,t+1}) \tag{8}$$

i.e. *individual consumption follows a martingale.*[3]

Dropping the index i, it is useful to note that from the law of iterated expectations and the martingale property (8) imply that

$$E_t \left(c_{t+2} \right) = E_t \left(E_{t+1} c_{t+2} \right) = E_t \left(c_{t+1} \right) = c_i(s^t),$$

and therefore, more in general, we obtain

$$E_t \left(c_{t+\tau} \right) = c_t, \text{ for any } \tau \geq 0. \tag{9}$$

[2] Indeed, this last assumption is not critical for the result discussed below; it just makes the computations less cumbersome.

[3] Observe that without the assumption that $\beta(1+r) = 1$, (7) generalizes to $c_i(s^t) = \alpha_0 + \alpha_1 E_t(c_{i,t+1})$ (that is, $\beta(1+r) = 1$ implies that $\alpha_0 = 0$ and $\alpha_1 = 1$).

Using (9) in expression (5), we obtain

$$\begin{aligned} a(s^{t-1}) + \sum_{\tau=0}^{\infty} \left(\frac{1}{1+r}\right)^{\tau} E_t\left(y_{t+\tau}\right) &= \sum_{\tau=0}^{\infty} \left(\frac{1}{1+r}\right)^{\tau} E_t\left(c_{t+\tau}\right) \\ &= c(s^t) \sum_{\tau=0}^{\infty} \left(\frac{1}{1+r}\right)^{\tau} \\ &= c(s^t) \frac{1+r}{r}. \end{aligned}$$

and therefore we express consumption

$$\begin{aligned} c(s^t) &= \frac{r}{1+r}\left[a(s^{t-1}) + \sum_{\tau=0}^{\infty} \left(\frac{1}{1+r}\right)^{\tau} E_t\left(y_{t+\tau}\right)\right] \\ &= \frac{r}{1+r}\left[a(s^{t-1}) + H(s^t)\right], \end{aligned} \tag{10}$$

where $H(s^t)$ denotes human wealth at s^t; that is, the expected discounted value of future individual earnings. Since financial wealth is $a_t = a(s^{t-1})$, define *permanent income* as the annuity value (i.e. $\frac{r}{1+r}$) of total (human and financial) wealth $W(s^t) = a(s^{t-1}) + H(s^t)$. Hence, under these assumptions optimal consumption is proportional to permanent income or wealth.

One key implication of this representation is that **permanent** changes in income lead to **permanent** changes in consumption. On the other hand, transitory shocks in income lead to relatively small changes in consumption.

Since $E_{t-1}\left(c_t\right) = c_{t-1}$ for all t, it follows from (10), the change in consumption at time t equals

$$\Delta c_t = c(s^t) - c(s^{t-1}) = c(s^t) - E_{t-1}\left(c_t\right) = \frac{r}{1+r}\left[W(s^t) - E_{t-1}\left(W_t\right)\right]. \tag{11}$$

Since agents decide asset holdings for period t at s^{t-1}, we have that $E_{t-1}(a_t) = a(s^{t-1})$. Thus, since $W(s^t) = a(s^{t-1}) + H(s^t)$, we have that $E_{t-1}\left(W_t\right) = a(s^{t-1}) + E_{t-1}\left(H_t\right)$ and, then, an innovation to human wealth at t reduces to

$$\begin{aligned} W(s^t) - E_{t-1}\left(W_t\right) &= H(s^t) - E_{t-1}\left(H_t\right) \\ &= \sum_{\tau=0}^{\infty} \left(\frac{1}{1+r}\right)^{\tau} \left[E_t\left(y_{t+\tau}\right) - E_{t-1}(E_t\left(y_{t+\tau}\right))\right] \\ &= \sum_{\tau=0}^{\infty} \left(\frac{1}{1+r}\right)^{\tau} \left(E_t - E_{t-1}\right)\left(y_{t+\tau}\right) \end{aligned} \tag{12}$$

since the law of iterated expectations implies that $E_{t-1}(E_t(y_{t+j})) = E_{t-1}(y_{t+j})$. Using (12) in (11) we obtain

$$\Delta c_t = \frac{r}{1+r}\sum_{\tau=0}^{\infty}\left(\frac{1}{1+r}\right)^{\tau}(E_t - E_{t-1})(y_{t+\tau}) \tag{13}$$

Equation (13) leads us to conclude that under the PIH, changes in individual consumption between $t-1$ and t are proportional to the revised value of expected individual earnings driven by the arrival of new information at the current period. This last expression will play a fundamental role to interpret the impact of the stabilizers.

2.3 The Implications of Borrowing Constraints

Zeldes (1989) derive testable implications for the behavior of consumption in the presence of borrowing constraints. He provides support to the hypothesis that an inability to borrow against future labor income affects the consumption of a significant portion of the population.

Depending on the individual income process, these constraints may be binding or not and, thus, they must be taking into account explicitly. It is more transparent to go back to our formulation in previous sections where the risk-free bonds can be traded at the price $q = \frac{1}{R}$ and pays one unit of consumption next period. In this case, it is easy to see that (7) generalizes to

$$c(s_t) = \begin{cases} E_t(c_{t+1}) & \text{if} \quad a(s^t) > 0 \\ y(s_t) + a(s^{t-1}) & \text{if} \quad a(s^t) = 0. \end{cases} \tag{14}$$

The first line is just the previous agent's FOC's when the constraint is not binding. The second line descends directly from the reformulated budget constraint

$$\frac{1}{R}a(s^t) = (y(s_t) + a(s^{t-1}) - c(s_t)),$$

when the borrowing constraint is binding, i.e. $a(s^t) = 0$. In this case, the agent would like to borrow to finance current consumption further, but she is not allowed to do so and so she must limit herself to consume as much as she has at hand, all her resources.

Will this borrowing constraint be ever binding? For instance, if individual income is a random walk one can show that financial wealth would follow a random walk, $i.i.d$ shocks compound with probability one and the non-negativity constraint on asset holding would be binding sooner or later.

Now notice that (14) can be reformulated as follows

$$\begin{aligned} c(s_t) &= \min\{y(s_t) + a(s^{t-1}), E_t\left(c_{t+1}\right)\} \\ &= \min\{y(s_t) + a(s^{t-1}), E_t\left(\min\{y_{t+1} + a_{t+1}, E_{t+1}\left(c_{t+2}\right)\}\right)\} \end{aligned} \tag{15}$$

This expression has two immediate implications. First, remember that in the absence of binding borrowing constraints at any period, we have that

$$c(s_t) = E_t\left(c_{t+\tau+1}\right)$$

for all $\tau \geq 0$. Suppose that there exists some future period $t+\tau$ such that for some realization of the income shock, $s_{t+\tau}$, the borrowing constraint is binding and thus $y(s_{t+\tau}) + a(s^{t+\tau-1}) < E_{t+\tau}(c_{t+\tau+1})$. Since all probabilities are positive, this implies that for any $s^{t+\tau-1}$

$$E_{t+\tau-1}\left(y(s_{t+\tau}) + a(s^{t+\tau-1})\right) < E_{t+\tau-1}\left(E_{t+\tau}(c_{t+\tau+1})\right).$$

Using this fact and the law of iterated expectations in equation (15), we can conclude that $c(s_t) < E_t\left(c_{t+\tau+1}\right)$. But this makes evident that even though the liquidity constraint is not necessarily binding in period t, future potential binding borrowing constraints affect current consumption.

Secondly, consider a mean-preserving spread in income risk. This makes the states with low income more likely and, consequently, the corresponding borrowing constraints are also more likely to bind in the future. More precisely, $E_t\left(\min\left\{y_{t+1} + a_{t+1}, E_t\left(c_{t+2}\right)\right\}\right)$ becomes smaller when the set of income realizations where the borrowing constraint bind enlarges (since the $\min$ operator takes the first value in more states). This reduces the value of $E_t\left(c_{t+1}\right)$ and so does current consumption c_t. Intuitively, saving increases in reaction to increases in future income risk because risk-averse agents fear future contingencies with low income and, aware of their inability to smooth low income shocks via higher borrowing, they increase their precautionary savings to prevent this situation (that is, they save for self-insurance). Very importantly, these precautionary savings shows up without prudence (that is, without a precautionary saving motive) but purely from the existence of binding liquidity constraints (and risk aversion). Hence, when observing increases in saving as reaction to increased income uncertainty, it may have a preference-based interpretation (that is, agents are prudent, $u''' > 0$) or due to credit markets imperfections preventing or limiting noncontingent borrowing.

