Financial disincentives for formal work in Ecuador and Colombia: a microsimulation approach

David Rodríguez [a]
H. Xavier Jara [a]

[a] ISER, University of Essex

Abstract

High and persistent labour informality has been a major problem for Latin American economies, where most workers are excluded from social protection and have low and variable incomes. In the case of Ecuador and Colombia, despite recent formalisation policies, there is still a long way ahead to reduce informality which affects near half of the workforce.

This paper seeks to quantify the role of tax and benefit systems on financial incentives to enter formal work. In order to do so, we assess the formalisation costs for Ecuadorian and Colombian informal workers using multi-country tax-benefit microsimulation techniques. In particular, we make use of representative microdata and simulate transitions from the informal into the formal sector to calculate the proportion of earnings that will be taxed away in the form of increased taxes and social insurance contributions or reduced cash transfers, when a worker enters formality. We test the sensitivity of our results to different assumptions about the wage level individuals would face when entering the formal sector with several imputation strategies.

Our findings show that the distribution of formalisation tax rates varies widely between Ecuador and Colombia due to differences in the design of tax-benefit systems in each country. On average, formalisation tax rates at the population level are low in Ecuador, around 5-6 percent. In Colombia, they are much higher, around 34 percent on average. When introducing hypothetical loss of means tested benefit entitlements at household level, formalisation tax rates increase around 4 pp for Ecuador and 9 pp for Colombia. Our measure of tax burden is strikingly high for Colombian workers at the bottom of the income distribution due to minimum social insurance contribution payments. The opposite is observed for Ecuador, where incomes below the national minimum wage are exempt from social insurance contribution payments. From a policy-making point of view, our results invite to consider changes in social insurance contributions and means tested benefits designs in order to avoid further segmentation of the labour market.

JEL: J42, H22, H55

Keywords: Informality, microsimulation, formalisation tax rate

1. Introduction

For Latin American economies, characterised by highly concentrated capital revenue, labour income represents the only way available to families to overcome poverty. However, in the region good quality jobs are not the rule either, prompting interest on what economists usually refer to as informality, a concept which has continuously evolved over time due to the complexity of its definition.

Reducing this so called labour informality has been one of the priorities for governments especially since the opening up of economies and market flexibilisation at the beginning of the nineties which caused a great surge in informal activities. However, despite extensive studies, the important economic growth of recent years, and the introduction of several formalisation policies, little has been achieved to reduce labour informality significantly.

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 and thus they are excluded from the formal sector (de Soto, 1989). The latter proposes that firms and workers optimally choose whether to be formal or not having both options available (Maloney, 1999).

Within these two lenses, this paper proposes to make use of household microdata from Ecuador and Colombia in order to quantify the cost of formality for individuals currently working in the informal sector. In addition to the role of taxes and social insurance contributions, we propose to quantify the potential formalisation loss of non-contributory benefits and conditional cash transfers (CCT).

More formally, we simulate transitions from the informal to the formal sector by means of multi-country tax-benefit microsimulation techniques in order to elucidate the financial disincentives of formality for informal workers. Different imputation methods are used in order to estimate the labour income of informal workers when they enter formality.

Both models are based on cross sectional and publicly available household surveys. The microsimulation models take advantage of the EUROMOD interface. To the best of our knowledge, these are the first tax-benefit microsimulations models for Latin American countries using microdata and the first attempt to give a comprehensive estimation of the financial disincentives for formal work based on household surveys

Our results show that differences in the design of tax-benefit systems in Ecuador and Colombia translate into strikingly different formalisation costs for workers in each country, with higher penalties for the Colombian labour market. For this country, the penalty is around 34 percent of labour earnings and as high as 180 percent of income for households at the bottom of the distribution when assuming no labour income change. We find that the major contributor to this high cost is a minimum social insurance contribution in Colombia non-existent in the Ecuadorian system. Our results are robust to three estimation strategies proposed to capture labour income changes after transition to the formal sector.

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 transition strategies. Section 4 presents a brief quantitative overview of informality in Colombia and Ecuador and focuses on the estimations of the cost of formality for workers. The last section concludes with some policy recommendations.

2. Literature Review

2.1 Labour Informality: definition and causes

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

The complexity of defining informality is reflected in the existence of different approaches to measure the concept. Empirical studies have mainly considered informality according to two different perspectives: 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 ILO and the Delhi Group on Informal Sector Statistics, small firms with five workers or less are considered of low productivity and thus part of the informal sector. The *legalistic view*, on the other hand, considers as informal workers those not affiliated to the contributory social security system (hereinafter SIC). One less frequent and simplistic view considers as informal solely self-employed workers (hereinafter SE). As Henley et al. (2008) 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 academic origins, informality has been considered the result of low productivity and high labour market regulations. This mix excludes workers from the formal sector thus creating a segmented labour market. In that sense, early economic analysis of informality have been based on the insights of the two-sector model of Harris and Todaro (1970) popularised for the informality literature by de Soto's (1989) work, which argued that regulations hamper informal firms from formalising. In this branch of the literature we find the contributions of Tokman (2007) which considers that the economic system systematically fails to provide enough productive jobs. Loayza (1996) proposes a two-sector model where a binding minimum wage divides the economy between formal and informal sectors and determines their respective sizes. Loayza and Rigolini (2011) built a two sector model where regulation and productivity drive the size of the formal and informal sectors. They employ data for developing and developed countries and find that GDP per capita as a proxy for productivity reduces informality (SE) and regulation flexibility increases this sector's share.

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, taking into account low government's enforcement capacity, available non-contributory social security and CCT programmes. Informality is, thus, the result of a comparative advantage for a segment of activities or workers. The pioneer work in this regard is that of Portes, Castells and Benton (1989), which highlights among others that informality is not "solely a province of the poor". Other contributions following this approach are those of Maloney (1999), who finds that labour markets are not necessarily segmented, but that unskilled workers have access to formal and informal jobs and depending on job characteristics such as flexibility or entrepreneurship possibilities, choose one or another. In order to test his hypothesis he examines patterns of workers mobility towards and from informality (ES and SIC). In the same line, Bosh and Maloney (2010) found that a substantial part of the informality (ES) corresponds to voluntary entry. These last two papers employed panel data from Latin American countries to capture transitions between formal and informal sectors.

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

Finally, in terms of enforcement, Almeida and Carneiro (2012) found that stricter labour inspections in firms across municipalities in Brazil increase formal (SIC) sector employment as a result of increased attractiveness of this sector jobs due to compliance with mandated benefits highly valued by workers. However, their effects for the informal sector were ambiguous. Estrades and Terra (2011) employ a CGE model for Uruguay with an informal productive sector available only to unskilled and medium skilled individuals where equilibrium is achieved by adjusting wages. They analyse the effects of increasing enforcement via higher taxes in the informal sector and find positive effects reducing informality (SIC).

2.2 Labour market informality in Ecuador and Colombia

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

The first analysis of informality for Ecuador dates back to 1993 when Klein and Tokman 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's registration. Another study involving a survey of firms in Ecuador is that of Medveded and Oviedo (2015) which explores the relation between informality (measured as firm compliance with a set of regulations) and profits. Using OLS and 2SLS and data on compliance they found a strong positive relation indicating that formalisation allows for firm growth and higher profits.

