

Income Resilience in LAC during COVID-19: Digitalization, and Remittances

Patricia Gascón¹, Gemma Larramona² and Manuel Salvador³

¹ Department of Economic Analysis, Faculty of Economics and Business, Universidad de Zaragoza, 50005, Zaragoza Spain; email: 650912@unizar.es

² Department of Economic Analysis, Faculty of Economics and Business, Universidad de Zaragoza, 50005, Zaragoza Spain; email: gemmalar@unizar.es

³ Department of Applied Economics, Faculty of Economics and Business, Universidad de Zaragoza, 5005; email: salvador@unizar.es

*Corresponding: Gran Vía 2, 50005, Zaragoza ; email: 650912@unizar.es

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Abstract

This study investigates which types of income contributed to total household income resilience during COVID-19 in Latin America and Caribe. The results highlight that family networks, particularly remittances, have played a more significant role in mitigating total income challenges than national and supranational institutions, suggesting the limited effectiveness of institutional aid in times of crisis. Furthermore, it examines the impact of digitalization on household income dynamics, analyzing various income sources and their interaction with digital technologies. Our findings indicate that digitalization positively influenced income growth when measured through an infrastructure index or a professional internet usage index. Digital access enhanced income stability and mitigated income decline. However, when digitalization is assessed through social internet usage, no significant effect was observed on income maintenance or growth.

Key words: COVID-19, remittances, digitalization, household income

1. Introduction

In 2020, the world faced an unprecedented crisis due to the COVID-19 pandemic. Millions of people lost their lives, and the vast majority of the global population experienced significant disruptions in their daily routines. Beyond its impact on public health, COVID-19 also triggered a global economic recession, leading to a contraction in most national economies.

The effects of the pandemic were particularly severe for vulnerable populations, causing a dramatic increase in extreme poverty. In 2020 alone, 70 million people fell into extreme poverty, marking the end of over two decades of steady progress in reducing global poverty and inequality (World Bank, 2022). Specifically, global economic output contracted by 3.5% in 2020 (IMF, 2021). Unlike the Great Recession, this downturn affected not only developed economies but also emerging and developing nations. Among the hardest-hit regions, Latin America and the Caribbean (LAC) experienced the most severe contraction, with GDP declining by 7.4% (IMF, 2021). According with ILO

(2020a) COVID-19 crisis had an unprecedented impact on the job market in LAC, causing the bankruptcy of companies of all sizes, job losses and a sharp drop in people's income. It also highlighted the region's lack of formal employment opportunities, as evidenced by the high rate of informal work. In order to mitigate the economic impact of the pandemic, governments worldwide implemented fiscal measures. Specifically, between 2020 and 2021, over 3 trillion of dollars were spent in order to mitigate the impact of COVID-19 in social assistance, social insurance and labor markets (Gentilini *et al.*, 2022). However, significant disparities emerged between countries: high-income countries spent a total of USD 716 per capita on average while low-income countries only spent USD 8 per capita, while LAC spent USD 285 per capita.

These economic endowments allowed high-income countries to fully offset the impacts of the pandemic on poverty, while upper-middle-income economies offset half, and low- and middle-income economies only a quarter (World Bank, 2022). Literature comes to the same conclusions: fiscal measures were effective in European Union reducing income inequality and poverty (Almeida *et al.*, 2021), while in low-income countries, they were not (Fajardo-González *et al.*, 2021).

In a complex economic environment where there is a limited effectiveness of government measures, it is crucial to examine also the role of remittances in mitigating these adverse effects. Even more in LAC region, a traditional receiving region.

Historically, remittances have demonstrated resilience during financial crises. In financial crisis of 2008, remittances proved greater resilience compared to private capital flows (Ratha & Sirkeci, 2010), and have emerged as one of the primary sources of financing for developing countries due to the large volume of funds received (Alvarez *et al.*, 2015; Ratha, 2003; Tabit & Moussir, 2016). They have also become a crucial component in the fight against poverty and inequality (Acosta *et al.*, 2008; Adams & Page, 2005), with particularly strong impact in Latin America (Vacaflares, 2018).

Assessing the evolution of remittance flows in the global recession triggered by the COVID-19 crisis is essential. Remittances experienced GDP contractions, although the effects of remittance sending and receiving countries are not entirely clear. Several studies have found that remittance flows tend to be positively correlated with the economic conditions of the sending country and negatively correlated with those of the receiving country (Frankel, 2010). Moreover, remittances helped to cushion adverse shocks to receiving country economic activity from natural disasters (Yang & Choi, 2007), offset

the negative effects of rainfall shortages in countries with low level of financial development (Arezki & Bruckner, 2012) and smooth consumption and provided insurance against various shocks including natural disasters (Combes *et al.*, 2014).

The resilience of remittances during the COVID-19 crisis has been demonstrated. Kpodar *et al.* (2022), using a sample of 52 countries, tested the strong resilience of remittance flows during this COVID-19 crisis, reinforcing their critical role in supporting economies during global downturns and absorbing the shock in vulnerable households. Shimizutani & Yamada (2021) found that remittances helped mitigate the negative effects of the pandemic by playing an insurance role in Tajikistan.

In addition to their sustained flow, the most significant change observed in remittances during the pandemic was in the method of sending, driven by the increased use of digital platforms as physical establishments closed due to lockdown measures (CEMLA, 2020; Frisacho & Parrado, 2021). Digitalization not only played a key role in the field of remittances, but also established itself as a determining factor in other sectors. Furthermore, COVID-19 crisis has emerged as the great accelerator of the growing trend towards the adoption of new technologies, as pointed out by Amnkwah-Amoah *et al.* (2021), which represented a change in the labor market and in obtaining income. Piroșca *et al.* (2021) pointed out the existence of a positive correlation between the use of the internet and digital competence and the level of salary, as well as its role in making the labor market more effective and flexible. In addition, some authors found a positive effect of digitalization on income on rural Chine households (Li & Yang, 2023; Li, 2024). These results indicate that we must consider the effect of digitalization to analyze the change in total household income.

The macroeconomic effects of COVID-19 have been undeniable across economies worldwide, as evidenced by a sharp decline in key aggregate indicators such as GDP, economic growth, and employment. However, these macro-level indicators ultimately reflect the aggregated outcomes of millions of households. Understanding how the pandemic affected household income at the micro level is therefore essential, especially given the heterogeneous nature of its impacts and the limited literature that comprehensively examines all income sources at the same study.

This paper aims to identify which types of income contributed to the resilience of total household income during the COVID-19 pandemic. In particular, it considers wages, business income, agricultural rents, government and organizational transfers, as well as

internal and international remittances. Given the growing importance of digitalization during the COVID-19 era, the study also incorporates variables that capture household access to and use of digital tools, such as internet connectivity and banking services. These variables are not only considered independently, but also in interaction with each income source, in order to evaluate their role in enhancing household income resilience. By doing so, the study provides a deeper understanding of the economic consequences of the pandemic from a microeconomic perspective and assesses the extent to which macroeconomic patterns are reflected in the lived realities of households.

The analysis is based on data from 23 countries in Latin America and the Caribbean, using the World Bank's High-Frequency Phone Survey (HFPS), which provides comparable indicators of household living conditions before and after the onset of the crisis. This rich dataset allows for a comprehensive exploration of income dynamics in the region and the factors that shaped them. The results enhance our understanding of the factors that supported household income resilience in Latin American families during the COVID-19 crisis. The analysis highlights the critical role of digitalization in stabilizing income, particularly through salaries, business revenues, and remittances, while noting that its effectiveness varied depending on its specific application. Additionally, the research underscores the importance of salary, agricultural, and business income in sustaining household stability, also emphasizing that remittances served as a more effective safety net than institutional aid during the crisis. These results can help design public policies aimed at strengthening household resilience.

The remainder of this paper is organized as follows. Section 2 reviews the results found in the literature. Section 3 introduces the High-Frequency Phone Survey (HFPS) and data description. Section 4 describe the methodology and the econometric models. Section 5 analyzes the results, pointing out the effects of digitalization on the evolution of total household income, as well as the impact of each source of income. Finally, Section 6 provides the conclusions and discusses policy implications. Additionally, three appendices are included: Appendix 1 provides information on the variables, Appendix 2 presents the baseline models incorporating the digitalization index, and Appendix 3 contains the extended and interaction models.

2. Review of the literature

The COVID-19 crisis caused that the unemployment rate in LAC reached 10.6% at the end of 2020, representing the most significant economic downturn in the last century

(ILO, 2020a). Furthermore, assessing the labour market impact of the pandemic requires not only considering job losses but also reductions in working hours among those who remained employed. In LAC, working hours declined by 20.9% in the first three quarters of 2020, while labor income fell by 19.3% (ILO, 2020a). The pre-pandemic labor market conditions played a crucial role in shaping the impact of the crisis. Key factors included the structure of labor market (economic sectors and ratio of informality), the level of restrictions imposed to curb the spread of the virus and the ability of workers to perform their jobs remotely.

Firstly, the structure of the labor market determined the differences in the resilience of jobs in different countries. In LAC, the contraction in employment was mainly experienced in the services sector (-17.6%), construction (-13.6%), trade (-12.0%) and industry (-8.9%), with the agricultural sector showing greater resilience (-2.7%) (ILO, 2020a). Using representative data from 31 developing countries, Bundervoet *et al.* (2022) found that LAC experienced greater job losses because the dependence of these sectors, than sub-Saharan Africa and Eastern Asia and the Pacific, that had more presence of agricultural jobs.

It not only affected the sector, but also the quality of employment: in LAC around 60% of the workforce in the region was either informal or self-employed making LAC labor market particularly vulnerable (Levy-Yevati & Valdés, 2020). This kind of employment are more common among households with lower incomes (Busso *et al.*, 2020). Furthermore, these workers lack stability and social protection (Goñi *et al.*, 2011). For these reason, informal workers were particularly vulnerable to the pandemic (ILO 2020b, OECD 2020).

According to literature, some groups were disproportionately affected by job losses: women, less-educated workers, and urban employees (Bundervoet *et al.*, 2022; Kugler *et al.*, 2023). Specifically, Bundervoet *et al.* (2022) found that urban workers were more affected by the short-term economic consequences of the pandemic, with 41 percent reporting job loss versus 28 percent of rural workers, although in the regression location was only found to be marginally correlated.

