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Financial disincentives to formal work

Evidence from Ecuador and Colombia

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Abstract: The aim of this paper is to quantify the financial cost that informal workers would incur in the event of entering formality, accounting for potential earnings gains upon entry. To do so, we use representative microdata from Ecuador and Colombia, together with detailed tax–benefit models, and simulate transitions to formal employment for all workers observed in informality in the data, with informality defined as non-affiliation to social security. Our results point to strikingly high formalization costs in the two countries, with on average 52.8 and 78.5 per cent of workers' additional earnings taxed away due to social security payments in Ecuador and Colombia, respectively. Costs are particularly high for self-employed informal workers at the bottom of the earnings distribution. The results are mainly driven by the requirement that workers contribute to social security at least on the basis of the minimum wage in both countries.

Keywords: formalization tax rate, informality, microsimulation
JEL classification: J42, H22, H55

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1 Introduction

In Latin American economies, characterized by highly concentrated capital income and limited social protection systems, labour income represents the main alternative for families to overcome poverty. A particular feature characterizing labour markets in the region continues to prompt interest among academics and policy makers, namely informal employment, a concept that has evolved over time due to the complexity of its definition. Over recent years, the region has experienced important economic growth and a number of formalization policies have been introduced in different countries. However, informality remains prevalent and further research is needed to analyse its underlying causes.

The coexistence of two very dissimilar productive sectors, formal and informal, is usually studied within two perspectives: exclusion and exit (Perry et al. 2007). The former assumes that being formal is expensive for small companies and workers whose productivity is low relative to the burden of regulation and taxes; therefore, they are excluded from the formal sector (de Soto 1989). The latter suggests that firms and workers optimally choose whether to be formal and contribute to taxes and social insurance or not, having both options available (Maloney 1999).

Under these two perspectives, the role played by taxes, and more generally by the tax–benefit system, is central to the discussion. The aim of this paper is, therefore, to quantify the cost that informal workers would incur in the event of entering formality. For this, we make use of household microdata from Ecuador and Colombia and simulate transitions from informal to formal employment by means of multi-country tax–benefit microsimulation techniques in order to elucidate the financial disincentives to formality embedded in the tax–benefit system. We take into account potential income gains of informal workers when entering formal employment, as well as compliance with minimum wage legislation in place in each country. As such, we revise the concept of formalization tax rates and redefine it as the proportion of the change in earnings that would be taxed away in the form of increased taxes and social insurance contributions or reduced cash transfers when a worker enters formality.

Our analysis provides a number of interesting findings. First, formalization costs are very high in Ecuador and Colombia, and would outweigh most of the potential monetary gains on entry to formality. On average, around 52.8 and 78.5 per cent of workers' additional earnings in formality would be taxed away in the form of increased taxes and social insurance contributions in Ecuador and Colombia, respectively. Second, the high formalization costs are mainly driven by the payment of social insurance contributions, with income taxes playing only a marginal role due to high non-taxable thresholds and deductions from personal expenditures applied to taxable income. Third, formalization tax rates vary greatly between employees and self-employed workers in informal employment, and are particularly high at the bottom of the self-employed earnings distribution. Fourth, assuming informal workers would face similar earnings as their formal counterparts upon entry to formality, a full formalization of informal workers would reduce income inequality in both countries, and would increase total revenue from social insurance contributions by around 71 per cent. However, the largest burden of such increase would be borne by workers.

The contribution of this paper to the literature is twofold. First, to the best of our knowledge, our analysis represents the first attempt to give a comprehensive estimate of the financial disincentives to formal work based on microdata from Latin American countries, thanks to the recent development of detailed tax–benefit microsimulation models. Previous studies have mainly focused on European countries, and used models based on hypothetical households rather than microdata. Second, we consider the fact that informal workers would not necessarily face the same earnings on

entry to formal employment, and this has implications for the measurement of formalization tax rates. In this sense, future research should concentrate on improving the estimation of earnings of informal workers in the event of entering formality.

The paper is structured as follows. Section 2 discusses the definition of informality and reviews the literature on its causes, and in particular the role of tax and benefit systems. Section 3 presents the methodology of the Ecuadorian and Colombian microsimulation models and the simulation exercise. Section 4 presents a brief quantitative overview of informality in Colombia and Ecuador and focuses on the estimations of the cost of formalization for informal workers. The last section concludes with some recommendations.

2 Literature review

2.1 Labour informality: definition and causes

Informality is a complex concept that has been defined in multiple ways. Originally, the term referred to small-scale economic activities hidden from government supervision; often denoted as the 'underground', 'unrecorded', 'non-protected', or 'grey' sector of the economy.[1] The concept of informality first appeared in an International Labour Organization (1972) publication describing the employment situation in Kenya (Guerguil 1988).

The complexity of defining informality is reflected in the existence of different approaches to its measurement. Empirical studies have mainly considered two alternatives: the *productivity view* and the *legalistic view*. The *productivity view* defines informality according to the size of the establishment where the individual works (hereinafter ES). Following the ILO and the Delhi Group on Informal Sector Statistics, small firms (of five or fewer workers) are considered to be of low productivity and therefore part of the informal sector. The *legalistic view*, on the other hand, considers informal workers as those not affiliated to the contributory social security system (hereinafter SS). One less frequent and simplistic view considers as informal solely self-employed workers (hereinafter SE). As Henley et al. (2009) pointed out, the definition employed matters a lot as they are not observationally equivalent.

In addition to the lack of consensus in its definition, the causes of informality are also a matter of dispute. In its origins, it has been considered as the result of low productivity and high labour market regulations. This mix excludes certain workers from the formal sector, therefore creating a segmented labour market. In that sense, early economic analyses of informality have been based on the insights of the two-sector model of Harris and Todaro (1970) popularized for the informality literature by de Soto's (1989) work, which argued that regulations hamper informal firms from formalizing. More recent literature moves beyond this exclusion view by pointing out that workers and firms choose optimally to be in one or another sector, by analysing expected returns and costs, considering taxes and social contributions to be made, low government enforcement capacity, and availability of non-contributory social security and conditional cash transfer (CCT) programmes. Informality is, therefore, the result of a comparative advantage for a segment of activities or workers. The pioneer work in this regard is that of Portes et al. (1989), which highlights, among others, that informality is not 'solely a province of the poor'.

[1] Such activities were mainly focused on creating employment rather than profits.

2.2 Labour market informality in Ecuador and Colombia

In reference to Ecuador and Colombia, the literature has studied informality not only from the perspective of workers but also from firms. This section briefly summarizes some relevant studies analysing the determinants of informality in these countries, highlighting the different definitions of informality used.

The first analysis of informality for Ecuador dates back to Klein and Tokman (1993). They employed an OECD survey of micro and small enterprises in Ecuador and Jamaica to explore the determinants of compliance with regulations. They found that activity sector was not a significant factor, but firm size and location were important predictors of formality, measured as firm registration. Another study involving a survey of firms in Ecuador is that of Medvedev and Oviedo (2016), which explores the relation between informality (measured as firm compliance with a set of regulations) and profits. Using data on compliance, they found a strong positive relation indicating that formalization allows for firm growth and higher profits.

Regarding studies from the worker perspective, Vega (2014) constructs transition matrices between formal and informal (ES and SS) sectors, and out of the labour force for Ecuador to assess the level of mobility across sectors. She makes use of multinomial logit models to analyse determinants of transitions between these states and finds a high level of mobility, with income differences being one possible source of movement from the informal to the formal sector. Additionally, it is found that movements towards formality increase with education but decrease with age. Moreover, Canelas (2014) analyses the effect of minimum wage increases on informal and formal employment (ES, SS, and SE) for Ecuador, employing a panel of provinces and finding no effects on formal employment or wages in the formal sector, possibly because of the high level of non-compliance with minimum wage legislation in the country.

For Colombia, informality has also been considered from the perspective of workers and firms. Kugler (2004) uses microdata from household surveys to analyse the effect of a reduction in firing costs on formal (ES and SS) worker transitions in and out of employment. The study shows that relative to informal workers (not covered by the reform), formal turnover increased, especially for younger educated workers. Updating her previous work, but using a panel of formal firms for the period 1982–96, Kugler and Kugler (2009) find that a 10 per cent increase in payroll taxes decreased wages by up to 2.3 per cent (pass-through effect) and employment up to 5 per cent.

On the other hand, Mondragón-Vélez et al. (2010) find that a 10 per cent increase in the ratio of minimum wage to each city's median wage increases the probability of a worker being informal by 1.1 percentage point. Moreover, a 10 per cent increase in non-wage costs relative to each worker's income increases the probability of being informal (ES) by 8 percentage points. These results are statistically significant but dramatically change with the alternative definition of informality as contributory health. Lastly, García (2011) estimates determinants of the labour informality rate at the city level. Using data for 10 Colombian cities across 16 years, he finds that higher education and industry participation in value-added sectors reduces informality (ES). Furthermore, enforcement, measured via government expenditure on compliance, reduces the informal (SS) sector, but government size increases it.

2.3 The effects of taxes and benefits on informality

Previous research on labour informality has mainly focused on the effect of specific cash transfer programmes, instead of assessing the effect of the tax–benefit system as a whole. Most studies interested in the effect of social programmes on informality have made use of household surveys or administrative data for specific programmes as their source of information. For instance, Angel-

Urdinola et al. (2009) employ a regression discontinuity design in Turkey, where incomes of less than one-third of the minimum wage are entitled to non-contributory health coverage. Using the Household Budget Survey in 2006, they found no effect on informality (SS) of this rapidly expanding health programme.

Empirical findings of the effects of CCT on informality are recent and have been inconclusive. For instance Garganta and Gasparini (2015), using a rotating panel, find that *Asignación universal por hijo*, a CCT programme in Argentina, creates disincentives for labour formality (SS). Ribas and Soares (2011) create a panel of neighbourhoods from the Brazilian Household Survey and find that an increase of 1 per cent in coverage of *Bolsa Familia* (a CCT in Brazil) leads to a switch to the informal sector (SS and SE) of 0.13 per cent. De Brauw et al. (2013) use a panel of households and find that the Brazilian programme contributed to a significant movement of workers from the formal sector to the informal sector (SS). On the other hand, Azuara and Marinescu (2013) employ a panel of municipalities and find that *Oportunidades* (a CCT in Mexico) did not increase labour informality (SE and SS). Neves and Leite (2014) use a discontinuity in *Bolsa Familia* eligibility rules regarding children's ages to estimate the effect of the programme on informality and find that it did not affect the occupational choice between formal and informal (SS) of Brazilian households.

In the case of Colombia, most evidence points to a negative effect of social programmes on informality. For instance, Núñez (2002) uses a household survey to calculate the effect of each worker's marginal income tax rate (constructed using reported income) on the probability of being informal (ES), defined according to firm size, and finds a positive and significant effect. Camacho et al. (2009) analyse the effects of a programme that determines eligibility for subsidized health care on labour informality (SS) in Colombia. Carrying out an analysis at the municipal level, they find that informal employment would be 4 percentage points higher after the introduction of the programme.

Using data on *Familias en Accion*, a CCT programme aimed to increase human capital accumulation in Colombia, Ospina and Saavedra (2013) find that being a beneficiary increases informality (SS, SE, ES). Finally, Farné et al. (2016) employ a longitudinal household survey to estimate the effects of several CCT programmes and non-contributory health on labour participation and informality ES. They use difference-in-difference estimators after propensity score matching and find no important effects on participation, but important effects of programmes such as subsidized health care and *Familias en Accion* on labour informality.

For Ecuador, evidence of the effect of tax–benefit systems on informality is scarcer. Wong (2015) analyses the labour market effects of a formalization programme for domestic workers in 2010. She estimates the average treatment effect on the treated after propensity score matching for wages and hours worked using data from the National Survey on Employment, Unemployment, and Underemployment (ENEMDU in Spanish). While the programme increased social security coverage from 10 per cent in 2006 to 33 per cent in 2012, it also reduced both wages and hours worked.