From the worker perspective, Vega (2014) constructs transition matrices between formal, informal (ES and SIC) 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 finding a high level of mobility between them, with income differences being one possible source of movement from the informal to formal sector. Additionally, it is found that movements towards formality increase with education but decrease with age. Lastly, Canelas (2014) analyses the effect of minimum wage increases on informal and formal employment (ES, SIC and SE) for Ecuador employing a panel of provinces, finding no effects on formal employment or wages in the formal sector, possibly because of the high level of noncompliance with minimum wage legislation in the country.

For Colombia, informality has also been considered from the perspective of workers and firms. A very renown paper using microdata from household surveys is that of Kugler (2004) which analyses the effect of a reduction in firing costs on formal workers (ES and SIC) transitions in and out of employment, it shows that relative to informal workers (not covered by the reform) formal turnover increased, especially for younger educated workers. In an update of her previous work, but using a panel of formal firms for the period 1982-1996, Kugler and Kugler (2009) found that a 10 percent increase in payroll taxes decreased wages by up to 2.3 percent (pass-through effect) and employment up to 5 percent.

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

2.3 The effects of taxes and benefits on informality

The effect of tax-benefit systems on labour market outcomes has been widely studied. Notably, the role of tax-benefits systems in incentives at the extensive and intensive margin of labour supply has been shown to vary widely across countries depending on the design of tax-benefit instruments (Jara and Tumino 2013, Jara et al. 2017). In the case of labour informality, with very few exceptions, most studies have focused on the effect of specific cash transfer programs, rather than assessing the effect of the tax-benefit system as a whole.

Previous research has analysed some troublesome incentives created by CCT and non-contributory social security in terms of informality. Most studies interested in the effect of social programs 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 less than one third of the minimum wage are entitled to Green Cards, a programme of non-contributory health. Using the Household Budget Survey in 2006, they found no effect on informality (SIC) of this rapidly expanding programme.

Empirical findings of the effects of CCT on informality are recent and have been inconclusive. For instance Garganta y Gasparini (2012) found that *Asignación universal por hijo*, a CCT program in Argentina, creates disincentives for labour formality (SIC). They used a rotating panel and estimated the intention to treat due to lack of data on effective benefit reception. Ribas and Soares (2011) created a panel of neighbourhoods from the Brazilian Household survey and found that an increase in 1 percent in coverage of *Bolsa Familia* (a CCT in Brazil) led to a switch to the informal sector (SIC and SE) of 0.13 percent. De Brauw et al. (2013) used a panel of households and found that this Brazilian programme contributed to a significant movement of workers from the formal to the informal sector (SIC). On the other hand, Azuara and Marinescu (2013) employed a panel of municipalities and found that *Oportunidades* (a CCT in Mexico) did not increase labour informality (SE and SIC). Neves and Leite (2014) used a discontinuity in *Bolsa Familia* eligibility rules regarding children's age to estimate the effect of the programme on informality and found that it did not affect the occupational choice formal-informal (SIC) of Brazilian households.

In the case of Colombia most evidence points to a negative effect of social programs on informality. For instance, Núñez (2002) used a household survey to calculate the effect of each worker's marginal tax rate (constructed with reported income) on the probability of being informal (ES), defined according to firm size, and found a positive and significant effect. Camacho et al. (2009) analysed the effects of a programme that determines eligibility to subsidised health on labour informality (SIC) in Colombia. Carrying out an analysis at municipal level, they found 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) found that being beneficiary increases informality (SIC, SE, ES). Finally, Farné, Rodriguez and Rios (2016) employed 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 found no important effects on participation but important effects of programmes such as subsidised health and *Familias en Accion* on labour informality.

For Ecuador, evidence of the effect of tax-benefit systems on informality is scarcer. Wong (2015) analysed the labour market effects of a formalisation programme for domestic workers in 2010. She estimated 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 percent in 2006 to 33 percent in 2012, it also reduced both wages and hours worked.

The studies by Koettl (2013) and Weber (2015) represent an effort to quantify the financial disincentives embedded in the tax-benefit system and faced by informal workers; they are in line with the approach taken in this paper. Both of them 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 such as Bulgaria and Romania with two high-income economies Australia and the US, it is found that for transition economies formalisation tax rates are as high as 70 percent for lower wages (10 percent of the average) while the highest formalisation tax rate for higher-income economies is 40 percent which applies to incomes about 45 percent of the average.

Contrary to these last two studies, our paper uses representative household microdata together with microsimulation models in order to analyse the distribution of financial disincentives to formality at the population level in Ecuador and Colombia, as described in the following sections.

3. Methodology

In assessing the effects of the tax and benefit system on informality our approach differs from the usual econometric strategy. In order to take into account the effects of the tax-benefit system as a whole, we construct a detailed tax and benefit microsimulation model following each country's policy rules and use representative microdata to estimate for each informal worker 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 the formal sector. In practice, these transitions involve a likely change in labour earnings; therefore we use several imputation strategies to create counterfactual incomes for each worker in the formal sector.

Definition of informality used

Our paper follows the *legalistic view* proposed in the literature as this definition allows us to correctly establish SIC for formal and informal workers. We use information available in the microdata to define labour informality status in terms of whether the worker is affiliated to the contributory social security system or not.

For Ecuador effective affiliation requires XXX. We consider formal workers those XXX Affiliation entitles among others:XXXX. For Colombia effective affiliation is achieved firstly by a register with a Health Promoting Entity (EPS in Spanish) and a Pension Fund and secondly, by a monthly payment of SIC. We consider formal workers those contributing to pension when surveyed thus non-contributing registered workers are considered informal. Affiliation entitles among others: health insurance[2], sickness, maternity and paternity leave payments and an old age pension under some additional conditions.

The remainder of this section presents the data used and the models. It also highlights the procedures to simulate transition from informal to formal work.

3.1 Tax-benefit models and the data

Our study makes use of newly developed tax-benefit microsimulation models: ECUAMOD[3] for Ecuador, and COLMOD[4] for Colombia. Throughout this document, a tax and benefit microsimulation mod-

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[2] It is worth noting that in Colombia those not contributing to social security are covered by a subsidised health insurance with the same benefits of the contributory scheme.

[3] ECUAMOD has been validated both at the micro and macro level. See Jara et al. (2017) for more information.