Secondly, the relationship between job losses and the stringency of virus containment measures had also been analyzed in the literature. Bundervoet *et al.* (2022) demonstrated that in countries with the lowest level of stringency, the average probability of job loss

was 18.8%, whereas in countries with the highest stringency, it rose to 42%. Similarly, Brunckhorst *et al.* (2024) found that a 10% increase in the stringency index was associated with a 2.4% increase in the probability of job loss. Regarding Latin America, it was affected by the severity of lockdowns, that were among the highest globally, further exacerbating the impact on precarious employment sectors (Levy-Yevati & Valdés, 2020).

Thirdly, due to the lockdown measures, teleworking became popular. However, not all workers were able to work remotely. Gottlieb *et al.* (2021) demonstrated that the capacity of teleworking was strongly correlated with the likelihood of remaining employed during the pandemic. However, the feasibility of remote work varied significantly between developed and developing economies. For example, in United States the 37% of jobs could be performed remotely (Dingel & Neiman, 2020), while the proportion was much lower in developing economies. For instance, this proportion was below 25% in Mexico and Turkey, 13.3% in Brazil, and 10.6% in Costa Rica (Gottlieb *et al.*, 2021). The findings of Brunckhorst *et al.* (2024) also establish a diminishing role for remote work in developed countries.

The ability to work remotely was largely influenced by education level and employment type. According with Brunckhorst *et al.* (2024), those least likely to work from home included low-skilled workers, individuals in low-wage occupations and the self-employed. The latter faced particular challenges, as their work often depended on foot traffic and direct personal interaction, making telework impractical (Gottlieb *et al.*, 2020). Moreover, Delaporte *et al.* (2021) found that the feasibility of remote work was strongly correlated with income level, with lower-income workers having significantly fewer opportunities to telework.

The labor market in the LAC region was severely impacted due to the presence of highly affected sectors, its large number of informal workers and its limited capacity for remote work. Additionally, governments in low- and middle-income countries faced difficulties in implementing effective support. While high-income nations allocated substantial resources to assist individuals and businesses, middle and low-income countries lacked the fiscal capacity to offer similar levels of support because of restricted access to financing, poor delivery systems and high informality, which hindered job protection and the equitable distribution of taxes, subsidies and transfers (World Bank, 2022).

In low and middle income countries, government transfers took an average of nearly three months to reach beneficiaries, despite the immediate impact of income losses and increased food insecurity (Beazley *et al.*, 2021). Low banking penetration was an added challenge (World Bank, 2022), although where digital means of payment existed, payment was expedited (Busso *et al.*, 2020; Beazley *et al.*, 2021).

In LAC, government responses to the crisis primarily involved subsidies for formal workers and cash transfers for others. One of the main challenges in delivering aid was identifying households in need, particularly those not regularly enrolled in social protection programs or engaged in informal work (Levy-Yevati & Valdés, 2020). The difficulty in accurately targeting those resulted in many informal workers lacking adequate support. This issue was even more severe for poor and vulnerable households without sufficient savings or assets to cushion their income losses (Gentilini *et al.*, 2020).

Due to the loss of employment suffered in LAC and the limited effect of the aid implemented by governments, remittances were expected to play a crucial role in mitigating the economic impact of the COVID-19 crisis. According to central bank data, remittances to Latin American countries declined sharply in April 2020, following the strict mobility restrictions imposed in both sending and receiving countries. However, the impact varied across countries (Caruso *et al.*, 2021). For example, Colombia and El Salvador were the most affected with a 38.5% and 40% decline relative to April 2019, while Mexico experienced the smallest drop, only 2.6%¹.

According to literature, the initial decline in remittances was largely driven by uncertainty and the abrupt economic slowdown in the early months of the pandemic (Shimizutani & Yamada, 2021), but it gradually stabilized. The economic recession and containment measures in migrant-receiving countries, which would typically exert downward pressure on remittances, were counterbalanced by migrants' urgent need to support their families faced worse economy difficulties, driven by altruism or insurance motives (Kpodar *et al.*, 2022). This pattern aligns with the altruistic motivation for remittances described in classical literature (Lucas & Stark, 1985).

Despite this initial drop, remittances to the region rebounded along the year 2020, reaching 101.1 billions of dollars, an increase of 8.4% from 2019. Specifically, they increased by 5.7% in Central America, 18.2% in the Caribbean and 11.4% in Mexico,

¹ See Pew Research post: “Amid COVID-19, remittances to some Latin American nations fell sharply in April and then rebounded”.

while in the group of South American and Andean countries they decreased by 1.0% and 4.4%, respectively (CEMLA, 2020). This decline in South American and Andean countries was largely because a significant portion of their remittances came from neighboring nations, which were also severely impacted by the COVID-19 pandemic. As a result, many migrants in these countries faced economic hardship and were unable to send remittances.

In contrast, remittances increased in other parts of the region because they mainly originated from developed countries, particularly the United States, where the relative economic stability of migrants allowed them to continue sending financial support to their home countries. Remittance-sending economies also experienced rising unemployment and economic slowdowns, but sectors with high concentrations of migrant labor, such as agriculture, food supply chains and healthcare were classified as essential industries and not suffer severely impact (Frisancho & Parrado, 2021). Moreover, remittance-sending countries tended to have lower levels of informal employment, and many developed countries implemented economic policies to protect jobs², including fiscal stimulus measures, that benefited migrants by increasing their capacity to send remittances, although undocumented workers were largely excluded (Kpodar *et al.*, 2022; Frisancho & Parrado, 2021). For example, more than 40% of Venezuelan migrants living in Brazil, United States, Canada, Italy and Chile said they had received support from the government in the country where they resided, and 34% of them used that income to send remittances, so these supports helped migrants to send remittances (CEMLA, 2020). There were also migrants who used their savings to continue sending remittances or that, due to the impossibility of visiting their country of origin due to the closure of borders, they allocated that money to sending remittances (CEMLA, 2020).

It should also be noted that remittance flows were not only due to the economic capacity of migrants but also to their ability to access means of sending money. Before COVID-19, 80% of remittances were sent from physical locations. These remittance operators had to adapt due to the restrictions and offered non-face-to-face services, allowing migrants to continue sending remittances (CEMLA, 2020). In this way, remittances were redirected to digital media (Frisancho & Parrado, 2021).

² For example, Paycheck Protection Program (PPP) in USA or Temporary Employment Regulation Files (ERTE) in Spain.

The shift from informal to formal channels could have partly driven the increase in remittances (Kpodar *et al.*, 2022; Dinarte *et al.*, 2021). In particular, digitalization has facilitated this transition (Emara and Zhang, 2021). Although digital remittance services required migrants to have a bank account in the U.S., limiting their accessibility, as many migrants lacked the necessary documentation to open a bank account or preferred to manage their financial transactions outside the formal financial system (Frisancho & Parrado, 2021).

In summary, the change in total income in LAC during the COVID-19 crisis was driven by a combination of job losses, reduction in working hours, vulnerability of labor markets and changes in external transfers. In a context where lockdowns and social distancing were essential to combating the virus, but their intensity varied across countries, digitalization played a crucial role in sustaining society. It enabled remote work to protect employment, facilitating the distribution of government aid, and allowing remittances to be sent through digital channels. Therefore, digitalization must be considered a key factor when analyzing the evolution of household income.

3. High-Frequency Phone Survey (HFPS)

High-Frequency Phone Survey (HFPS) is a World Bank initiative conducted in Latin America and the Caribbean to evaluate the socio-economic impacts of the COVID-19 pandemic on households. The first wave of data collection took place between May and July 2021, covering 23 countries: Antigua & Barbuda, Belize, Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, Panama, Haiti, Peru, Mexico, Argentina, Chile, Colombia, Bolivia, Guyana, Ecuador, Paraguay, Uruguay, Saint Lucia, Dominica, the Dominican Republic, and Jamaica. The survey utilized a dual-frame approach, generating cell phone and landline numbers through Random Digit Dialing (RDD).

The 2021 HFPS gathered data on employment and income changes, food insecurity and access to health, education, and financial services. It also enabled comparisons with the 2020 HFPS on key household and individual living conditions. Additionally, the 2021 phase expanded its scope to include internet access, digital banking, gender issues, mental health, coping strategies, and childcare. The survey remained representative of individuals aged 18 and above with access to either a cell phone or landline.

HFPS employed two sampling units: households and individuals, although only one adult per household was interviewed. Specific weights were calculated for each unit of analysis,

which must be properly applied to ensure accurate estimates (see Mejía et al., 2022, for more details)³. In this study, the household is considered the sampling unit.

The following sections present data on the evolution of total household income and its components, along with information on internet access and usage among the surveyed households.

3.1. Changes in total income and its composition due to COVID-19

This section presents some stylized facts⁴ about the change produced by COVID-19 in total income and its composition.