Important efforts to quantify the financial disincentives embedded in the tax–benefit system and faced by informal workers are the studies by Koettl and Weber (2012), Koettl (2013), and Weber (2015); these are in line with the approach taken in this paper. Both of these authors use an OECD tax–benefit model to quantify the tax wedge for transitions to formality, based on hypothetical households. Contrasting experiences of two transition economies (Bulgaria and Romania) with two high-income economies (Australia and the USA), they find that for transition economies formalization tax rates, defined as the proportion of earnings in the informal sector that would be taxed away after entry to formality, are as high as 70 per cent for lower wages (10 per cent of the average), whereas the highest formalization tax rate for higher-income economies is 40 per cent, which applies to incomes that are about 45 per cent of the average.

Improving on the last two studies, our paper uses representative household survey data together with microsimulation models to analyse the distribution of financial disincentives to formality at the population level in Ecuador and Colombia. Moreover, we propose a definition of formalization tax rates which account for potential earnings changes on entry to formality, as described in the following sections.

3 Methodology

Our approach to assess the effect of the tax and benefit system on incentives to enter formality makes use of detailed tax and benefit microsimulation models combining country-specific policy rules with nationally representative household microdata to estimate, for each informal worker in the data, the proportion of income that will be lost as a result of higher taxes, higher social insurance contributions, and lower benefits after an eventual transition to formal employment. Our analysis takes into account that these transitions might involve a change in earnings and we therefore impute counterfactual earnings for each worker in the event of a transition to formality. We start this section with a brief discussion of the definition of informality used in this paper. We then present the data and tax–benefit microsimulation models used in the analysis. We describe our approach to simulate transitions into formality and finally we present our indicators to measures financial incentives to formality.

3.1 Definition of informality

Our paper follows the *legalistic view* proposed in the literature and defines informality in terms of non-affiliation to the contributory social security system. This definition is particularly suited to our analysis because it is directly linked with the effect the tax–benefit system would have in the event of a transition to formal employment. More precisely, we make use of the detailed information available in the household survey data for each worker about affiliation to social security and define as informal workers those reporting non-affiliation.

In Ecuador, effective affiliation requires formal registration at the Ecuadorean Institute of Social Security. Therefore, we consider formal workers those individuals who report being affiliated to social security in the data. Affiliation offers entitlement to, among others, health and pension insurance, severance pay, and disability and occupational risk insurance. In Colombia, effective affiliation is achieved first by registering with a Health Promoting Entity (EPS in Spanish) and a pension fund, and second by a monthly payment of social insurance contributions (SICs). We consider formal workers those who declare making pension contributions to a pension fund in the survey; therefore, non-contributing registered workers are considered informal. Affiliation offers entitlement to, among others, health insurance, sickness, maternity, and paternity leave payments, and an old-age pension under some conditions.[2]

It is important to note that, for the purpose of our simulations, when a worker is defined as informal, we assume that the person does not pay SICs or personal income tax. After formalization, we assume both payments are made and calculate SICs and income tax liabilities for each worker entering formality with our microsimulation models, as discussed in the following sections.

[2] In Colombia those not contributing to social security are covered by subsidized health insurance with the same benefits as the contributory scheme.

3.2 Data and simulations

Data

Our analysis is based on representative household survey data from Ecuador and Colombia. Data from Ecuador come from the National Survey of Income and Expenditures of Urban and Rural Households (Encuesta Nacional de Ingresos y Gastos de Hogares Urbanos y Rurales, ENIGHUR) 2011–12. Data from Colombia come from the Quality of Life National Survey for 2014 (Encuesta Nacional de Calidad de Vida, ENCV). The surveys contain detailed information on employment, earnings, income from different sources, and expenditures, as well as household and personal characteristics needed for tax–benefit simulations. Most importantly, both surveys contained detailed information about affiliation to contributory social security, which we use to define informal workers in our analysis. Income concepts have been harmonized in both datasets with the purpose of cross-country analysis (see Jara et al. 2017; Rodriguez 2018). The sample for our simulations contains 153,341 individuals for Ecuador and 67,332 individuals for Colombia.

Tax–benefit simulations

Our study makes use of the recently developed tax–benefit microsimulation models: ECUAMOD for Ecuador and COLMOD for Colombia. Both models combine detailed country-specific coded policy rules with microdata in order to simulate direct taxes, SICs, and cash transfers for the household population of Ecuador and Colombia. The models have been implemented under a common modelling language using the EUROMOD platform to ensure comparability of tax–benefit policy simulations.[3] Both models are static in the sense that tax–benefit simulations abstract from behavioural reactions of individuals and no adjustments are made for changes in the population composition over time. Simulated income components obtained with ECUAMOD and COLMOD have been validated against external statistics (Jara et al. 2018; Rodriguez 2018).

Our analysis takes 2014 policies (as on 30 June) in Ecuador and Colombia as the starting point. In the case of Ecuador, market incomes and non-simulated tax–benefit variables in the data are adjusted to 2014 levels using source-specific updating factors (Jara et al. 2018). In what follows, we present a brief discussion of the main income components simulated in our models. For detailed information, see Jara et al. (2018) and Rodriguez (2018).

In both countries, employee and self-employed SICs are simulated for formal workers, that is, individuals who report affiliation (contribution in Colombia) to social security in the survey. Some differences in the design of SICs between Ecuador and Colombia can be highlighted. First, all self-employed workers are liable to pay SICs in Colombia, whereas payment is voluntary for this group in Ecuador. Second, the contribution base for the self-employed corresponds to all self-employment income in Ecuador, whereas only 40 per cent of it is considered in Colombia. In Ecuador, employee contribution rates vary between 9.45 per cent and 11.45 per cent, depending on the sector of work, whereas the self-employed contribute at a rate of 20.5 per cent. In Colombia, contribution rates for employees are between 8 per cent and 10 per cent, and 28.5 per cent for the self-employed. Finally, a minimum contribution equal to the rates applied to the minimum wage applies for the self-employed in Ecuador and to all workers in Colombia. In Ecuador, a minimum contribution of 9.45 per cent or 11.45 per cent of the minimum wage applies to full-time employees; part-time employees

[3] EUROMOD is the tax–benefit microsimulation model for the European Union. For more information, see Sutherland and Figari (2013).

pay a minimum contribution based on a proportion of the minimum wage according to the number of days they work.

Baseline simulation results from ECUAMOD and COLMOD, as well as previous studies based on these models, have simulated personal income tax under the assumption of full compliance (Bargain et al. 2017; Jara and Varela 2019; Jara et al. 2018; Rodriguez 2018). Our study departs from this assumption and simulates personal income tax only for those individuals reporting affiliation to social security in the survey. This assumption is made with the aim of assessing the effects of personal income tax when an individual enters formal employment. However, it is important to note that this might overestimate the financial cost of formalization as individuals not affiliated to social security might already be paying taxes, particularly so in Ecuador, where the self-employed can opt for affiliation on a voluntary basis but are required to file income tax.[4] In terms of design, in both countries, personal income tax is characterized by the presence of deductions from personal expenditures. In Ecuador the tax schedule is formed of nine bands with rates from 0 to 35 per cent, whereas in Colombia two alternative tax regimes co-existed in 2014 in addition to the standard tax regime, with different bands applying to each regime and rates between 0 and 33 per cent.

In terms of benefits, our models simulate the main cash transfers available in the two countries: *Bono de Desarrollo Humano* and *Bono Joaquin Gallegos Lara* in Ecuador and *Familias en acción* and *Colombia Mayor* in Colombia. These programmes are proxy means-tested CCTs that do not depend on formality status, with the minor exception of the elderly and disabled in Ecuador. Finally, tax–benefit instruments, which cannot be simulated in our models due to data limitations, are taken directly from the data. This is the case of contributory public pensions, which cannot be simulated given the lack of information on contribution records in the surveys. Non-simulated instruments also include disability benefits, severance payments, and property and motor vehicle taxes, among others. Besides contributory pensions, all other non-simulated instruments represent a minor part of tax–benefit systems in Ecuador and Colombia.

3.3 Simulating transitions from informal to formal work

Our strategy to quantify the financial cost of formalization consists of moving informal workers in the data into formal employment and comparing their household disposable income before and after the transition. The effects of a transition to formality are simulated for all those currently in work and reporting non-affiliation to social security in the data (i.e. informal workers), aged 18–60, to exclude those in mandatory education or retirement. Table A1 in the Appendix presents the characteristics of the samples in each country.

Importantly, transitioning to formal employment might not only entail starting to contribute to social security and being subject to personal income tax at the same level of earnings. It is quite likely that the earnings a worker would face when moving from informal to formal employment would change. From the exclusion point of view, the segmentation of the labour market implies that workers in the formal sector receive higher wages. This is a result of labour demand rationing due to the burden of legislation, especially minimum wage and non-wage costs for formal activities. On the other hand, from the exit perspective, a worker is formal/informal because there is a comparative advantage to

[4] In practice, however, we would expect only a marginal effect of personal income tax on financial incentives to formality. This is the case because of two main factors associated with the design of personal income tax in Latin American countries. First, the non-taxable threshold is rather high in most Latin American countries. It represents 2.54 times and 4.17 times the annualized minimum wage in Ecuador and Colombia, respectively. Second, deductions from personal expenditures can be made from taxable income. Therefore, most informal workers, who are usually low earners, would not be liable to pay income tax after formalization, as shown in our results.

being in that specific sector. Therefore, allocating the person in the alternative sector would possibly represent a disadvantage, given the worker's characteristics.

More formally, our approach to simulating transitions from informal to formal employment proceeds as follows. First, household disposable income is calculated for all informal workers in the data before any transition takes place. Then, for each informal worker in the household, we impose affiliation to social security and estimate counterfactual earnings under their new status of formal workers. Lastly, with our tax–benefit models, we simulate the amount of SICs and personal income tax they would be liable to pay, as well as their corresponding household disposable income under formalization. In case there is more than one informal worker in the household, we simulate transitions to formality for each of them separately, assuming that the status of any other informal workers remains unchanged.

Accounting for earnings differentials

Our approach follows Pratap and Quintin (2006) and uses matching techniques and an OLS estimation to account for potential changes in earnings from moving to formal employment. The strategy has two stages. First, we define a broad set of personal characteristics (X_i) and job attributes (Z_i) known to affect wages and test the best-matching strategy (non- and semi-parametric) from those frequently used in the literature on impact evaluation. We compare means, standardised bias, and variance ratios across covariates in the treated (informal) and the matched untreated (formal) populations to decide the best strategy.[5] Matching restricts the comparison group of informal workers to similar (in observed characteristics) formal workers. We found that the strategy that reduces both standardized bias and variance of the residuals for both countries the most is a matching one-to-one based on the Mahalanobis distance between treated and controls.[6]

In the second stage we use the matched subsample to predict log hourly earnings for informal workers based on their characteristics. More formally, we consider a Mincer equation with informality interactions of the type:

$$\log(\mathrm{w_j}) = \alpha + X_j'\beta + Z_j'\delta + d_j X_j'\gamma + d_j Z_j'\vartheta + \varepsilon_j \qquad (1)$$

where $\log(w_j)$ represents the log of hourly earnings for worker j in the matched subsample, d_j is a dummy taking the value of 1 if the worker is treated (informal) and ε_j is an idiosyncratic error term. We estimate equation (1) by OLS and use the estimated parameters of this regression $(\hat{\alpha},\hat{\beta},\hat{\delta},\hat{\gamma},\hat{\vartheta})$ together with the vector of attributes of informal workers to predict the earnings they would face in

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[5] Standardized bias between an attribute x for the treated (1) and control (0) groups could be defined as

$$SB = 100\left(\frac{\overline{x}_1 - \overline{x}_0}{\sqrt{\left(V(x_1) + V(x_1)\right)/2}}\right)$$

where $\overline{x}_i$ and $V(x_i)$ represent the mean and variance of the variable x for group i respectively.

[6] The Mahalanobis distance between two observations $x_i = (x_{i1}, x_{i2}, \ldots, x_{in})$ and $x_j = (x_{j1}, x_{j2}, \ldots, x_{jn})$ could be defined as $D(x_i, x_j) = \sqrt{(x_i - x_j)' V^{-1} (x_i - x_j)}$ where V is the covariance matrix between the n variables.

formal employment. More precisely, the dummy variable d_f is set equal to zero for informal workers, that is, assuming informal workers are now formal.

