

Financial inclusion and its heterogeneous effect on household income

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Abstract

This paper examines how, in the main Colombian cities, the effect of financial inclusion (FI) on income changes along the distribution of household income considering labor informality. We construct a multidimensional FI indicator based on the World Bank definition and on the data. Using a quantile regression technique, we estimate the effect of FI on income at each quantile for informal and formal households. The findings indicate that FI has a positive impact throughout the income distribution but is greater in low-income and informal households. The results suggest that FI can have potential effects in alleviating poverty and closing the income gap.

1. Introduction

In recent decades, it has been found in the academic literature that financial inclusion (FI) can have significant effects on several economic variables, such as food security (Beaman et al., 2014; Karlan et al., 2012), business profits (Brune et al., 2016; Dupas & Robinson, 2013a), investment in health (Dupas & Robinson, 2013b), housing quality (Ksoll et al., 2016) and other important variables such as household income and economic wellbeing (Ibrahim et al., 2018).

In particular, the effect that FI has on income magnifies its interest since it can open the way to other variables associated with economic welfare. Using different measures of FI, the relationship between this variable and income has been evidenced at the microeconomic level (Zhang & Posso, 2019), macroeconomic level (Dabla-Norris et al., 2020) and in experimental analysis (Ksoll et al., 2016). It is also possible to find cross-country studies that inquire about the potential effect that FI has on income distribution (Mushtaq & Bruneau, 2019).

Although FI has been found to have a positive effect on income, this effect may vary throughout its distribution. Thus, FI can also have an impact on the income inequality of countries. However, the results found in the literature are not conclusive. While some macroeconomic studies indicate that FI would covaries negatively with income inequality (Mushtaq & Bruneau, 2019)¹, others find a positive correlation (Demirgüç-Kunt & Klapper, 2013; Park & Mercado, 2018).

From a microeconomic perspective, some studies analyze the effect of FI on each of the percentiles of the distribution of household income. In this way, it is possible to analyze in relative terms who benefits most from FI. On the one hand, Zhang & Posso (2019) find that FI has a greater effect on households with lower income, which helps to close the income gap. On the other hand, Ibrahim et al. (2018) and Ndlovu & Toerien (2020) find opposite results, i.e., households with high income benefit relatively more from a higher FI, which in turn helps to increase income inequality.

In addition, it is also quite common to find income analyses that include the labor informality of households. Some studies, such as Nordman et al. (2016) and Xue et al. (2014), have found that formal households receive on average more labor incomes compared to their informal counterparts. In other words, it is possible to find a significant income gap between these households. Likewise, the response of earnings to unexpected shocks may differ according to the labor status of households (Pérez-Pérez, 2020), suggesting different behaviors inside each sector (formal and informal).

Similar to FI, the income gap between formal and informal households varies along the income distribution. Nordman et al. (2016) estimate the income gap at the mean and at several conditional quantiles of the distribution. The results show that the income gap is greater in the lower quantiles, while in the upper quantiles the gap may be non-existent or even change

¹Similarly, Beck et al. (2007) find that development or financial depth decreases countries' income inequality.

sign, that is, some findings show that in the upper quantiles, informal households are receiving more incomes compared to their formal counterparts.

Consequently, labor informality is a key variable in this analysis because the income of informal households may respond or behave differently in relation to their formal counterparts when they have access to more financial goods and services, particularly in the formal financial system. In fact, it is arguably to expect these differences in the response between the informal and formal sectors also change (as does FI) as the level of household income increases. In this way, both the distinction between the labor status and the analysis along the income distribution adds heterogeneity to the study of FI and income households.

In addition, consider this heterogeneity is relevant because it can shed light on economic policy regarding poverty. This is a topic of high academic relevance for which wide evidence has been found on its possible determinants. Studies in Africa (Arimah, 2004; Mukherjee & Benson, 2003; Tambo et al., 2020), Asia (Félix & Belo, 2019; Gounder & Xing, 2012; Montalvo & Ravallion, 2010; Ravallion & Chen, 2007), Latin America (Ferreira et al., 2010; Vacaflores, 2018) and Europe (Aisa et al., 2019; Bosco, 2019) have shown that multiple variables can affect poverty, including FI.

Given the extensive literature on FI, the World Bank has recognized this variable as a potential tool for poverty alleviation and has established a definition which facilitates the measurement of FI². Accordingly, FI has become a fundamental item of policy agendas of many countries, particularly in the developing world. Colombia is not the exception. This country has a high degree of income inequality and a sizeable proportion of people living in poverty, so promoting greater FI may help mitigate these issues.

Despite all the evidence on FI, it is not possible to find studies in Colombia that directly explore how FI impacts household income considering the possible sources of heterogeneity mentioned above. Therefore, the aim of this article is to analyze how, in the main Colombian cities, this relationship changes along the distribution of household income taking into account labor informality. We decide to include labor status in the analysis because, according to the evidence, informal households may have a different response to FI in relation to their formal counterparts.

Thus, the paper contributes to the literature in several ways. First, we use an innovative proxy for IF based on the World Bank definition and on the sample we use. Second, there are no studies in Colombia that address the impact of IF on household income. In addition, we use a quantile regression which enriches the analysis since it makes it possible to study the effect of FI at each quantile of the income distribution and partially allows to shed some lights on the implications for income inequality and poverty in the Colombian case. Finally, the paper also analyzes how the effect of IF on household income varies according to whether the household is informal or not.

² The World Bank defines and explains some of the benefits of being financially included: <https://www.worldbank.org/en/topic/financialinclusion/overview>.

The remainder of the paper is organized as follows. Section 2 reviews the literature relevant to the study. Section 3 outlines the methodology and empirical strategy used to address the research problem. The estimates and results are shown in Section 4. Finally, Section 5 concludes.

2. Literature review

In the literature it is common to find studies that address FI and labor informality independently. The former has shown to have a positive effect on household income both in micro and macroeconomic researches using multiples proxies for FI. On the other hand, it is also possible to find evidence for the implications of labor informality on household income, showing how informal households tend to receive lower incomes relative to their formal counterparts. Therefore, since these variables have been studied independently, this part of the paper is divided into 2 subsections, addressing the relevant literature of each.

2.1. Financial inclusion

According to the latest Findex data (2017), about 1.7 billion people are still unbanked, i.e., close to 23% of the world's population in 2017 was not able to have access to a transaction account. This means that a large number of people may not be part of the formal financial system, as a transaction account could be seen as a first step toward broader FI by making it easier for people to store money, and send and receive payments (World Bank, 2018). Hence, there is still a lot to do in terms of FI, especially in the developing world.

This has led to the development of multiple experiments in economics. Many of the studies are based on randomized controlled trials (RCTs) in communities belonging to developing countries. Some of these studies assess the impact of implementing collaborative village-based saving groups or offering individual bank savings accounts. The former is usually based on communities making regular deposits (savings) into a common fund and, from this, loans are made to members at an interest rate agreed upon by the community. At the end of a cycle (usually 1 year), the common fund is disbursed among the community members. In this sense, Beaman et al. (2014) test this type of intervention in Mali. Although it can be considered an informal savings and credit tool, the authors find that it can affect some economic variables, such as savings, food security and agricultural output. However, they find no impact on profit business (which can be seen as the income of these households).

Similar interventions in other countries based on communities, such as Village Savings and Loan Association (VSLA), have also significantly impacted households. Ksoll et al. (2016) in Malawi and Karlan et al. (2012) in Malawi, Ghana, and Uganda, find that VSLAs can increase agricultural investments, income from small business and partly household expenditure. Ksoll et al. (2016) mention some possible channels of these impacts, one of them: VSLAs usually involve a minimum level of obligatory savings, which can serve as a means of compromise for households. In addition, the disbursement of VSLAs at the end of the cycles, along with the credits they grant, allow households to invest in economic activities and in education.