[4] COLMOD has been validated against external statistics. See Rodriguez (2017)

el is understood as set of functions (policy rules) for each observation, that map a vector of characteristics ($\mathbb{X}_i$) and original incomes ($\mathbb{Y}_i$) taken from household surveys onto vectors of taxes ($\mathbb{T}_i$), social insurance contributions ($\mathbb{S}_i$) and benefits ($\mathbb{B}_i$) in order to determine a monetary disposable income ($\mathbb{DI}_i$).[5] Due to the cumbersome nature of tax and benefits in most countries, these functions are not always simple to compute. COLMOD and ECUAMOD have been implemented in the EUROMOD platform in order to ensure harmonisation and cross-country comparability.[6]

Table 1. Mapping of Tax-Benefits for Colombia

			Inputs			
			$\mathbb{Y}_i$	$\mathbb{X}_i$	$\mathbb{S}_i$	$\mathbb{B}_i$
Output	$\mathbb{T}_i$	Income Tax	Original Income	Educ. Mortgage paym.	Health and Pension	Pension Income
		Extraordinary income tax	Income from property sale			
		Property Tax	Not Simulated but available from the data			
		Car Tax				
	$\mathbb{S}_i$	Health	Labour Income			Pension Income
		Pension	Labour Income			Pension Income
		FSP[7]	Labour Income			Pension Income
	$\mathbb{B}_i$	Old Age Pension	Not Simulated but available from the data			
		Survivors Pension				
		Disability Pension				
		"Familias en Acción"		Demographics		
		"Colombia Mayor"		Age, Location		Pension Income
		Displacement/Emergency	Not Simulated but available from the data			

Mapping of Tax-Benefits for Ecuador

			Inputs			
			$\mathbb{Y}_i$	$\mathbb{X}_i$	$\mathbb{S}_i$	$\mathbb{P}_i$
Output	$\mathbb{T}_i$	Income Tax	Original Income	Expenditures	SIC contributions	
		Property tax	Not Simulated but available from the data			
		Property transfer tax				
		Vehicle tax				
		Other taxes self-employed				
		Wealth tax				
	$\mathbb{S}_i$	Health	Labour Income			
		Pension	Labour Income			
		Unemployment	Labour Income			
		Others	Labour Income			
	$\mathbb{B}_i$	Old Age Pension	Not Simulated but available from the data			
		Survivors Pension				
		Disability Pension				
		Human Development Transfer		Demographics		
		Disability Carer benefit	Part-simulated based on benefit receipt in the data			
		Housing grant	Not Simulated but available from the data			
		Injury benefit				
		Scholarships				
		Severance pay				

Table 1 presents a mapping of the tax-benefit instruments simulated and included in the models of each country. Firstly, original income ($\mathbb{Y}_i$) and characteristics ($\mathbb{X}_i$) are built for the two countries from survey data. $\mathbb{Y}_i$ is composed of: labour income, private transfers and income from financial investments or from property rent while $\mathbb{X}_i$ comprises among others: age, education, location, worker characteristics such as: industry, informality and self-employment status, and expenditures in education and mortgage interests. When a policy is not simulated due to lack of information on eligibility or amounts, the monetary values are those reported in the survey, if available.

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[5] Notice that our monetary disposable income by definition omits non-tangible services or in kind benefits for instance those provided by health services.

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

[7] FSP stands for Fondo de Solidaridad Pensional (Pension Solidarity Fund) a fund to finance non-contributory pensions.

Broadly speaking, original income adjusted for deductions and exemptions (i.e health and education expenditure, social insurance contributions and pension income, mortgage interest payments) determine income tax. Pension and property and vehicle taxes are not possible to simulate and are taken from the data. Social insurance contributions depend on original income. Benefits depend mostly on family characteristics. Lastly, Disposable income equals original income and benefits deducting taxes and SIC.

ECUAMOD is based on household representative data from the National Survey on Income and Expenditures of Urban and Rural Households for 2011 in Ecuador (Encuesta Nacional de Ingresos y Gastos de Hogares Urbanos y Rurales, ENIGHUR), and COLMOD is based on data from the Quality of Life National Survey for 2014 in Colombia (Encuesta Nacional de Calidad de Vida, ENCV). Each survey is the latest available with detailed income and expenditure information, as well as personal and household characteristics needed for tax-benefit simulations. As part of the development of the models, both datasets have been harmonised for the purposes of cross country analysis. Our sample contains 153,341 observations for Ecuador and 67,332 observations for Colombia.

3.2 Simulating transitions from the informal to the formal sector

Transitioning to the formal sector is more than just contributing to social insurance. From the exclusion point of view, the segmentation of the labour market implies higher wages for workers in the formal sector. 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, within the exit perspective, if a worker is formal/informal there is a comparative advantage of being in this sector, thus allocating him in the alternative (in this case formal sector) will necessarily mean being in a disadvantaged sector given worker's characteristics.

In order to account for these possibilities we handle four strategies to compute labour incomes for transitioning workers: (i) same income, (ii) simple OLS Mincer equation with informality interaction terms, (iii) simple OLS Mincer equation for a subsample comprising only formal workers and (iv) Heckman selectivity correction in a Mincer equation. For all strategies the models were estimated individually for employed and self-employed workers to account for income heterogeneities between these two groups.[8] The transition has also been restricted to those aged 18-60 years old to avoid inclusion of children and elderly.

The OLS specification with the full sample follows equation 1, where $\log(w_i)$ represents the log of hourly labour income for worker i. D_i is a vector of worker attributes including age, age squared, dummies for: gender, rural zone, region (department or province), education and ethnicity. F_i is a vector of family attributes such as a dummy for married, and the number of dependent children. J_i is a vector of job attributes such as: dummies for industry and profession (manager, technician, vendor etc.) and work history in years.

$$\log(w_i) = \alpha + \beta D_i + \gamma F_i + \delta J_i + \sigma I_i + u_i \tag{1}$$

A dummy of informal work and its interaction with each covariate are included as defined in vector I_i. Lastly, u_i is an idiosyncratic error. After estimation, I_i components are set to zero (i.e. all workers are formal) to predict earnings of informal workers under the assumption they would enter formality.

$$\log(w_i) = \alpha + \beta D_i + \gamma J_i + u_i \tag{2}$$

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[8] This implies we are not allowing for occupational change after formalisation in order to obtain more precise estimates.

The OLS specification with the restricted sample includes demographic and job attributes and follows the structure of equation 2, where each i represents a formal worker. Using this equation a prediction of income is made for each informal worker vector of attributes on the estimated formal income equation. This estimation represents a good comparison benchmark to the Heckman selectivity correction estimate for which a two-step procedure is carried out as explained below.

Selection into formality

As discussed before, it is possible that workers self-select into formal or informal activities. If this is the case, our simple mincer equation will give a poor counterfactual income. In order to take into account selection, literature proposes a correction *a la Heckman*. Following Carneiro and Henley (2002), in the first part a selection into formality probit model is estimated with the following specification:

$$\Pr\left(U_i^F - U_i^I \geq 0\right) = \Pr(\rho + \phi D_i + \eta F_i + \kappa X_i + e_i) = \Pr(\Psi_i + e_i) \tag{3}$$

Where the vector X_i comprises the following variables: regional unemployment by gender and other household income different than each observation's labour income and F_i is the abovementioned vector of family attributes. A selectivity correction term in the spirit of the inverse Mills ratio is constructed.

$$M_i = \frac{\phi(\Psi_i)}{\Phi(\Psi_i)} \tag{4}$$

Where $\phi(.)$ and $\Phi(.)$ represent the normal standard density and cumulative distribution functions respectively. This new variable is included in the Mincer equation of formal work which now has the following specification:

$$\log(w_i) = \alpha + \beta D_i + \delta J_i + \lambda M_i + \xi_i \tag{5}$$

Where ξ_i is an error term. In the presence of selection, the λ coefficient is expected to be positive and statistically different than zero, that is, formal workers have a comparative advantage in terms of income in the formal sector. This procedure has been carried among others to account for selection into informality in Brazil (Carneiro and Henley, 2002), self-employment in the UK (Rees and Shah, 1986) and labour unions in the US (Lee, 1978).