We use a comprehensive set of variables including age and education in years, dummies for gender, rural area, region, and ethnicity. Job attributes include work history (in months) and dummies for industry and occupation. Ideally, one would estimate this equation separately for employees and self-employed. However, small sample sizes of formal self-employed workers in our data prevent us doing so. Therefore, we pool employees and self-employed but include dummies for this category. If one is willing to assume some sorting of workers into each sector, this simple counterfactual exercise provides an upper bound of the income of informal workers in formal employment—that is, without the penalty of being in a disadvantaged sector.

An alternatively to the strategy described above would be to estimate a selection correction model *à la* Heckman, which has been applied to the formal/informal sector setting in very few papers (Carneiro and Henley 2002; Marcouiller et al. 1997; Pratap and Quintin 2006). Under this approach, a sector selection model is estimated in a first-stage regression, and then a correction term is included in the log hourly earnings equation in the second stage to account for potential selection. We applied this second approach to our data but favoured the simpler model for two main reasons. First, previous literature has found contrasting evidence on the sign of the estimated parameter for the correction term in the second-stage equation.[7] Our own estimates are in line with the contrasting evidence. The sign depends on the sample used, with large differences between employees and self-employed in both countries. When combining the two groups, the coefficient becomes statistically insignificant. This implies that instead of a comparative advantage there could be a penalty of being in the formal sector for some workers, which is inconsistent with the underlying assumption of free movement between sectors in the model. Second, we found that counterfactual earnings are extremely sensitive to the set of exclusion variables employed and, admittedly, is difficult to come up with variables that exclusively affect the probability of being in the formal sector but do not affect earnings.[8]

Minimum wage enforcement

An important aspect of formalization relates to the enforcement of minimum wage legislation. By law, formal workers are required to be paid no less than the national minimum wage in each country. In 2014, the national minimum wage was set at US$340 per month in Ecuador and COP$616.027 in Colombia.[9] Our analysis considers the enforcement of the minimum wage in order to provide an idea of its effect on financial incentives to formalization. More precisely, we first predict earnings for informal workers as described in the previous section. Then, in case a worker's predicted hourly earnings fall below the threshold in each country, we apply the hourly minimum wage.[10]

[7] Yet the implications are rarely discussed. The only exception is Pratap and Quintin (2006).

[8] These results are available upon request from the authors.

[9] Equivalent to US$326 (exchange rate of 20 June 2014).

[10] In both countries the monthly minimum wage is related to full-time (48 hours per week in Colombia and 40 hours per week in Ecuador). Less than full-time hours of work are paid proportionally to the minimum wage. Although the majority of workers in our sample work full-time, we account for different time regimes by using hourly minimum wages in order not to overestimate counterfactual earnings.

3.4 Measuring financial incentives to formal work

There is only limited research analysing the financial incentives to formalization embedded in tax–benefit systems (Koettl 2013; Koettl and Weber 2012; Weber 2015). Previous studies have mainly used hypothetical data to measure the burden of formalization implied by the tax–benefit system, and for this reason they have assumed no change in earnings when moving from informal to formal employment.

Koettl and Weber (2012) introduce the concept of formalization tax rates (FTR), defined as the proportion of earnings in informal employment that would be taxed away after entry to formality. More formally, FTR of individual *i* is defined as:

$$FTR_i = \frac{Y_{h,i}^1 - Y_{h,i}^0}{w_i} \tag{2}$$

where w_i represents worker *i*'s earnings in informal employment and $y_{h,i}$ represents household disposable income for worker *i*. The superscripts 1 and 0 represent time—that is, before and after simulated formalization takes place.

Our measure of formalization costs departs from that of Koettl and Weber (2012) and draws from the literature on work incentives to account for potential changes in earnings following a transition between informal and formal employment. In particular, we redefine FTRs as the proportion of the change in earnings that would be taxed away in the form of increased taxes and SICs or reduced cash transfers when a worker enters formality. More formally, we define the FTR of individual *i* by:

$$FTR_i = \begin{cases} \left(1 - \frac{y_{h,i}^1 - y_{h,i}^0}{w_i^1 - w_i^0}\right) \; if \; w_i^1 > w_i^0 \\ -\left(1 - \frac{y_{h,i}^1 - y_{h,i}^0}{w_i^1 - w_i^0}\right) \; if \; w_i^1 < w_i^0 \end{cases} \tag{3}$$

where w_i represents labour earnings of worker *i* and $y_{h,i}$ represents disposable income of household *h*, to which worker *i* belongs. The superscripts 0 and 1 represent the worker states: 1 represents the situation in which worker *i* is in informal employment, and 0 the situation in which she is in formal employment. As previously mentioned, in the case that there are multiple informal workers in the household, transitions to formal work are simulated for each of them separately, assuming the situation of other informal workers in the household remains unchanged.

In general, we would expect FTR values to range between 0 and 100 per cent, with higher FTRs representing higher financial disincentives generated by the tax and benefit system to enter formal work. For example, assuming that following a transition to formal work earnings would increase, an FTR equal to 80 per cent would represent that 80 per cent of the additional earnings would be taxed away because of increased SICs and tax payments or reduced cash transfers. In the case of a negative change in earnings (i.e. a decrease in earnings following entry into formality), a sign correction is applied to preserve the correct direction of incentives implied by the indicator.

As highlighted by Jara and Tumino (2013) for the case of marginal effective tax rates, some features of the tax–benefit system could lead to values of FTR outside the range of 0–100 per cent. An FTR above 100 per cent could be observed if, facing an earnings increase upon formalization, changes in household disposable income are negative, for instance due to the loss of an important benefit entitlement or to a burdensome tax. On the other hand, a negative FTR implies that the tax–benefit system provides financial incentives to enter formality, for example by means of additional benefits

after formalization. In our analysis, in order to prevent mean FTR being affected by such 'outliers', we focus our analysis on workers earning more than US$1 in Ecuador and COP$10,000 in Colombia per month and exclude from our calculations FTRs above the 99th and below the 1st percentiles of the distribution.[11]

The contribution of different tax–benefit instruments to FTR can be analysed by decomposing the indicator. In particular, household disposable income can be expressed as the sum of market income ($o_{h,i}$) plus benefits and pensions (b_i), minus taxes (t_i) and SIC (s_i):

$$FTR_i = \pm\left(1 - \frac{o^1_{h,i}+b^1_{h,i}-t^1_{h,i}-s^1_{h,i}-\left(o^0_{h,i}+b^0_{h,i}-t^0_{h,i}-s^0_{h,i}\right)}{w^1_i - w^0_i}\right) \quad (4)$$

Following a transition to formal employment, the only change assumed in household market income ($o_{h,i}$) is that of labour income, therefore necessarily $\Delta o_{h,i} = \Delta w_i$, allowing us to decompose the FTR into each of its components. In the case of an increase in earnings after formalization we have:[12]

$$FTR_i = \left(-\frac{\Delta b_{h,i}}{\Delta w_i}\right) + \left(\frac{\Delta t_{h,i}}{\Delta w_i}\right) + \left(\frac{\Delta s_{h,i}}{\Delta w_i}\right) = FTR^b_i + FTR^t_i + FTR^s_i \text{ if } w^1_i > w^0_i \quad (5)$$

4 Empirical results

This section starts by discussing the relative size of tax–benefit instruments in Ecuador and Colombia and providing a basic portrait of labour formality in the two countries. We then present results of predicted earnings for informal workers in formal employment. Finally, we provide a detailed analysis of formalization tax rate in both countries, and discuss the implications of formalization in terms of distributional and budgetary effects.

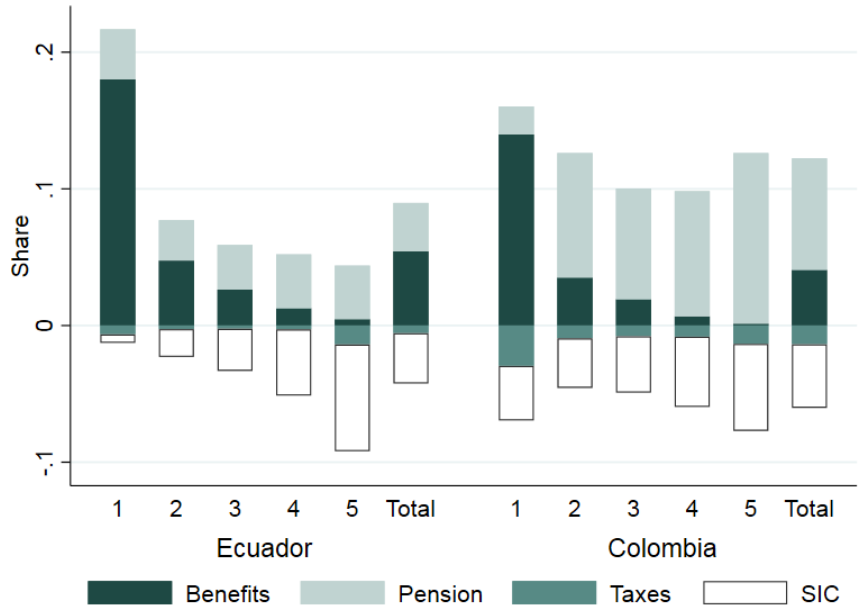
4.1 Tax–benefit instruments in Ecuador and Colombia

Figure 1 shows the main results of the microsimulation models for the two countries. For each income quintile it presents the contribution of each policy instrument to disposable income. Several features of the systems are worth noting. Benefits are progressive in both countries and represent a larger share of disposable income in Ecuador than in Colombia. They represent around 18 per cent of disposable income in the bottom quintile in Ecuador, whereas they account for 14 per cent of the same group in Colombia. Pensions play a larger role in Colombia; however, their relative size increases along the income distribution, representing a larger share of disposable income for richer households.

[11] USD$5.3 (exchange rate of 20 June 2014).

[12] In the case of $w^1_i < w^0_i$, $FTR_i = \left(\frac{\Delta b_{h,i}}{\Delta w_i}\right) + \left(-\frac{\Delta t_{h,i}}{\Delta w_i}\right) + \left(-\frac{\Delta s_{h,i}}{\Delta w_i}\right) = FTR^b_i + FTR^t_i + FTR^s_i$.

Figure 1: Mean share of tax–benefit instruments in household disposable income (2014) by quintiles of household disposable income



Source: authors' own calculations based on the microsimulation models.

Personal income tax plays, on the other hand, only a minor role due to the presence of high non-taxable thresholds and deductions from personal expenditures in the two countries; it represents less than 3 per cent of disposable income regardless of the quintile. However, property and car taxes are burdensome, especially for the first quintile in Colombia. Finally, SICs are more progressive in Ecuador than in Colombia. For the first quintile the share is almost 4 per cent in Colombia but less than 1 per cent in Ecuador. This might be related to the fact that Colombian self-employed workers below the minimum wage are required to contribute on the basis of the minimum wage if they are affiliated to social security, but contribution is voluntary in Ecuador. It could also be associated with the presence of *Seguro Campesino* in Ecuador, a rural worker social insurance regime for self-employed rural workers with lower contribution rates than the general regime.[13]

Results from our tax–benefit simulations also highlight the reduced effect of government intervention on income inequality. In line with previous research, we found that the redistributive effect of the tax–benefit system in Colombia is very small (the Gini coefficient from market income equals 0.587 compared to 0.561 based on disposable income), whereas the Ecuadorian tax–benefit system has a greater impact in reducing inequality (with a reduction in the Gini coefficient from 0.501 to 0.464 when market income is compared to disposable income).[14] Alternatively, the P80/P20 ratio of disposable income is remarkably higher for Colombia than for Ecuador, amounting to 21.4 compared to 10.5 respectively. When applying this measure to market income, results are 26.4 and 14 respectively.[15]

[13] The amount of SICs paid by members of the rural worker social security regime is equal to 2.5 per cent of 22.5 per cent of the minimum wage.

[14] As a point of comparison, for the 28 European countries in EUROMOD, government intervention reduced the Gini coefficient 21 percentage points, from 0.505 (market income) to 0.296 (disposable income).