Karlan et al. (2012) complement these mechanisms as follows. Being a member of VSLAs may change the way people manage their personal finances and the tools they use to finance expenses and investments. Additionally, access to credit through VSLAs can ease credit constraints and extend credit to those who have never received it. In the short-term, households with greater access to credit could invest in income-generating activities, smooth the impacts of unexpected shocks, guarantee household food security and fund education expenses. In the long-term, higher savings and loan volumes could imply higher returns on economic activities, growth in business ownership, increased profits, better health and education indicators and greater assets accumulation in households.

On the other hand, it is also possible to find evidence from interventions with formal financial instruments. Brune et al. (2016) offer bank savings accounts to crop farm households in Malawi and find that this intervention can have meaningful effects on some household economic variables, such as their expenditures and profits. Similarly, Dupas & Robinson (2013a) test an analogous formal financial product offered to Kenyan market vendors and bicycle taxi drivers at no opening cost to themselves, but with withdrawal fees. Findings show that the treatment group uses more bank accounts, saves more on average, and has a higher level of investment in business and expenditure in households.

Although the previous studies do not directly involve household income, the economic variables analyzed are quite related and can be intermediate outcomes that have long-term effects on household income. Only some studies explore and find significant effects on earned incomes or poverty indicators (Jamison et al., 2014; Ksoll et al., 2016). Nonetheless, in some other experiments such as Dupas et al. (2018) in Uganda and Malawi, it is not possible to find statically significant results after similar interventions. The authors argue that the lack of significance may be due to the fact that a large percentage of households decide not to open or use the account; however, households that do use the account have increased their savings. According to follow-up surveys carried out by Dupas et al. (2018), the reason why people did not use bank savings accounts in these countries may be because they did not receive enough money to save (80-89% of households surveyed).

Besides the field experiments, observational studies have also found important results. Using country databases, some of them find how financial development can have positive implications on growth (Rioja & Valev, 2004). However, the benefits on growth may be uneven across the population. According to Greenwood & Jovanovic (1990), there is a non-linear relationship between financial development and inequality, where at early stages of development, only the rich can afford and access to the financial intermediation. Then, as the economies develops, costs and restrictions are lower for the poor, allowing them to enter the financial system.

In this way, financial development can have partial effects on poverty as well. Odhiambo (2009) has shown the different possible mechanisms behind this relationship. Financial development can reduce some sources of failure markets such as information asymmetry, transaction costs and contract enforcement costs. These would allow capital flows to reach the poor individuals. In addition, financial development helps this part of the population to

save and borrow from the formal financial system, which in turn could help fund microenterprises and subsequently generate more employment, higher income and thus reduce poverty.

At a macroeconomic level, in the literature it is possible to find how financial development affects poverty (Boukhatem, 2016; Donou-Adonsou & Sylwester, 2016; Mushtaq & Bruneau, 2019; Zhang & Ben Naceur, 2019). Using several aggregate measures, these cross-country studies find a positive relationship between financial development and poverty. On the other hand, from a micro perspective Burgess et al. (2005) y Burgess & Pande (2005) find that the expansion of bank branches in rural zones of India significantly reduced poverty, as it enables individuals and firms to access formal finance. Likewise, Bruhn & Love (2014) estimate the causal effect of the opening of Azteca Bank branches on labor market variables. The authors find that expanding access to finance to low-income individuals through more branches can have a positive effect on their income.

However, financial development (or increased coverage) is not the same as FI. According to World Bank (2015), the former is a tool that facilitates transactions, information acquisition and contract enforcement, while the latter is the usage of financial services by individuals and firms. In this sense, there is an extensive literature using bank account ownership or access to credit to measure the impact of IF on income. Many studies find a positive relationship between these variables (Agbola et al., 2017; Honohan & King, 2018; Kumar et al., 2017). Particularly, Ndlovu & Toerien (2020) adopt the World Bank's definition of “being banked” to estimate the impact of FI along the wealth distribution of households in some sub-Saharan African countries. The findings show that banked households have higher levels of wealth; however, the benefit of being banked is greater in the upper quantiles of the wealth distribution relative to the lower quantiles. This implies FI can widen the gap wealth between households.

Although the previous experimental and observational literature has evidenced the implications of FI on different outcome variables (poverty, income, profit business, etc.), the approaches used are focused on two broad categories: providing access to credit and saving mechanisms. However, FI encompasses more aspects. For this reason, World Bank (2018) updates and provides a more precise definition in 2018: “Financial inclusion means that individuals and businesses have access to useful and affordable financial products and services that meet their needs – transactions, payments, savings, credit and insurance – delivered in a responsible and sustainable way”. Thus, FI can be roughly summarized in four dimensions: transaction and payments, savings, credit and insurance.

Based on the World Bank’s definition and its dimensions, a handful of studies have created an FI indicator from household surveys (Ibrahim et al., 2018; Ibrahim & Aliero, 2020; Zhang & Posso, 2019). These articles find that FI has a positive impact on household income. Nonetheless, the effect of FI along the income distribution is heterogeneous. Ibrahim et al. (2018) finds in that Nigerian middle- and high-income households benefit more from FI than low-income households, which means that FI can widen the income gap. Similarly, and using three survey waves in Nigeria, Ibrahim & Aliero (2020) find that FI has a greater effect in

middle- and high-income households in a first and second wave. In a third wave, however, the impact of FI is greater in the lower quantiles of household income distribution, indicating that the effect of FI can also vary over time.

On the other hand, Zhang & Posso (2019) using a similar methodology, that is, quantile regression, find that IF has a positive on household income in China. Furthermore, the findings show that IF can help close the income gap since the effect of IF is greater in low-income households relative to high-income households. In addition, Zhang & Posso (2019) find, though a counterfactual decomposition, that income differences in Chinese households are mainly driven by FI.

All the previous literature show that IF have a positive impact on poverty or income. Yet the evidence is not conclusive regarding the heterogeneous effect it may have on income distribution and, therefore, on income inequality. Additionally, in Colombia the evidence is scarce. There are no studies that show the heterogeneous effect that FI may have; however, authors such as Granda et al. (2019) show, through general equilibrium models, that reducing some frictions in the financial sector can increase formal access to the financial system, which could eventually increase the well-being of individuals. Similarly, Karpowicz (2016) using the same type of modeling, finds that FI can favor growth and combat inequality. However, these papers draw conclusions about aggregate variables. Therefore, the lack of evidence in Colombia, especially at the microeconomic level, motivates the study of how the impact of FI is and what role it can play in the Colombian context, that is, as a reducer or a widener of the income gap.

2.2. Informality

Informality in the market labor is a topic whose literature is quite extensive. The evidence shows that there are significant differences between formal and informal households in terms of their economic characteristics, particularly, their income. In China, Xue et al. (2014) find that informal workers receive on average 23% less earnings than their formal counterparts. Moreover, returns of education and work experience are higher for formal workers. On the other hand, the results also suggest that the marital status has more influence on the income of formal workers. Additionally, using the Blinder-Oaxaca decomposition, Xue et al. (2014) find that approximately half of the earnings gap is driven by worker characteristics (formal and informal), especially education. The findings also suggest that the relevance of education as a driver of the earnings gap is increasing over time, while the proportion of the gap explained by the difference in returns of characteristics of the workers is decreasing.