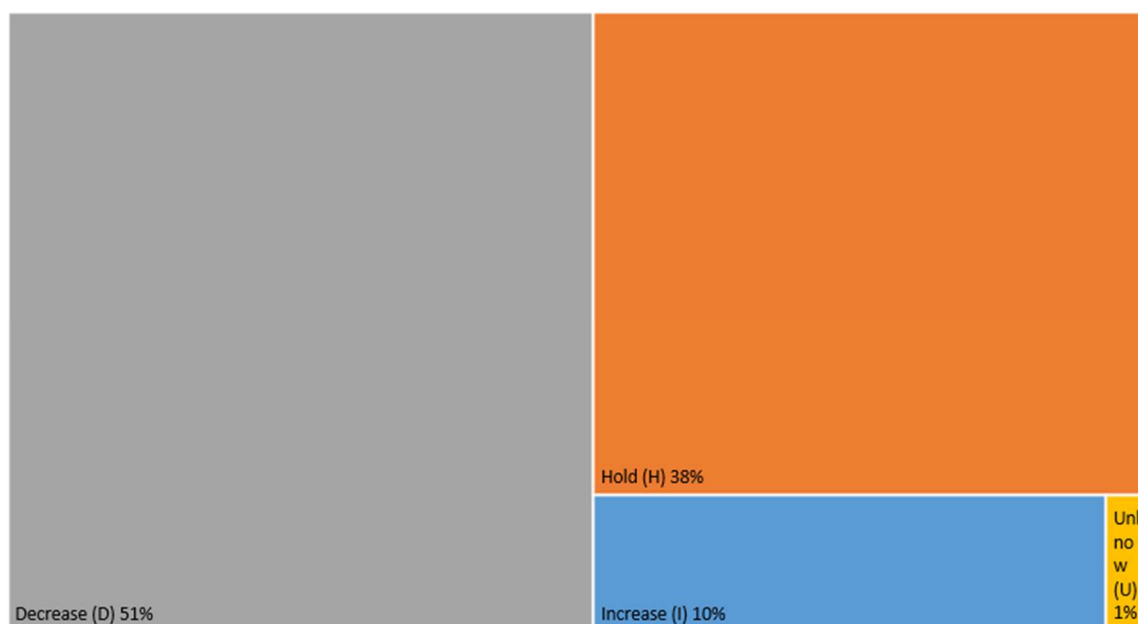
Total household income is an aggregate magnitude that includes several concepts: salaries, income from own or family business, self-employment, their own account (summarized in two variables: agricultural income and income from other business), government transfers or NGO assistance (including foundations and church), internal transfers (from family and friends) and remittances from abroad. Database presents only qualitative data, that is, if the total income and their components increase, decrease, or hold in the same amount than before COVID-19.

Figure 1 illustrates that the primary impact of COVID-19 was a decline in total household income, affecting 51% of households, while only 38% maintained their income levels.

³ <https://microdata.worldbank.org/index.php/catalog/4571>

⁴ Weight provided in the database are used to calculate the descriptive statistics.

Figure 1: Change in the total household income from pre-COVID19 to 2021



Source: *High-Frequency Phone Surveys (HFPS)*, 2021

A country-specific analysis reveals variations, as Table 1 shows. In El Salvador, the majority of households (51.92%) retained their income, and in Honduras, Nicaragua, Guatemala, and Mexico, more than 45% of households maintained their income compared to those experiencing a reduction. In contrast, 24.65% of households in Argentina saw an increase in total income post-COVID-19, whereas this figure dropped to just 3.69% in Ecuador. Notably, Haiti, Colombia, Ecuador and Belize recorded proportion of households facing an income decline greater than 65%.

Table 1: Change in the total household income from pre-COVID19 to 2021 by country

	Increase	Hold	Decrease	Unknown
Antigua	9.41%	40.43%	47.23%	2.93%
Belize	6.30%	26.62%	65.50%	1.59%
Guatemala	6.03%	48.21%	45.14%	0.62%
El Salvador	8.90%	51.92%	38.90%	0.27%
Honduras	9.06%	49.01%	40.95%	0.97%
Nicaragua	9.04%	46.17%	44.42%	0.37%
Costa Rica	4.75%	44.61%	50.45%	0.19%
Panamá	5.22%	36.78%	58.00%	0.00%
Haiti	7.83%	16.78%	67.69%	7.69%
Peru	5.21%	30.35%	64.32%	0.12%
Mexico	8.76%	45.95%	44.16%	1.12%
Argentina	24.65%	35.04%	38.80%	1.52%
Chile	14.71%	41.88%	43.10%	0.31%
Colombia	5.79%	27.36%	66.69%	0.16%

Bolivia	7.16%	32.17%	60.04%	0.63%
Guyana	9.15%	39.25%	47.29%	4.31%
Ecuador	3.69%	29.92%	65.99%	0.40%
Paraguay	7.01%	30.95%	61.71%	0.34%
Uruguay	13.14%	42.63%	43.44%	0.79%
Santa Lucia	8.91%	33.00%	55.08%	3.01%
Dominica	10.14%	34.26%	52.62%	2.97%
Dominican Republic	11.31%	40.54%	47.80%	0.35%
Jamaica	11.21%	30.87%	53.15%	4.77%
Total	9.85%	38.04%	51.25%	0.86%

Source: *High-Frequency Phone Surveys (HFPS)*, 2021

Table 2 shows the percentage of households that did or did not receive each source of income contributing to total household income. For each income source, the rows "Increase," "Hold," "Decrease," and "Unknown" indicate the percentage of households (among those who received that income) that experienced each type of change. Specifically, the income sources included are wages (salary), agriculture, other business, transfers of government (transfers) or non-governmental organization assistance (NGO) and remittances internes (internal) and international (remittances).

It is noticed that most households (86%) received salaries, and nearly 42% earn income from businesses. However, the majority did not receive agricultural income, government transfers, NGO or internal and external remittances. Notably, except for government transfers, all other income sources mainly decreased during this period among recipients. This result was largely due to Latin American governments implementing cash and in-kind transfers to support vulnerable families most affected by lockdowns, as highlighted by Levy and Valdes (2020).

Remittances from abroad constitute a component of total household income. The majority of households in the sample, a 92.6%, did not received remittances before of Covid-19. Among those that did, a 7.4% of total of households, 51.8% of them reported a decrease in the amount received during the COVID-19 pandemic, while only 9.3% experienced an increase.

Table 2: Income sources received by households before COVID-19 and subsequent changes among recipients.

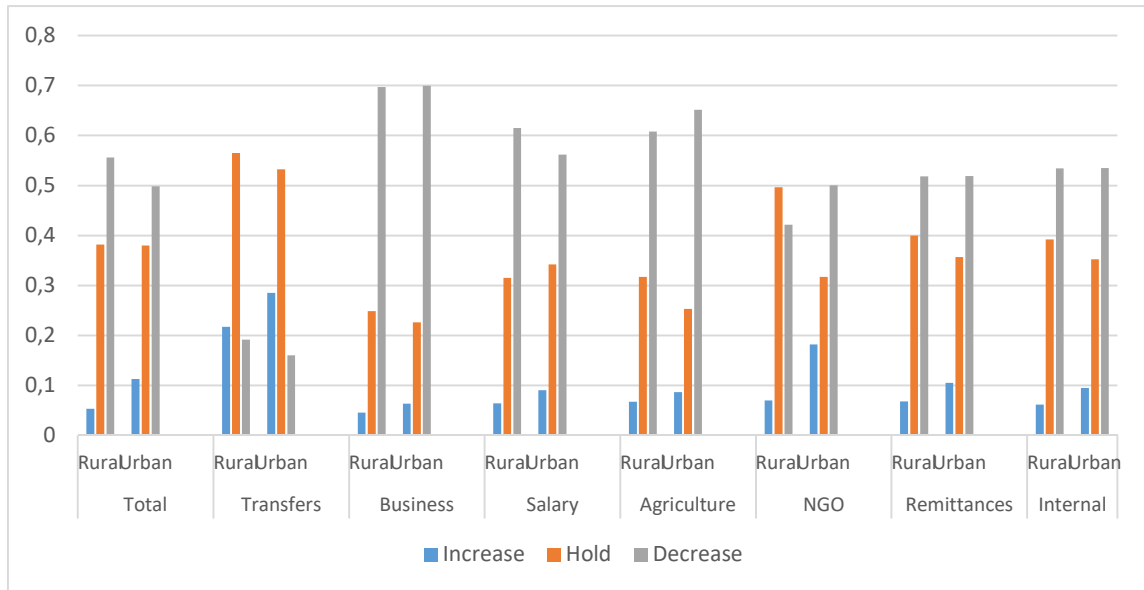
	Salary	Business	Agriculture	Transfers	NGO	Remittances	Internal
No receiving	13.9%	57.9%	91.1%	80.9%	98.1%	92.6%	88.4%
Receiving	86.1%	42.1%	8.9%	19.1%	1.9%	7.4%	11.6%
Increase (I)	8.5%	6.0%	7.6%	26.4%	14.2%	9.3%	8.6%
Hold (H)	33.6%	23.2%	28.9%	54.3%	38.4%	37.1%	36.3%
Decrease (D)	57.4%	69.9%	62.7%	17.0%	47.4%	51.8%	53.5%
Unknown (U)	0.5%	1.0%	0.8%	2.2%	0.0%	1.8%	1.6%

Source: *High-Frequency Phone Surveys (HFPS)*, 2021

A country-level analysis of HFPS data revealed significant cross-national differences in remittance reception. In Haiti and Jamaica, approximately 50% of households received external remittances. In contrast, in Argentina, Uruguay, and Chile, less than 2% of households benefited from remittances, despite Argentina and Uruguay experienced an almost 30% increase in the total remittances received. For other countries, the proportion of households reporting an increase in remittances following the COVID-19 pandemic ranged from 2% in Costa Rica to 18% in Bolivia. Notably, in Argentina and Chile, over 50% of households retained the remittances they received. Conversely, Haiti exhibited the highest percentage of households experiencing a decline, with 75% reporting a reduction in remittance inflows after the pandemic.

Beyond cross-national differences, disparities also existed based on household location. Specifically, households situated in rural areas exhibit a lower likelihood of experiencing an increase in total income or in any of its individual components, as illustrated in Figure 2.

Figure 2: Change in the different incomes from pre-COVID_19 to 2021 for rural and urban areas



Source: *High-Frequency Phone Surveys (HFPS)*, 2021

3.2. Digitalization index

As highlighted in the literature (Li & Yang, 2023; Li, 2024), digitalization has had a positive impact on household income, and for this reason, it is included into our analysis. Given that digitalization is a multidimensional concept, we used all available information from the survey, which included data on both household access to technology and its usage. To this end, three indices were constructed: the first measured household access to digitalization using principal component analysis (PCA), while the other two were focused on usage, applying multiple correspondence analysis (MCA).

To construct the first index, three variables were considered: number of smartphones, mobile data availability and computers or tablets within the household. To account for household size, these measures were adjusted by the number of household members, creating per capita ratio. Regarding digitalization tools, such as smartphones and computers (see Table 3), Antigua and Barbuda exhibited the highest per capita ratio, while Haiti reports the lowest. In terms of mobile data, Chile demonstrated the greatest access, whereas Guyana had the lowest.