After estimation, the vector of informal worker attributes, including the resulting M_i variable from equation 2, are plugged into this equation (4) to construct counterfactual labour income for each informal worker.

3.3. Measuring the burden of formalisation

In order to measure formalisation costs, we define formalisation tax rates (FTR) following literature on work incentives. We depart from Koettl (2013) who defines FTR as the ratio of formalisation costs to informal income in order to account for possible changes in income with formalisation. Thus we define FTR as:[9]

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[9] In the case of no labour earnings change, we define $FTR_i = -\frac{y_h^1 - y_h^0}{w_i^0}$, however, in this case the FTR captures the share of current earnings taxed away while, facing income changes it represents the share of changes in labour income taxed way .

$$\text{FTR}_i = 1 - \frac{y_h^1 - y_h^0}{w_i^1 - w_i^0} \qquad (6)$$

Where w_i represents each workers' labour earnings and y_h is his household disposable income. The superscripts 0 and 1 represent time i.e before and after formalisation took place. In the case of several informal workers per household, hypothetical disposable income after formalisation is constructed as if the only transitioning worker in the household is the one being analysed.

The ratio $\frac{\Delta y_h}{\Delta w_i}$ captures for each unit of labour income change how many units of disposable income remain, thus the complement i.e the FTR, is the proportion of the change in labour income that is taxed away. The higher the formalisation tax rate the higher the financial disincentives to enter formal work each individual faces.

As highlighted by Jara and Tumino (2013), some features of the tax-benefit system could lead to measures of work incentives, such as the FTR, to be outside its theoretical interval between 0 to 100 percent. The FTR lies above 100 percent if changes in household disposable income and in labour earnings go in different directions, for instance if formal labour income is higher than informal, but after formalisation there is a significant reduction in household disposable income (for instance the case of an important benefit entitlement loss). On the other hand, FTR lies below 0 percent if changes go in the same direction but Δy_h is higher than Δw_i. For instance, if counterfactual formal income decreases but formalisation implies additional tax and social insurance payments or possible benefit entitlement loss which reduce even further household income.

The abovementioned caveats for FTR should also be taken into account when dealing with distributions or sample statistics. For instance, after counterfactuals, small changes in labour earnings or high changes in disposable income could lead to the presence of outliers. In order to overcome these difficulties we follow Jara and Tumino (2013) and focus on the sub sample of FTR for workers earning more than 1 US\$ in Ecuador and COP\$10.000 in Colombia per month[10]. Moreover, in order to prevent the average FTR to be affected by outliers we drop FTR on the 99th and 1st percentiles of the distribution.

Further analysis of the FTR can be done by means of its natural decomposition. From equation (4) each household disposable income can be transformed into original income (yo_h) and tax, benefit and SIC components (b_h, t_h, s_h respectively):

$$\text{FTR}_i = 1 - \frac{yo_h^1 + b_h^1 - t_h^1 - s_h^1 - \left(yo_h^0 + b_h^0 - t_h^0 - s_h^0\right)}{w_i^1 - w_i^0}$$

$$\text{FTR}_i = 1 - \frac{\Delta yo_h + \Delta b_h - \Delta t_h - \Delta s_h}{\Delta w_i}$$

In each simulation it is assumed that the only change in household original income is that of labour income for each transition worker, thus necessarily $\Delta yo_h = \Delta w_i$, allowing us to decompose the FTR in each of its components as follows[11]:

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[10]USD\$ 5.3 (exchange rate of 20/June/2014)

[11] For no income change, in the same spirit the decomposition results as $\text{FTR}_i = \left(-\frac{\Delta b_h}{w_i^0}\right) + \left(\frac{\Delta t_h}{\Delta w_i}\right) + \left(\frac{\Delta s_h}{\Delta w_i}\right) = \text{FTR}_i^b + \text{FTR}_i^t + \text{FTR}_i^s$

$$FTR_i = \left(\frac{\Delta b_h}{\Delta w_i}\right) + \left(-\frac{\Delta t_h}{\Delta w_i}\right) + \left(-\frac{\Delta s_h}{\Delta w_i}\right) = FTR_i^b + FTR_i^t + FTR_i^s \qquad (7)$$

4. Empirical results

This section starts with a discussion of the relative size of tax-benefit instruments in Ecuador and Colombia. The second part presents a basic portrait of labour informality for the two countries including probit estimates of its determinants. We then provide results of different strategies to impute labour income for the simulations of the transitions to formality. Finally, we present estimates of the formalisation tax rate, our measure of formalisation costs under two hypothetical scenarios involving different eligibility criteria to social assistance after formalisation.

4.1. Tax-benefit instruments in Ecuador and Colombia

Figure 1 shows the main results of the microsimulations models for the two countries. For each quintile it presents the mean share of tax-benefits components to household disposable income. Several features of the systems are worth noting: Benefits are progressive in both countries; however non-means tested benefits are a negligible share on disposable income. On the other hand, means tested benefits affect income much more in Ecuador than in Colombia, for instance, while they represent close to 25 percent of disposable income for the bottom 20 percent earners in the former they account for 15 percent for the same group in the latter.

Regarding pensions, this source of income is more important in Colombia with an increasing share in disposable income. Another feature of the two countries is that taxes are not very important; they represent less than 5 percent of disposable income regardless of quantile. However, property and car taxes (which do not depend on income) seem to be important for low income households. Lastly, SIC are more progressive in Ecuador than in Colombia. For the latter, the last quintile pays less than 10 percent of disposable income in SIC, however for the first quintile the share is almost 2 percent (in Ecuador the contribution for this quantile is null).

Figure 1. Mean share of Tax-Benefits in HH Disposable Income by quintiles
Ecuador (2011)   Colombia(2014)

Source: Authors own calculations based on microsimulation models, households earning less than 1 US$ in Ecuador and $10.000 in Colombia were dropped as outliers. MT stands for Means Tested.

Our two tax and benefit microsimulation models also tell of a reduced effect of government intervention on income inequality. In line with previous research[12] we found that Gini coefficients before and after taxes and benefits are almost identical for Colombia at 0.566 and 0.536 respectively, while Ecuadorian government has a greater impact reducing inequality Gini going from 0.492 to 0.444.

Alternatively, the ratio of disposable earnings of the 20 percent top earners to the 20 percent bottom earners is remarkably higher for Colombia than for Ecuador, the figures are 19.2 and 9.6 respectively. When applying the measure to original income results are 27.9 and 13.8, evidencing the higher impact of Ecuadorian government reducing inequality.

4.2. A portrait of informal work in Ecuador and Colombia

Figure 2 presents the distribution of labour income by formality status. The vertical dotted line represents monthly minimum wage. In most cases there is a natural partition of informal (solid grey distribution) and formal incomes (dashed black distribution) below and above the minimum wage respectively. It is important to highlight that almost half of workers in both countries earn less than a minimum wage, regardless of formality status. This is consistent with the exclusion perspective, where low productivity and regulations prevent workers from receiving the minimum wage and firms to contribute to social security. There is only one exception for this pattern, self-employment in Ecuador, for which both distributions are very similar, symmetric around the minimum wage, consistent with the exit perspective and also as a result of SIC not being mandatory for those self-employed in Ecuador.