2.4 Implications for Empirical Analysis

As the analysis above suggests, and as in Auerbach and Feenberg (2000), we assume that liquidity-constrained households fully adjust consumption in response to changes in (disposable) income while unconstrained households only adjust according to the previous formula. So, the adjustment of liquidity-constrained households makes changes in disposable income equal to changes in consumption; that is, change in household i's consumption is

$$\Delta c_i = \begin{cases} \Delta y_i^D \text{ if i is liquidity constrained} \\ 0 \qquad\qquad \text{otherwise} \end{cases}$$

Thus, if we define the *demand stabilization coefficient*, denoted by e^C, as

$$1 - e^C = \frac{\sum_i \Delta c_i}{\sum_i \Delta y_i^M}$$

this reduces, under our assumptions, to

$$1 - e^C = \frac{\sum_{i \in LQ} \Delta c_i}{\sum_i \Delta y_i^D}(1 - e^I)$$

where $\sum_{i \in LQ} \Delta c_i$ denotes the consumption response of liquidity-constrained households. We implement empirically the estimation of the demand stabilization coefficient identifying the liquidity-constrained households as those households below the poverty line. The poverty line is established as US$ 4 per day so we can compare the results for the countries we analyze.

We can add consumption taxes into this framework. Household survey data include no information on consumption expenditures of households so consumption taxes actually paid cannot be calculated directly. Following Dolls, Fuest and Peichl (2010), we use the implicit tax rates on consumption. This implicit tax rate relates consumption taxes paid to overall consumption. In our framework, household i's budget constraint becomes

$$(1 + t^c(s_t))\, c_i(s^t) + q(s^t) a_i(s^t) = y_i(s^t) + a_i(s^{t-1}), \tag{16}$$

where t^c is the implicit consumption tax rate and $T^C = t^c C_i$ denotes the consumption tax payment.

In our analysis we assume that only constrained households will adjust their consumption to an income shock. Then, an automatic stabilization effect of consumption taxes can only occur through these liquidity-constrained households. For those, changes in disposable income are equal to changes in consumption and, hence, consumption tax payments. Given this, we focus on demand, rather than income stabilization through the consumption tax. The demand stabilization coefficient can now be written as:

$$e^C = \frac{\sum_{i \in LQ} \Delta T_i^C + \sum_{i \in LQ} \Delta T_i + \sum_{i \in LQ} \Delta S_i - \sum_{i \in LQ} \Delta B_i}{\sum_i \Delta y_i^M} \tag{17}$$

where LQ indicates that sums go over liquidity-constrained households.

3 Empirical Strategy

In order to explore the size and effectiveness of automatic stabilizers in LAC we use a microsimulation approach. As highlighted in the previous section, and similar to the one advanced in Dolls, Fuest and Peichl (2010), our baseline methodology uses the *income stabilization coefficient* e^I and the *demand stabilization coefficient* e^C as the key measures of automatic stabilization.

We measure the size of automatic stabilizers in two scenarios: one in which there is a $\gamma\%$ of formal workers who become workers in the informal sector of the economy; and another in which there is an unemployment shock, that is the unemployment rate increases by $\gamma\%$. The second scenario is used to compare the size of automatic stabilizers in LAC countries with their size in Europe and the United States. We use a microsimulation approach based on Gonzalez-Rozada and Menendez (2006) (see Appendix 1 for a complete description of this approach) to simulate the impact over the size of the income and demand stabilization coefficient of a negative unemployment shock and an informal transition shock inducing workers to move from the formal to the informal sector of the economy.

We extend the microsimulation approach used to measure the size of automatic stabilizers to address tax reform options to enlarge the size of these stabilizers in LAC countries in order to mitigate output fluctuations (that is, to perform countercyclical fiscal policy without the use of a discretionary fiscal intervention). We study four policies affecting the income stabilization coefficient and two policies affecting directly the demand stabilization coefficient for the countries where we have information about household consumption. (Mexico, Nicaragua and Peru). These last three policies are applied only to Mexico and Nicaragua where we have information about household consumption.

The first policy takes the minimum tax exemption of the personal income tax in LAC countries and replaces it by the minimum tax exemption of middle-income countries outside Latin America and the Caribbean. For this tax reform we define the minimum tax exempt as 50 percent of per capita income. The second policy changes the minimum tax exemption and its progressiveness using the tax structure of middle-income countries outside the LAC region. Table 1 shows the personal income tax structure used for this policy.

Table 1. Personal Income Tax of Middle Income Countries

Income level (in times per capita income)	Tax rate
<0.5	0%
0.5 - 1.5	5%
1.5 - 2.5	10%
2.5 - 3	15%
3 - 5.5	20%
5.5 - 6.5	25%
6.5 - 9.5	30%
>9.5	35%

The third policy analyzed is the introduction of a flat personal income tax of 18 percent. Finally, the fourth simulation exercise broadens the personal income tax base to informal people, increasing the size of the formal sector in the economy by reducing in 50 percent the number of informal workers in the economy. In this policy the 50 percent of the informal workers with the largest probability of being formal workers are assigned to the formal sector as explained in Appendix 1.

The two policies that affect the demand stabilization coefficient directly are: (i) eliminating exemptions in the VAT base except for education, health, renting, financial services, and transport; and (ii) policy in (i) plus raising the VAT rate for all items in the household consumption basket to 50 percent of the standard VAT rate.

4 Data

For the estimation of the size and effectiveness of the automatic stabilizers we use household surveys of 2005 and 2006 for the following countries: Argentina, Brazil, Mexico, Nicaragua and Peru. In particular we used the first quarter of 2006 for Argentina, the annual survey of 2006 for Brazil, Mexico and Peru and the annual survey of 2005 for Nicaragua.

Table 2 shows a summary of the information in each household survey. In addition to the traditional socio-demographic and socio-economic information, for three countries, Mexico, Nicaragua and Peru the household surveys contain information about consumption expenditures. In the case of Argentina, the household survey covers 31 urban cities in the country, while for the rest of the countries the coverage of the survey is national. Brazil has the largest survey covering around 58 million households, next in magnitude is the household survey for Mexico covering near 27 million of households. The survey in Argentina covers around 7 million urban household while the coverage for Nicaragua and Peru is around 5 and 6.7 million households, respectively. Table 3 describe some relevant variable for our exercises. The second column of the table reports the

household poverty rate by country computed using a poverty line of US$ 4 per day (in PPP terms). We use this definition in order to compare the results of our simulation exercises across countries. The poverty line defines how many households are liquidity constrained and as can be seen from the table Argentina is, according to this definition of poverty, the country with the fewest liquidity-constrained households, so we expect a small translation from the income stabilization coefficient to the demand stabilization coefficient for this country. On the other hand, Nicaragua and Peru have the largest poverty rate so we expect a larger absorbtion of the demand stabilization coefficient to the shocks in these countries. The third column in the table reports the average household per capita income and the fourth column shows the average household per capita income for the poor households (in PPP terms). In Argentina, for example, the average household per capita income of the poor represents only 3 percent of the average household per capita income. This figure is 2 percent in Mexico and Peru, 4 percent in Brazil and 17.6 percent in Nicaragua. The next two columns show the Gini coefficient as a measure of income and consumption inequality, respectively. In terms of the household per capita income (in PPP terms) Argentina is the country with the lowest inequality while Peru is the country with the highest inequality. In the middle of these two countries are Brazil, Mexico and Nicaragua with a coefficient near 0.60. For Nicaragua Mexico and Peru we computed the Gini coefficient in terms of consumption expenditure. Of these three countries Nicaragua is the one with the highest inequality. Finally, the last column of the table shows the real exchange rate in PPP terms.

5 Results

In this section we present the main results of the paper. First, we estimate the size of automatic stabilizers when a shock increases the unemployment rate by 5 percent. Then, we reproduce the size of automatic stabilizers when a negative shock induces 5 percent of the formal employment population to transit towards informality. This last shock can be interpreted as a negative shock to GDP. We estimated the elasticity of formality to GDP for the case of Argentina and found an elasticity close to one.[4] This means that a shock diminishing the GDP by 5 percent implies a reduction of 5 percent in the formal sector of the economy.

In a second exercise, we measure different policy instruments to enlarge the size of the automatic stabilizers in LAC countries as described in Section 3.

[4] See Appendix 2.

Table 2. Household Surveys Summary Statistics

Country	Acronym	Year	Field work	Coverage	Households	Individuals	Weighted Observations	
							Households	Individuals
Argentina	EPH-C	2006	First quarter	Urban-31 cities	13,315	45,878	7,102,296	23,495,655
Brazil	PNAD	2006	Annual	National	128,882	410,241	58,718,056	186,020,850
Mexico	ENIGH	2006	Annual	National	20,875	83,624	26,541,327	105,044,520
Nicaragua	EMNV	2005	Annual	National	6,898	40,927	5,142,098	38,203,050
Peru	ENAHO	2006	Annual	National	20,578	90,784	6,667,732	29,236,539

Source: Authors' calculations using household surveys.