Table 3: Mean of smart phones, mobile data and computers per capita in 2021

Country	Smart phones	Mobile data	Computer
Antigua and Barbuda	0.906	0.574	0.478
Belize	0.627	0.267	0.278
Guatemala	0.523	0.346	0.127
Salvador	0.661	0.409	0.162
Honduras	0.561	0.319	0.123
Nicaragua	0.566	0.302	0.092
Costa Rica	0.778	0.514	0.286
Panamá	0.726	0.465	0.203
Haiti	0.417	0.359	0.070
Peru	0.606	0.405	0.189
Mexico	0.715	0.508	0.273
Argentina	0.777	0.601	0.353
Chile	0.864	0.724	0.477
Colombia	0.631	0.396	0.174
Bolivia	0.705	0.497	0.252
Guyana	0.662	0.224	0.280
Ecuador	0.572	0.250	0.184
Paraguay	0.689	0.462	0.193
Uruguay	0.833	0.648	0.445
Santa Lucia	0.858	0.336	0.450
Dominica	0.829	0.362	0.426
Dominican Republic	0.695	0.362	0.214
Jamaica	0.843	0.470	0.366
TOTAL	0.688	0.474	0.252

Source: *High-Frequency Phone Surveys (HFPS)*, 2021

In order to construct an index that measures the household digitization, PCA was applied, helped to mitigate potential collinearity issues. This index integrates three key variables: the number of smartphones, mobile data availability and the presence of computers or tablets within the household. All these variables were standardized by household size to ensure comparability.

The results are shown in Table 4, which showed that, according to the Kaiser criterion, only one principal component was retained, explaining 68.79% of the total variation.

Table 4: Principal components analysis results

PC	Eigenvalue	Proportion	Cumulative
PC1	2.0637	0.6879	0.6879
PC2	0.5986	0.1995	0.8875
PC3	0.3376	0.1125	1.0000

Source: *Own elaboration*

In Table 5, the correlation of each variable with this principal component is shown. PC1 is correlated positively with all the variables. For this reason, we named it the *Digital Access Index (DAI)* in such a way that if a household has a high (low) level of digitalization, it corresponds to a household with a high (low) number of smartphones, mobile data and computers per capita, i.e., it corresponds to a household with a high (low) access to digitalization devices.

Table 5: Correlation of PC1 with digitalization variables

Variable	PC1
Smart phones	0.8597
Mobile data	0.7943
Computer	0.7277

Source: *Own elaboration*

To complement the first index, two additional indices were developed to capture how households use digital technologies. The survey included several questions designed to measure this dimension. Table 6 summarizes the percentage of respondents who reported using the internet across all countries in the sample.

Table 6: Internet usages in 2021

Internet Usages	Mean	Std. Err.
EMAIL	3.60%	0.27%
SOCIAL NETWORKS	25.61%	0.63%
GENERAL BROWSING/NOTICE	22.30%	0.60%
INSTANT MESSAGING (WHATSAPP, SKYPE..)	29.80%	0.65%
BANK CONSULTATION OR TRANSACTION	1.33%	0.16%
BUY OR SELL ONLINE	1.08%	0.14%
ONLINE EDUCATION	45.13%	0.71%
REMOTE WORK	21.40%	0.58%
ACCESING GOVERNMENT SERVICES ONLINE	0.44%	0.07%
ENTERTAINMENT (GAMES, NETFLIX..)	26.61%	0.63%
OTHER	5.52%	0.34%
RECEIVE MONEY MOBILE WALLET	15.56%	0.50%
SEND MONEY MOBILE WALLET	19.49%	0.57%
APP FOR BANK TRANSACTIONS	46.11%	0.72%

Source: *High-Frequency Phone Surveys (HFPS), 2021*

It can be seen a high prevalence of internet use for app of bank transactions (46.11% of the households) and online education (45.13%), with nearly half of the population utilizing the internet for these purposes. However, access to government services online

(0.44%) remained minimal, which may be attributed to the inadequate adaptation of government services to the changing circumstances during the pandemic. It is also worth noting that only 21.40% of the sample used the internet for remote work, underscoring the limited popularity of teleworking in LAC compared to developed countries.

In the same way that the Digital Access Index was developed, and given the nominal character of the variables, we carried out a MCA (Benzécri, 1973; Greenacre, 1984) to analyze the different uses of the internet by households. The obtained results are shown in Table 7. We retained two dimensions, which explain the 55.36% of the total inertia.

Table 7: MCA Results

Dimension	Inertia	Explained Percentage of Total Inertia	Cumulative Percentage of Total Inertia
Dim 1	0.0027	48.84	48.84
Dim 2	0.0004	6.52	55.36
Dim 3	0.0002	3.79	59.15
Dim 4	0.0001	2.53	61.68
Dim 5	0.0000	0.19	61.87
Dim 6	0.0000	0.04	61.91
Total	0.0057	100.00	

Source: *Own elaboration*

Table 8 shows the standardized principal coordinates of the initial variables. Thus, on the one hand, we have the first dimension highly related with sending and receiving money via mobile, consulting the bank's app and with remote work. On the other hand, the second dimension is related with the use of the Internet for social networks and instant messages and inversely with remote work. For ease of interpretation, the first dimension was introduced in its inverse form, so that higher values reflect greater engagement with digital finance and professional uses. Based on the variables captured by each of the dimensions, the first can be named as *Digital Finance and Professional Usages Index (DFPI)*, and the second, the *Digital Social Usages Index (DSI)*. Notice, in particular, that remote work is directly related with DFPI and inversely with DSI. This highlights that household, which developed remote work, tended to make more Internet uses related with digital finance operations and less Internet usages related to social relationships activities. These indices help to highlight the main uses of digital technology of households, facilitating the analysis of their impact on household income.

Table 8: Standardized principal coordinates of the initial variables

Internet Usages	Dim1	Dim2
EMAIL	-0.0087	0.0758
SOCIAL NETWORKS	-0.0229	0.5527
GENERAL BROWSING/NOTICE	0.1151	0.1293
INSTANT MESSAGING (WHATSAPP, SKYPE..)	-0.2190	0.5828
BANK CONSULTATION OR TRANSACTION	0.0329	-0.0847
BUY OR SELL ONLINE	0.0578	-0.1062
ONLINE EDUCATION	0.2570	-0.1268
REMOTE WORK	0.4789	-0.4537
ACCESING GOVERNMENT SERVICES ONLINE	0.0039	-0.0075
ENTERTAINMENT (GAMES, NETFLIX..)	0.1824	-0.0568
OTHER	-0.1292	-0.3340
RECEIVE MONEY MOBILE WALLET	0.7091	0.3339
SEND MONEY MOBILE WALLET	0.7702	0.2627
APP FOR BANK TRANSACTIONS	0.4125	-0.2109

Source: *Own elaboration*

Table 9 shows the value of the three indices for the analyzed countries. Countries with a high Digital Access Index were Chile, Uruguay and Antigua & Barbuda, while Ecuador, Nicaragua and Haiti were the countries with the lowest values. Regarding Internet uses, Haiti was the country with the highest Digital Finance and Digital Social uses, followed by Paraguay in the case of Digital Finance and Nicaragua in the case of Digital Social uses.

Table 9: Index average values for the analyzed countries

Country	Digital Access Index (DAI)	Digital Finance Index (DFPI)	Digital Social Index (DSI)
Antigua & Barbuda	0.890	0.020	0.100
Belize	-0.225	-0.109	0.091
Guatemala	-0.310	-0.257	-0.161
El Salvador	-0.030	-0.541	-0.070
Honduras	-0.399	-0.149	0.363
Nicaragua	-0.468	-0.0691	0.541
Costa Rica	0.352	-0.349	-0.195
Panamá	0.107	-0.235	-0.151
Haiti	-0.595	2.797	1.988
Peru	-0.160	0.290	0.024
México	0.263	0.015	-0.126
Argentina	0.711	0.396	0.057
Chile	1.083	0.054	-0.583
Colombia	-0.183	-0.094	0.055
Bolivia	0.181	-0.086	0.006
Guyana	-0.267	-0.317	0.201

Ecuador	-0.440	-0.190	-0.277
Paraguay	0.182	0.675	0.485
Uruguay	0.949	-0.232	-0.140
Santa Lucia	0.436	-0.296	-0.187
Dominica	0.390	-0.355	-0.043
Republic			
Dominican	-0.086	-0.549	0.162
Jamaica	0.521	-0.388	-0.291

Source: *Own elaboration*

The introduction of indices capturing different dimensions of digitalization will enable us to conduct a more comprehensive and robust analysis.

4. Econometric Model Specification

The objective of this paper is to analyze the effect of digitalization and variations in individual income sources on the change in total household income, comparing the situation of each household before and after the onset of COVID-19. To this end, the dependent variable is the change in total household income, defined as a categorical variable with four possible outcomes: Increase (I), Hold (H), Decrease (D), and Unknown (U). The categorical nature of this variable determined the choice of model. We apply a multinomial logistic regression model, which allows us to estimate, for each household, the conditional probability of experiencing each of the possible income change outcomes, based on changes in income components, the level of digitalization and types of internet use.

Although the dependent variable presents a structure that could be interpreted as ordinal, with categories such as “Increase,” “Maintain,” and “Reduce”, a multinomial logit model (mlogit) was chosen instead of an ordinal logit model (*ologit*). This decision was based on two main considerations. First, for the ordinal model to be valid, the parallel lines assumption (or proportional odds) must hold. This assumption implies that the coefficients describing the relationship between the independent variables and the dependent variable remain constant across the different thresholds. To verify this condition, specific tests were applied, such as the Brant test and likelihood-ratio tests comparing restricted and unrestricted models. The results indicated that the assumption does not hold, thereby invalidating the *ologit* model due to misspecification. Second, the multinomial logit model allows for the inclusion of the “Don’t know/No answer” category, which, while not a substantive alternative in the same sense as the others, reflects a real survey response. Although this category represents only 2% of the observations, excluding it could introduce selection bias if non-respondent households

differ systematically from the rest. Consequently, the multinomial logit model offers a more flexible and appropriate specification, both technically and empirically, as it better fits the nature of the data and makes fuller use of the available information (Long & Freese, 2014).