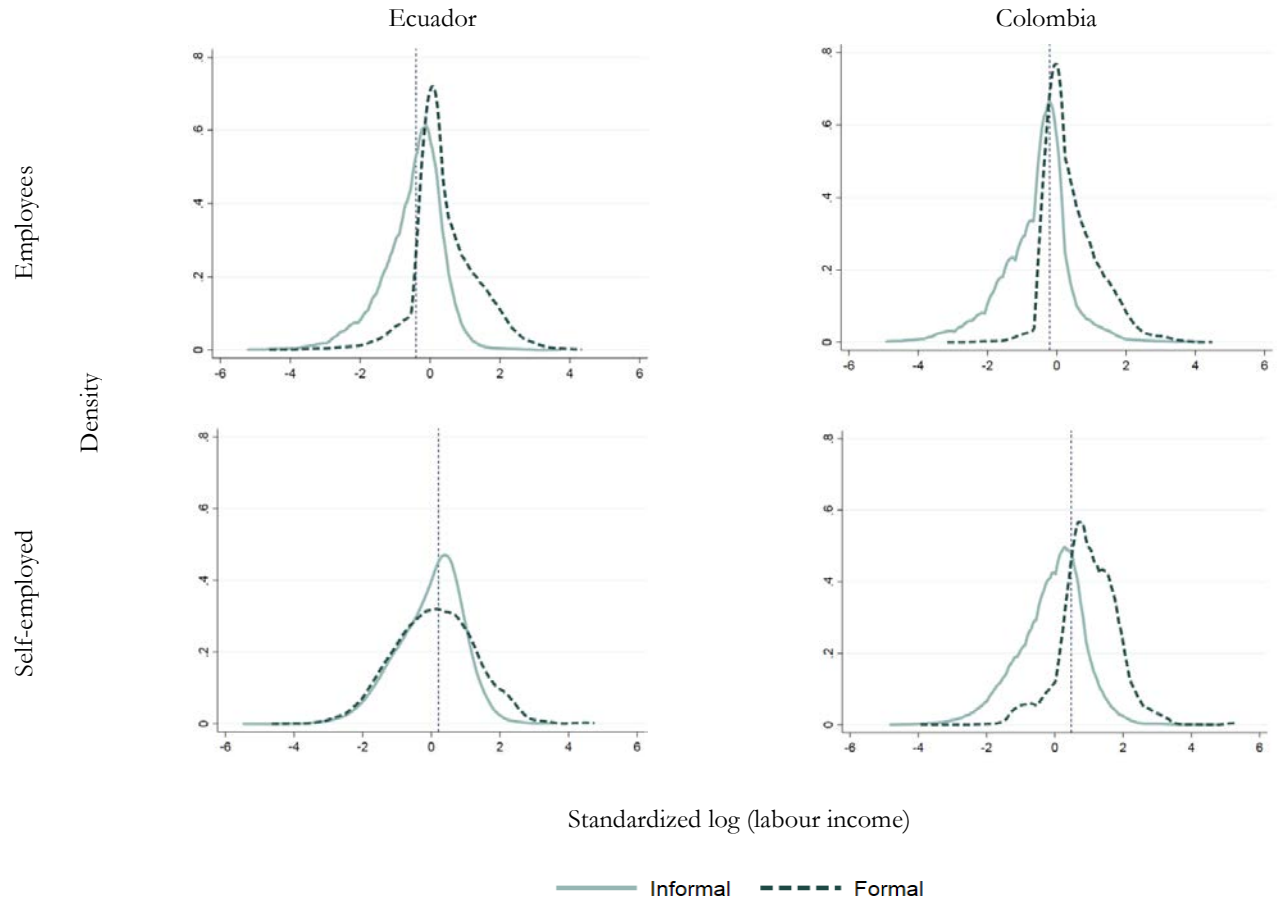
[15] Lustig (2017) assesses the effect of taxes and benefits in Latin America, finding similar results for the reduced role of government for several countries, including Ecuador and Colombia.

4.2 A portrait of informal work in Ecuador and Colombia

Our two countries under analysis are characterized by very high levels of informality. The unconditional labour informality rate at the population level reaches 58 per cent in Ecuador and around 65 per cent in Colombia. Moreover, there are also marked differences in the structure of the informal economy (see Table A1 in the Appendix). In Colombia, the majority of informal workers are self-employed (67 per cent), whereas the composition is more balanced in Ecuador, with around 47 per cent of self-employed workers in informal employment. In both countries, the largest share of informal workers comprises low-skilled workers with low earnings (bottom two quintiles).

Figure 2 presents the distribution of labour income by formality status. The vertical dotted line represents the national minimum wage. In most cases there is a natural partition of informal (solid distribution) and formal earnings (dashed distribution) below and above the minimum wage respectively, which is consistent with the exclusion perspective.[16] There is only one exception to this pattern. For self-employment income in Ecuador, both distributions (formal vs informal) are very similar and symmetric around the minimum wage, which is consistent with the exit perspective and possibly as a result of SICs not being mandatory for the self-employed in Ecuador.

Figure 2: Earnings distribution of formal and informal workers (2014)



Note: the minimum wage is shown by the vertical dotted line.

[16] It is important to highlight that the unconditional labour income (regardless of formality status) of almost half of workers in both countries is below the minimum wage.

Source: authors' own calculations based on household surveys.

Table 1 presents probit estimates of the main determinants of labour formality. We include as dependent variables those previously used in the literature, such as age, gender, dummies for education, rural area, industry and occupation, and variables related to the household, namely a dummy for containing a couple and the number of children. Our results for most variables are in line with the previous literature. For instance, Carneiro and Henley (2002) for Brazil; Uribe et al. (2007) for Colombia; Delgado and Navarro (2013) for Costa Rica; or Cuevas et al. (2016) for Mexico. The models confirm the concave effect of age and the remarkable increase in the likelihood of being a formal worker with additional schooling. In Colombia, rural workers are less prone to working in formal employment, whereas in Ecuador the opposite is observed due to the presence of the abovementioned *Seguro Campesino*. Finally, living as a couple increases the chance of being in informal employment, and more children in the household decreases the probability of being in formal employment.

Table 1: Determinants of labour formality: average marginal effects of probit estimates

	Ecuador	Colombia
Male	0.065***	0.085***
	(16.09)	(17.28)
Age	0.012***	0.022***
	(14.88)	(20.48)
Age squared	−0.00011***	−0.00028***
	(−12.08)	(−21.16)
Secondary education	0.150***	0.150***
	(33.08)	(25.73)
Tertiary education	0.381***	0.344***
	(75.72)	(51.85)
Couple	0.069***	0.038***
	(15.76)	(7.36)
Number of children	−0.015***	−0.013***
	(−8.16)	(−5.29)
Rural	0.058***	−0.032***
	(11.33)	(−5.53)
Industry dummies	Yes	Yes
Region dummies	Yes	Yes
Pseudo R^2	0.153	0.267
No. observations	56,340	27,786
No. informal workers	32,776	20,100

Notes: delta-method *t* statistics in parentheses; significance level: *** $p < 0.01$.

Source: authors' own calculations based on household surveys.

4.3 Earnings differentials between formal and informal employment

This section briefly discusses the results of our predictions of earnings for informal workers in the event of entering formality, based on the estimation of equation (1). Figure 3 summarizes the results, presenting the percentage change in earnings by earnings deciles of informal workers before the transition. The table distinguishes between employees and the self-employed due to the marked differences in the change in earnings obtained from the predictions. Results from the matching balancing properties are presented in Tables A2 and A3 in the Appendix for Ecuador and Colombia, respectively. Results from the earnings estimations are presented in Table A4 in the Appendix.

As depicted in Figure 3, changes in earnings resulting from the econometric estimates are positive for most informal workers except for those in the last decile of baseline earnings.[17] Gains are on average larger for workers in Colombia (210 per cent) than in Ecuador (132 per cent), for the self-employed (230 per cent) compared to employees (80 per cent), and for rural workers (203 per cent) compared to urban workers (142 per cent). Most predicted formal earnings for informal workers are already above the minimum wage; therefore, the lines with and without the minimum wage are frequently on top of each other in Figure 3, with the average gains increasing only slightly when minimum wage enforcement is imposed. It is important to highlight that these increases do not imply that earnings gaps between women and men or between rural and urban workers disappear. As a matter of fact, these formal earnings gaps remain for previously informal workers.

Figure 3: Percentage change in labour income by decile of baseline earnings of each informal type of work

Note: mw, minimum wage.

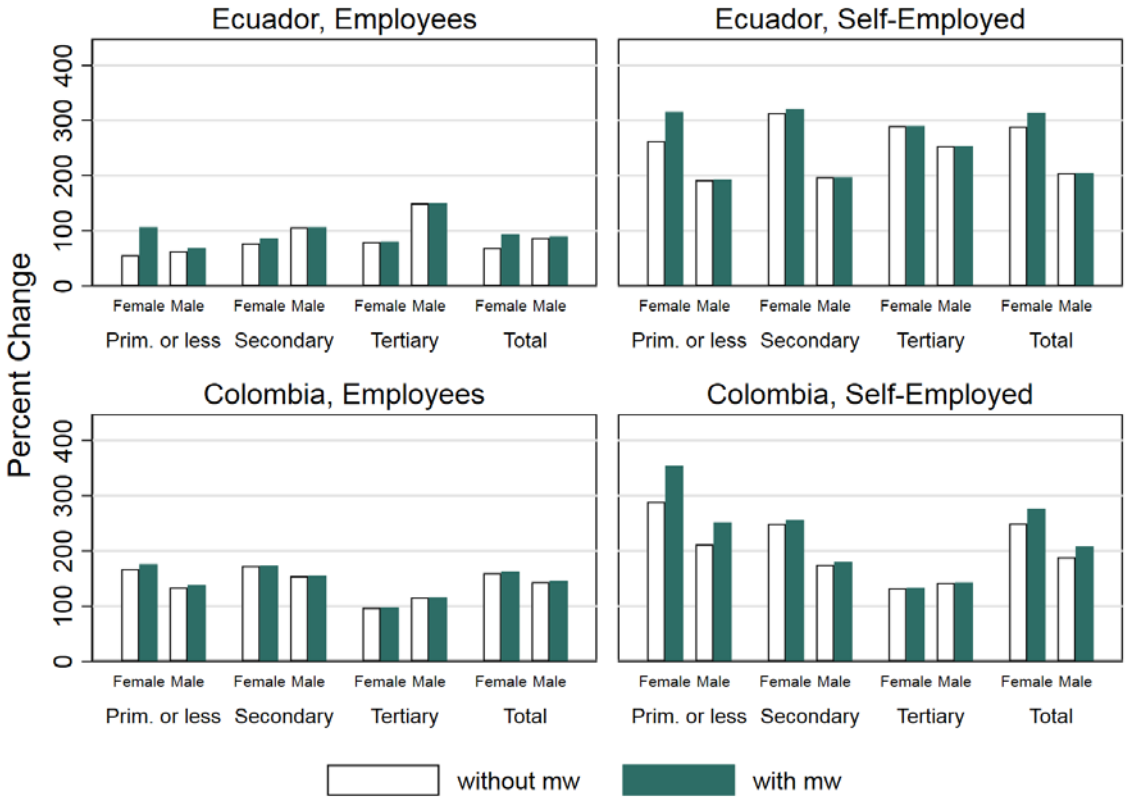
Source: authors' own calculations based on household surveys.

Figure 4 presents the percentage change in labour income after formalization for different groups of informal workers. Earnings gains are higher for women in informal employment compared to men, with the minor exception of employees with tertiary education in Ecuador. In this country, the higher the education level achieved the larger the formalization gains; in Colombia the opposite holds. Moreover, when we take into account the enforcement of the national minimum wage there is a small additional increase in earnings gains for workers with primary or no education, especially for Ecuador. Nevertheless, even from this perspective we observe that counterfactual earnings are mostly above the minimum wage for most groups of informal workers. Therefore, for simplicity,

[17] Around 25 per cent of the sample in Ecuador and 17 per cent in Colombia would experience a decrease in earnings according to our predictions.

throughout the rest of the paper we use the counterfactual incomes, which include the adjustment for minimum wage enforcement.