Inequality in earnings can also be observed in developing countries such as Madagascar and Vietnam. Nguyen et al. (2013) and Nordman et al. (2016) use quantile regressions to analyze how the informal-formal earnings gap varies along the earnings distribution. In both economies, estimates at the mean show a negative gap, i.e., formal households receive on average more earnings relative to their informal counterparts. However, when the earnings gap is analyzed at each quantile, it is possible to observe that the gap decreases and even reverses its sign in the upper quantiles, indicating that informal households receive higher earnings than their formal counterparts at the top of the earnings distribution.

More evidence is found by Bargain & Kwenda (2011) in Mexico, Brazil and South Africa. They use rich panel datasets to estimate the informal-formal earnings gap using a comparable definition of informality across countries. The findings show that in all the countries informal workers earn on average less than their formal counterpart. Yet South Africa has the most pronounced gap among the economies studied. While in this country the gap is on average 21%, in the Latin countries it is only 4-5%. According to Bargain & Kwenda (2011), the differences between these countries may be due to distinct legal contexts. These patterns hold even when quantiles regression is used.

The findings found by previous studies confirm that workers (or households) in the informal sector are systematically underpaid relative to formal sector counterparts. However, labor informality has additional implications on earnings and consequently on household income. In this sense, Krstić & Sanfey (2011) find that labor informality can exert a widening influence on earnings inequality in Serbia. The previous result suggests that addressing labor informality can help reduce inequality and thereby alleviate poverty, since by reducing the earnings gap, wages and incomes in the informal sector would be expected to move closer to those in the formal sector.

In addition to a wage gap, there is also evidence in favor of the existence of a different behavior between informal and formal sectors. Much of the literature has focused on how these sectors react to policies or changes in economic variables, such as minimum wage increases. El-Hamidi & Terrell (2002) have found in Costa Rica that relative changes in the minimum wage can only have significant effects on the formal sector. On the other hand, Khamis (2013) finds uncommon results in Argentina. The findings show that the minimum wage and changes in the minimum wage have a larger impact on informal wages than on formal wages. The results found in Costa Rican and Argentina suggest that the behavior of informal and formal sectors is different and varies according to the country.

In the Colombian case, Pérez-Pérez (2020) analyze how an unexpected increase in the real minimum wage affects informal wages, formal wages and employment. Using unconditional quantile regressions and difference-in-difference design, the author finds that only wages close to the minimum wage rise. However, the increase in the formal sector is higher than their informal counterpart. Moreover, the results show a slight evidence of negative employment effects in the informal sector. Pérez-Pérez (2020), like the rest of the literature above, shows that informal households can behave differently, which makes it important to consider the labor status of households when analyzing how FI affects household income.

Despite the relevance of FI and labor informality, there are no studies that address these variables at the same time, which implies that little is known about how the effect of FI on household income can vary along the income distribution and according to labor informality. In this sense, we consider it is important to integrate both variables into a single framework, since it would shed lights on the possible informal-formal gap that may exist in the benefits that households have when the level of FI increases. And if it does exist, it is worthwhile to analyze how this gap behaves along the household income distribution. The

results of this analysis could have implications on how to design public policies to improve financial inclusion, in such a way that it mainly benefits the households that need it most.

3. Data and methodology

3.1. Data

Since 2007 to date, the National Administrative Department of Statistics (DANE, in Spanish) carries out the Large Integrated Household Survey (GEIH, in Spanish) in thirteen large cities with their metropolitan areas, 11 intermediate cities and the rural zone in 23 departments. The survey collects information on Colombian individuals and households regarding housing, household utilities, general characteristics, labor force, employment, wages, other incomes, industry, etc. In addition, GEIH has several modules that are answered by subsamples, which are usually chosen according to certain filter questions.

One of the modules is the Financial Burden and Financial Education Survey (IEFIC, in Spanish), which is conducted jointly with Banco de la República. Not all households are surveyed since some do not pass the GEIH filter question that is associated with ownership of informal or formal financial products (see Table 1). The purpose of the survey is to collect information on the financial characteristics of individuals and households (savings, credit, insurance, means of transaction), as well as their perception of financial burden and credit restrictions. EIFIC has been applied since 2010 on a continuous and face-to-face basis in the urban area of Bogotá. However, in 2017 and 2018 (the last year it was conducted), the sample was expanded to Medellín and Cali.

Table 1. Filter question in GEIH survey.

Question:	Which of the following financial products do you or any member of your household currently use?
Answers:	<ol style="list-style-type: none">a. Checking accountb. Savings accountc. Term Certificate of Depositd. Mortgage loane. Loan for the purchase of a vehiclef. Free Investment Loang. Credit cardh. Other, which one?i. Nonej. Does not know

For this paper, the sample used corresponds to GEIH-IEFIC 2018 for the urban areas of Bogotá, Medellín y Cali. To carry out our research, we take the following variables: monthly household income, which includes all types of income received from work activities, rentals, interest, dividends, pensions or retirements, etc. Household size and household members engaged in work, either as an employee, business owner or self-employed; with these variables, we construct the proportion of children (under the age of 12) within the household as a proxy for the dependency ratio. People over 65 years are not included as is usually done

because in the Colombian context this part of the population tends to be working and would still be part of the labor force³. Similarly, we construct the proportion of employed people within the household to measure the size of the productive proportion of the household.

We also take the following characteristics of the household head: age (squared), gender, marital status, highest education level, occupation, type of employment and number of workers in the firm. The last four variables are the input to calculate the informality variable. On the other hand, we use information about household members' financial products (savings, credit, insurance, means of transaction) to construct our multidimensional IF indicator. Thus, we have a cross-section sample with 32,771 households (98,979 individuals). The variables mentioned above are incorporated in the specification proposed in Section 3.3.

3.2. Indicators

Attempts have been made in the literature to measure FI in various ways according to available information. Ndlovu & Toerien (2020) use as an approximation the ownership of an account or credit with a bank or financial institution. Other studies at the macro level use deposits in commercial banks or the number of borrowers per capita (Mushtaq & Bruneau, 2019). Although these measures are quite related to FI, it considers more aspects that go beyond access to credit or the ownership of bank accounts. For this reason, as mentioned above, the World Bank has roughly summarized FI in four dimensions: transaction and payments, savings, credit and insurance.

This definition has been used in several papers (Ibrahim et al., 2018; Ibrahim & Aliero, 2020; Zhang & Posso, 2019). The authors use information from household surveys to measure each dimension and then average it to obtain the FI indicator. In these studies, the 4 dimensions was weighted equally (25%) in an arbitrary way; however, it could be incorrect to consider that, for an individual's immersion in the financial world, the acquisition of insurance is just as relevant as the acquisition of a savings account or access to some type of credit product in the formal financial system.

In order not to enter into arbitrariness, for the present analysis the weights are constructed from the same data. For this purpose, IEFIC conducted in 2018 by Banco de la República and DANE is used. The database allows for obtaining information from households regarding different financial products such as mortgage loans, business loans, other types of free investment loans, financial assets, savings accounts, debit and credit cards, payment of voluntary insurance, means of payment, etc.

Based on this information, the following procedure is performed. First, the corresponding variables are grouped in each of the four dimensions, as shown in Table 2. This gives six variables in both the transaction and savings dimensions, 14 variables in the credit dimension and only one in the insurance dimension. Then, the quantity of each product in the sample is counted and then added up by dimension.

³ According to the DANE's definition, the working age population in urban areas consists of all persons aged 12 and over.