Table 3. Household Surveys Descriptive Data

	Household poverty rate	Household per capita income (in PPP USD)	Household per capita income poor households (in PPP USD)	Gini coefficient household per capita income	Gini coefficient household per capita consumption	Real exchange rate (PPP)
Argentina	16.8%	469.14	14.34	0.47	NA	1.27
Brazil	46.7%	264.56	10.42	0.63	NA	1.36
Peru	53.1%	214.14	4.16	0.84	0.58	1.49
Nicaragua	77.0%	100.39	18.39	0.58	0.86	5.83
Mexico	71.2%	199.33	4.19	0.60	0.48	7.13

Source: Authors' calculations using household surveys.

Note: Household poverty is rate was computed as the fraction of households that earn less than 120 PPP USD per household member. To convert national currency to PPP USD, we have used the real exchange rates calculated by World Bank (2005).

5.1 Estimation of the Size of Automatic Stabilizers in LAC Countries

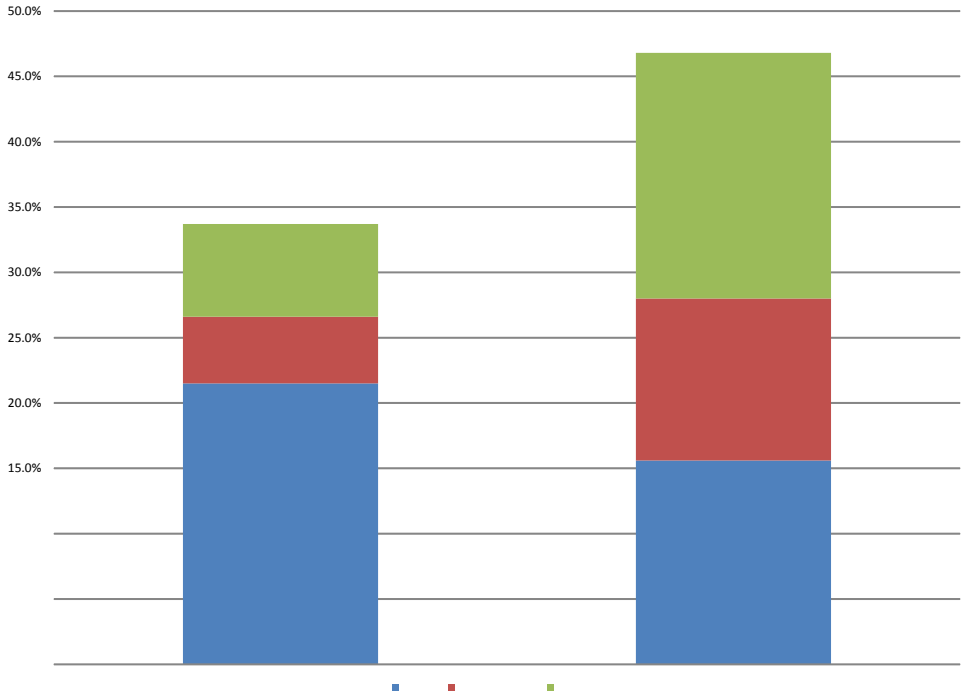
Table 4 shows the estimation of the size of the *income stabilization coefficient*, e^I, when a negative shock increases the unemployment rate by 5 percent. As can be seen in the table, the negative unemployment shock produces an income stabilization coefficient that ranges, on average, from 4 percent in Nicaragua to almost 15 percent in Peru. In all countries the estimation of e^I seems to be statistically significant considering the 95 percent confidence interval. The size of the income stabilization coefficient is much lower than the one found in the literature for the United States and Europe (see Dolls, Fuest and Peichl (2010)). In Europe automatic stabilizers absorb 47 percent of a 5 percent negative shock in the unemployment rate whereas the stabilization effect in the United States is around 34 percent (see Figure 1). In the figure, the green area in the bars represent the absorption by social benefits, the brown area represent the absorption by the social security system and the blue area the absorption by the personal income tax.

In Argentina, the income stabilization coefficient is on average around 11 percent, and 69 percent of this effect is due to the changes in social security while 26 percent of the negative unemployment shock is absorbed by social benefits. The personal income tax seems to have no effect on the income stabilization in this country. These figures contrast with the decomposition of the shock in Brazil. The size of the income stabilization coefficient is 14.85 percent, very similar to the e^I in Argentina. But in Brazil, 51 percent of this automatic stabilizer is due to changes in the personal income tax. Social security contributes a 48 percent of the change in the income stabilization coefficient. Social benefits represent only 0.23 percent in Brazil. In Peru, income automatic stabilizers absorb 15.22 percent of the unemployment shock. Sixty-seven percent of this coefficient is represented by changes in social security and the rest come from changes in personal income taxes. In Mexico, the income stabilization coefficient absorbs, on average, almost 15 percent of the negative unemployment shock. The personal income tax is responsible for about 88 percent of this absorbtion. Finally, in Nicaragua the unemployment shock produces an income stabilization coefficient of about 4 percent, which is explained by an absorbtion of 1.64 percent produced by personal income taxes and an absorbtion of 2.52 percent produced by social security.

This evidence suggests that in Argentina, Brazil, Nicaragua and Peru, social security is relatively important in the decomposition of the income stabilization coefficient, while in Mexico, Nicaragua, Peru and Brazil, the personal income tax is very relevant in explaining the size of e^I.

Table 5 summarizes the results of a shock that induces 5 percent of the formal workers to move to the informal sector (we call this shock an informal transition shock). The table also shows the decomposition of the income stabilization coefficient. By construction, there are not changes in social benefits because the unemployment rate remains constant.

Figure 1. The Size of Automatic Stabilizers in Europe (EU) and the United States (USA)



Source: Estimations by Dolls, Fuest, and Peichl (2010).

Table 4. The Size of the Income Stabilization Coefficient. Negative Unemployment Shock

	Argentina	Brazil	Peru	Nicaragua	Mexico
Income stabilization coefficient (e^I)	10.81% [9.18% 13.29%]	14.85% [13.10% 17.36%]	15.22% [7.35% 21.66%]	4.16% [0.72% 11.06%]	14.62% [11.50% 21.09%]
Taxes (e^τ)	0.51% [0.00% 2.27%]	7.56% [6.11% 9.54%]	5.04% [1.06% 10.22%]	1.64% [0.00% 7.73%]	12.86% [10.07% 19.08%]
Social Security (e^p)	7.45% [5.34% 9.65%]	7.16% [6.64% 7.66%]	10.18% [5.79% 12.23%]	2.52% [0.11% 5.00%]	1.76% [0.98% 2.32%]
Benefits (e^b)	2.85% [1.50% 4.66%]	0.23% [0.03% 0.48%]	0.00% [0.00% 0.00%]	0.00% [0.00% 0.00%]	0.00% [0.00% 0.00%]

Source: Authors' simulations.

Note: Figures in square brackets are 95% confidence intervals obtained through 1,000 Monte Carlo samples.

Overall, the income stabilization coefficient absorbs, on average, between 9 and 20 percent of the informal transition shock. All these effects appear to be statistically significant. In Argentina, the income automatic stabilization absorbs 19.87 percent of the shock. Decomposition shows that changes in social security absorb the largest part of the shock. This pattern is similar for Nicaragua and Peru, where social security accounts for 62 and 67 percent, respectively. Brazil and Mexico differ from the rest of the countries. In Brazil the income automatic stabilizers absorb 19.47 percent of the informal transition shock, and almost 55 percent of this coefficient is explained by changes in the personal income tax system, while around 45 percent is explained by changes in social security. In Mexico, the income stabilization coefficient is 18.37 percent and 74 percent of this absorbtion is explained by the personal income tax.

How much of these changes in the income stabilization coefficient translate into changes in the consumption expenditure of goods and services? As explained in the methodology section, we measure the stabilization of aggregate demand through the *demand stabilization coefficient*, e^C. We implement empirically the estimation of the demand stabilization coefficient identifying liquidity-constrained households as those households below the poverty line. The poverty line is established as US$ 4 per day, so we can compare the results for the countries we analyze.