Figure 4: Percentage change in labour income by groups of gender, education, and worker type



Note: mw, minimum wage.

Source: authors' own calculations based on household surveys.

4.4 Financial disincentives to formal work

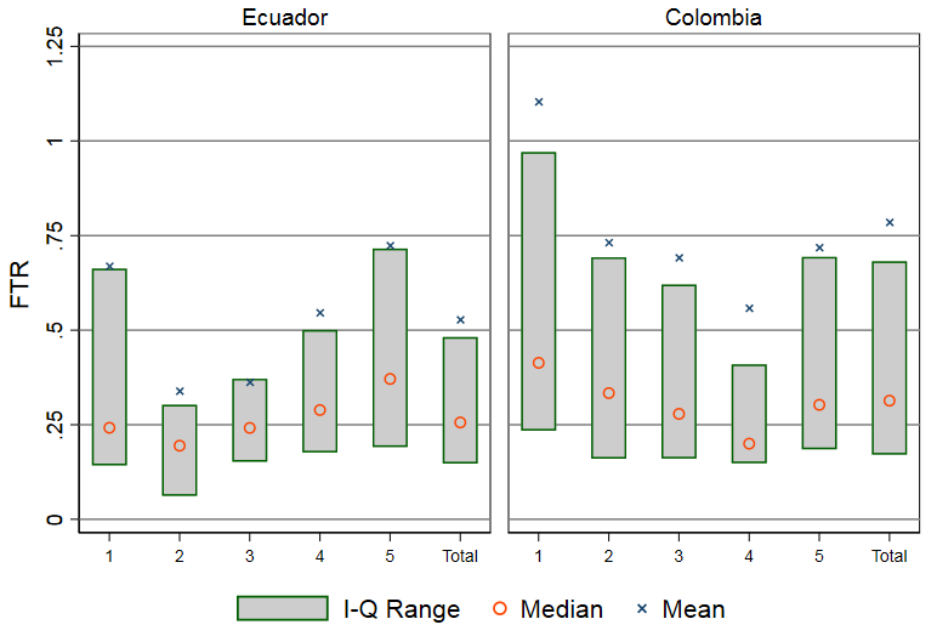
This section focuses on the analysis of our FTR indicator (equation (3)), measuring the proportion of the change in earnings that would be taxed away in the form of increased SICs and taxes or reduced benefits following a transition from informal to formal employment. We start with an analysis of the distribution of FTRs in Ecuador and Colombia, distinguishing between employees and self-employed informal workers who show contrasting patterns in both countries. We then discuss the contribution of different tax–benefit components to FTRs. Finally, we compare how formalization costs vary across different population subgroups. For information, Figures A1 and A2 in the Appendix present a similar set of results based on Koettl and Weber's (2012) original definition of FTRs. It is, however, important to emphasize that their results are not comparable with ours as their formula measures the change in disposable income on entry to formality as a percentage of earnings in informality, rather than as a percentage of the change in earnings following formalization.

Distribution of FTRs

Figure 5 presents mean and median FTRs, as well as percentiles 25 and 75 of FTR per quintiles of earnings in informality. Our results point to the presence of high FTRs in the two countries, but particularly so in Colombia. Mean FTRs equal 52.8 per cent in Ecuador and 78.5 per cent in

Colombia, meaning that in Colombia (Ecuador) 78.5 (52.8) per cent of the additional earnings gained from formalization would be taxed away as a result of increased SICs and tax payments or reduced benefits. In both countries, a U-shaped relationship between FTRs and earnings is observed. Mean FTRs are particularly high for workers in the bottom quintile of the earnings distribution, with mean FTRs of 67 per cent in Ecuador and 110 per cent in Colombia for this group. In Ecuador, workers in the top earning quintile face the highest FTRs of around 72 per cent; mean FTRs are equally high for this group in Colombia. The information of median FTR and percentiles 25 and 75 of FTR depict that FTRs are skewed to the right, with means systematically above the 75 percentile.

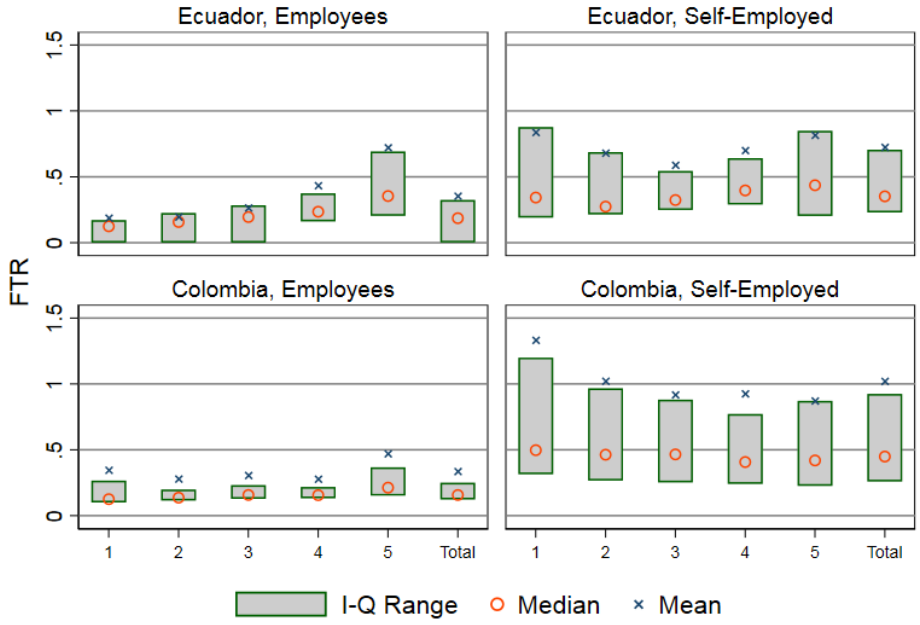
Figure 5: FTR by quintile of baseline earnings in informality



Source: authors' own calculations based on microsimulation models.

Figure 6 presents similar results, but now distinguishing between informal employees and informal self-employed workers. In both countries, informal self-employed workers face higher FTRs than employees. Mean FTRs for employees are around 35 per cent in the two countries, whereas mean FTRs for the self-employed are much higher in Colombia (102 per cent) compared to Ecuador (72.5 per cent). Moreover, the results show very different patterns across earning deciles for these population groups. In Ecuador, mean FTRs increase with earnings of informal employees, whereas a U-shaped pattern is observed for the self-employed. In Colombia, for both employees and self-employed informal workers, we observe a somewhat U-shaped pattern between mean FTRs and informal earnings. However, the pattern of mean FTRs seems to be driven by observations with high values of FTRs. In fact, median FTRs increase with earnings in the case of informal employees and are relatively constant for the self-employed. Looking at Figures 5 and 6, it becomes evident that the pattern of mean FTRs for the whole informal population is mainly driven by the pattern of mean FTRs of the self-employed.

Figure 6: Formalization tax rate by category of employment by quintile of informal earnings of each category



Source: authors' own calculations based on microsimulation models.

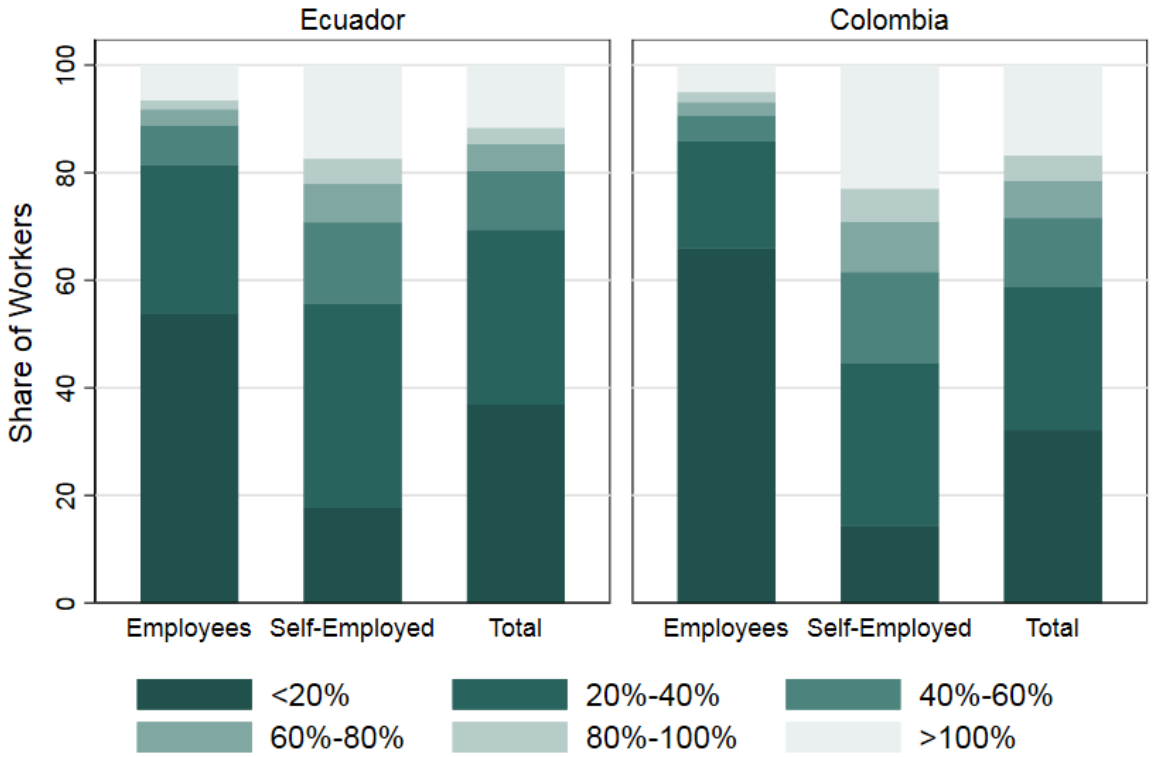
Formalization costs are most likely driven by the design of SICs in each country.[18] In Colombia, a minimum contribution based on the national minimum wage applies to both employees and the self-employed, even if their labour income is below the minimum wage. The same applies to full-time employees and the self-employed in Ecuador, whereas part-time employees contribute on the basis of the proportion of the minimum wage based on their working days.[19] These features of the SICs system pose an extremely high burden on formalization, particularly for low earners who represent the largest proportion of informal workers in the two countries. The higher FTRs for the self-employed are the result of lower earnings among this group of informal workers.

A more in depth analysis of the distribution of FTRs is presented in Figure 7, which shows the share of workers at different ranges of FTRs. In Ecuador, around 70 per cent of informal workers face an FTR below 40 per cent, whereas in Colombia this group is smaller, representing around 55 per cent of the informal population. On the other hand, the percentage of workers facing high disincentives to formalization, that is FTRs above 100 per cent, is much higher in Colombia, representing 18 per cent of informal workers versus 11 per cent in Ecuador.

[18] As depicted in Figure 1, income taxes are not particularly binding and there are no activation clauses that prevent formalizing workers receiving means-tested benefits; therefore, the effect is driven almost completely by SIC.

[19] For self-employed workers, these minimum contributions are equal to 20.5 and 28.5 per cent of the minimum wage for Ecuador and Colombia respectively. For employees they are 9.45 and 8 per cent respectively.

Figure 7: Share of workers by range of FTR (2014) : employees vs self-employed



Source: authors' own calculations based on microsimulation models.

The higher concentration of FTR in the upper part of the distribution for Colombia could be explained by the relative share of employees and self-employed in informal work. As we pointed out before, self-employed informal workers are predominant in Colombia, whereas the divide between employees and self-employed workers is more balanced in Ecuador. Additionally, self-employed workers face higher SIC rates than employees in both countries. Therefore, the penalty must be larger in Colombia and it is important to analyse formalization incentives separately for these two groups.

Decomposition of FTRs

As previously mentioned, the distribution of FTRs and the differences in formalization costs across groups are most likely related to the design of SICs in the two countries. A decomposition of our FTRs measures following equation (5) confirms that SICs are the instrument contributing the most to the financial cost of formalization.