The model estimates the conditional probabilities of each category given the characteristics $\mathbf{X} = (X_1, \dots, X_k)'$ of each household by means of the expressions:

$$P(\text{Income} = H | \mathbf{X}) = \frac{1}{1 + \sum_{k=1}^3 \exp \left[\beta_{k0} + \sum_{i=1}^K \beta_{ki} X_i \right]}$$

$$P(\text{Income} = I | \mathbf{X}) = \frac{\exp \left[\beta_{10} + \sum_{i=1}^K \beta_{1i} X_i \right]}{1 + \sum_{k=1}^3 \exp \left[\beta_{k0} + \sum_{i=1}^K \beta_{ki} X_i \right]}$$

$$P(\text{Income} = D | \mathbf{X}) = \frac{\exp \left[\beta_{20} + \sum_{i=1}^K \beta_{2i} X_i \right]}{1 + \sum_{k=1}^3 \exp \left[\beta_{k0} + \sum_{i=1}^K \beta_{ki} X_i \right]}$$

$$P(\text{Income} = U | \mathbf{X}) = \frac{\exp \left[\beta_{30} + \sum_{i=1}^K \beta_{3i} X_i \right]}{1 + \sum_{k=1}^3 \exp \left[\beta_{k0} + \sum_{i=1}^K \beta_{ki} X_i \right]}$$

where Income denotes the household total income and we took the category Hold as the reference category.

The analysis considers as explanatory variables different types of household incomes: salaries, agricultural income, other business income, government transfers, support from NGOs, internal transfers (excluding government aid), and remittances. These are categorical variables that indicate whether each type of income increased, remained the same, decreased, or is unknown compared to pre-COVID-19 levels. In the model, these variables are represented using dummy variables, with households that did not receive that specific type of income before the crisis serving as the reference group. In addition, the three developed indices (DAI, DFPI, and DSI) and its interaction with each type of income are also included. All these variables are summarizing in Appendix 1.

Finally, and given the significant cross-country differences observed in the descriptive statistics, the household's country of residence is included as control variable in all

models. Similarly, due to the disparities between rural and urban households, a binary variable is also included as a control.

Nine models were considered: the baseline model that includes only the country effects (Model 1). Models 2 to 4 add each digitalization index, DAI, DFPI and DSI to the baseline model, respectively. Model 5 introduces at the same time both uses of internet (DFPI and DSI), Model 6 also introduces DAI, and Model 7 – 9 introduces each index and their interaction with each type of income. Table 10 summarize the baseline model and the extensions developed in the next section. Stata 15.0 software has been used in this analyze.

Table 10: Models considered in the paper

Model	Digitalization Variable Introduced	Interaction between digitalization and type of income
Model 1	None	-
Model 2	DAI	No
Model 3	DFPI	No
Model 4	DSI	No
Model 5	DFPI and DSI	No
Model 6	DAI, DFPI and DSI	No
Model 7	DAI	DAI and variables of different type of income
Model 8	DFPI	DFPI and variables of different type of income
Model 9	DSI	DSI and variables of different type of income

Source: *Own elaboration*

The regression β coefficients estimated for each multinomial logit model considered in the paper are shown in appendices 2 (Models 1 to 4) and 3 (Models 5 to 6). The sample size used for the model estimations ranged between 24,061 and 24,816 households, depending on the digitalization variables included in each specification.

In addition, we calculated the McFadden's pseudo R^2 and the values of the Wald test together with its p-value where we test if all the β coefficients are equal to 0. In all models this hypothesis was rejected, confirming that at least one of the explanatory variables significantly contributes to the model. Furthermore, all models demonstrated an adequate goodness-of-fit, as reflected by McFadden' pseudo R^2 , which exceeds 0.34 in all models, suggesting a satisfactory explanatory power. According to the literature, McFadden

(1974) and Long (1997) establish that values of McFadden's pseudo R^2 between 0.2 and 0.4 indicate a good model fit in the context of discrete choice models, making the results obtained here consistent with these benchmarks.

Among the estimated models, Model 7 provided the best fit based on the Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC), which yields the lowest value. Moreover, to ensure that the models are properly fitted, a cross-validation analysis was conducted. The models were estimated using 80% of the sample and then used to predict the remaining 20%. The comparison between the predicted and actual values indicates that all models achieve an accuracy exceeding 80%.

5. Analysis of the Contribution of Digitalization and Sources of Income to Household Resilience.

To facilitate the interpretation of the results, in this section the marginal effects derived from selected models are presented, which provide a basis for analyzing the contribution of each income component and the impact of digitalization. Specifically, Tables 11, 12, and 13 show the marginal effects of the independent variables on the conditional probabilities of household income evolution in Models 2, 6, 7, 8, and 9.

Models 2 and 6 do not include interactions between digitalization variables: the first one incorporates only the Digital Access Index DAI (Table 10), while the second one additionally includes the two internet usage indices, DFPI and DSI (Table 10). The remaining three models introduce interactions between the three indices DAI, DFPI and DSI, and income components (Table 10).

The main findings are presented in the following subsections. The first subsection focuses on the effects of the digitalization indices, while the second examines the role of each income source. Similar patterns were found among the main income sources, which differ from those observed for secondary sources. For this reason, we first present the results related to wages, agriculture, and other businesses, followed by those related to government transfers, NGO assistance, and domestic and international remittances.

5.1. Digitalization Findings

The results shown in Table 11 highlight that:

- Household with high values of Digital Access and Finance and Professional Usages of Internet tended to significantly increase or, at least, to hold their income. Similarly, Digital Access reduces households that decrease income.

- There are not significant effects of internet usage for social purposes on the household income evolution.
- Not all uses of the Internet significantly influenced in the increase in household income. Hence, the need to educate the population on the use of digitalization in different environments, and to promote the digitalization of financial development are highlighted.

Table 11 Marginal Effects for digitalization indices.

Variable	Model				
	Model 2	Model 6	Model 7	Model 8	Model 9
DAI					
Increase	0.0118*** (0.0021)	0.0102*** (0.0020)	0.0155*** (0.0032)		
Hold	0.0194*** (0.0069)	0.0235*** (0.0070)	0.0136 (0.0083)		
Decrease	-0.0318*** (0.0069)	-0.0343*** (0.0070)	-0.0291*** (0.0082)		
Unknown	0.0005*** (0.0002)	0.0005*** (0.0002)	-0.0000 (0.0003)		
DFPI					
Increase		0.0089*** (0.0025)		0.0141*** (0.0030)	
Hold		-0.0173*** (0.0066)		-0.0191*** (0.0072)	
Decrease		0.0084 (0.0068)		0.0046 (0.0071)	
2Unknown		0.0000 (0.0002)		0.0003 (0.0002)	
DSI					
Increase		-0.0004 (0.0036)			-0.0002 (0.0050)
Hold		0.0076 (0.0085)			0.0076 (0.0084)
Decrease		-0.0075 (0.0091)			-0.0077 (0.0087)
Unknown		0.0004 (0.0005)			0.0003 (0.0002)

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

The results about the household digitalization effects on their income are aligned with those found in the literature (Li & Yang, 2023; Li, 2024). Furthermore, it seems that these effects go beyond those established by the literature on maintaining employment through teleworking and greater ease in receiving government transfers or remittances, since once the evolution of these types of income is controlled, the DAI and DFPI present a positive effect in increasing and maintaining income and decreases households that receive lower income.

5.2 Income components findings

5.2.1 Agriculture/ Other Business/Salary,

The results shown in Table 12 highlight that:

- If a household's income from salary, agriculture, and other business increase, the probability of overall income growth tended to hold or increases. This effect tended to be more pronounced when interaction with digitalization is considered, particularly for other business and salary than agriculture, likely due to the sector's lower digital dependency.
- Increases in these types of income also had an effect in reducing the number of households that reduce their income. Whereas the effects on households that maintain their income were different for agriculture income from for business and salary. An increase in agriculture income had a positive effect on likely of maintaining income, independently from its interaction with digitalization index. Whereas for business and salary, this effect was only significant in model without interaction.
- Households maintaining income from work, regardless of the activity, were more likely to sustain total income levels and less likely to experience income decline.
- A decline in other business and salary income reduced the probability of income growth and maintenance while increased the probability of decline. Whereas a decline in agricultural income reduced the probability of maintaining income and increased the probability of experiencing a decrease in total income. Digitalization household level tended to mitigate these negative effects for other business incomes.

Table 12 Marginal Effects for income components: agriculture, other business and salary.

Variable	Model				
	Model 2	Model 6	Model 7	Model 8	Model 9
Salary_I					
Increase	0.1760*** (0.0152)	0.1686*** (0.0148)	0.4085*** (0.0416)	0.3981*** (0.0407)	0.4418*** (0.0399)
Hold	0.1205*** (0.0454)	0.1303*** (0.0458)	-0.0512 (0.0362)	-0.0350 (0.0370)	-0.0697** (0.0345)
Decrease	-0.2951*** (0.0483)	-0.2975*** (0.0487)	-0.3558*** (0.0321)	-0.3612*** (0.0330)	-0.3702*** (0.0296)
Unknown	-0.0014 (0.0014)	-0.0014 (0.0014)	-0.0015** (0.0006)	-0.0019*** (0.0007)	-0.0019*** (0.0006)
Salary_H					
Increase	-0.0065 (0.0100)	-0.0103 (0.0101)	-0.0076 (0.0093)	-0.0112 (0.0085)	-0.0082 (0.0087)
Hold	0.3342*** (0.0245)	0.3415*** (0.0250)	0.3271*** (0.0233)	0.3335*** (0.0222)	0.3278*** (0.0217)
Decrease	-0.3228*** (0.0259)	-0.3263*** (0.0265)	-0.3160*** (0.0233)	-0.3181*** (0.0222)	-0.3157*** (0.0217)
Unknown	-0.0050*** (0.0011)	-0.0049*** (0.0012)	-0.0034*** (0.0008)	-0.0041*** (0.0008)	-0.0039*** (0.0007)
Salary_D					