Figure 2. Distribution of formal-informal workers labour income
Ecuador (2011)   Colombia(2014)

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[12] Lustig (2017) synthetize results on inequality and poverty for 16 countries prepared by the Commitment to Equity (CEQ) Institute at Tulane University US, an initiative to assess the effect of taxes and benefits in Latin America.

Source: Authors own calculations based on household surveys, minimum wage vertical dotted line, bdwith: 0.2

Figure 3 shows the age distribution of informality which is quite different for the two countries. While for Ecuador the age distribution is similar for formal and informal workers, in the case of Colombia informality is more entrenched on young adults and old age workers while formal employment is highly concentrated in the group of those aged 30-50. The Colombian age distribution and, in a much lesser degree the Ecuadorian, could uncover barriers to enter or to remain in a formal job following the exclusion view.

Figure 3. Distribution of formal-informal workers by age

Ecuador (2011)   Colombia(2014)

Source: Authors own calculations based on household surveys

Labour informality rate varies considerably with education. For skilled workers, the rate is between one third and a half of that for unskilled, regardless of country and gender. For unskilled women, informality incidence seems to be higher relative to men in both countries. However, as depicted in Fig-

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ure 4, there is no such difference between skilled men and women, for Ecuador labour informality rate is higher for skilled men than for skilled women, for Colombia they are the same.

Figure 4. Labour informality rate by gender and skill level
Ecuador (2011) Colombia (2014)
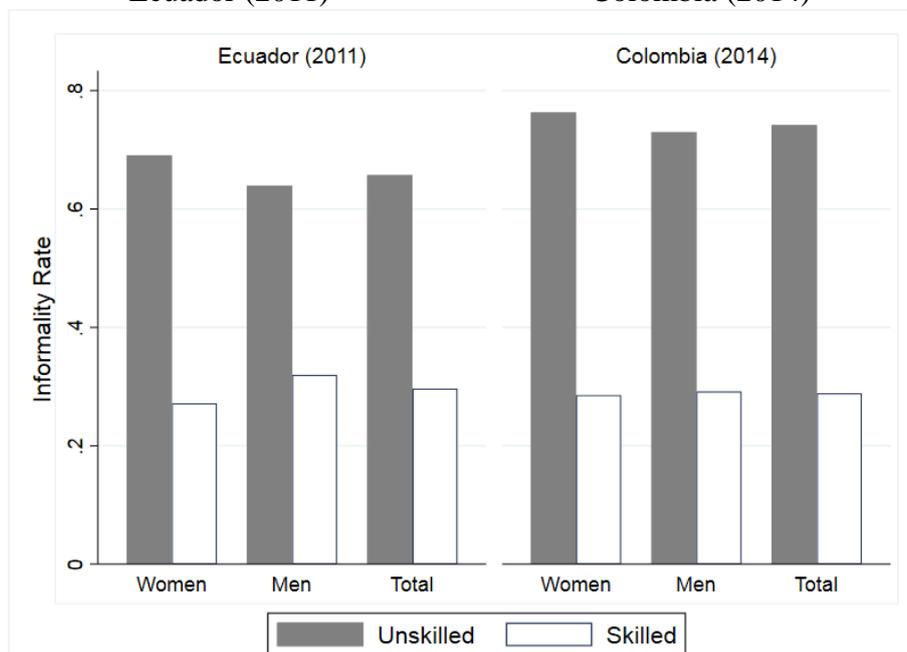
Source: Authors own calculations based on household surveys: skilled: completed higher education.

Labour informality also varies considerably across industries as can be seen form Figure 5. While for the two countries incidence is particularly low in public administration, financial intermediation and education, it is considerably high in trade, construction, transport and communication. There are marked differences in the informal share of employment and self-employment for the two countries, being informal employment the most relevant in Ecuador and informal self-employment in Colombia. The overall informality rate reaches almost 50 percent in Ecuador while is above 60 percent in Colombia.

Figure 5. Share of Informal work by Industry and (self) employment status
Ecuador(2011) Colombia(2014)
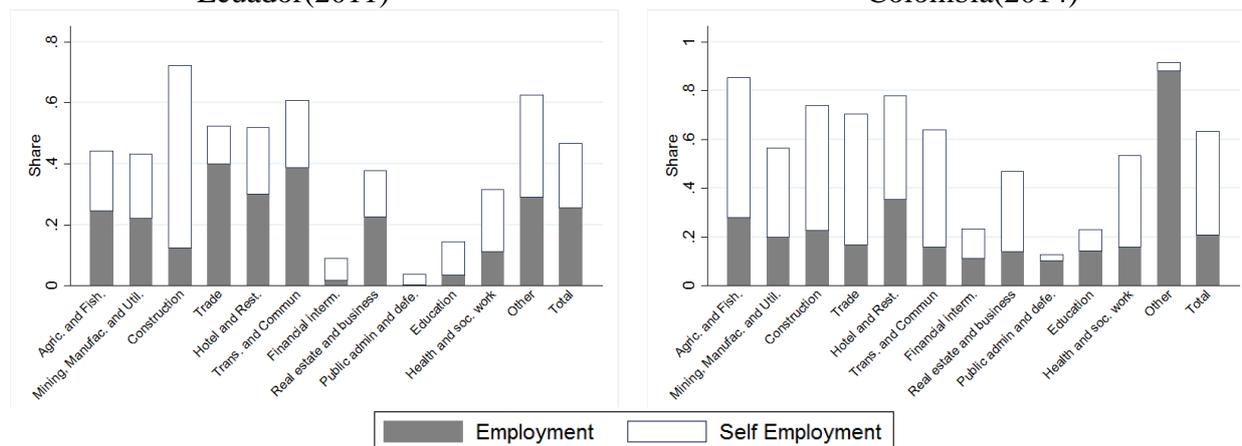
Source: Authors own calculations based on household surveys

Table 2 presents probit estimates of the determinants of labour informality for employment and self-employment. We include as dependent variables those previously used in the literature such as age, gender, dummies for: education, industry or occupation, and other household income. The first group

of models (1) include all the covariates and the second (2) excludes those not significant at an arbitrary 10 percent level.