The contribution of cash transfers to FTRs is practically null because in both countries eligibility for benefits (i.e. CCTs) does not depend directly on the formal status of the person but on composite welfare indexes (being below a certain threshold of the index), with the minor exception of the elderly and the disabled in Ecuador, who are not part of the sample of analysis. The effect of taxes is minimal, with a marginal contribution noticeable only for the top decile of the earnings distribution. In Ecuador, taxes contribute 1.6 percentage points of FTR in the top decile, whereas their contribution for this group represents 0.21 percentage points in Colombia. The minor effect of taxes is due to the two characteristics of personal income tax mentioned before. First, in both countries the non-taxable threshold is very high, meaning that most informal workers would not enter the tax brackets to be liable for income tax on entry to formality. Second, even if after transition to formality the earnings

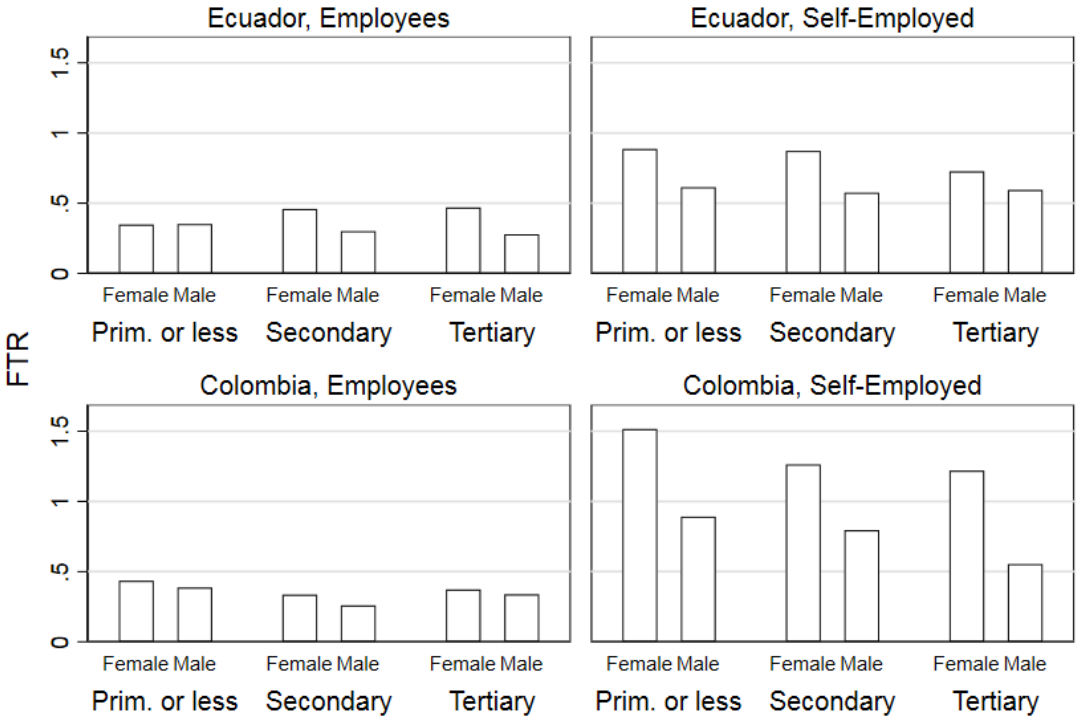
gain of informal workers results in taxable income above the non-taxable threshold, deductions from personal expenditures can be made from taxable income, meaning that effectively very few workers would be subject to income tax payments. Nevertheless, we do observe a higher contribution of taxes to formalization costs in Ecuador than in Colombia, resulting from the higher progressivity of income tax in the first country, as discussed in Section 4.6.

Heterogeneity across population subgroups

The results from the previous section have already highlighted the importance of looking at FTRs across different population subgroups. We observed important differences in formalization costs between employees and the self-employed. However, there could be other patterns for different groups of the population. Figure 8 compares mean FTRs by gender, education, and type of work status, that is employment vs self-employment.

Our results provide a number of interesting findings. First, as previously acknowledged, the largest differences in FTRs are observed between employees and self-employed informal workers. Second, with the exception of female employees in Ecuador, informal workers with tertiary education face on average lower disincentives to formalization independent of their gender. Differences are particularly pronounced for self-employed workers in Colombia. Third, differences in formalization costs between male and female employees are small, but they are large between male and female self-employed workers, with the latter group always facing higher disincentives to formalization. The gap in FTRs between male and female self-employed workers ranges between 11.5 and 29 per cent in Ecuador, depending on the education level, whereas the gap ranges between 46.8 and 66 per cent in Colombia.

Figure 8: Mean FTRs by gender, education, and type of work (2014) (mean of each component)

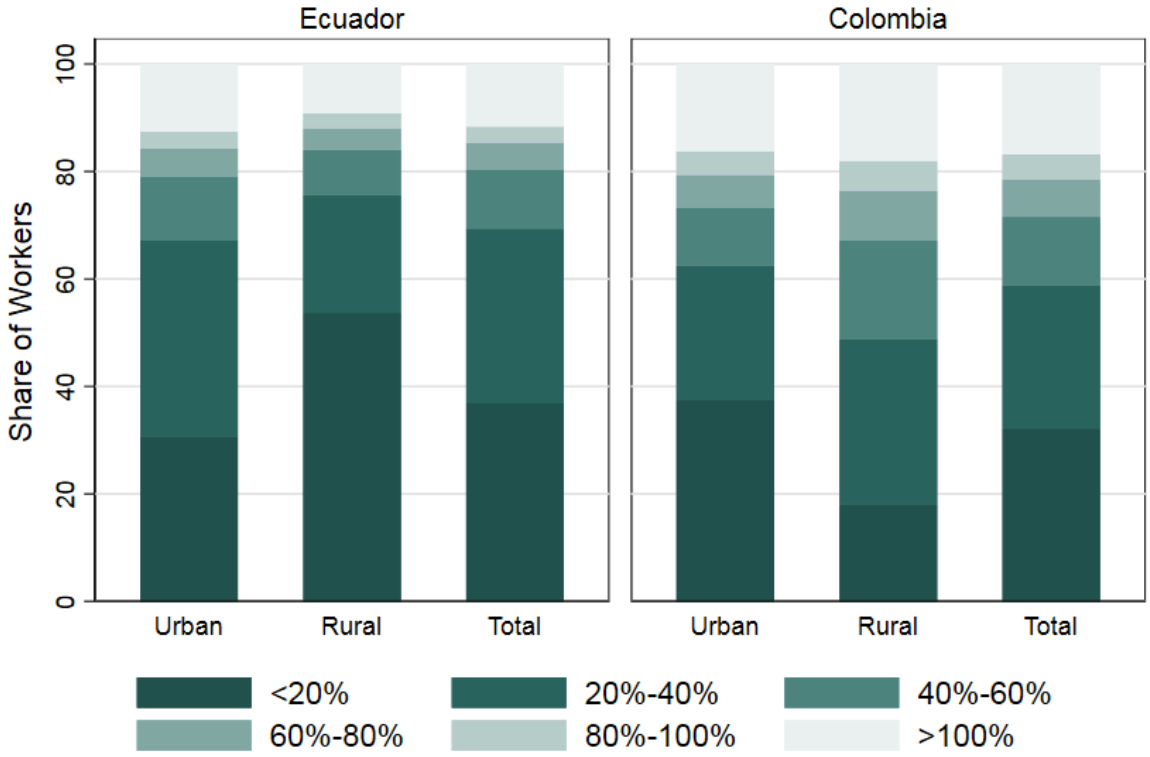


Source: authors' own calculations based on microsimulation models.

Another interesting divide to consider in the analysis of FTRs is that between workers in rural and urban areas. Our results show contrasting differences in FTRs between workers in rural and urban areas in Ecuador and Colombia. In Ecuador, mean FTRs for rural workers are 42.7 per cent and for

urban workers are 56.5 per cent on average, whereas in Colombia rural workers face higher FTRs, of 87.2 per cent, compared to 75.3 per cent for urban workers. The distribution of FTRs for rural and urban workers in the two countries is depicted in Figure 9, which presents the share of workers at different ranges of FTR. The figure shows that the percentage of informal workers facing low FTRs (FTRs below 20 per cent) is much higher in rural areas than urban areas (53.6 per cent compared to 30.7 per cent of workers) in Ecuador. The opposite is observed in Colombia. The rural–urban pattern observed in Ecuador is related to the presence of *Seguro Campesino* in Ecuador.

Figure 9: Share of workers by range of FTR (2014): rural–urban classification



Source: authors' own calculations based on microsimulation models.

In order to better capture the patterns of FTRs across different population subgroups, Table 2 presents mean and median regression estimates of FTRs on a range of personal characteristics. As expected, the beta coefficients of the mean regression are higher in absolute terms than those for the median regressions. However, the direction of the effect in both estimations is in most cases the same. Our regression results confirm that male workers have lower FTR (mean and median) than female workers. The differences in formalization costs between women and men are the result of differences in earnings. Informal earnings of female workers are so low that despite a higher increase in (counterfactual) earnings on entry to formality compared to male workers, a relatively fixed payment of SICs is more burdensome.[20] Controlling for other characteristics, we observe that FTRs decrease with both age and education.

We find no clear pattern of FTRs, depending on the quintiles of informal earnings, when mean and median regressions are compared. From the mean regressions a U-shaped relationship emerges but,

[20] Social contributions are relatively constant due to the abovementioned fixed contribution based on the minimum wage.

alternatively, from the median regressions the higher the informal earnings the higher the formalization costs. Note that this finding is consistent with the results presented in Figures 5 and 6. Table 2 also confirms that FTRs are higher for the self-employed compared to employees. The higher formalization costs for this group of workers are explained entirely by the tax and benefit system. In fact, counterfactual (predicted) earnings in formality for self-employed informal workers are higher than those for employees. However, higher social contribution rates for these groups and the abovementioned minimum contribution translates into a higher cost of formalization. Finally, rural workers have a lower mean and median FTR than urban workers in Ecuador, but the opposite is observed for workers in Colombia. As previously mentioned, this is due to the presence of the rural worker social insurance regime (*Seguro Campesino*) in Ecuador.

Table 2: Mean and median regression estimates of FTR

	Ecuador		Colombia	
	Mean	Median	Mean	Median
Male	–0.242***	–0.088***	–0.425***	–0.082***
	(–19.011)	(–22.993)	(–15.201)	(–12.003)
Secondary	–0.075***	–0.021***	–0.142***	–0.057***
	(–5.917)	(–5.472)	(–4.816)	(–7.921)
Tertiary	–0.154***	–0.048***	–0.250***	–0.089***
	(–8.142)	(–8.486)	(–4.618)	(–6.722)
Age 25–34	0.013	–0.010**	–0.058	–0.017*
	(0.748)	(–1.998)	(–1.413)	(–1.688)
Age 35–44	–0.051***	–0.028***	–0.059	–0.028***
	(–2.841)	(–5.189)	(–1.396)	(–2.648)
Age 45–54	–0.077***	–0.033***	–0.037	–0.032***
	(–3.918)	(–5.659)	(–0.847)	(–2.994)
Age 55+	–0.078***	–0.043***	–0.126**	–0.043***
	(–3.096)	(–5.682)	(–2.396)	(–3.336)
Self–employed	0.297***	0.147***	0.717***	0.309***
	(23.425)	(38.872)	(25.38)	(44.609)
Rural	–0.035**	–0.079***	0.153***	0.085***
	(–2.49)	(–18.601)	(5.469)	(12.359)
Quintile 2	–0.165***	0.004	–0.165***	0.01
	(–9.087)	(0.739)	(–4.351)	(1.114)
Quintile 3	–0.110***	0.062***	0.044	0.062***
	(–5.746)	(10.836)	(1.226)	(7.022)
Quintile 4	0.074***	0.116***	0.094**	0.081***
	(3.823)	(20.031)	(1.99)	(6.947)
Quintile 5	0.227***	0.177***	0.090**	0.111***
	(11.89)	(30.877)	(2.004)	(10.103)
Constant	0.618***	0.234***	0.690***	0.203***
	(28.567)	(36.252)	(13.488)	(16.197)
No. observations	28,195	28,195	16,389	16,389
Adjusted or pseudo R^2	0.0648	0.0624	0.0567	0.0708

Notes: *t* statistics in parenthesis; significance level: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Source: authors' own calculations based on microsimulation models.