Increase	-0.0508*** (0.0100)	-0.0534*** (0.0100)	-0.0482*** (0.0104)	-0.0504*** (0.0096)	-0.0460*** (0.0096)
Hold	-0.2863*** (0.0229)	-0.2812*** (0.0231)	-0.2836*** (0.0217)	-0.288*** (0.0208)	-0.2883*** (0.0200)
Decrease	0.3409*** (0.0236)	0.3384*** (0.0238)	0.3353*** (0.0217)	0.3428*** (0.0207)	0.3389*** (0.0201)
Unknown	-0.0038*** (0.0014)	-0.0038*** (0.0014)	-0.0035** (0.0008)	-0.0044*** (0.0014)	-0.0046*** (0.0012)
Business_I					
Increase	0.1486*** (0.0169)	0.1436*** (0.0163)	0.3365*** (0.0506)	0.3223*** (0.0499)	0.3521*** (0.0511)
Hold	0.1270** (0.0603)	0.1331** (0.0610)	-0.0046 (0.0418)	0.0004 (0.0466)	-0.0116 (0.0429)
Decrease	-0.2750*** (0.0690)	-0.2762*** (0.0692)	-0.3311*** (0.0491)	-0.3212*** (0.0508)	-0.3393*** (0.0471)
Unknown	-0.0006 (0.0016)	-0.0006 (0.0016)	-0.0008 (0.0008)	-0.0015 (0.0009)	-0.0012 (0.0009)
Business_H					
Increase	-0.0241** (0.0105)	-0.0242** (0.0103)	-0.0264*** (0.0078)	-0.0216*** (0.0080)	-0.0207*** (0.0079)
Hold	0.1571*** (0.0299)	0.1577*** (0.0298)	0.1659*** (0.0314)	0.1617*** (0.0306)	0.1602*** (0.0305)
Decrease	-0.1325*** (0.0331)	-0.1329*** (0.0331)	-0.1385*** (0.0326)	-0.1393*** (0.0320)	-0.1388*** (0.0319)
Unknown	-0.0006 (0.0014)	-0.0006 (0.0014)	-0.0009 (0.0007)	-0.0008 (0.0010)	-0.0007 (0.0009)
Business_D					
Increase	-0.0388*** (0.0095)	-0.0401*** (0.0094)	-0.0373*** (0.0075)	-0.0390*** (0.0072)	-0.0354*** (0.0072)
Hold	-0.2913*** (0.0212)	-0.2893*** (0.0212)	-0.269*** (0.0169)	-0.2654*** (0.0167)	-0.2728*** (0.0163)
Decrease	0.3345*** (0.0218)	0.3337*** (0.0219)	0.3093*** (0.0179)	0.3078*** (0.0178)	0.3114*** (0.0173)
Unknown	-0.0043*** (0.0011)	-0.0043*** (0.0010)	-0.0030*** (0.0006)	-0.0034*** (0.0007)	-0.0032*** (0.0006)
Agriculture_I					
Increase	0.1111*** (0.0241)	0.1118*** (0.0235)	0.1967*** (0.0701)	0.2094*** (0.0666)	0.1867*** (0.0708)
Hold	0.2869*** (0.0865)	0.2830*** (0.0852)	0.1027 (0.0712)	0.1212* (0.0654)	0.1760** (0.0687)
Decrease	-0.4045*** (0.0961)	-0.4012*** (0.0948)	-0.3134*** (0.0631)	-0.3457*** (0.0547)	-0.3778*** (0.0510)
Unknown	0.0066** (0.0031)	0.0065** (0.0030)	0.0139 (0.0153)	0.0151 (0.0203)	0.0151 (0.0207)
Agriculture_H					
Increase	-0.0082 (0.0189)	-0.0081 (0.0189)	-0.0100 (0.0169)	-0.0107 (0.0169)	0.1867*** (0.0708)
Hold	0.1500*** (0.0434)	0.1502*** (0.0435)	0.1641*** (0.0414)	0.1701*** (0.0436)	0.1760** (0.0687)
Decrease	-0.1375*** (0.0477)	-0.1378*** (0.0477)	-0.1520*** (0.0422)	-0.157*** (0.0441)	-0.3778*** (0.0510)
Unknown	-0.0043** (0.0017)	-0.0043** (0.0017)	-0.0021*** (0.0005)	-0.0024*** (0.0005)	0.0151 (0.0207)
Agriculture_D					
Increase	-0.0148 (0.0184)	-0.0160 (0.0184)	-0.0166 (0.0139)	-0.018 (0.0132)	-0.0154 (0.0155)
Hold	-0.1493*** (0.0451)	-0.1491*** (0.0450)	-0.1680*** (0.0323)	-0.1586*** (0.0310)	-0.1372*** (0.0350)
Decrease	0.1674*** (0.0464)	0.1683*** (0.0464)	0.1868*** (0.0360)	0.1786*** (0.0342)	0.1545*** (0.0385)
Unknown	-0.0033*** (0.0011)	-0.0032*** (0.0011)	-0.0021*** (0.0005)	-0.002*** (0.0005)	-0.0019*** (0.0005)

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

In general terms, salary, agricultural, and business income represented the primary sources of household earnings, and their evolution, (increasing, remaining stable or decreasing) shaped the overall trend of total household income.

5.2.2. Remittances, Government Transfers and Other Income components

The results shown in Table 13 highlight that:

- If remittances, external or internal, or government transfers increased, there was a greater probability of an increase of total income. These effects tended to be higher in the models that incorporates interaction with digitalization indices
- If these type of incomes remained stable, total income maintenance trend was more pronounced and total income reduction was less likely.
- If remittances and government transfer decreased, they had no significant effects on total income, due to the smoothing effect of this kind of income components, used to compensate crisis periods to avoid vulnerability of households. An internal transference decrease low the probability of a higher total income.
- The effects of non-governmental organizations transfers were similar but less significant given that only they were significant in models without interaction with digitalization indices.

These results demonstrate that remittances helped households to absorb the shock of COVID-19 crisis according with literature (Kpodar *et al.*, 2022; Shimizutani & Yamada, 2021).

Table 13 Marginal Effects for income components: remittances, government transfers and other income components

Variable	Model				
	Model 2	Model 6	Model 7	Model 8	Model 9
Transfer_I					
Increase	0.0588*** (0.0116)	0.0591*** (0.0115)	0.0853*** (0.0228)	0.0704*** (0.0205)	0.0645*** (0.0196)
Hold	0.0103 (0.0441)	0.0091 (0.0442)	-0.0168 (0.0458)	-0.0113 (0.0441)	-0.0175 (0.0381)
Decrease	-0.0698 (0.0474)	-0.0687 (0.0475)	-0.0685 (0.0534)	-0.0604 (0.0502)	-0.049 (0.0428)
Unknown	0.0006 (0.0019)	0.0006 (0.0018)	0.0000 (0.0016)	0.0013 (0.0023)	0.0021 (0.0027)
Transfer_H					
Increase	-0.0041 (0.0114)	-0.0030 (0.0113)	-0.0018 (0.0109)	0.0704*** (0.0205)	-0.0183** (0.0089)
Hold	0.0650** (0.0283)	0.0640** (0.0283)	0.0733** (0.0332)	-0.0113 (0.0441)	0.0735*** (0.0281)

	Decrease	-0.0589** (0.0298)	-0.0591** (0.0298)	-0.0702** (0.0342)	-0.0604 (0.0502)	-0.0538* (0.0288)
	Unknown	-0.0019 (0.0015)	-0.0019 (0.0014)	-0.0014* (0.0008)	0.0013 (0.0023)	-0.0013 (0.0010)
	Transfer_D					
	Increase	0.0105 (0.0349)	0.0109 (0.0347)	-0.0092 (0.0200)	0.0010 (0.0302)	0.0008 (0.0304)
	Hold	0.0189 (0.0518)	0.0185 (0.0516)	0.0196 (0.0715)	0.0148 (0.0479)	-0.0023 (0.0493)
	Decrease	-0.0178 (0.0570)	-0.0179 (0.0569)	-0.0076 (0.0738)	-0.0126 (0.0528)	0.0044 (0.0536)
	Unknown	-0.0116*** (0.0032)	-0.0116*** (0.0032)	-0.0028*** (0.0006)	-0.0032*** (0.0006)	-0.003*** (0.0005)
	NGO_I					
	Increase	0.0979** (0.0388)	0.0982*** (0.0371)	0.0604 (0.0714)	0.1332 (0.0930)	0.1403 (0.0999)
	Hold	0.2316 (0.2917)	0.2338 (0.2951)	-0.1441 (0.1274)	0.1073 (0.2013)	0.1823 (0.2484)
	Decrease	-0.3314 (0.3035)	-0.3337 (0.3065)	0.0824 (0.1688)	-0.2415 (0.1827)	-0.3226 (0.2043)
	Unknown	0.0019 (0.0027)	0.0017 (0.0028)	0.0014 (0.0033)	0.0010 (0.0033)	0.0000 (0.0030)
	NGO_H					
	Increase	-0.0161 (0.0401)	-0.0144 (0.0389)	-0.0100 (0.0346)	0.0789 (0.0721)	0.0815 (0.0742)
	Hold	0.1890* (0.1015)	0.1891* (0.1010)	0.1336 (0.0870)	-0.0436 (0.1004)	0.0538 (0.0967)
	Decrease	-0.1635 (0.1125)	-0.1657 (0.1119)	-0.1213 (0.0842)	-0.0324 (0.1253)	-0.1326 (0.1080)
	Unknown	-0.0094** (0.0037)	-0.0090** (0.0036)	-0.0024*** (0.0005)	-0.0028*** (0.0005)	-0.0027*** (0.0005)
	NGO_D					
	Increase	0.0283 (0.0329)	0.0276 (0.0328)	0.0015 (0.0382)	0.0145 (0.0473)	0.0239 (0.0473)
	Hold	-0.1890 (0.1284)	-0.1866 (0.1260)	-0.2844*** (0.0626)	-0.2152*** (0.0816)	-0.1922** (0.0838)
	Decrease	0.1601 (0.1374)	0.1585 (0.1358)	0.2841*** (0.0853)	0.2006* (0.1113)	0.1686 (0.1085)
	Unknown	0.0005 (0.0014)	0.0005 (0.0014)	-0.0012 (0.0008)	0.0000 (0.0017)	-0.0003 (0.0013)
	Remittances_I					
	Increase	0.0748*** (0.0217)	0.0723*** (0.0222)	0.1094** (0.0459)	0.1091** (0.0480)	0.1101** (0.0494)
	Hold	0.1112 (0.0902)	0.1124 (0.0905)	0.0556 (0.0792)	0.1651** (0.0813)	0.1488* (0.0836)
	Decrease	-0.1856* (0.0952)	-0.1842* (0.0954)	-0.1639** (0.0822)	-0.2724*** (0.0730)	-0.2571*** (0.0732)
	Unknown	-0.0004 (0.0016)	-0.0005 (0.0015)	-0.0011 (0.0008)	-0.0018*** (0.0007)	-0.0018*** (0.0006)
	Remittances_H					
	Increase	-0.0011 (0.0174)	-0.0023 (0.0168)	-0.0009 (0.0162)	-0.0046 (0.0153)	-0.0018 (0.0156)
	Hold	0.1764*** (0.0619)	0.1772*** (0.0615)	0.1761*** (0.0640)	0.1471** (0.0653)	0.1265** (0.0612)
	Decrease	-0.1798*** (0.0692)	-0.1791*** (0.0686)	-0.1824*** (0.0680)	-0.1483** (0.0694)	-0.1275** (0.0645)
	Unknown	0.0044 (0.0033)	0.0042 (0.0031)	0.0072 (0.0085)	0.0059 (0.0095)	0.0028 (0.0044)
	Remittances_D					
	Increase	0.0074 (0.0187)	0.0052 (0.0186)	0.0065 (0.0187)	0.0071 (0.0188)	0.0042 (0.0196)
	Hold	-0.0206 (0.0475)	-0.0174 (0.0474)	-0.0223 (0.0502)	-0.0333 (0.0449)	-0.0321 (0.0477)
	Decrease	0.0150 (0.0477)	0.0141 (0.0477)	0.0171 (0.0516)	0.0276 (0.0460)	0.0293 (0.0487)
	Unknown	-0.0018* (0.0018)	-0.0019** (0.0018)	-0.0014*** (0.0014)	-0.0014*** (0.0014)	-0.0014*** (0.0014)