Table 6 shows the demand stabilization coefficient in the case of both unemployment and informal transition shocks. As can be seen from the table, when a negative unemployment shock hits the economy in Argentina, Brazil and Mexico, the demand stabilization coefficients absorb between 10 and 13 percent of the shock. In Nicaragua and Peru, the demand stabilization coefficient absorbs between 6 and 7 percent of the unemployment shock. All these coefficient are statistically significant; however, as was the case with income stabilization, the magnitude of these demand stabilization coefficients in the LAC countries is much smaller than the results for stabilization of aggregate demand in Europe and the United States. In the United States, a negative shock reducing the unemployment rate by 5 percent produces an absorbtion by the demand stabilization coefficient of about 22 percent, while in Europe the same kind of shock produces an absorbtion of about 36 percent (see Dolls, Fuest and Peichl (2010))

The second column in Table 6 summarizes the size of the demand stabilization coefficient in the case of the informal transition shock. Overall, when formal workers transit to informality the demand stabilization coefficient absorbs much less of the shock than in the case of the negative unemployment shock in Argentina. This is mainly because the shock does not have a large impact on the liquidity constrained households of this country. In Brazil, both shocks produce similar demand stabilization coefficients of around 12 percent. The demand stabilization coefficient absorbs around 8 percent of the shock in Peru and around 6 percent in Nicaragua and Mexico. All these figures are statistically significant.

These results suggest a lower contribution of the automatic stabilizers to demand stabilization for the LAC countries analyzed here.

Overall, the evidence presented in this section shows that the automatic income and demand stabilization in LAC countries is low when compared with Europe and the United States. This suggests that there is room to enlarge the size of these automatic stabilizers in the region. In next section we show several alternative policies that could be implemented with this objective in mind.

5.2 Alternative Policies to Enlarge the Size of Automatic Stabilizers in LAC Countries

Table 7 summarizes the impact of the first four policies affecting the income stabilization coefficient directly when a negative unemployment or an informal transition shock hits the economy. The first row for each country measures the new size of e^I. This is the size of the income stabilization coefficient after the relevant policy was implemented. The second row for each country measures the average percent change of the new size of e^I with respect to its original size shown in Tables 4 and 5. Policy 1 in the table shows the impact on the income stabilization coefficient of changing the minimum tax exemption to 50 percent of per capita income. Policy 2 adds to Policy 1 the tax structure of middle-income countries outside the LAC region, shown in Table 1. Policy 3 introduce a flat income tax rate of 18 percent, and Policy 4 increases the size of the formal sector in the economy by reducing by 50 percent the number of informal workers in the economy. As can be seen from the table, changing the minimum tax exemption and adding the tax structure of middle-income countries outside the LAC region is the policy that has the largeest effect on the income stabilization coefficient when a negative unemployment shock or an informal transition shock hits these economies. When this policy is in effect, a negative unemployment shock increases the absorbtion of the shock by the income stabilization coefficient in around 142 percent. The income stabilization coefficient rises from 10.81 percent in the baseline scenario to 26.24 percent after the implementation of the policy. Most of this absorbtion comes from the change in the minimum tax exemption (see column (1) in the table). Similar effects are found in Brazil, where the income stabilization coefficient rises around 56 percent from the baseline scenario, as shown in column (3). Most of the absorbtion of the shock comes from the implementation of Policy 1. Changing the minimum tax exemption in Brazil increases, on average, the income stabilization coefficient by 55 percent (see column (1)). In Nicaragua and Peru, most of the impact of Policy 2 over the income stabilization coefficient comes from the change in the personal income tax structure. Changing the minimum tax exemption increases, on average, the income stabilization coefficient by 56 percent in Peru and by 161 percent in Nicaragua, and when we add the tax structure of middle-income countries, these increments are 128 and 494 percent, respectively. In Mexico there is no minimum tax exemption, therefore the impact of Policy 2 comes from the change in the personal income tax structure. In this case, when a negative unemployment shock hits the economy, the income sta-

Table 5. The Size of the Income Stabilization Coefficient. Informal transition Shock

	Argentina	Brazil	Peru	Nicaragua	Mexico
Income stabilization coefficient (e^I)	19.87% [18.8% 21.28%]	19.47% [18.85% 20.01%]	19.66% [17.32% 21.45%]	9.35% [6.05% 14.40%]	18.37% [16.62% 19.22%]
Taxes (e^τ)	0.85% [0.10% 2.18%]	10.68% [10.11% 11.18%]	6.67% [4.32% 8.45%]	3.51% [0.23% 8.45%]	13.61% [11.43% 14.53%]
Social Security (e^p)	19.02% [18.11% 19.80%]	8.79% [8.73% 8.84%]	13.00% [13.00% 13.00%]	5.84% [5.60% 5.96%]	4.75% [4.50% 5.18%]
Benefits (e^b)	0.00% [0.00% 0.00%]	0.00% [0.00% 0.00%]	0.00% [0.00% 0.00%]	0.00% [0.00% 0.00%]	0.00% [0.00% 0.00%]

Source: Authors' simulations.

Note: Figures in square brackets are 95% confidence intervals obtained through 1,000 Monte Carlo samples.

Table 6. The Size of the Demand Stabilization Coefficient. Unemployment and Informal Transition Shocks

	Unemployment shock	Informal Transition shock
Argentina	10.13% [3.46% 15.36%]	4.95% [3.02% 6.64%]
Brazil	12.49% [10.93% 14.77%]	11.53% [9.08% 13.46%]
Peru	5.95% [1.13% 10.44%]	8.34% [5.08% 10.42%]
Nicaragua	7.10% [1.17% 15.94%]	5.66% [3.09% 8.67%]
Mexico	9.59% [3.38% 18.10%]	6.44% [5.29% 8.13%]

Source: Authors' simulations.

Note: Figures in square brackets are 95% confidence intervals obtained through 1,000 Monte Carlo samples.

bilization coefficient absorbs around 22 percent of the shock. This implies an average increment of around 50 percent with respect to the baseline scenario. When decomposing the impact of the policy on e^I, most of the effect comes from a rise in e^τ as expected (see Table 16 in Appendix 3). For all countries analyzed here, the increase in the income stabilization coefficient is statistically significant as is shown in tables 10, 15 and 20 in Appendix 3. When an informal transition shock hits the economy and Policy 2 is in place, the income stabilization coefficient increases 85 percent with respect to the baseline case in Argentina. Half of this impact is due to the change in the minimum exemption and the other half to the change in the personal income tax structure. In Brazil the absorbtion by the income stabilization coefficient is around 29 percent (see column (4)) after Policy 2 is implemented and most of the increment over the baseline scenario is due to the change of the minimum tax exemption. As was the case with the negative unemployment shock, in Nicaragua and Peru most of the absorbtion of the informal transition shock when Policy 2 is in place is due to the change in the personal income tax structure. The income stabilization coefficient increases 108 percent in Peru and 234 percent in Nicaragua with respect to the baseline scenario. In these countries, the income stabilization coefficient absorbs 15 and 26 percent of the shock when only the minimum tax exemption is changed in Nicaragua and Peru, respectively. In Mexico, the results are similar to those obtained when a negative unemployment shock hits the economy. The income stabilization coefficient increases 51 percent with respect to the baseline case when an informal transition shock hits the economy and the personal income tax structure of the middle-income countries is adopted.

Table 7. Effects of Alternative Policies over the Income Stabilization Coefficient

	Policy 1		Policy 2		Policy 3		Policy 4	
	Unemployment	Informal	Unemployment	Informal	Unemployment	Informal	Unemployment	Informal
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Argentina	20.31%	28.23%	26.24%	36.69%	16.43%	26.21%	15.26%	14.20%
	87.88%	42.07%	142.74%	84.65%	51.99%	31.91%	41.17%	-28.54%
Brazil	23.08%	27.25%	23.22%	28.60%	13.89%	18.63%	15.80%	19.47%
	55.42%	39.96%	56.36%	46.89%	-6.46%	-4.31%	6.40%	0.00%
Peru	23.78%	26.01%	34.72%	40.99%	21.61%	26.15%	17.59%	19.49%
	56.24%	32.30%	128.12%	108.49%	41.98%	33.01%	15.57%	-0.86%
Nicaragua	10.88%	15.29%	24.73%	31.27%	12.17%	17.67%	7.73%	8.08%
	161.54%	63.53%	494.47%	234.44%	192.55%	88.98%	85.82%	-13.58%
Mexico	NA	NA	21.97%	27.74%	10.28%	14.44%	14.77%	16.67%
	NA	NA	50.27%	51.01%	-29.69%	-21.39%	1.03%	-9.25%

Source: Authors' calculations.