4.5 Distributional implications of formalization

An important advantage of tax–benefit microsimulation is that it allows us to study the distributional implications of counterfactual scenarios. In this section, we consider a counterfactual situation in which all informal workers would be formalized. Note that this exercise is slightly different from the

approach used to simulate transitions into formality in the previous sections. The previous analysis was aimed at calculating the formalization cost of each informal worker in the event of entering formal employment. For this, we simulated transitions into unemployment separately for each informal worker in the household in the case that there was more than one informal worker. In this section, our counterfactual assumes that all informal workers would be formalized at the same time, meaning that for households with more than one informal worker, we would calculate household disposable income when all of them are formal.

Table 3 presents some distributional effects of the counterfactual exercise. In particular, four different scenarios are evaluated in order to differentiate two different effects when we consider formalization of workers in informal employment. The first scenario (baseline) presents inequality and poverty indicators for the economy as it is, without assuming any change in individuals' circumstances. The second scenario (earnings change without transition), considers a counterfactual distribution in which informal workers would face similar earnings as their formal counterparts but would still pay no SICs and no taxes. The third scenario (transition without earnings change) represents a situation in which informal workers would start contributing to SICs and paying taxes but under the same earnings they currently have in informal employment. Finally, the last scenario (transition with earnings change) considers our main counterfactual scenario, in which informal workers would enter formality (pay SICs and taxes) but receive counterfactual earnings based on those observed for formal workers.

Table 3: Distributional measures for the formalization exercise

	Ecuador				Colombia			
	Baseline	Earnings change without transition	Transition without earnings change	Transition with earnings change	Baseline	Earnings change without transition	Transition without earnings change	Transition with earnings change
Gini coefficient								
Market income	0.501	0.464	0.501	0.464	0.587	0.512	0.587	0.512
Disposable income	0.464	0.431	0.472	0.435	0.563	0.491	0.606	0.514
P80/P20 ratio								
Market income	13.95	12.19	13.95	12.19	26.39	17.90	26.39	17.90
Disposable income	10.52	9.49	10.98	9.54	21.27	14.00	44.60	17.19
Poverty headcount								
Market income	0.197	0.139	0.197	0.139	0.431	0.256	0.431	0.256
Disposable income	0.16	0.111	0.187	0.122	0.394	0.222	0.461	0.276

Source: authors' own calculations based on microsimulation models.

A comparison of the baseline results with our main counterfactual scenario (transition with earnings change) shows that market income inequality, measured by the Gini coefficient, would be reduced by 3.8 and 7.5 percentage points in Ecuador and Colombia respectively. The effect on market income inequality is driven by the increase in earnings of informal workers on entry to formality, due to the fact that most informal workers are at the bottom of the distribution. In the case of disposable income inequality, the Gini coefficient would decrease in both countries but less than the decrease observed in market income inequality. Around one-fifth and one-third of the reduction in market income inequality would not translate into a reduction of disposable income inequality in Ecuador and Colombia respectively, because they are offset by high social contributions for workers who enter formality.

Our intermediate counterfactual scenarios allow us to disentangle the two combined effects affecting disposable income inequality. Under our scenario in which earnings of informal workers would match those of formal workers but without entry to formality (i.e. without liability to SICs or taxes), the decrease in market income inequality translates almost one to one in a reduction of disposable income inequality. On the other hand, under the scenario of a transition to formality without earnings change, we would observe an increase in the Gini coefficient from disposable income of around 1 percentage point in Ecuador and 4.2 points in Colombia. Another way to look at this increase in inequality is by means of the ratio of disposable incomes for the top 20 per cent and bottom 20 per cent of the population. This indicator increases by around 4 per cent for Ecuador but more than doubles for Colombia—that is, enforcing social insurance payments affects the poor disproportionally more in Colombia.

Finally, under our main counterfactual scenario, assuming informal workers would enter formality (i.e. pay SICs and taxes) with earnings similar to those of workers in formal employment, income poverty, based on per capita disposable income, would decrease by 3.8 and 11.8 percentage points in Ecuador and Colombia respectively.[21] This positive effect is fully driven by the (counterfactual) earnings gains of informal workers. In fact, assuming that informal workers would experience the same change in earnings but without contributing to social security or paying taxes, an additional decrease in poverty of around 1 and 6 percentage points would be observed in Ecuador and Colombia respectively. On the contrary, if informal workers become liable to pay SICs and taxes but under the same earnings they experience in informal employment, poverty would increase by around 3 and 7 percentage points relative to the baseline in Ecuador and Colombia respectively.

4.6 Budgetary implications of formalization

In this section we present the budgetary effects of the main counterfactual scenario presented in Section 4.5, in which all informal workers would enter formality (i.e. pay SICs and taxes) and have a change in earnings based on the earnings of workers in formal employment. Table 4 presents aggregate revenue from SICs and taxes in our baseline and reform scenario. In the case of SICs, we differentiate between workers' and employers' SICs to analyse who would bear a higher burden from formalization. Table 4 also compares changes in aggregate earnings, market income, and disposable income in our baseline and reform scenarios.

Our results show that due to the high levels of informality in Ecuador and Colombia, aggregate revenue from SICs would increase considerably under our counterfactual scenario. In both countries, revenue from SICs would increase by around 71 per cent. Moreover, because of the large proportion of self-employed workers in informal employment and due to the higher contribution rates for this group of workers, the burden from formalization would be larger for workers than for employers. As shown in the table, aggregate revenue from workers' SICs would increase by 86 per cent in Ecuador and 136 per cent in Colombia. Aggregate revenue from employers' SICs would, on the other hand, rise by 68 and 54 per cent in Ecuador and Colombia respectively.

On the contrary, the increase in tax revenue would be modest due to the high non-taxable thresholds and deductions from personal expenditures characterizing the design of personal income tax in the two countries. Income tax revenue would increase by 12 per cent in Ecuador and only 1.1 per cent in Colombia. Finally, formalization of informal workers under our counterfactual scenario would represent an increase in aggregate earnings of 16 and 21 per cent in Ecuador and Colombia respectively. The increase in aggregate market income would fully reflect the increase in aggregate

[21] For poverty measures we apply national poverty lines calculated by the statistics office of each country. In the case of Colombia we apply different lines for rural and urban areas.

earnings, whereas the increase in aggregate disposable income would capture both the effect of increased earnings but also the increase in SICs and tax payments.

Table 4. Budgetary effects of different scenarios (2014)

	Ecuador			Colombia		
	Baseline[a]	Reform[a]	Change (%)	Baseline[b]	Reform[b]	Change (%)
Worker SIC	2,721	5,059	85.9	14.77	34.81	135.7
Employer SIC	1,826	3,068	68.0	28.77	44.43	54.4
Total SIC	4,547	7,758	70.6	43.53	74.45	71.0
Income tax	724	810	11.9	3.37	3.41	1.1
Earnings	39,245	45,489	15.9	235.67	285.40	21.1
Market income	46,715	52,959	13.4	258.14	307.87	19.3%
Disposable income	45,597	49,419	8.4	268.51	300.74	10.9

Notes: [a] US dollars (millions) per year; [b] Colombian pesos (billions) per year

Source: Authors own calculations based on microsimulation models.

5 Conclusion

Despite recent efforts to encourage formalization by a number of governments in Latin America, a large share of the workforce in the region still works in the informal sector. Understanding the role of the tax–benefit system in creating disincentives to enter formality is paramount when considering potential policies aiming at reducing the prevalence of informal employment in the economy. Focusing on the worker's perspective, this paper aimed to quantify the costs that informal workers would incur in the event of entering formality, due to social insurance and tax payments, as well as the potential loss of cash benefits.

In order to measure the cost of formalization, the approach proposed in this paper is to exploit the advantages offered by tax–benefit microsimulation models and simulate transitions from informal to formal employment for all workers observed in informality in nationally representative household survey data from Ecuador and Colombia. Microsimulation models provide a comprehensive way to assess the effect of different tax–benefit instruments on individuals' financial (dis)incentives to enter formality. Moreover, in contrast with previous research, we account for the fact that informal workers would not necessarily face the same earnings upon formality and this would influence their financial incentives to formalization.

Our results show that despite potential gains in earnings on entry to formality, formalization costs are strikingly high in both countries, mainly due to the design of SICs. In the two countries, most informal workers are at the bottom of the earnings distribution and despite a large gain in earnings on entry to formality, the existence of minimum SIC payments represents a significant financial burden. On average, around 52.8 and 78.5 per cent of worker's additional earnings in formality would be taxed away in the form of increased taxes and SICs in Ecuador and Colombia, respectively. Moreover, formalization costs vary widely across different population subgroups, with the most marked differences found between employees and self-employed informal workers. Finally, under a counterfactual scenario in which all informal workers would be formalized, income inequality would decrease due to a potential improvement in earnings of (previously) informal workers; the burden posed by the tax–benefit system is, however, very important. This is especially true in Colombia,

where a 7.5 percentage points decrease in market income inequality would translate into a lower 5 percentage points decrease in disposable income inequality.

From a policy perspective, our analysis highlights that government strategies aiming to increase formalization necessarily need to review the design of tax–benefit systems. In Ecuador and Colombia, minimum payments of SICs would represent an important burden to self-employed informal workers with low earnings in the event of formalization. The Ecuadorian system represents an example of how to account for the specificities of the labour market in the design of SICs. A specific social insurance regime (*Seguro Campesino*) exists in Ecuador to cover self-employed rural workers, with lower contribution rates than those in the general regime. Similar designs could be considered to target other categories of self-employed workers characterized by low earnings in the two countries.

Due to the challenging nature of labour market informality, some caveats are worth noting. First, our analysis focuses on the financial disincentives to formal work implied by the tax–benefit system. The choice between formal and informal employment are, however, also associated with other factors. As stressed by the exclusion perspective, there could be barriers between formal and informal activities and these might vary depending on worker characteristics. Accounting for these potential demand-side constraints is important for highlighting the nature of informality not only as a choice but also as a lack of opportunities. Second, our analysis has been purely static in the sense that payments of SICs are considered a cost in the short term. However, from a dynamic perspective, workers might value benefits derived from SICs. In both countries, SICs entitle the worker to sickness leave, paternity and maternity leave, and, in the long run, to a pension. As such, our measure of FTR might overestimate the cost of formalization. Third, our distributional and budgetary analysis of the counterfactual fully formalized economy was purely illustrative and did not account for second- or higher-order effects of the proposed formalization. As depicted by the large budgetary effects of such scenarios, general equilibrium effects should be considered to provide a broader picture of such changes. All these extensions represent promising areas for future research.

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Appendix

Table A1: Descriptive statistics for Ecuador and Colombia

	Colombia			Ecuador		
	Formal	Informal	All	Formal	Informal	All
Sample of observations	7,686	20,100	27,786	23,564	32,776	56,340
Total population (in thousands)	6,771	12,635	19,406	2,352	3,196	5,548
Share of employees	0.86	0.33	0.51	0.88	0.56	0.69
Share of self-employed	0.14	0.67	0.49	0.16	0.47	0.34
Share of skilled	0.42	0.09	0.21	0.36	0.11	0.22
Share of unskilled	0.58	0.91	0.79	0.64	0.89	0.78
Share of rural	0.07	0.28	0.21	0.22	0.28	0.25
Share of urban	0.93	0.72	0.79	0.78	0.72	0.75
Share of female	0.40	0.38	0.39	0.39	0.38	0.38
Share of male	0.60	0.62	0.61	0.61	0.62	0.62
Share of ethnic minorities	0.10	0.17	0.15	0.11	0.17	0.14
Share of part-time	0.50	0.76	0.67	0.54	0.79	0.68
Share of 1st quintile	0.01	0.30	0.20	0.08	0.30	0.21
Share of 2nd quintile	0.03	0.30	0.21	0.09	0.28	0.20
Share of 3rd quintile	0.25	0.16	0.19	0.29	0.15	0.21
Share of 4th quintile	0.31	0.14	0.20	0.21	0.17	0.18
Share of 5th quintile	0.40	0.09	0.20	0.33	0.10	0.20
Average monthly earnings, LCU	1,464,720	569,009	881,522	716	346	503

Notes: monetary variables have been updated to 2014 values in Ecuador. Quintiles are defined in terms of labour earnings. LCU, local currency (pesos and US dollars respectively).