Internal_I	(0.0010)	(0.0010)	(0.0005)	(0.0005)	(0.0005)
Increase	0.0593** (0.0284)	0.0571** (0.0279)	0.0880* (0.0523)	0.1137* (0.0613)	0.1110* (0.0621)
Hold	0.0254 (0.0727)	0.0294 (0.0730)	0.0243 (0.0683)	0.0404 (0.0731)	0.0207 (0.0723)
Decrease	-0.0843 (0.0800)	-0.0861 (0.0803)	-0.1114 (0.0774)	-0.1538** (0.0763)	-0.1315* (0.0761)
Unknown	-0.0004 (0.0022)	-0.0005 (0.0021)	-0.0008 (0.0013)	-0.0003 (0.0018)	-0.0002 (0.0016)
Internal_H					
Increase	-0.0043 (0.0156)	-0.0020 (0.0150)	0.0002 (0.0145)	-0.0057 (0.0130)	-0.0091 (0.0123)
Hold	0.1296*** (0.0383)	0.1291*** (0.0377)	0.1495*** (0.0399)	0.1315*** (0.0388)	0.1603*** (0.0401)
Decrease	-0.1225*** (0.0412)	-0.1242*** (0.0409)	-0.1476*** (0.0408)	-0.1236*** (0.0401)	-0.1494*** (0.0408)
Unknown	-0.0028* (0.0016)	-0.0028* (0.0016)	-0.0021*** (0.0005)	-0.0022*** (0.0006)	-0.0018*** (0.0006)
Internal_D					
Increase	-0.0325* (0.0191)	-0.0342* (0.0188)	-0.0311** (0.0133)	-0.0353*** (0.0104)	-0.035*** (0.0108)
Hold	0.0105 (0.0414)	0.0128 (0.0414)	-0.0099 (0.0396)	0.0078 (0.0422)	0.0051 (0.0432)
Decrease	0.0267 (0.0420)	0.0263 (0.0420)	0.0434 (0.0405)	0.03 (0.0423)	0.0325 (0.0437)
Unknown	-0.0048*** (0.0013)	-0.0049*** (0.0013)	-0.0024*** (0.0005)	-0.0026*** (0.0005)	-0.0025*** (0.0005)

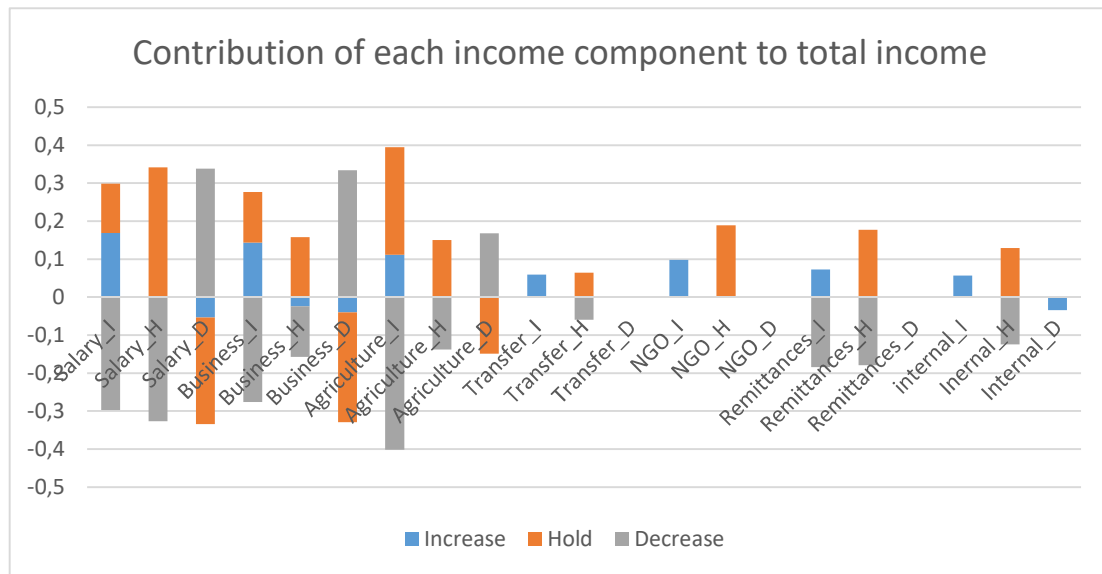
Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

The significant marginal effects of all the variables considered are jointly presented in Figure 3 for Model 6, which includes the three digitalization indices, DAI, DFPI and DSI as independent covariates without digitalization interaction (Table 10). This figure illustrates that the three primary sources of household income contributing most to total household income were salaries and business activities (both agricultural and non-agricultural). An increase in salaries was the main driver of total income growth, followed by an increase in non-agricultural businesses. Paradoxically, an increase in agricultural income had a high probability of ensuring that total household income remained stable or did not decrease, rather than significantly increasing it.

Regarding the remaining income components, which may not constitute the primary sources of income, remittances played an important role. An increase or stabilization in remittances significantly reduced the probability of a decline in total household income. Remittances had a greater effect on total household income than aid from governments or non-governmental entities. Furthermore, within remittances, international remittances had a greater effect than domestic ones. Perhaps the high level of informal employment hampered the ability of government aid to alleviate the economic crisis in households. In this sense, the results are in line with those of Busso *et al.* (2020), highlighting the

weakness of the region's social protection systems, highlighting the need to reform them in the face of future crises.

Figure 3: Contribution of each income component to total income



Source: Own elaboration.

6. Conclusions and policy implications

This study is particularly important as it helps identify which income sources contributed to household resilience in the face of an economic context where the main income (such as wages, agricultural earnings and business revenues) declined for most families. By focusing on the role of digitalization and various income components, the study provides valuable insights into how households faced the economic challenges during the COVID-19 pandemic in Latin America and the Caribbean. It also examines whether the effects observed at the macroeconomic level are reflected in household-level outcomes.

Our findings underscore the importance of considering digitalization when analyzing income changes in the region during the pandemic.

The results show that digitalization played a crucial role in stabilizing and enhancing household income, particularly through salary income or business and remittances, and especially in households with high levels of digitalization. However, the role of digitalization was not valid in any case: it was effective only when used for some purposes (financial and remote works of internet). Future policies should consider strengthening digital inclusion as a means to enhance economic resilience and prioritize the

development of programs that educate the population in digital skills and professional applications of technology in order to achieve income stability.

Regarding income components, the study reveals that salary income, agricultural income, and business income were key drivers of household income stability. In addition, the results suggest that in times of economic crisis, supranational and national institutions have been less effective in addressing income challenges than family networks, emphasizing the importance of remittances over institutional aid. Remittances have proven to play a key role as a complementary social safety net.

At the same time, measures to encourage remittance flows should also be considered, given their crucial role in household economic stability. One example could be reducing transfer costs, which would incentivize remittance sending and ensure that families receive a larger share of the funds.

It should be noted that these results cannot be generalized to all regions of the world due to the high level of labor market informality in Latin America and the degree of institutional development, which has been shaped by significant political instability. These factors influenced how these countries were affected by the COVID-19 pandemic. Therefore, conducting similar studies in other regions would be necessary, as we might find that government assistance exhibited greater resilience than remittances in areas with more protected labor markets and institutions with higher capacity and efficiency in responding to adverse situations.

Furthermore, it could also be of interest to extend this analysis to a macroeconomic context by examining, at the national level, whether digitalization contributed to the resilience of GDP in response to the economic crisis triggered by COVID-19. This includes analyzing the role of remittances and government support measures. Such an approach could provide insights into which policies aimed at promoting digitalization, strengthening remittances, or enhancing institutional support systems may be effective in mitigating future economic crises.