Table 2. IF indicator dimension weights

Dimension	Variable	Frequency	Weight
Transaction	6	48,837	43%
Savings	6	2,115	2%
Credit	14	41,057	36%
Insurance	1	21,881	19%
Total	27	113,890	100%

By performing the previous process, it is obtained that in the sample there is a total of 113,890 products, distributed as follows: 48,837 transaction products, 2,115 savings products, 41,057 credit products and 21,881 insurance products (see Table 2). The percentage or proportion (weights) that each dimension represents within the total number of products is then calculated. Table 2 shows the weights for each dimension: 43% (transaction), 2% (savings)⁴, 36% (credit), 19% (insurance). Finally, for the construction of the multidimensional FI indicator at the household level, the weighted average is calculated as shown in Equation (1).

$$IF_h = \omega_t \bar{D}_{t,h} + \omega_a \bar{D}_{a,h} + \omega_c \bar{D}_{c,h} + \omega_s \bar{D}_{s,h} \quad (1)$$

$$\text{where } \bar{D}_{j,h} = \frac{1}{N} \sum_{i=1}^{N_j} d_{ijh}, j = t, a, c, s.$$

Where ω_t , ω_a , ω_c and ω_s represent the weights for the transaction, savings, credit and insurance dimensions, respectively. $\bar{D}_{t,h}$, $\bar{D}_{a,h}$, $\bar{D}_{c,h}$ and $\bar{D}_{s,h}$ are the simple averages at the household level of the variables belonging to each of the mentioned dimensions. d_{ijh} is a dummy variable that take a value of 1 in the case that at least one member of the household h has a certain financial product of the dimension j , and 0 otherwise. Thus, the multidimensional IF indicator ranges from 0 to 1, with 0 being the case in which household h is totally excluded from the formal financial system and 1 the case in which it is totally included.

Additionally, the IF indicator with equal weights is used as a robustness measure. In other words, ω_t , ω_a , ω_c and ω_s are equal to 0.25, and the simple averages ($\bar{D}_{t,h}$, $\bar{D}_{a,h}$, $\bar{D}_{c,h}$ and $\bar{D}_{s,h}$) are calculated in the same way as mentioned above. This IF indicator will be incorporated into the same econometric techniques proposed in the following section. The results will be compared with those obtained with the first indicator. Likewise, comparisons will also be made with international literature.

On the other hand, DANE methodology is used to calculate labor informality. The DANE criteria are based on the International Conference of Labor Statisticians and the recommendations of the group of experts convened by the United Nations to measure the informal phenomenon. This measure of informality considers only people engaged in work⁵,

⁴ The savings dimension has a low weight since it does not include "savings account". This product is included in the transaction dimension because, in Colombia, savings accounts are primarily used to make purchases or payments.

⁵ The sample is reduced because the informality measure only considers people engaged in work.

i.e., people who during the reference period a) worked at least one hour paid, b) did not work in the reference period, but had a job, or c) worked without pay in the reference period for at least 1 hour. Then, DANE uses 4 criteria to classify workers as informal, namely:

- Employees who work in companies with 5 workers or less.
- Unpaid workers.
- Self-employed people in companies of up to five persons, except independent professionals.
- Government workers are excluded.

The process above gives the labor status of each household member. For model specification in the next section, we use the labor status of the household head to determine the status of the household. Finally, this methodology only considers two categories, that is, those households that are not informal are consequently formal.

3.3. Empirical strategy

First, we use Ordinary Squared Least (OLS) to estimate Equation (2) and review the effects of IF and informality on household incomes at the mean. To explore initially the relationship of the variables of interest of the paper and based on the international literature, the empirical model is given as:

$$y_h = \beta_0 + \beta_1 IF_h + \beta_2 Informal_h + \beta_3 FI_h \times Informal_h + x'_{c,h} \gamma + \varepsilon_{c,h} \quad (2)$$

where y_h is the logarithm of monthly household income. FI_h is the financial inclusion indicator explained in Section 3.2 and $Informal_h$ is a dummy variable that is 1 if the head household is informal and 0 otherwise. The interaction term $FI_h \times Informal_h$ is included to observe how the effect of IF varies according to the labor status of the household. $x'_{c,h}$ is a vector of control variables that includes household size, age, age squared, gender, marital status, education⁶, proportion of children and of employed people in the household and city-fixed effects. Finally, $\varepsilon_{c,h}$ is a normally distributed mean-zero error term.

We are interested in β_1 and β_3 . Given the interaction term in Equation (2), the former shows the average impact of FI on income in formal households. The latter, however, shows the additional impact on informal households. Therefore, the sum between β_1 and β_3 can be interpreted as the average impact of FI in informal households. As found in the literature, we expect to find a positive effect of FI for all workers; with respect to the interaction term, a greater impact on income of informal households is expected (β_3 positive and significant).

However, OLS only provides an aggregate value, which ignores that low, medium and high-income households may respond differently to changes in FI and informality. For this reason, we use a conditional quantile regression (QR) method proposed by Koenker & Bassett (1978) to estimate Equation (3). This econometric technique enables to analyze the heterogeneous

⁶ Age, age squared, gender, marital status and education correspond to the head household.

effects of FI and informality on our outcome variable (y_h), since it allows to calculate the effects at various conditional quantiles of the household income distribution. Using the notation above, the model to be estimated is:

$$Q_\tau(y_h) = \beta_0(\tau) + \beta_1(\tau)IF_h + \beta_2(\tau)Informal_h + \beta_3(\tau)FI_h \times Informal_h + x'_{c,h}\gamma(\tau) + \varepsilon_{c,h}, \forall \tau \in [0,1] \quad (3)$$

where $Q_\tau(y_h)$ is the τ^{th} conditional quantile of the log household income distribution. The set of coefficients $\beta_1(\tau)$, $\beta_2(\tau)$, $\beta_3(\tau)$ and $\gamma(\tau)$ are the rate of returns to the covariates at the τ^{th} conditional quantile of the distribution. Similar to Equation (2), the coefficients of interest are $\beta_1(\tau)$ and $\beta_3(\tau)$. We expect to observe the same relationships and to find sizeable variation of these coefficients along the household income distribution. This variation will show that there is a heterogeneous effect of FI and informality on household income and will shed lights on the role that FI can play in income inequality. Finally, Equations (2) and (3) are also estimated for the equally weighted FI indicator to compare the results between our indicator and the one used in the literature (Ibrahim et al., 2018; Ibrahim & Aliero, 2020; Zhang & Posso, 2019).

4. Results

4.1. Colombian context and data

FI in Colombia has been defined as one of the main public policy objectives. In 2006, the Government officially launched the Bank of Opportunities program, which aims to promote FI (through increased access to financial services by households and firms) in order to reduce poverty, promote social equality and stimulate economic development in Colombia. Figure 1 shows how the indicator of access to financial services (Bank of Opportunities' FI indicator) has evolved over the last 10 years⁷. Access has steadily increased since 2010 (62%) to 2020 (86%) at an average annual rate of 2.4%, although at a slower pace⁸ (Bank of Opportunities, 2020).

⁷ The indicator of access to financial services is measured as the percentage of adults with at least one financial product over the adult population (over 18 years old).

⁸ In 2020 there has been a large increase (3.4%) due to current government policies to fight the consequences of the Covid-19 pandemic, such as Solidarity Income, which sought to help vulnerable households by providing them with regular economic aid. Payments were made mainly through bank accounts or mobile banking applications, so beneficiaries began to acquire these types of financial products.