Note: Policy 1 takes the minimum tax exempt of the personal income tax in LAC countries and replace it by the minimum tax exempt of middle income countries outside Latin America and the Caribbean. Policy 2 changes the minimum tax exempt and its progressiveness using the tax structure of middle income countries outside the LAC region showed in Table 1. Policy 3 introduce a flat personal income tax of 18%. Policy 4 broadens the personal income tax base to informal people, increasing the size of the formal sector in the economy by reducing in 50% the number of informal workers in the economy. Columns (1), (3), (5) and (7) show the effect of the relevant policy when a negative unemployment shock hits the economy while the rest of the columns show the impact of the policy when an informal transition shock occurs.

How much of these shocks are absorbed by the demand stabilization coefficient when the different policies are implemented? Table 8 suggests a potential answer to this question. As was the case with the income stabilization coefficient, demand automatic stabilizers are larger when Policy 2 is in place. When a negative unemployment shock hits the Argentine economy and the minimum tax exempt and the personal income tax structure of middle-income countries is taken into account the demand stabilization coefficient increase around 55 percent with respect to the baseline case (see column (3) of Table 8 and Table 6). The same policy produces an increment in the absorbtion of the demand stabilization coefficient of 26 percent in Brazil and 35 percent in Mexico. Again as was the case with the income stabilization coefficient, the larger absorbtion is in Nicaragua and Peru where the demand stabilization coefficient increases 189 and 91 percent with respect to the baseline scenario, respectively. When there is an informal transition shock and the Policy 2 is in place (column (4) in Table 8) the demand stabilization coefficient decreases 6.5 percent in Argentina but increases in the rest of the LAC countries analyzed. The rise in the demand stabilization coefficient is 23 percent in Brazil, 50 percent in Mexico, 131 percent in Peru and 189 percent in Nicaragua.

The last two policies considered here directly affect the demand stabilization coefficient. These policies are: (i) eliminating exemptions in the VAT base except for education, health, renting, financial services, and transport (Policy 5 in Table 9); and (ii) policy in (i) plus raising the VAT rate for all items in the household consumption basket to 50 percent of the standard VAT rate (Policy 6 in Table 9). These two policies are applied only to Mexico and Nicaragua because these are the countries where we have detailed information about household consumption in the household surveys. Peru is the other country where we have information about household consumption, but in Peru there are no exemptions for the VAT. Table 9 summarizes the results of these two policies. The structure of 9 is similar to the last two tables. The first row for each country measures the new size of the demand stabilization coefficient, e^C, after the relevant policy was implemented. The second row for each country measures the average percent change of the new size of e^C with respect to its original size shown in Table 6. As can be seen in Table 9, both policies have a positive effect over the demand stabilization coefficient in Nicaragua in the sense that when the economy is affected by a negative unemployment shock or an informal transition shock the demand stabilization coefficient increases, on average, between 30 and 120 percent with respect to its original size. For Mexico, neither Policy 5 nor Policy 6 appears to affect the demand stabilization coefficient in a meaningful way.

Overall, the evidence presented in this section suggests that replacing the minimum tax exemption and the personal income tax structure in LAC countries for those in place in middle-income countries outside the region is a policy that could be applied in order to enlarge the absorbtion by the income and demand stabilization coefficients.

Table 8. Effects of Alternative Policies over the Demand Stabilization Coefficient

	Policy 1		Policy 2		Policy 3		Policy 4	
	Unemployment	Informal	Unemployment	Informal	Unemployment	Informal	Unemployment	Informal
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Argentina	13.83%	4.51%	15.75%	4.63%	13.12%	3.99%	13.09%	3.74%
	36.53%	-8.89%	55.48%	-6.46%	29.52%	-19.39%	29.22%	-24.44%
Brazil	16.32%	14.38%	15.70%	14.18%	12.46%	11.58%	13.33%	11.48%
	30.66%	24.72%	25.70%	22.98%	-0.24%	0.43%	6.73%	-0.43%
Peru	9.86%	12.00%	11.39%	19.28%	8.43%	13.02%	5.83%	10.35%
	65.71%	43.88%	91.43%	131.18%	41.68%	56.12%	-2.02%	24.10%
Nicaragua	11.06%	9.59%	20.52%	14.03%	12.75%	9.36%	9.07%	4.96%
	55.77%	69.43%	189.01%	147.88%	79.58%	65.37%	27.75%	-12.37%
Mexico	NA	NA	12.99%	9.67%	6.89%	5.14%	9.47%	5.85%
	NA	NA	35.45%	50.16%	-28.15%	-20.19%	-1.25%	-9.16%

Source: Authors' calculations.

Note: Policy 1 takes the minimum tax exempt of the personal income tax in LAC countries and replace it by the minimum tax exempt of middle income countries outside Latin America and the Caribbean. Policy 2 changes the minimum tax exempt and its progressiveness using the tax structure of middle income countries outside the LAC region showed in Table 1. Policy 3 introduce a flat personal income tax of 18%. Policy 4 broadens the personal income tax base to informal people, increasing the size of the formal sector in the economy by reducing in 50% the number of informal workers in the economy. Columns (1), (3), (5) and (7) show the effect of the relevant policy when a negative unemployment shock hits the economy while the rest of the columns show the impact of the policy when an informal transition shock occurs.

Table 9. Effects of Alternative Policies over the Demand Stabilization Coefficient

	Policy 5		Policy 6	
	Unemployment (1)	Informal (2)	Unemployment (3)	Informal (4)
Nicaragua	9.30%	10.93%	10.32%	12.34%
	30.99%	93.11%	45.35%	118.02%
Mexico	9.07%	6.62%	9.56%	6.80%
	-5.42%	2.80%	-0.31%	5.59%

Source: Authors' calculations.

Note: Policy 5 eliminates exemptions in the VAT base except for education, health, renting, financial services, and transport; and Policy 6 adds to Policy 5 a VAT rate for all items in the household consumption basket to reach 50% of the standard VAT rate. Columns (1), (3), (5) and (7) show the effect of the relevant policy when a negative unemployment shock hits the economy while the rest of the columns show the impact of the policy when an informal transition shock occurs.

6 Conclusion

In this paper we measure the size of automatic stabilizers in a representative sample of LAC countries and find that, when a negative unemployment shock hits the economy, income and demand automatic stabilizers coefficients are much smaller than the size of these coefficients in Europe and the United States. This evidence suggests that there is room for policies that can enlarge the absorbtion by these coefficients as a way to contribute to macroeconomic stability in LAC countries. We analyze several policies toward this end.

We consider four policies affecting the income stabilization coefficient: (i) replacing the minimum tax exemption of the personal income tax in LAC countries by the minimum tax exemption of middle-income countries outside Latin America and the Caribbean; (ii) changing the minimum tax exemption and its progressiveness using the tax structure of middle-income countries outside the LAC region reported in Table 1; (iii) introducing a flat personal income tax of 18 percent; and (iv) broadening the personal income tax base to informal people, increasing the size of the formal sector in the economy by reducing by 50 percent the number of informal workers in the economy. We also study two policies affecting the demand stabilization coefficient directly: (i) eliminating exemptions in the VAT base except for education, health, renting, financial services, and transport; and (ii) adding to policy (i) a VAT rate for all items in the household consumption basket to reach 50 percent of the standard VAT rate.

Overall, the main results of the paper suggest that changing the minimum tax exemption and its progressiveness using the tax structure of middle-income countries outside the LAC region reported in Table 1 is the best option to enlarge the size of the income and demand stabilization

coefficients and in this way to reduce the need for discretionary fiscal policies in the region. We believe that these results are important in the sense that they should contribute to the growing policy discussion about the importance of the fiscal policy over the business cycle in LAC countries.

Appendix 1

6.1 The Size of Automatic Stabilizers in LAC Countries

6.1.1 Scenarios: unemployment and transition to informality shocks

We measure the size of automatic stabilizers in two scenarios: one in which there is a $\gamma\%$ of formal workers who become workers in the informal sector of the economy; and another in which there is an unemployment shock, that is, the unemployment rate increases by $\gamma\%$. The second scenario is used to compare the size of automatic stabilizers in LAC countries with their size in Europe and the United States.

In the unemployment shock case we use a behavioral micro-simulation model. In this case some households become unemployed and therefore lose all their labor earnings. Following Gonzalez-Rozada and Menendez (2006) we simulate the change in unemployment rate at the micro level by estimating, for each individual in the sample, working status probabilities using four mutually exclusive alternatives. These alternatives are (1) employed in the formal sector of the economy, (2) employed in the informal sector of the economy, (3) unemployed and, (4) out of the labor force. Using the conditional Logit model (see McFadden (1974)) the estimated probability that individual k will be in category s ($s = 1, 2, 3, 4$) is given by the following expression,

$$P_{s,k} = \frac{e^{\hat{\delta}'_s X}}{\sum_{j=1}^{4} e^{\hat{\delta}'_j X}}, \tag{18}$$

where X is a vector of explanatory variables that captures socio-demographic characteristics of the individual and $\hat{\delta}_j$ ($j = 1, 2, 3, 4$) are estimations of the parameter vectors.