Table 2. Determinants of Labour Informality

	Employment (1)	Employment (2)	Self-Employment (1)	Self-Employment (2)
Colombia (2014)				
Age	-0.03461***	-0.03464***	-0.01030***	-0.01033***
Age sq.	0.00042***	0.00042***	0.00010***	0.00010***
Men	-0.00154		-0.01216	
Rural	0.00937		0.01454***	0.01463***
Primary	-0.07099***	-0.07290***	-0.02629*	-0.02701**
Secondary	-0.11868***	-0.12004***	-0.04353***	-0.04456***
Post Secondary	-0.24491***	-0.24840***	-0.08468***	-0.08551***
Tertiary	-0.34353***	-0.34836***	-0.15162***	-0.15284***
Couple	-0.04046***	-0.03756***	-0.00325	
Other HH income	-0.46842		-4.74363***	-4.81655***
Regional Unemployment	-1.37996***	-1.39195***	-0.29413	-0.48551***
Observations	12839	12839	14156	14156
Ecuador (2011)				
Age	-0.01704***	-0.01704***	-0.00467***	-0.00447***
Age sq.	0.00016***	0.00016***	0.0000	
Men	-0.04412***	-0.04442***	-0.00261	
Rural	-0.02652***	-0.02572***	-0.10391***	-0.10300***
Primary	-0.07384***	-0.07390***	-0.06188***	-0.06219***
Lower Secondary	-0.09712***	-0.09758***	-0.10405***	-0.10476***
Upper Secondary	-0.17934***	-0.17951***	-0.15625***	-0.15720***
Post Secondary	-0.24523***	-0.24428***	-0.20151***	-0.20230***
Tertiary	-0.23979***	-0.23935***	-0.21495***	-0.21557***
Couple	-0.06095***	-0.06008***	-0.05344***	-0.05467***
Other HH income	-0.48601		-2.50324*	-2.39637*
Observations	38540	38540	19568	19568
Regional dummies	Yes			
Ethnicity dummies	Yes			
Occupation dummies	Yes			
Industry dummies	Yes			
Family compos dummies	Yes			

Source: Authors own calculations based on household surveys, Average Marginal Effects of probit estimates.

Our results for most variables are in line with previous literature, for instance Carneiro and Henley (2002) for Brazil, Uribe Ortiz and Garcia (2007) for Colombia, Delgado y Navarro (2013) for Costa Rica or Cuevas, de la Torre and Regla (2016) for Mexico. The models confirm the concave effect of age, the negative relation with education, the negative effect of living as a couple and the ambiguous effect of gender on informality. In Colombia rural workers are more prone to work in the informal sector while, in Ecuador, is the opposite due to the presence of Seguro Campesino, a programme of insurance for farmers. Living as a couple and higher HH income (different from each worker's labour earnings) reduce the chances of being informal.

4.2 Labour income after transition to formality

Figure 6 presents the CDF of log income for transitioning workers under our four approaches.[13] Counterfactual formal earnings increases relative to informal income for almost all scenarios analysed and the distributions resulting from our three economic strategies are very similar for the two countries and the two types of employment analysed.

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[13] Coefficients for estimated Mincer equations are shown in appendix A1.

In the case of Ecuador, although for employees there is evidence of an improvement on counterfactual income (average wage increases by 14.8 percent), for self-employment, income improves for those below the median and worsens for those above, these translates into a reduction of labour earnings of around 14 percent.

Figure 6. Cumulative Distribution Functions for Transition to Formality strategies
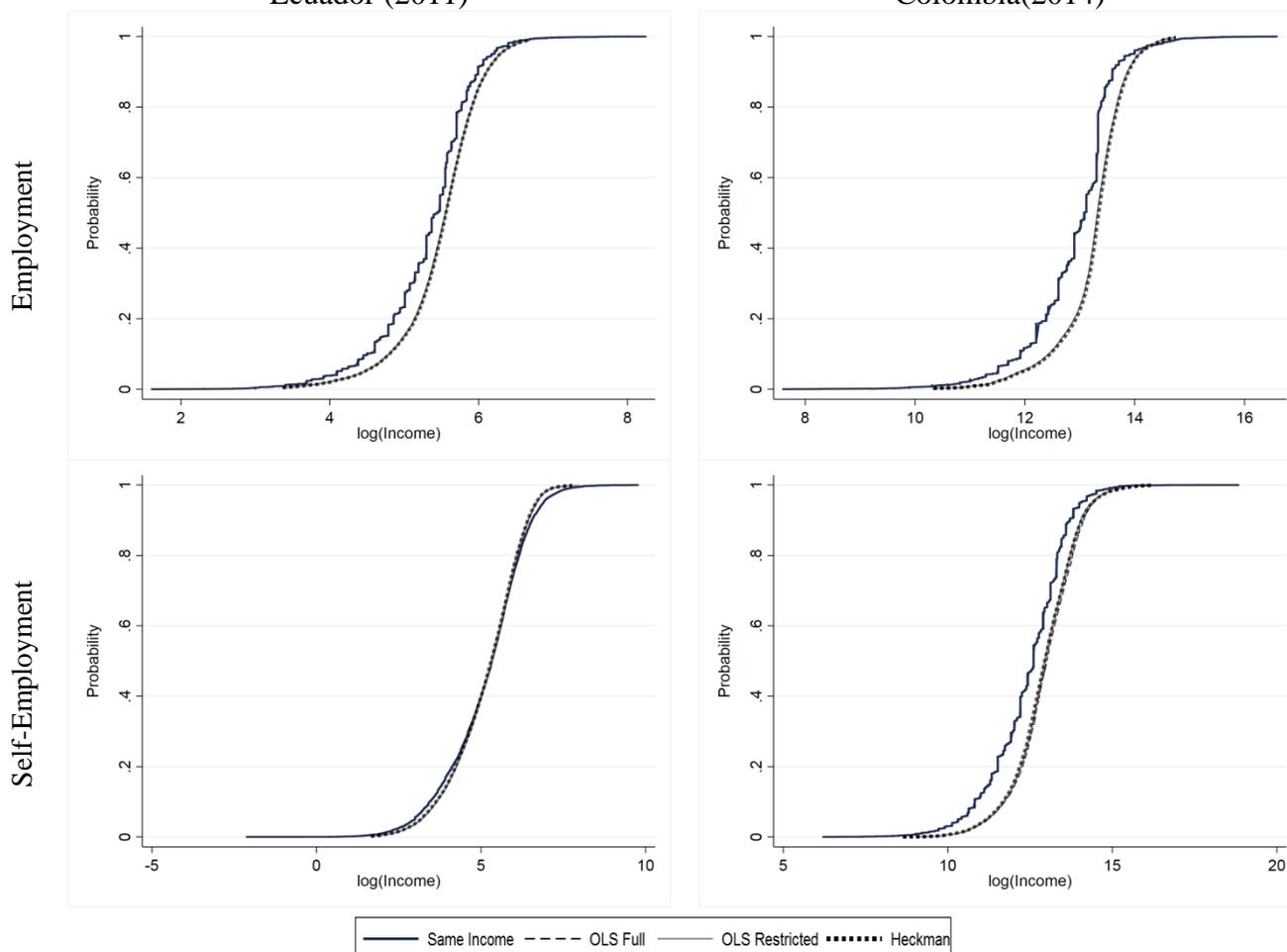
Source: Authors own calculations based on household surveys

For Colombia income is always higher or equal after transition regardless of the strategy used. For employees, wages increase around 23.2 percent (25.5 percent with the Heckman estimation) and for self-employment workers it increase 44.8 percent with the OLS full sample and around 35.8 percent for the two remaining econometric alternatives.

Selection into informality

Turning to the Heckman selection estimates, the lambda coefficient associated to the M_i variable has the expected positive sign and is statistically significant for employment in Ecuador and Colombia. Therefore, formal employees in both countries seem to have a comparative advantage in the formal sector. For our counterfactual income this implies that, if taking an informal employee with the same measured characteristics of a formal employee, the latter will earn a higher wage in the formal sector.