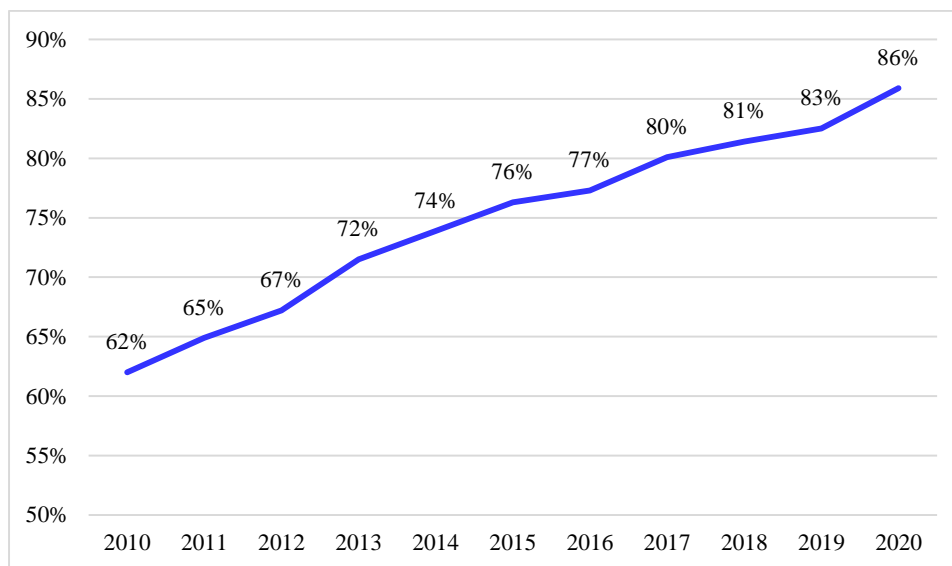


Figure 1. Indicator of access to financial services in Colombia

Source: Bank of Opportunities

Bank of Opportunities also calculates the number of adults with some active or current financial product over the total adult population, which can be seen as a usage indicator. According to this indicator, the number of active users was about 66% in 2019 and 70% in June 2020⁹ (Bank of Opportunities, 2020). Although significant progress has been made in the last 10 years in access to financial services, there are still important barriers to be removed, particularly those associated with the most vulnerable populations. Moreover, it is necessary to change the approach of the Bank of Opportunities' FI indicator, since it only includes access to financial products, but does not include the usage. In addition, it is an aggregate indicator and thereby has little heterogeneity.

In this sense, our multidimensional FI indicator based on the World Bank definition and on the data has a high degree of heterogeneity since it is calculated at the household level. Figure 2 shows the distribution of FI in the main Colombian cities according to our indicator. The total average of FI is 0.14 (0.18 in Bogotá, 0.12 in Cali and 0.11 in Medellín; see Table 3), indicating a high level of financial exclusion, especially in Medellín. There is a high concentration in the left tail of the distribution because 10,634 (32% of the sample) households are totally excluded financially, of which 6,051 are due to not answering the IEFIC survey. On the other hand, the highest level of FI is 0.75, obtained by households in Bogotá and Cali (no household in the sample is 100% included in financial terms).

⁹ Arguably, the large change in this indicator is also due to the government policies, since a financial product is considered active if it has been used in less than 6 months. Therefore, all bank accounts that were opened only to receive the government subsidy are considered active.

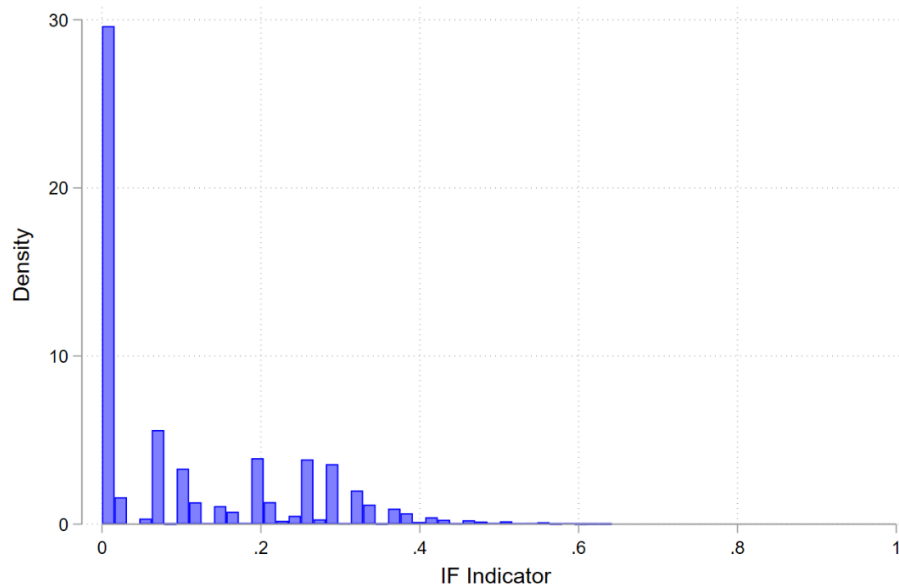


Figure 2. Histogram of the multidimensional FI indicator with data-based weights (see Table 2)
 Source: Authors' calculations with weights based on the data from GEIH-IEFIC 2018.

We also calculate the FI indicator with equal weights for each dimension, which is shown in Figure 3. A similar characteristic can be observed: the distribution is skewed to the left; however, it seems to be bimodal (unusual distribution)¹⁰, i.e., there are two peaks or two high-density centers in the histogram. According to Table 3, the equally weighted indicator also shows a lower average level of FI in the sample (0.12), but Cali is now the city with the highest level of financial exclusion on the average (0.09); with this indicator, the average level of FI is 0.11 in Medellín and 0.16 in Bogotá. Finally, the highest level of FI in the sample is 0.79 in Cali, higher than that obtained with our indicator. Overall, the estimation of FI from both indicators shows a similar pattern, so we expect that the results will not differ much from each other.

¹⁰ The distribution of the data based FI indicator has greater dispersion (244 unique values) and therefore reduces considerably the accumulation of observations at certain values of the distribution. On the other hand, the equally weighted IF indicator only has 100 unique values, i.e., less variability.

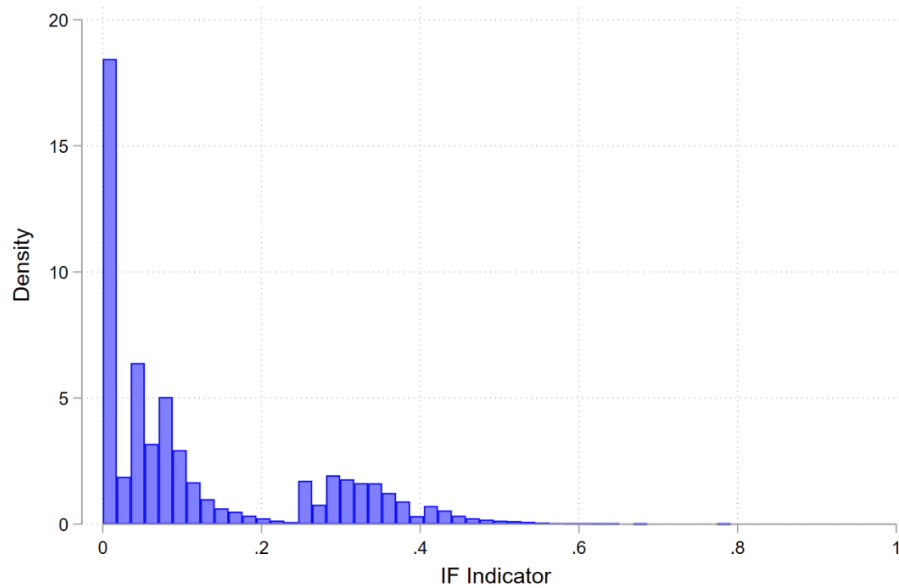


Figure 3. Histogram of the multidimensional FI indicator with equal weights (25% each dimension).
Source: Authors' calculations with weights based on the data from GEIH-IEFIC 2018.