The model considered in this section represents the optimal behavior of individuals in the sense that, given their socioeconomic characteristics and the structural features of the labor market, individuals select the alternative that maximizes their utility.

Let V_{ij} be the maximum utility attainable for individual i if she is in state j. If we assume V_{ij} to be linear,

$$V_{ij} = \delta'_j X + u_{ij}$$

where the individual selects the alternative for which V_{ij} is a maximum. Assuming u_{ij} is a disturbance independent and identically Gumbel distributed. This model can be transformed into a binary decision problem as follows. For each of the four alternatives there is a utility as in last equation. Alternative s ($s = 1, 2, 3, 4$) is chosen if and only if it provides the highest utility, i.e.,

$$V_{is} > \max_{j \neq s} V_{ij}$$

Now define $\pi_{is} = \max_{j \neq s} V_{ij} - u_{is}$. Then, it follows that alternative s will be chosen if and only if $\delta_s' X > \pi_{is}$ and the probability that the alternative s will be chosen is given by (18) (see McFadden (1974)).

If markets were in equilibrium the allocation of individuals into counterfactual choice categories would be based on the fact that each individual selects the category that provides her with the highest utility (see Bourguignon, Fournier, and Gurgand (2001), de Hollanda Guimares Ferreira and Paes de Barros (1999) and Bourguignon, Ferreira and Lustig (2005)). When the labor market is not in equilibrium, as is the case in the majority of developing countries, some individuals are prevented to achieve their selected choice category because there is some kind of rationing from the demand side of the market. That is, maybe for some individuals the highest utility would be achieved by selecting to be employed at the market wage but, since the labor market is not clearing, they cannot find a job and they remain unemployed. We implement this rationing from the demand side of the labor market by using a sequential Poisson sampling (see Ohlsson (1998)) as explained below.

First, we estimate for each individual in the sample a probability of being employed, $P_{e,k} = P_{1,k} + P_{2,k}$, and a probability of being unemployed, $P_{u,k} = P_{3,k}$, using the conditional Logit model described above. With these probabilities and using a sequential Poisson sampling, we reproduce the counterfactual scenario of increase in unemployment rate in the following way.

Define N_u^* as the number of unemployed people in the counterfactual scenario and generate a random number from a uniform distribution, $\xi_{u,k}$, for each individual k belonging to the counterfactual labor force. Then, individuals are sorted in ascending order according to $\epsilon_{u,k} = \xi_{u,k}/P_{u,k}$ (where $P_{u,k}$ is the probability of being unemployed at time t) such that the first individuals in the counterfactual labor force sample will be those with greater probability of being unemployed. Once the individuals are arranged in this way, the first N_u^* individuals are assigned to the counterfactual unemployed sample. After this procedure is finished, the counterfactual participating sample will be composed by N_p^* individuals, N_u^* of which are unemployed.

Notice that when we select the counterfactual labor force sample with size N_u^*, if all individuals had the same probability of being unemployed, say P_u^*, then we would obtain a simple random sample because we are multiplying a constant, $(1/P_u^*)$, by a random variable, $\xi_{u,k}$, that has equal probability realizations. That is, since observations are sorted in ascending order by $\epsilon_{u,k} = (1/P_u^*) \times \xi_{u,k}$, and P_u^* is constant, observations are sorted in ascending order by $\xi_{u,k}$ and the uniform distribution assures that each individual has exactly the same probability of being selected for the counterfactual labor force. In our sample, individuals have different probabilities of being unemployed, $P_{u,k}^*$, therefore the resulting counterfactual sample consists of individuals selected randomly with probability proportional to their probability of being unemployed. That is, in the Poisson sampling the probability of selection is not constant through individuals; it depends on the

probability of being unemployed of each one of them, which in turn reflects different individual preferences. Selecting the individuals by $\epsilon_{u,k} = (1/P^*_{u,k}) \times \xi_{u,k}$ means that $\xi_{u,k}$ drawn from a uniform distribution gives each individual k the same chance of being selected, however, multiplying these values by $(1/P^*_{u,k})$ implies that the probability of selection of each individual varies with $P^*_{u,k}$.

In other words, by selecting the first N^*_u observations, the counterfactual unemployment sample will include those individuals with the greatest probability of being unemployed, those individuals for which stay in the unemployment state provides them with the highest utility. Of course, since this is a random sampling, there will be some cases that, by chance, having low probability of being unemployed will end up unemployed in the counterfactual labor force and/or some individuals with high probability of being unemployed ending up employed in the labor force. These cases are necessary to obtain a representative counterfactual labor force because they are precisely the individuals prevented to achieve their selected choice category due to the restrictions in the labor market. Remember that our counterfactual labor force has to resemble the characteristics of labor markets that are not always in equilibrium.

Once the counterfactual sample is obtained, we assign labor earnings to the individuals employed using a random regression imputation. Then, we estimate the total household income change from the original situation (including changes in taxes, social insurance employee contributions and benefits). Then we add together all the individual direct tax changes, individual social insurance changes and benefits changes and divide them by the sum of assumed income changes to define our estimations of e^τ, e^p, and e^b respectively. Then, using the poverty line as a threshold we identify the liquidity-constrained households and estimate e^C. Notice that with this procedure we can address the statistical evaluation of the income stabilization coefficient estimate constructing empirical statistical confidence intervals using a Monte Carlo experiment (see Gonzalez-Rozada and Menendez (2006)).

We perform a second exercise considering a negative shock that modifies the composition of employment. In general a negative shock will induce a transition from the formal sector of the economy to the informal sector. To measure this effect we repeat the sequential Poisson sampling described above but this time using $N^*_i = N_i \times (1 + \delta)$ as the number of informal workers in our sample and generating a random number from a uniform distribution, $\xi_{i,k}$, for each individual k belonging to the counterfactual employment sample. Then, individuals are sorted in ascending order according to $\epsilon_{i,k} = \xi_{i,k}/P_{i,k}$ (where $P_{i,k}$ is the probability of being employed in the informal sector at time t) such that the first individuals in the counterfactual employment sample will be those with greater probability of being employed in the informal sector of the economy. Once

the individuals are arranged in this way, the first N_i^* individuals are assigned to the counterfactual informal employment sample.

Once the counterfactual sample is obtained, we assign labor earnings to the individuals employed using a random regression imputation. Then, we estimate the total household income and proceed as in the unemployment shock case.

Appendix 2

In order to measure the size of fiscal stabilizers, we have applied two different shocks: an unemployment shock, which consists of a 5 percent rise in the unemployment rate, and a formal labor shock, which consists of a 5 percent rise in the rate of informal workers to total workers. Both shocks can be viewed as consequences of a negative macroeconomic shock to the economy. The relation between GDP and unemployment is straightforward and has been widely documented. On the other hand, the relation between GDP and formal labor may not be so clear, which is why we have used Argentinean data to estimate it.

Using data for 31 quarters (2003-2011), we estimated a model with the logarithm of total formal workers as dependent variable and the logarithm of seasonally-adjusted real GDP as independent variable. The elasticity obtained is equal to 92 percent and is statistically significant at any conventional level. These results provide empirical support for our original conjecture, as an exogenous reduction in real GDP causes an almost proportional reduction in the number or formal workers. Our microsimulations capture this phenomenon as a reduction in the ratio of formal to total workers.

Appendix 3

In this Appendix we present tables that summarize the effect of a negative unemployment shock or an informal transition shock over the income stabilization coefficient, e^I, and its decomposition in personal income taxes, e^τ, social security, e^p, and social benefits, e^b and over the demand stabilization coefficient, e^C when the alternative policies described in Section 3 are in place.

Table 10. Policy 1: Changing the minimum tax exempt of the personal income tax. Income stabilization coefficient

e^I	New size		Mean percent change	
	Unemployment shock	Informal transition shock	Unemployment shock	Informal transition shock
Argentina	20.31% [17.61% 25.08%]	28.23% [27.51% 29.07%]	87.88%	42.07%
Brazil	23.08% [21.95% 24.65%]	27.25% [27.05% 27.53%]	55.42%	39.96%
Peru	23.78% [19.96% 25.27%]	26.01% [25.98% 26.02%]	56.24%	32.30%
Nicaragua	10.88% [8.26% 13.45%]	15.29% [13.42% 17.94%]	161.54%	63.53%
Mexico	NA NA	NA NA	NA NA	NA NA

Source: Authors' simulations.

Note: Figures in square brackets are 95% confidence intervals obtained through 1,000 Monte Carlo samples.