For self-employment, the lambda coefficient despite being statistically significant is negatively signed for both countries. This means, contrary to the employee case, that there is no comparative advantage on being formal for actual formal self-employed workers.

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Overall, the inclusion of this selection component does not alter greatly our estimates for labour income after formalisation compared to the OLS strategies. For instance, relative to the estimation using the restricted sample of formal workers, the Heckman correction modifies coefficients for other covariates, implying some bias in the OLS estimate. However, the resulting distributions of counterfactual incomes are quite similar thus, on the aggregate, the additional variable M_i and the change in coefficients almost cancel-out.

4.3. Financial disincentives to formal work

In this section, we propose two hypothetical scenarios to analyse formalisation costs for informal workers: (i) individuals enter formality and do not lose their eligibility to social assistance benefits; (ii) individuals enter formality and are no longer eligible to social assistance benefits. The first is more realistic because assessments for social assistance eligibility are not done on a regular basis (Ecuador and Colombia) or do not depend directly on the formality status (Colombia). Nevertheless, the second scenario provides an idea of the perceived additional cost of losing social assistance payments in case of entering formality.

Individuals enter formality and do not lose their eligibility to social assistance benefits

In this scenario, the tax and benefit system is applied to counterfactual labour incomes. As each worker becomes formal social insurance contribution rules start to apply, results are shown in Figure 7. There are striking differences in formalisation costs between the two countries, for Ecuador, the average FTR is very low, in no case, higher than 6 percent. However, for Colombia FTR is extremely high being on average between 32 percent and 34 percent using counterfactual incomes and an even higher value of 73 percent assuming no income change.[14]

These results are driven by the way SIC policies are designed in each country.[15] For Colombia, if a worker is contributing to SIC, there is a minimum contribution based on an income equals to the minimum wage (even if actual labour income is lower). On the other hand, in Ecuador workers with labour income below the national minimum wage are exempt from SIC payments. This feature in the Colombian SIC system, pose an extremely high burden on formalisation. Different counterfactual incomes attenuate this effect by increasing income for earners below the minimum wage while keeping the contribution fixed (at the minimum) thus reducing the FTR relative to the transition with the same income.

Figure 7. Distribution of Formalisation Tax Rate, Scenario I

Ecuador (2011)   Colombia(2014)

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[14] For Ecuador average FTR is driven by high FTR of employees while for Colombia is the opposite, this feature is discussed below.

[15] As depicted in Figure 1, income taxes are not particularly binding and there are no activation clauses that prevent formalising workers to receive mean tested benefits, thus the effect is driven almost completely by SIC.

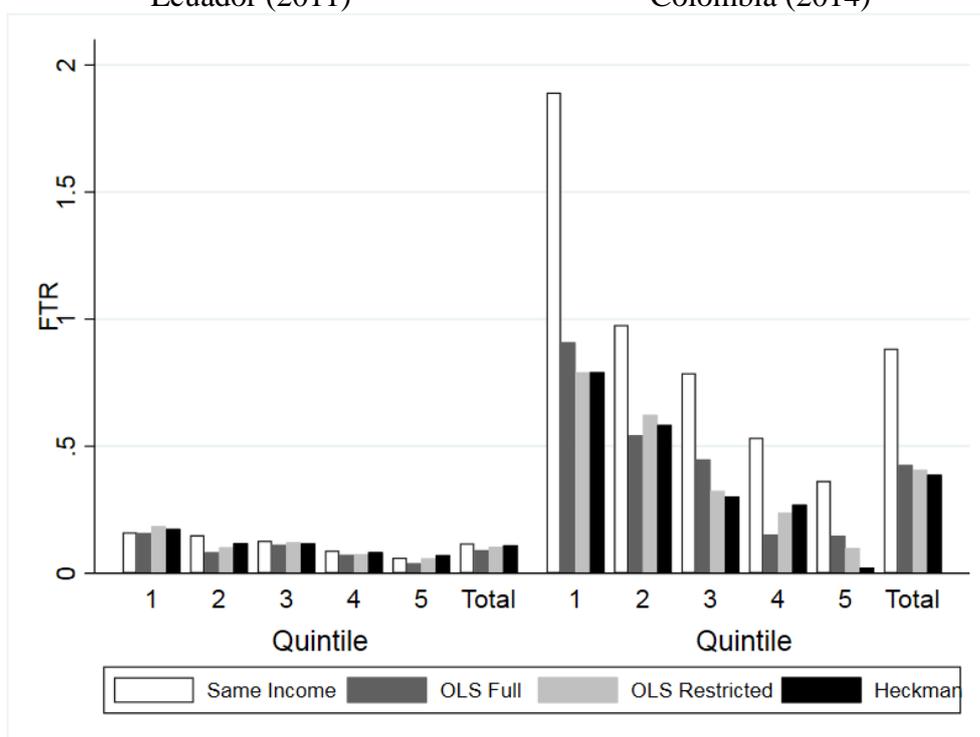Source: Authors own calculations based on microsimulation models

It is worth highlighting the higher dispersion of FTR for Colombia relative to Ecuador as depicted in Figure 7. For the former, when applying the same income formalisation, the FTR is always positive, with an interquartile range between 13 percent and 80 percent. However, when considering counterfactual incomes, the interquartile range of the FTR goes from -15 percent to 85 percent. For Ecuador, the interquartile range in any case collapses to zero. Lastly, for Colombia, the FTR is negative for some workers as a result of a shrinking labour income especially for self-employment and even higher reductions in household disposable income due to the payment of social insurance contributions.

Figure 8. Average Formalisation Tax Rate, Scenario I
Quintiles of household disposable income

Ecuador (2011)   Colombia (2014)

Source: Authors own calculations based on microsimulation models

Figure 8 presents FTR by quintile of household disposable income. For Ecuador, it can be seen that the mentioned low value of FTR does not change with household income. However, for Colombia, the lower the income quintile the higher the FTR, that is, for low labour incomes the fixed payment of SIC represents an extremely high share of income, around 85 percent for counterfactual incomes and 180 percent if there is no income change. For higher household incomes, the FTR decreases considerably being slightly greater to that of Ecuador for the last quintile of income.

Individuals enter formality and are no longer eligible to social assistance benefits

In this scenario, additionally to the change in labour income, each transitioning worker's household becomes ineligible to receive mean tested benefits at all. Despite that in practice this cash transfers do not depend directly on formality status, workers perceive that contributory social security affiliation

will directly exclude them from benefits[16]. Thus, in this scenario we want to analyse this "perceived" FTR. The effect on benefit reception of this measure is significant, in the Ecuadorian case, household beneficiaries of *Bono de Desarrollo Humano* decrease by more than half. For Colombia household reception of *Familias en Acción* is reduced by 80 percent and for *Colombia Mayor* by almost a half.

Figure 9. Formalisation Tax Rate by type of employment, Scenario II

Ecuador (2011)   Colombia (2014)

Source: Authors own calculations based on microsimulation models

When introducing this hypothetical loss of means tested benefits, FTR rises for both countries as can be seen from Figure 9. The effect is more notorious for Ecuador where the FTR increases from the previous scenario of less than 6 percent to between 9 and 12 percent. For Colombia, using counterfactual incomes, it increases from 34 percent to 43 percent.