Table 3 shows the descriptive statistics of the variables used in the estimates. The distribution of the households in the sample is: 32% in Bogotá, 39% in Medellín and 29% in Cali. The data indicates that the average household income in the sample is US\$ 937¹¹. The city with the highest household income is Bogotá (US\$ 1,051) whereas the city with the lowest one is Cali (US\$ 814). With respect to informality, 45% of the households are informal, with Cali being the city with the highest proportion of households in this status (47%). The number of people per household is approximately 3, with slight variations across cities. These households are composed on average of 11% children and 54% people engaged in work, indicating low dependency and productivity ratios within the households.

In Colombia's main cities, the household head is usually between 48 and 50 years old, and 56%-62% of these are men. Table 3 also shows that 51%-56% of the household heads are domestic partners or married, 18%-24% are separated or divorced, and 12%-21% are single. In terms of education, 24% of household heads have elementary school, 15% secondary school, 29% high school and 30% a college degree. In this aspect, Cali has the lowest level of people with a college degree (25%), compared to Bogotá and Medellín (33% and 32%, respectively). Bogotá, Medellín and Cali are the most developed cities in the country, which is why the number of people without education is almost zero.

Table 3. Summary statistics

Variable	Total			Bogotá			Medellín			Cali		
	Obs	Mean	SD	Obs	Mean	SD	Obs	Mean	SD	Obs	Mean	SD
Income	32,771	937	1087	10,567	1,051	1330	12,783	934	996	9,421	814	869
IF Indicator ¹	32,771	0.14	0.14	10,567	0.18	0.16	12,783	0.11	0.13	9,421	0.12	0.12
IF Indicator ²	32,771	0.12	0.14	10,567	0.16	0.15	12,783	0.11	0.14	9,421	0.09	0.12

¹¹ The USD-COP exchange rate of the year 2019 was used (World Bank).

Informality	23,239	0.45	0.50	7,885	0.44	0.50	8,722	0.44	0.50	6,632	0.47	0.50
Household size	32,771	3.02	1.57	10,567	3.05	1.54	12,783	3.02	1.60	9,421	2.99	1.55
Age	32,771	49.52	16.50	10,567	48.42	16.34	12,783	50.06	16.64	9,421	50.01	16.42
Gender	32,771	0.58	0.49	10,567	0.62	0.48	12,783	0.56	0.50	9,421	0.58	0.49
Marital status												
Domestic partner	32,771	0.27	0.44	10,567	0.30	0.46	12,783	0.22	0.41	9,421	0.30	0.46
Married	32,771	0.27	0.44	10,567	0.26	0.44	12,783	0.29	0.45	9,421	0.24	0.43
Separated or divorced	32,771	0.20	0.40	10,567	0.20	0.40	12,783	0.18	0.39	9,421	0.24	0.43
Widowed	32,771	0.09	0.29	10,567	0.08	0.27	12,783	0.10	0.30	9,421	0.10	0.30
Single	32,771	0.17	0.37	10,567	0.16	0.37	12,783	0.21	0.41	9,421	0.12	0.32
Education												
None	32,771	0.02	0.14	10,567	0.01	0.12	12,783	0.03	0.16	9,421	0.02	0.15
Elementary	32,771	0.24	0.43	10,567	0.23	0.42	12,783	0.25	0.43	9,421	0.24	0.43
Secondary	32,771	0.15	0.35	10,567	0.14	0.34	12,783	0.15	0.35	9,421	0.15	0.36
High school	32,771	0.29	0.45	10,567	0.29	0.45	12,783	0.26	0.44	9,421	0.34	0.47
College	32,771	0.30	0.46	10,567	0.33	0.47	12,783	0.32	0.47	9,421	0.25	0.43
Children proportion	32,771	0.11	0.17	10,567	0.12	0.18	12,783	0.10	0.17	9,421	0.11	0.17
Employed proportion	32,771	0.54	0.33	10,567	0.56	0.32	12,783	0.53	0.33	9,421	0.54	0.33

¹ FI indicator with data-based weights.

² FI indicator with equal weights.

4.2. OLS and QR estimates

This session discusses the results of Equations (2) and (3) in detail. **¡Error! No se encuentra el origen de la referencia.** contains the OLS (column 1) and QR (columns 2-8) estimates using the FI indicator with data-based weights. Overall, the coefficients of the control variables have the expected sign, so special emphasis is placed on point estimates of the variables of interest. As can be observed in column 1, informal households receive less incomes than their formal counterparts (about 30.2%), indicating the existence of an income gap between households, as shown in the literature (Bargain & Kwenda, 2011; Nguyen et al., 2013; Nordman et al., 2016; Xue et al., 2014).

The estimates also show a positive effect of FI on household income. The results indicate that a change of 1% generates an average increase of 1.04% in the income of formal households. The coefficient of the interaction term is positive and significant, suggesting that informal households benefit on average more from positive changes in FI. This gap in the effect of FI is 0.24%, that is, informal households have an average increase of 1.28% (1.04% + 0.24%) after a change in 1% in the FI indicator¹². All other demographic variables are significant at a 1% level. Particularly, households with more members tends to have more incomes. However, if the household composition is concentrated on children, the household

¹² The sum of the coefficients is statistically significant different from zero ($\beta_2 + \beta_4 \neq 0$).

income is on average lower; in contrast, households with a higher proportion of people engaged in work tend to have higher incomes.

The results found with respect to FI and labor informality are in line with the intuition. Vulnerable households tend to have a low-education level, unfavorable labor relationships (informal jobs) and thereby lower and unstable income. When these households improve their level of FI (e.g. having access to a bank account), they can save more easily since access to formal savings may give better means of preserving their income. In this way, households can avoid self-control problems, demands for sharing with one's social network, and losses due to unexpected events such as theft and fire (Brune et al., 2016).

Table 4. OLS and QR estimates using the data based FI indicator.

Variables	(1) OLS	(2) Q5	(3) Q10	(4) Q25	(5) Q50	(6) Q75	(7) Q90	(8) Q95
<i>Informal_h</i>	-0.302*** (0.0115)	-0.644*** (0.0281)	-0.529*** (0.0212)	-0.346*** (0.0135)	-0.250*** (0.0114)	-0.168*** (0.0136)	-0.139*** (0.0181)	-0.124*** (0.0245)
<i>FI_h</i>	1.036*** (0.0389)	0.778*** (0.0631)	0.744*** (0.0459)	0.898*** (0.0433)	0.979*** (0.0421)	1.053*** (0.0437)	1.046*** (0.0568)	0.937*** (0.0884)
<i>FI_h × Informal_h</i>	0.242*** (0.0612)	0.896*** (0.1533)	0.792*** (0.0919)	0.394*** (0.0695)	0.182*** (0.0613)	-0.001 (0.0672)	0.107 (0.0948)	0.291** (0.1280)
<i>Household size</i>	0.226*** (0.0037)	0.235*** (0.0081)	0.236*** (0.0060)	0.234*** (0.0044)	0.231*** (0.0032)	0.221*** (0.0041)	0.207*** (0.0036)	0.203*** (0.0055)
<i>Children prop.</i>	-0.125*** (0.0285)	-0.258*** (0.0616)	-0.225*** (0.0428)	-0.146*** (0.0321)	-0.119*** (0.0275)	-0.075** (0.0334)	-0.031 (0.0446)	-0.060 (0.0631)
<i>Employed prop.</i>	0.993*** (0.0207)	1.098*** (0.0441)	1.071*** (0.0311)	1.047*** (0.0237)	1.014*** (0.0203)	0.991*** (0.0235)	0.954*** (0.0307)	0.922*** (0.0424)
<i>Controls</i>	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
<i>Observations</i>	23,219	23,219	23,219	23,219	23,219	23,219	23,219	23,219
<i>R²</i>	0.490	0.271	0.261	0.285	0.305	0.326	0.343	0.339

Notes: (i) Robust standard errors in parentheses (***) $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. (ii) Q5 to Q95 represent quantiles from 5 to 95. (iii) Pseudo R^2 is calculated in QR estimates, instead of R^2 . (iv) *Informal_h* is 1 if household head is informal and 0 otherwise. (v) Variable controls include age, aged squared, gender, marital status, education, and city-fixed effects. (vi) Multidimensional FI indicator with weights according to Table 2.