Source: authors' own calculations based on household surveys.

Table A2: Balancing of covariates before and after matching, Ecuador

		Mean for treated (informal)	Mean for control (formal)	Standardized bias	Residuals variance ratio
Age	Unmatched	36.419	37.711	–11.50	1.18
	Matched	36.419	36.565	–1.30	1.06
Gender	Unmatched	0.60353	0.60325	0.10	1.00
	Matched	0.60353	0.60651	–0.60	1.00
Rural	Unmatched	0.2197	0.18267	9.20	1.19
	Matched	0.2197	0.21942	0.10	1.00
Litoral region	Unmatched	0.35521	0.29709	12.40	1.12
	Matched	0.35521	0.35569	–0.10	1.00
Central region	Unmatched	0.15531	0.17545	–5.40	0.91
	Matched	0.15531	0.15514	0.00	1.00
South region	Unmatched	0.17809	0.20291	–6.30	0.91
	Matched	0.17809	0.17722	0.20	1.00
Education (in years)	Unmatched	8.6499	12.111	–79.30	1.32
	Matched	8.6499	8.9181	–6.10	1.06
Black	Unmatched	0.04894	0.03702	5.90	1.30
	Matched	0.04894	0.04888	0.00	1.00
Mestizo	Unmatched	0.85753	0.89767	–12.30	1.31
	Matched	0.85753	0.85763	0.00	1.00
White	Unmatched	0.02835	0.02842	0.00	1.00
	Matched	0.02835	0.02831	0.00	1.00
Mining	Unmatched	0.12908	0.15687	–7.90	0.83
	Matched	0.12908	0.12894	0.00	1.00
Construction and trade	Unmatched	0.53915	0.28086	54.40	1.32
	Matched	0.53915	0.53932	0.00	1.00
Services	Unmatched	0.18643	0.46348	–61.90	0.82
	Matched	0.18643	0.18664	0.00	1.00
Managers	Unmatched	0.00422	0.04788	–27.70	0.10
	Matched	0.00422	0.00422	0.00	1.00
Professionals	Unmatched	0.03164	0.211	–57.10	0.24
	Matched	0.03164	0.0316	0.00	1.00
Self–employed	Unmatched	0.46442	0.14404	74.30	1.53
	Matched	0.46442	0.45403	2.40	1.00
Employer	Unmatched	0.00758	0.01439	–6.50	0.53
	Matched	0.00758	0.00758	0.00	1.00
Work history (in months)	Unmatched	97.651	105.15	–7.00	1.04
	Matched	97.651	93.534	3.80	1.10

Source: authors' own calculations based on household surveys.

Table A3: Balancing of covariates before and after matching, Colombia

		Mean fortreated(informal)	Mean forcontrol(formal)	Standardized bias	Residuals variance ratio
Age	Unmatched	38.5250	37.8470	5.90	1.22
	Matched	38.5250	39.4730	–8.30	1.11
Gender	Unmatched	0.6119	0.5916	4.10	0.98
	Matched	0.6119	0.6626	–10.40	1.03
Rural	Unmatched	0.4556	0.1956	57.70	1.49
	Matched	0.4556	0.4300	5.70	0.99
Eastern region	Unmatched	0.1448	0.1183	7.80	1.19
	Matched	0.1448	0.1447	0.00	1.00
Central region	Unmatched	0.1537	0.1270	7.70	1.18
	Matched	0.1537	0.1541	–0.10	1.00
Pacific region	Unmatched	0.1861	0.0982	25.40	1.63
	Matched	0.1861	0.1862	0.00	1.00
Bogota	Unmatched	0.0491	0.1620	–37.40	0.34
	Matched	0.0491	0.0491	0.00	1.00
Antioquia region	Unmatched	0.1053	0.1197	–4.60	0.89
	Matched	0.1053	0.1046	0.20	1.01
Valle region	Unmatched	0.1486	0.1811	–8.80	0.84
	Matched	0.1486	0.1498	–0.30	0.99
San Andres region	Unmatched	0.0180	0.0678	–24.80	0.28
	Matched	0.0180	0.0180	0.00	1.00
Orinoquia-Amazonia region	Unmatched	0.0250	0.0262	–0.70	0.96
	Matched	0.0250	0.0250	0.00	1.00
Education (in years)	Unmatched	7.2414	11.8990	–112.10	1.03
	Matched	7.2414	8.3078	–25.70	0.96
Black	Unmatched	0.1392	0.1255	4.00	1.09
	Matched	0.1392	0.1329	1.90	1.03
White	Unmatched	0.7990	0.8351	–9.30	1.15
	Matched	0.7990	0.8065	–1.90	1.02
Mining	Unmatched	0.0958	0.1386	–13.30	0.72
	Matched	0.0958	0.0904	1.70	1.05
Construction and trade	Unmatched	0.4265	0.3201	22.10	1.21
	Matched	0.4265	0.4442	–3.70	0.99
Services	Unmatched	0.1706	0.4648	–66.60	0.60
	Matched	0.1706	0.1779	–1.70	0.96
Managers	Unmatched	0.0418	0.2373	–58.80	0.24
	Matched	0.0418	0.0418	0.00	1.00
Professionals	Unmatched	0.01	0.04	–18.70	0.25
	Matched	0.01	0.01	0.00	1.00
Self-employed	Unmatched	0.63	0.12	123.60	1.55
	Matched	0.63	0.52	25.20	0.87
Employer	Unmatched	0.04	0.02	12.30	2.14
	Matched	0.04	0.04	0.10	1.00
Work history (in months)	Unmatched	9.74	59.34	–76.60	0.20
	Matched	9.74	12.97	–5.00	1.01

Source: authors' own calculations based on household surveys.

Table A4: OLS estimates of log hourly wages for formal workers on the matched subsample

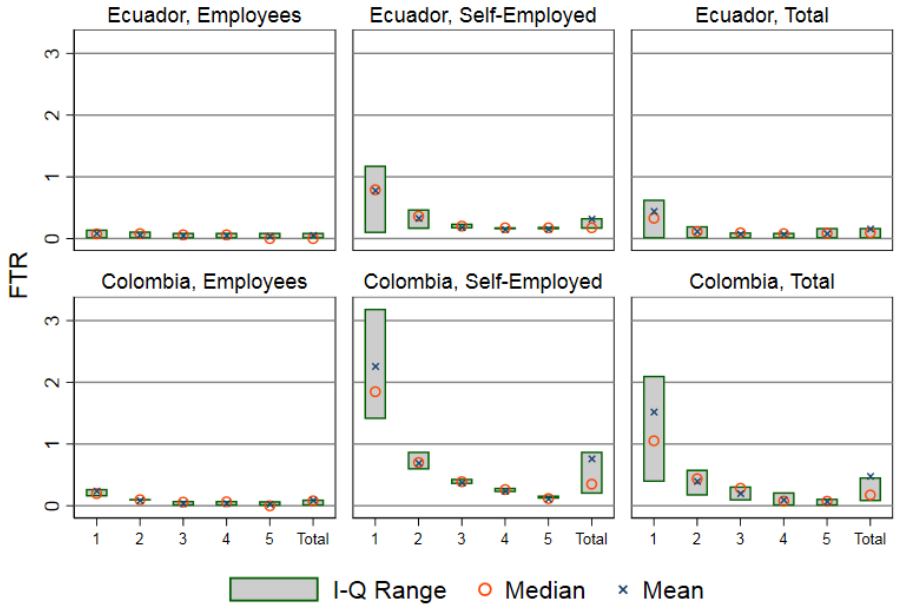
	Ecuador	Colombia
Age	0.004***	0.004***
	(7.64)	(6.32)
Education (in years)	0.049***	0.033***
	(38.66)	(17.21)
Work history (in months)	0.001***	0.001***
	(10.01)	(3.59)
Male	0.527***	0.289***
	(54.19)	(19.12)
Rural	–0.161***	–0.192***
	(–13.94)	(–12.25)
Black	0.008	0.392***
	(0.29)	(12.93)
Mestizo	0.067***	
	(3.88)	
White	0.137***	0.405***
	(4.39)	(15.38)
Managers	1.054***	0.423***
	(15.47)	(12.07)
Professionals	0.304***	0.288***
	(10.89)	(4.11)
Self-employed	0.143***	–0.228***
	(14.06)	(–13.86)
Employer	0.468***	0.385***
	(9.19)	(10.51)
Informal X age	–0.000	0.002***
	(–0.45)	(2.76)
Informal X education (in years)	–0.018***	0.006***
	(–10.71)	(2.6)
Informal X work history (in months)	–0.000***	0.000
	(–2.89)	(0.56)
Informal X male	–0.062***	0.026
	(–4.58)	(1.3)
Informal X black	–0.092***	–0.289***
	(–2.64)	(–7.2)
Informal X Mestizo	–0.039*	
	(–1.72)	
Informal X white	–0.041	–0.330***
	(–0.95)	(–9.59)
Informal X managers	–0.098	0.016
	(–1.02)	(0.32)
Informal X professionals	0.084**	0.051
	(2.14)	(0.52)
Informal X self-employed	–0.092***	–0.103***
	(–6.48)	(–4.56)
Informal X employer	0.239***	–0.140***
	(3.32)	(–2.73)
Region dummies	Yes	Yes
Industry dummies	Yes	Yes
Informal X region dummies	Yes	Yes
Informal X industry dummies	Yes	Yes

Constant	–0.371***	7.098***
	(–16.88)	(204.3)
Observations	57,780	33,710
Adjusted R^2	0.202	0.293

Note: *t* statistics in parenthesis; significance level: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$..

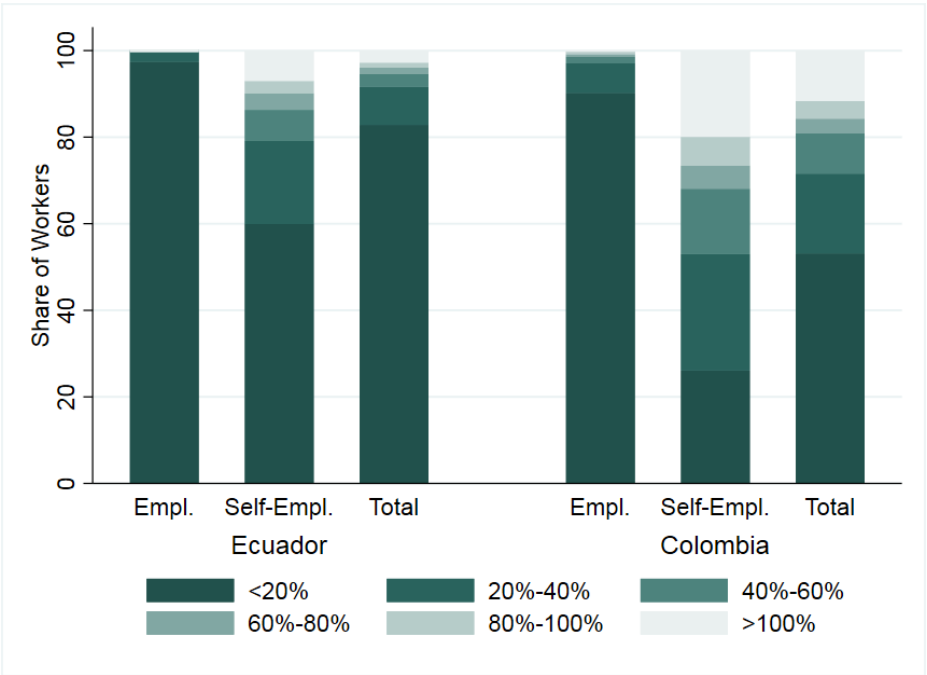
Source: authors' own calculations based on household surveys.

Figure A1: FTRs, assuming no change in earnings (2014) by quintile of earnings in informality of each informal type of work



Source: authors' own calculations based on microsimulation models.

Figure A2: Share of workers by range of FTR, assuming no change in earnings (2014)



Source: authors' own calculations based on microsimulation models.