There are also considerable differences in FTR within types of employment. For Ecuador, FTR is higher for employees (around 15 percent) than for self-employment workers (average of 11 percent if no income change and null if using counterfactual incomes). The contrary is observed for Colombia, self-employment workers face higher FTR (average between 51 percent and 123 percent) than employees (between 19 percent and 27 percent). In Colombia, the differences between these two groups highlight the precarious labour and household income of those in self-employment. For Ecuador, results depend mostly on SIC not being mandatory for self-employed in Ecuador

Figure 10. FTR decomposition quintiles of household income, Scenario II

Ecuador (2011)   Colombia(2014)

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[16] Workers could also believe that contributions screen them as having higher incomes than they actually have and eventually exclude them from benefits.

Source: Authors own calculations based on microsimulation models

For Figure 10 we apply the decomposition of each FTR into its natural components (following Eq. 5). We find that for low income household in Ecuador, most of the effect comes from benefit loss (between 10pp and 10pp of total FTR) and a smaller portion comes from SIC (up to 5pp of total FTR). Lastly, for high income workers a small contribution comes from taxes (up to 1 pp of total FTR).

In the case of Colombia, regardless of quintile of income most of the effect still comes from SIC. These results for Colombia rely on the one hand on the extremely low labour income of workers in the poorest households now having to face a fix payment of SIC. On the other hand, low coverage of means tested benefits and the small amount of the monetary transfer imply that their withdrawal increase the average FTR by only around 5 pp, with a maximum value of 10pp for low income households. The highest FTR for Colombia (213 percent) will be faced by a worker in the first quintile of income with no income change. In this case 186 pp of total FTR will come from higher SIC and 27 pp of total FTR from lower benefits.

Distributional considerations of the proposed scenarios

Some considerations on the impact of our hypothetical scenarios on income distribution are worth noting. For the first scenario, inequality, as measured by original income, is reduced in our three imputation strategies (OLS Full, OLS Restricted and Heckman) and for the two countries as depicted in Table 3. In other words, when formalising informal workers (which, as mentioned, are usually at the bottom of the income distribution) their income improves and inequality reduces. For Ecuador, Gini goes from 0.49 to 0.48 and for Colombia from 0.56 to around 0.53.

For Ecuador, the almost null impact of SIC for lower income workers implies that much of the improvement in labour earnings translates vis-à-vis to reductions in disposable income inequality. However, disposable income Gini does not decrease for Colombia due to the burden of SIC for formalised workers. The mentioned minimum SIC payment punishes harder lower income workers, reducing their disposable income. In the case of no income change, Gini coefficient reaches 0.58 and with counterfactual incomes disposable income Gini has almost no change relative to baseline (being around 0.53)

Table 3. Income inequality measures under changes in labour income

		ECUADOR (2011)				COLOMBIA (2014)			
	Measure:	Gini		20/20 Ratio		Gini		20/20 Ratio	
Scenario	Strategy:	Original	Disposable	Original	Disposable	Original	Disposable	Original	Disposable
B	Baseline	0.492	0.444	13.78	9.63	0.566	0.537	27.91	19.23
I	Same Income	0.492	0.445	13.78	9.65	0.566	0.582	27.91	42.53
	OLS Full	0.480	0.436	13.32	9.45	0.529	0.532	21.57	23.45
	OLS Restricted	0.481	0.437	13.36	9.47	0.529	0.535	21.79	24.38
	Heckman	0.480	0.436	13.33	9.45	0.531	0.537	22.14	25.13
II	Same Income	0.492	0.455	13.78	10.40	0.566	0.590	27.91	56.56
	OLS Full	0.480	0.445	13.32	10.15	0.529	0.539	21.57	26.62
	OLS Restricted	0.481	0.446	13.36	10.17	0.529	0.542	21.79	27.92
	Heckman	0.480	0.445	13.33	10.15	0.531	0.543	22.14	28.87

*(Equivalized OECD scale), Source: Authors own calculations based on microsimulation models

When introducing the benefit withdrawal in the second scenario, income inequality as measured by disposable income increases as expected. Gini coefficients increase relative to the previous scenario, For Ecuador, the country with the most comprehensive benefit scheme Gini increases by around 1.1 pp while for Colombia, Gini increases by around 0.7 pp. Similar results are obtained for the ratio of disposable earnings of the 20 percent top earners to the 20 percent bottom earners, with especially marked differences for the transition to formality with the same income.

5. Conclusion

This paper attempted to stress the challenging nature of labour formalisation for developing economies. Focusing on a worker perspective, we highlight how the tax and benefit structure create disincentives to formalise. Results are strikingly alarming for Colombia, country for which, despite consistently higher incomes in the formal sector, the formalisation tax burden is extremely high especially for low productivity workers which could face a tax of around 84 percent of income, or even 180 percent in the case of no income change. On average, FTR for Colombia is around one-third of labour income, 14 percent for employees and 42 percent for self-employees. For Ecuador formalisation is not that expensive; the average FTR is 10 percent for employees, 0.5 percent for self-employment and around 5.5 percent for all workers.

As mentioned, these differences appear as social insurance contribution rules are not alike between the two countries, especially for workers below monthly minimum wage, a group of considerable size (almost 50 percent of total workforce in both countries). For Ecuador contributions begin to be positive only if a worker is earning above a minimum wage. In Colombia, there is a minimum contribution to be paid based on an income equal to a minimum wage.

What if we take into account benefits? As expected our perceived FTR (taking into account the loss of cash transfer programmes for family members) is higher for all workers. For Ecuador, FTR would be 4 pp up relative to the previous scenario reaching between 9 and 12 percent. For Colombia the increase is proportionally lower at around 9 pp; FTR would reach an eventual 43 percent.

Some caveats are worth noting. Despite our focus on financial aspects of labour formalisation, there are several additional dimensions to analyse. First of all, formalisation is not always a matter of choice as stressed by the exit perspective. From our analysis of age and income distribution of informality we found that there are likely to be barriers between formal and informal activities, especially for low productivity young worker. Moreover, we found no comparative advantage on being formal for self-

employees thus our Heckman selection specification based on workers choice could be insufficient to determine counterfactual self-employment income. Secondly, we are not taking into account second or higher order effects of the proposed formalisation that will likely change incomes for already formal workers. Thus one has to ideally take into account these barriers and general equilibrium effects of formalisation by means of more elaborated models.

In third place, workers value some of the benefits derived from SIC and thus our measure of tax rate will overestimate the value of contributions (Summers, 1989). For Ecuador contributions allow workers to XXX while for Colombia they entitle the worker to sickness leave, paternity and maternity leave and in the long run to a pension of at least the minimum wage.

To conclude, our formalisation tax rates highlight some of the difficulties faced by informal workers in Latin America but by no means are the only aspect to be taken into account by policy makers trying to deal with precarious employment in developing economies. The proposed FTR investigation of this paper invites to analyse tax and benefit system designs further in order to reduce their effect segmenting the labour market in developing economies.

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Appendix

A1 Colombia, Mincer and Probit Estimates

A2 Ecuador, Mincer and Probit Estimates