Table 11. Policy 1: Changing the minimum tax exempt of the personal income tax. e^{τ}

	New size		Mean percent change	
	Unemployment shock	Informal transition shock	Unemployment shock	Informal transition shock
Argentina	9.88% [8.00% 14.77%]	9.32% [8.40% 10.48%]	1837.25%	996.47%
Brazil	15.78% [15.09% 16.78%]	18.46% [18.32% 18.70%]	108.73%	72.85%
Peru	13.29% [12.94% 13.76%]	13.00% [12.98% 13.02%]	163.69%	94.90%
Nicaragua	8.41% [7.19% 11.02%]	9.46% [7.55% 12.10%]	412.80%	169.52%
Mexico	NA NA	NA NA	NA NA	NA NA

Source: Authors' simulations.

Note: Figures in square brackets are 95% confidence intervals obtained through 1,000 Monte Carlo samples.

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Table 12. Policy 1: Changing the minimum tax exempt of the personal income tax. e^p

	New size		Mean percent change	
	Unemployment shock	Informal transition shock	Unemployment shock	Informal transition shock
Argentina	7.81% [4.42% 9.64%]	18.91% [17.68% 20.38%]	4.83%	-0.58%
Brazil	7.17% [6.63% 7.78%]	8.79% [8.71% 8.85%]	0.14%	0.00%
Peru	10.49% [7.07% 11.82%]	13.00% [13.00% 13.00%]	3.05%	0.00%
Nicaragua	2.47% [0.16% 4.70%]	5.83% [5.59% 5.98%]	-1.98%	-0.17%
Mexico	NA NA	NA NA	NA NA	NA NA

Source: Authors' simulations.

Note: Figures in square brackets are 95% confidence intervals obtained through 1,000 Monte Carlo samples.

Table 13. Policy 1: Changing the minimum tax exempt of the personal income tax. e^b

	New size		Mean percent change	
	Unemployment shock	Informal transition shock	Unemployment shock	Informal transition shock
Argentina	2.62% [1.37% 4.44%]	0.00% [0.00% 0.00%]	-8.07%	–
Brazil	0.21% [0.02% 0.43%]	0.00% [0.00% 0.00%]	-8.70%	–
Peru	0.00% [0.00% 0.00%]	0.00% [0.00% 0.00%]	–	–
Nicaragua	0.00% [0.00% 0.00%]	0.00% [0.00% 0.00%]	–	–
Mexico	NA NA	NA NA	NA NA	NA NA

Source: Authors' simulations.

Note: Figures in square brackets are 95% confidence intervals obtained through 1,000 Monte Carlo samples.

Table 14. Policy 1: Changing the minimum tax exempt of the personal income tax. Demand stabilization coefficient

e^C	New size		Mean percent change	
	Unemployment shock	Informal transition shock	Unemployment shock	Informal transition shock
Argentina	13.83% [6.90% 27.28%]	4.51% [2.58% 8.32%]	36.53%	-8.89%
Brazil	16.32% [14.05% 19.67%]	14.38% [13.24% 15.95%]	30.66%	24.72%
Peru	9.86% [1.93% 23.49%]	12.00% [7.41% 16.15%]	65.71%	43.88%
Nicaragua	11.06% [3.11% 17.76%]	9.59% [5.51% 16.22%]	55.77%	69.43%
Mexico	NA NA	NA NA	NA NA	NA NA

Source: Authors' simulations.

Note: Figures in square brackets are 95% confidence intervals obtained through 1,000 Monte Carlo samples.

Table 15. Policy 2: Changing the minimum tax exempt and the tax structure. Income stabilization coefficient

e^I	New size		Mean percent change	
	Unemployment shock	Informal transition shock	Unemployment shock	Informal transition shock
Argentina	26.24% [22.49% 32.27%]	36.69% [35.16% 38.11%]	142.74%	84.65%
Brazil	23.22% [21.33% 25.81%]	28.60% [28.09% 29.12%]	56.36%	46.89%
Peru	34.72% [26.45% 40.69%]	40.99% [39.87% 41.80%]	128.12%	108.49%
Nicaragua	24.73% [15.35% 34.04%]	31.27% [26.22% 35.16%]	494.47%	234.44%
Mexico	21.97% [16.46% 27.80%]	27.74% [26.56% 28.81%]	50.27%	51.01%

Source: Authors' simulations.

Note: Figures in square brackets are 95% confidence intervals obtained through 1,000 Monte Carlo samples.

Table 16. Policy 2: Changing the minimum tax exempt and the tax structure. e^{τ}

	New size		Mean percent change	
	Unemployment shock	Informal transition shock	Unemployment shock	Informal transition shock
Argentina	16.19% [12.29% 21.38%]	17.95% [16.09% 19.89%]	3074.51%	2011.76%
Brazil	15.89% [14.23% 18.48%]	19.82% [19.33% 20.29%]	110.19%	85.58%
Peru	24.22% [18.02% 29.56%]	27.99% [26.87% 28.80%]	380.56%	319.64%
Nicaragua	22.33% [14.21% 31.48%]	25.43% [20.48% 29.21%]	1261.59%	624.50%
Mexico	20.18% [15.04% 25.64%]	22.99% [21.74% 24.08%]	56.92%	68.92%

Source: Authors' simulations.

Note: Figures in square brackets are 95% confidence intervals obtained through 1,000 Monte Carlo samples.

Table 17. Policy 2: Changing the minimum tax exempt and the tax structure. e^{p}

	New size		Mean percent change	
	Unemployment shock	Informal transition shock	Unemployment shock	Informal transition shock
Argentina	7.30% [4.49% 9.55%]	18.74% [17.51% 19.59%]	-2.01%	-1.47%
Brazil	7.18% [6.59% 7.64%]	8.79% [8.72% 8.83%]	0.28%	0.00%
Peru	10.51% [7.50% 12.29%]	13.00% [13.00% 13.00%]	3.24%	0.00%
Nicaragua	2.41% [0.00% 5.04%]	5.83% [5.64% 5.97%]	-4.37%	-0.17%
Mexico	1.79% [1.12% 2.34%]	4.74% [4.49% 5.08%]	1.70%	-0.21%

Source: Authors' simulations.

Note: Figures in square brackets are 95% confidence intervals obtained through 1,000 Monte Carlo samples.

Table 18. Policy 2: Changing the minimum tax exempt and the tax structure. e^b

	New size		Mean percent change	
	Unemployment shock	Informal transition shock	Unemployment shock	Informal transition shock
Argentina	2.75% [1.55% 4.32%]	0.00% [0.00% 0.00%]	-3.51%	NA
Brazil	0.23% [0.04% 0.45%]	0.00% [0.00% 0.00%]	0.00%	NA
Peru	0.00% [0.00% 0.00%]	0.00% [0.00% 0.00%]	NA	NA
Nicaragua	0.00% [0.00% 0.00%]	0.00% [0.00% 0.00%]	NA	NA
Mexico	0.00% [0.00% 0.00%]	0.00% [0.00% 0.00%]	NA	NA

Source: Authors' simulations.

Note: Figures in square brackets are 95% confidence intervals obtained through 1,000 Monte Carlo samples.

Table 19. Policy 2: Changing the minimum tax exempt and the tax structure. Demand stabilization coefficient

e^C	New size		Mean percent change	
	Unemployment shock	Informal transition shock	Unemployment shock	Informal transition shock
Argentina	15.75% [4.32% 7.42%]	4.63% [2.54% 7.75%]	55.48%	-6.46%
Brazil	15.70% [13.51% 18.06%]	14.18% [12.64% 15.27%]	25.70%	22.98%
Peru	11.39% [1.82% 34.05%]	19.28% [9.77% 27.69%]	91.43%	131.18%
Nicaragua	20.52% [5.25% 35.71%]	14.03% [7.48% 23.17%]	189.01%	147.88%
Mexico	12.99% [5.27% 21.89%]	9.67% [7.94% 12.18%]	35.45%	50.16%

Source: Authors' simulations.

Note: Figures in square brackets are 95% confidence intervals obtained through 1,000 Monte Carlo samples.

Table 20. Policy 3: Flat personal income tax rate at 18%. Income stabilization coefficient

e^I	New size		Mean percent change	
	Unemployment shock	Informal transition shock	Unemployment shock	Informal transition shock
Argentina	16.43% [13.50% 18.92%]	26.21% [25.04% 27.29%]	51.99%	31.91%
Brazil	13.89% [12.58% 15.62%]	18.63% [18.33% 18.90%]	-6.46%	-4.31%
Peru	21.61% [16.93% 26.38%]	26.15% [25.33% 26.83%]	41.98%	33.01%
Nicaragua	12.17% [5.94% 18.72%]	17.67% [14.23% 20.08%]	192.55%	88.98%
Mexico	10.28% [5.92% 13.66%]	14.44% [13.23% 15.27%]	-29.69%	-21.39%

Source: Authors' simulations.