Higher savings through formal means can facilitate monitoring or tracking by formal financial institutions and thereby the granting of credit. In turn, higher savings along with access to credit can facilitate to cope with unexpected shocks (e.g. unemployment, unforeseen health expenditure) and guarantee food security (Karlan et al., 2012). Furthermore, households can use loans to invest in income-generating activities and in education (Brune et al., 2016). The above mechanisms are also connected to improvements in FI through the transaction and insurance dimensions, as these aspects can enable households to access credit, smooth the impacts of unexpected shocks and invest.

According to these mechanisms, the impact of FI on income distribution would be larger in low-income households. However, OLS estimates is not adequate for the purpose of this paper because they only show the impact at the mean of the income distribution. In this sense, QR estimates allow to obtain the impact of FI at different conditional quantiles, which would

make it possible to validate the previous hypothesis related to the magnitude of the impact along the income distribution. **¡Error! No se encuentra el origen de la referencia.** shows the QR estimates for the 5th, 10th, 25th, 50th (median), 75th, 90th, 95th quantiles. First, columns 2-8 indicates that the income gap between informal and formal households is found throughout the income distribution, but it is higher for low-income households. The results show that informal households receive 64.4% less incomes than their formal counterparts at the 5th quantiles. The gap is constantly closing, being 12.4% at the 95th quantile.

QR estimates also show FI has a positive impact on household income, regardless of the quantile. The effect in formal households range from 0.78% to 0.94% along the household income distribution, however, it is not monotonic. In the 5th quantile, a positive change in 1% of FI increases the household income by 0.78%, and the magnitude rises to 1.05 % at the 75th quantile. Then, the effect of FI decreases to 0.94% at the 95th quantile. Although the effect changes along the distribution, the magnitude of the variation is not very high as found in Ndlovu & Toerien (2020).

On the other hand, the estimate of the effect of FI is greater in informal households (positive coefficient of the interaction term), but it not significant at the 75th-90th quantiles. At the 5th quantile, the effect of FI in informal households is 1.68% (0.78%+0.90%), which is double that found in formal households. The effect in these households decreases to 1.16% at the 50th quantiles and becomes significant and positive again at the 95th quantile. The results suggest that low-income households benefit more from improvements in FI than middle- and high-income households, which is consistent with the evidence found by Zhang & Posso (2019) and with the general mechanisms mentioned by Brune et al. (2016).

Equation (3) is re-estimated at each quantile (from 1 to 99) and the coefficients associated with the impact of FI on income in formal and in informal households are graphed (β_2 and $\beta_2 + \beta_4$, respectively). Figure 4 shows the “FI curve”, that is, the effect of FI along the household income distribution taking into account the labor status. As discussed in **¡Error! No se encuentra el origen de la referencia.**, formal households are less responsive to changes in financial inclusion compared to their informal counterparts. In the first quantiles, the magnitude of the effect is relatively large (not evident in **¡Error! No se encuentra el origen de la referencia.**), however, it decreases rapidly. After the 5th quantile, the slope of FI curve is slightly positive, but after the 84th quantile, the effect of FI in formal households decreases sharply.

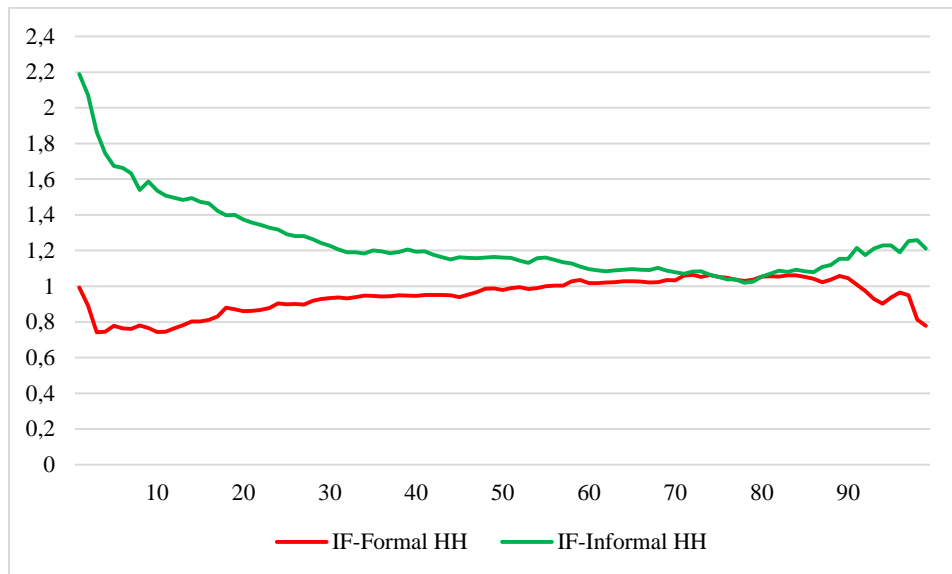


Figure 4. Effect of FI along the household income distribution using the data based IF indicator.

The FI curve of informal households is represented by the green line in Figure 4. In 1st-4th quantiles, a 1% change in FI increases the household income by 1.75%-2.2%. The slope of FI curve in this part of the distribution is quite steep, but after the 5th quantile, the effect of FI starts to slowly decrease until the quantiles 60th-90th, where there are no significant differences of the impact of FI on income between informal and formal households. Finally, the difference increases again and is significant in the 91st-95th quantiles (0.21%-0.33%), showing that after a 1% change in FI, the income of informal households increases by 1.21%-1.23%, while that of formal households increases by 0.9%-1.01%.

Overall, Figure 4 shows how the informal-formal gap of the effect of FI varies along the household income distribution. The gap is quite wide in low-income households; however, it closes and converges at about the 60th quantile, with a small widening of the gap at the end of the income distribution. In this way, Figure 4 shows the heterogeneity of the effect of FI on household income and, in turn, suggests that the mechanisms explained above are consistent with the context in the main Colombian cities.

Similar patterns can be observed using the equally weighted FI indicator. Table 5 shows the OLS and QR estimates of Equations (2) and (3). According to the results, there is an income gap between informal and formal households, which is greater in low-income households than in middle- or high-income households. Likewise, the effect of FI on income is positive in both informal and formal households. However, the magnitude of the coefficients is lower (especially in low- and middle-income households), compared to the estimates using the FI indicator with data-based weights.