Note: Figures in square brackets are 95% confidence intervals obtained through 1,000 Monte Carlo samples.

Table 21. Policy 3: Flat personal income tax rate at 18%. e^τ

	New size		Mean percent change	
	Unemployment shock	Informal transition shock	Unemployment shock	Informal transition shock
Argentina	6.54% [4.51% 8.53%]	7.49% [6.28% 8.35%]	1182.35%	781.18%
Brazil	6.58% [5.68% 7.78%]	9.84% [9.59% 10.07%]	-12.96%	-7.87%
Peru	11.16% [8.25% 14.22%]	13.15% [12.33% 13.83%]	121.43%	97.15%
Nicaragua	9.95% [4.51% 14.60%]	11.83% [8.42% 14.31%]	506.71%	237.04%
Mexico	8.47% [4.38% 11.45%]	9.68% [8.42% 10.62%]	-34.14%	-28.88%

Source: Authors' simulations.

Note: Figures in square brackets are 95% confidence intervals obtained through 1,000 Monte Carlo samples.

Table 22. Policy 3: Flat personal income tax rate at 18%. e^p

	New size		Mean percent change	
	Unemployment shock	Informal transition shock	Unemployment shock	Informal transition shock
Argentina	7.16% [3.72% 9.37%]	18.72% [17.72% 19.98%]	-3.89%	-1.58%
Brazil	7.18% [6.63% 7.62%]	8.78% [8.73% 8.84%]	0.28%	-0.11%
Peru	10.45% [7.31% 12.35%]	13.00% [13.00% 13.00%]	2.65%	0.00%
Nicaragua	2.23% [0.00% 5.02%]	5.84% [5.63% 5.97%]	-11.51%	0.00%
Mexico	1.81% [1.07% 2.34%]	4.76% [4.50% 5.18%]	2.84%	0.21%

Source: Authors' simulations.

Note: Figures in square brackets are 95% confidence intervals obtained through 1,000 Monte Carlo samples.

Table 23. Policy 3: Flat personal income tax rate at 18%. e^b

	New size		Mean percent change	
	Unemployment shock	Informal transition shock	Unemployment shock	Informal transition shock
Argentina	2.72% [1.57% 4.08%]	0.00% [0.00% 0.00%]	-4.56%	–
Brazil	0.23% [0.02% 0.46%]	0.00% [0.00% 0.00%]	0.00%	–
Peru	0.00% [0.00% 0.00%]	0.00% [0.00% 0.00%]	–	–
Nicaragua	0.00% [0.00% 0.00%]	0.00% [0.00% 0.00%]	–	–
Mexico	0.00% [0.00% 0.00%]	0.00% [0.00% 0.00%]	– –	– –

Source: Authors' simulations.

Note: Figures in square brackets are 95% confidence intervals obtained through 1,000 Monte Carlo samples.

Table 24. Policy 3: Flat personal income tax rate at 18%. Demand stabilization coefficient

e^C	New size		Mean percent change	
	Unemployment shock	Informal transition shock	Unemployment shock	Informal transition shock
Argentina	16.43% [13.50% 18.92%]	26.21% [25.04% 27.29%]	51.99%	31.91%
Brazil	13.89% [12.58% 15.62%]	18.63% [18.33% 18.90%]	-6.46%	-4.31%
Peru	21.61% [16.93% 26.38%]	26.15% [25.33% 26.83%]	41.98%	33.01%
Nicaragua	12.17% [5.94% 18.72%]	17.67% [14.23% 20.08%]	192.55%	88.98%
Mexico	10.28% [5.92% 13.66%]	14.44% [13.23% 15.27%]	-29.69%	-21.39%

Source: Authors' simulations.

Note: Figures in square brackets are 95% confidence intervals obtained through 1,000 Monte Carlo samples.

Table 25. Policy 4: Broadening the Personal Income Tax Base to Informal People. Income stabilization coefficient

e^I	New size		Mean percent change	
	Unemployment shock	Informal transition shock	Unemployment shock	Informal transition shock
Argentina	15.26% [13.82% 17.27%]	14.20% [13.13% 15.44%]	41.17%	-28.54%
Brazil	15.80% [13.49% 18.43%]	19.47% [18.98% 20.04%]	6.40%	0.00%
Peru	17.59% [12.93% 22.74%]	19.49% [18.42% 20.89%]	15.57%	-0.86%
Nicaragua	7.73% [6.00% 13.65%]	8.08% [6.38% 12.81%]	85.82%	-13.58%
Mexico	14.77% [11.80% 20.18%]	16.67% [15.88% 17.45%]	1.03%	-9.25%

Source: Authors' simulations.

Note: Figures in square brackets are 95% confidence intervals obtained through 1,000 Monte Carlo samples.

Table 26. Policy 4: Broadening the Personal Income Tax Base to Informal People. e^{τ}

	New size		Mean percent change	
	Unemployment shock	Informal transition shock	Unemployment shock	Informal transition shock
Argentina	0.78% [0.02% 2.90%]	1.13% [0.11% 2.38%]	52.94%	32.94%
Brazil	7.36% [5.15% 9.82%]	10.73% [10.29% 11.24%]	-2.65%	0.47%
Peru	4.76% [0.24% 10.08%]	6.49% [5.32% 7.67%]	-5.56%	-2.70%
Nicaragua	1.74% [0.00% 7.65%]	2.08% [0.39% 6.81%]	6.10%	-40.74%
Mexico	12.10% [9.10% 17.49%]	13.95% [13.16% 14.75%]	-5.91%	2.50%

Source: Authors' simulations.

Note: Figures in square brackets are 95% confidence intervals obtained through 1,000 Monte Carlo samples.

Table 27. Policy 4: Broadening the Personal Income Tax Base to Informal People. e^{p}

	New size		Mean percent change	
	Unemployment shock	Informal transition shock	Unemployment shock	Informal transition shock
Argentina	11.82% [10.52% 12.54%]	13.07% [12.97% 13.18%]	58.66%	-31.28%
Brazil	8.31% [8.00% 8.56%]	8.74% [8.69% 8.80%]	16.06%	-0.57%
Peru	12.83% [12.63% 12.97%]	13.00% [12.99% 13.00%]	26.03%	0.00%
Nicaragua	5.99% [5.90% 6.00%]	6.00% [5.99% 6.00%]	137.70%	2.74%
Mexico	2.67% [2.42% 2.70%]	2.70% [2.69% 2.70%]	51.70%	-43.16%

Source: Authors' simulations.

Note: Figures in square brackets are 95% confidence intervals obtained through 1,000 Monte Carlo samples.

Table 28. Policy 4: Broadening the Personal Income Tax Base to Informal People. Demand stabilization coefficient

e^C	New size		Mean percent change	
	Unemployment shock	Informal transition shock	Unemployment shock	Informal transition shock
Argentina	13.09% [7.26% 19.88%]	3.74% [1.88% 8.19%]	29.22%	-24.44%
Brazil	13.33% [9.97% 15.43%]	11.48% [10.30% 12.39%]	6.73%	-0.43%
Peru	5.83% [0.40% 18.76%]	10.35% [5.26% 13.28%]	-2.02%	24.10%
Nicaragua	9.07% [3.28% 17.86%]	4.96% [3.13% 15.24%]	27.75%	-12.37%
Mexico	9.47% [4.05% 17.06%]	5.85% [4.44% 7.42%]	-1.25%	-9.16%

Source: Authors' simulations.

Note: Figures in square brackets are 95% confidence intervals obtained through 1,000 Monte Carlo samples.

Table 29. Policy 4: Broadening the Personal Income Tax Base to Informal People. e^b

	New size		Mean percent change	
	Unemployment shock	Informal transition shock	Unemployment shock	Informal transition shock
Argentina	2.66% [1.50% 4.58%]	0.00% [0.00% 0.00%]	-6.67%	–
Brazil	0.22% [0.01% 0.48%]	0.00% [0.00% 0.00%]	-4.35%	–
Peru	0.00% [0.00% 0.00%]	0.00% [0.00% 0.00%]	–	–
Nicaragua	0.00% [0.00% 0.00%]	0.00% [0.00% 0.00%]	–	–
Mexico	0.00% [0.00% 0.00%]	0.00% [0.00% 0.00%]	–	–

Source: Authors' simulations.

Note: Figures in square brackets are 95% confidence intervals obtained through 1,000 Monte Carlo samples.