Table 5. OLS and QR estimates using the equally weighted FI indicator

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	OLS	Q5	Q10	Q25	Q50	Q75	Q90	Q95
<i>Informal_h</i>	-0.295*** (0.0108)	-0.622*** (0.0270)	-0.506*** (0.0195)	-0.343*** (0.0130)	-0.243*** (0.0110)	-0.166*** (0.0124)	-0.130*** (0.0165)	-0.125*** (0.0225)

FI_h	0.966*** (0.0391)	0.651*** (0.0599)	0.654*** (0.0495)	0.801*** (0.0435)	0.917*** (0.0444)	1.016*** (0.0490)	0.972*** (0.0627)	0.901*** (0.1020)
$FI_h \times Informal_h$	0.132** (0.0618)	0.749*** (0.1241)	0.637*** (0.1115)	0.327*** (0.0675)	0.063 (0.0664)	-0.102 (0.0761)	0.081 (0.0962)	0.288** (0.1335)
Household size	0.230*** (0.0038)	0.235*** (0.0079)	0.239*** (0.0060)	0.239*** (0.0044)	0.233*** (0.0033)	0.224*** (0.0039)	0.210*** (0.0048)	0.205*** (0.0061)
Children prop.	-0.130*** (0.0287)	-0.253*** (0.0605)	-0.229*** (0.0449)	-0.148*** (0.0328)	-0.120*** (0.0284)	-0.082** (0.0336)	-0.037 (0.0455)	-0.076 (0.0615)
Employed prop.	1.006*** (0.0208)	1.099*** (0.0408)	1.078*** (0.0326)	1.054*** (0.0237)	1.030*** (0.0209)	1.005*** (0.0245)	0.953*** (0.0324)	0.928*** (0.0421)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	23,219	23,219	23,219	23,219	23,219	23,219	23,219	23,219
R^2	0.484	0.265	0.255	0.280	0.300	0.322	0.340	0.337

Notes: (i) Robust standard errors in parentheses (*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$). (ii) Q5 to Q95 represent quantiles from 5 to 95. (iii) Pseudo R^2 is calculated in QR estimates, instead of R^2 . (iv) $Informal_h$ is 1 if household head is informal and 0 otherwise. (v) Control variables include age, aged squared, gender, marital status, education, and city-fixed effects. (vi) Multidimensional FI indicator with weights equal to 25% in each dimension.

In some quantiles the gap in the effect of FI between both types of households is not significant. In the 75th quantile the gap is even reversed but it is not statistically significant. This gap reverts and is statistically significant again at the 95th quantile. The above results are better shown in Figure 5. It is possible to observe that the gap in the effect of FI remains but closes much more quickly (45th quantile). Like what is shown in Table 5, the impact of FI in formal households is greater in the 65th-85th quantiles but it is not statistically different from the effect found for informal households. Finally, at the 94th-95th quantiles, informal households are more responsive to changes in FI.

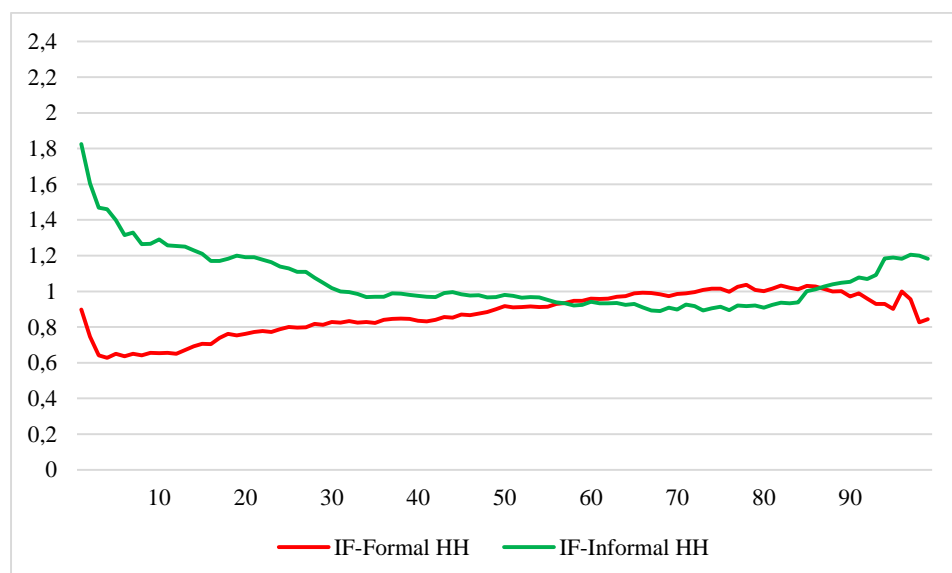


Figure 5. Effect of FI along the household income distribution using the equally weighted IF indicator.

The results using both FI indicators are similar. Nonetheless, with the equally weighted indicator, it is possible to find convergence in the benefits of a greater FI among the

households at lower income levels (45th quantile according to Table 5 and Figure 5). In addition, the effect of FI using the equally weighted indicator is lower at both the mean and each quantile, compared to the estimates in **¡Error! No se encuentra el origen de la referencia.** and Figure 4. These particularities may be related to the unusual distribution of this indicator shown in Figure 3, suggesting that indicator weights can play an important role in the results. However, the data based FI indicator may be a better option because it has more variability and thereby a potentially more satisfactory performance on estimates.

5. Conclusions

FI and labor informality are variables present in the economic policy agendas of governments, especially in developing countries. Although both can have implications on household income, there is not many studies that simultaneously integrate them. In this sense, this paper examines the potential implications of FI on income considering the labor informality of the households. Moreover, it also analyzes the effect of FI along the household income distribution, since it has been found in the literature that low-, middle- and high-income households can respond differently to changes in the level of FI.

We apply the DANE methodology to estimate the labor informality, which is based on the type of worker and the size of the firm. As for the FI indicator, we use a particular methodology based on the World Bank definition and on the data. We also calculate the FI indicator commonly used in the literature (Ibrahim et al., 2018; Ibrahim & Aliero, 2020; Q. Zhang & Posso, 2019). According to both indicators, a large proportion of households have a high level of financial exclusion.

We use quantile regressions to analyze the heterogenous effect of FI on household income. This technique allows us to estimate the effect at each quantile of the income distribution and thus evaluate which households benefit most from improvements in FI. Moreover, we consider the labor informality in the estimates, since informal households have certain characteristics (low levels of education, unfavorable labor relationships and thereby lower and unstable income) that can affect the size of the benefits obtained from greater FI. In this sense, the heterogeneity we analyze is according to labor status and income level of the households.

Using the data based IF indicator, the estimates show that formal households have more income relative to their informal counterparts. However, the income gap varies along the income distribution, being higher at the bottom quantiles. The results also indicate a positive effect of FI at the mean and at each quantile. It is possible to observe that this effect varies along the income distribution and according to the type of household. At the first quantiles, the effect is greater in informal households, however, almost at the middle of the distribution, the effect is statistically equal and slightly constant among households. The above results do not change significantly using the equally weighted FI indicator.

The results found in this paper suggest that FI affects more informal and low-income households, which is consistent with the intuitive mechanisms mentioned in the literature (Brune et al., 2016; Karlan et al., 2012). This means FI can have implications on poverty

alleviation at least in the Colombian context, since we found an overall positive impact of this variable. In this way, the government could promote FI through policies because the country still has a lot of room for improvement in terms of FI, based on both our indicators and those of the Bank of Opportunities. This would help reduce or alleviate Colombia's monetary poverty (35.7% in 2019), which is expected to increase in the coming years due to the Covid-19 pandemic.

Furthermore, through the analysis along the household income distribution, we find that FI has potential effects on income distribution, as low-income households benefit more from FI than their formal counterparts (as found in Zhang & Posso (2019)). Therefore, FI can also help fight income inequality, which increased in 2019 (0.53 using the Gini index as a measure of inequality) and is also expected to increase in subsequent years as a result of the Covid-19 pandemic. In this way, economic policies can be focused on FI to mitigate these issues (poverty and inequality), especially targeting informal households as they would benefit most.

This paper is a good starting point to understand the possible implications of FI and labor informality on important outcomes such as household income, and thereby poverty and income inequality. In the Colombian context, where the literature on the subject is scarce, the findings of this paper have important implications due to high levels of poverty and income inequality experienced in the country. Nonetheless, for future research it would be valuable to control for possible endogeneity in order to establish clearer causal relationships between FI and household income.

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