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Appendix 1: Variables used in the paper

Variable Set	Description	Reference Category
DAI	Digital Access Index	-
DFPI	Digital Finance and Professional Usages Index	-
DSI	Digital Social Usages Index	-
Salary_I Salary_H Salary_D	Dummies indicating increase, no change, or decrease in household wage income (pre-COVID recipients only).	Households with no wage income before COVID-19.
Business_I Business_H Business_D	Dummies for change in household other business income among pre-COVID business income recipients.	Households with no other business income before COVID-19.
Agriculture_I Agriculture_H Agriculture_D	Dummies for change in household agricultural income among pre-COVID recipients.	Households with no agricultural income before COVID-19.
Transfer_I Transfer_H Transfer_D	Dummies for change in government/organizational transfer income among pre-COVID recipients.	Households with no transfer income before COVID-19.
NGO_I NGO_H NGO_D	Dummies for change in NGO assistance income among pre-COVID recipients.	Households with no NGO assistance before COVID-19.
Remittances_I Remittances_H Remittances_D	Dummies for change in international remittance income among pre-COVID recipients.	Households with no international remittance income before COVID-19.
Internal_I Internal_H Internal_D	Dummies for change in internal remittance income among pre-COVID recipients.	Households with no internal remittance income before COVID-19.

Appendix 2: Baseline models with digitalization index

	Model 1 Baseline model			Model 2 Baseline model with DAI			Model 3 Baseline model with DFPI			Model 4 Baseline model with DSI		
	Increase	Decrease	Unknown	Increase	Decrease	Unknown	Increase	Decrease	Unknown	Increase	Decrease	Unknown
DAI				0.1265*** (0.0383)	-0.1088*** (0.0302)	0.1296* (0.0691)						
DFPI							0.1950*** (0.0398)	0.0281 (0.0255)	0.0918** (0.0436)			
DSI										0.0022 (0.0591)	-0.0297 (0.0355)	0.0779 (0.1157)
Salary_I	2.3876*** (0.1735)	-0.8813*** (0.2006)	-0.9071* (0.4720)	2.3147*** (0.1799)	-0.8553*** (0.2036)	-0.8004* (0.4667)	2.2496*** (0.1766)	-0.8926*** (0.2030)	-0.9709** (0.4784)	2.3879*** (0.1735)	-0.8821*** (0.2006)	-0.9103* (0.4706)
Salary_H	-0.8718*** (0.1570)	-1.4280*** (0.1021)	-2.7006*** (0.3068)	-0.9557*** (0.1651)	-1.4559*** (0.1070)	-2.5562*** (0.3192)	-0.9661*** (0.1602)	-1.4399*** (0.1042)	-2.7466*** (0.3085)	-0.8716*** (0.1571)	-1.4285*** (0.1021)	-2.7008*** (0.3070)
Salary_D	0.0391 (0.1755)	1.4092*** (0.0969)	-0.7309* (0.3934)	-0.0205 (0.1810)	1.3663*** (0.1014)	-0.5666 (0.3886)	-0.0347 (0.1754)	1.4003*** (0.0977)	-0.7637** (0.3876)	0.0390 (0.1755)	1.4102*** (0.0969)	-0.7357* (0.3861)
Business_I	1.8974*** (0.2059)	-0.9267*** (0.2833)	-0.5748 (0.5275)	1.8884*** (0.1948)	-0.8350*** (0.2810)	-0.5158 (0.5488)	1.8173*** (0.2085)	-0.9233*** (0.2839)	-0.6044 (0.5311)	1.8972*** (0.2058)	-0.9279*** (0.2830)	-0.5920 (0.5392)
Business_H	-0.6991*** (0.1624)	-0.6334*** (0.1352)	-0.6413 (0.4905)	-0.7633*** (0.1617)	-0.6489*** (0.1358)	-0.6013 (0.4883)	-0.7168*** (0.1612)	-0.6350*** (0.1354)	-0.6621 (0.4865)	-0.6998*** (0.1625)	-0.6335*** (0.1351)	-0.6458 (0.4953)
Business_D	0.2084 (0.1640)	1.3536*** (0.0931)	-0.7451** (0.3389)	0.1708 (0.1684)	1.3673*** (0.0940)	-0.7291* (0.3744)	0.1559 (0.1650)	1.3485*** (0.0935)	-0.7730** (0.3437)	0.2082 (0.1646)	1.3547*** (0.0928)	-0.7514** (0.3428)
Agriculture_I	1.0192*** (0.3489)	-1.4816*** (0.3822)	1.4408 (1.1198)	0.9183*** (0.3459)	-1.4853*** (0.3972)	1.4965 (1.0955)	1.0681*** (0.3436)	-1.4768*** (0.3798)	1.4549 (1.1210)	1.0209*** (0.3480)	-1.4829*** (0.3835)	1.4357 (1.1222)
Agriculture_H	-0.5510* (0.3148)	-0.7182*** (0.1925)	-1.9922*** (0.5086)	-0.5074* (0.3013)	-0.6397*** (0.1958)	-1.8473*** (0.5473)	-0.5605* (0.3205)	-0.7200*** (0.1925)	-1.9959*** (0.5113)	-0.5513* (0.3148)	-0.7158*** (0.1927)	-2.0015*** (0.5106)
Agriculture_D	0.1924 (0.3042)	0.7015*** (0.1889)	-0.6879** (0.3304)	0.1627 (0.3119)	0.6932*** (0.1980)	-0.7332* (0.3745)	0.1677 (0.3078)	0.7011*** (0.1884)	-0.6746** (0.3281)	0.1918 (0.3045)	0.7020*** (0.1894)	-0.6775** (0.3303)
Transfers_I	0.7376***	-0.0358	0.6296	0.8508***	-0.1555	0.1738	0.7803***	-0.0307	0.6485	0.7370***	-0.0353	0.6377

Transfers_H	(0.1876)	(0.1906)	(0.6381)	(0.1935)	(0.1994)	(0.6471)	(0.1870)	(0.1912)	(0.6361)	(0.1877)	(0.1901)	(0.6340)
	-0.4594**	-0.2805**	-0.6334	-0.2287	-0.2759**	-0.8252	-0.4114**	-0.2748**	-0.6187	-0.4600**	-0.2819**	-0.6257
Transfers_D	(0.1851)	(0.1202)	(0.5791)	(0.1893)	(0.1254)	(0.5177)	(0.1861)	(0.1205)	(0.5780)	(0.1852)	(0.1202)	(0.5736)
	-0.0520	-0.0193	-4.1925***	0.1082	-0.0814	-3.9885***	-0.0255	-0.0168	-4.1847***	-0.0536	-0.0169	-4.2063***
	(0.4903)	(0.2136)	(0.9544)	(0.5592)	(0.2262)	(0.9757)	(0.4914)	(0.2140)	(0.9550)	(0.4924)	(0.2134)	(0.9598)
NGO_I	0.7452	-1.1485	-0.2307	0.8649	-1.2080	0.0425	0.7808	-1.1440	-0.2139	0.7449	-1.1425	-0.2704
	(0.7953)	(1.2378)	(1.0066)	(0.8330)	(1.3079)	(1.0178)	(0.7892)	(1.2428)	(1.0056)	(0.7955)	(1.2366)	(1.0149)
NGO_H	0.7087	-0.1998	-3.9841***	-0.7253	-0.7882*	-3.6750***	0.7448	-0.1934	-3.9361***	0.7104	-0.2081	-3.9291***
	(0.5672)	(0.5065)	(1.1568)	(0.6340)	(0.4610)	(1.1613)	(0.5634)	(0.5061)	(1.1475)	(0.5674)	(0.5058)	(1.1366)
NGO_D	0.8850	0.8979	0.7077	0.9083*	0.7819	0.6641	0.8887	0.8949	0.7111	0.8863	0.8941	0.6930
	(0.5517)	(0.5519)	(0.5492)	(0.5487)	(0.5800)	(0.5929)	(0.5405)	(0.5460)	(0.5448)	(0.5518)	(0.5526)	(0.5514)
Remittances_I	0.6310*	-1.0114**	-0.6873	0.8292**	-0.6289	-0.4280	0.5784	-1.0168**	-0.7300	0.6316*	-1.0142**	-0.7066
	(0.3639)	(0.4108)	(0.5124)	(0.3749)	(0.4051)	(0.5601)	(0.3801)	(0.4138)	(0.5116)	(0.3639)	(0.4099)	(0.5041)
Remittances_H	-0.3494	-0.5983**	0.9197	-0.4695*	-0.7858***	1.0511	-0.3788	-0.6042**	0.8854	-0.3501	-0.5909**	0.8887
	(0.2699)	(0.2938)	(1.1126)	(0.2649)	(0.2843)	(1.1517)	(0.2622)	(0.2939)	(1.1175)	(0.2698)	(0.2916)	(1.0788)
Remittances_D	0.1516	0.1237	-0.5408*	0.1641	0.0807	-0.5506*	0.1051	0.1168	-0.6093**	0.1513	0.1275	-0.5776**
	(0.3074)	(0.2014)	(0.2917)	(0.3241)	(0.2062)	(0.3319)	(0.3105)	(0.2011)	(0.2934)	(0.3082)	(0.2014)	(0.2780)
Internal_I	0.9143**	-0.3658	-0.2148	0.8191*	-0.2211	-0.2169	0.8936**	-0.3645	-0.2280	0.9135**	-0.3672	-0.2148
	(0.4459)	(0.3287)	(0.7348)	(0.4476)	(0.3292)	(0.7584)	(0.4448)	(0.3304)	(0.7366)	(0.4459)	(0.3278)	(0.7349)
Internal_H	-0.4707**	-0.6545***	-1.5646***	-0.3967	-0.5597***	-1.2881**	-0.4385*	-0.6535***	-1.5750***	-0.4707**	-0.6536***	-1.5810***
	(0.2353)	(0.1711)	(0.5118)	(0.2540)	(0.1713)	(0.5447)	(0.2297)	(0.1707)	(0.5147)	(0.2352)	(0.1712)	(0.5152)
Internal_D	-0.5958*	0.0491	-1.6808***	-0.5112	0.0223	-1.6656***	-0.6337*	0.0472	-1.7097***	-0.5968*	0.0510	-1.7042***
	(0.3281)	(0.1766)	(0.3509)	(0.3255)	(0.1793)	(0.3507)	(0.3254)	(0.1763)	(0.3521)	(0.3274)	(0.1770)	(0.3579)
Constant	-1.6614***	-0.5070***	-2.4275***	-1.6142***	-0.4595***	-2.7244***	-1.5888***	-0.4956***	-2.3870***	-1.6610***	-0.5121***	-2.4172***
	(0.1527)	(0.1059)	(0.2892)	(0.1614)	(0.1126)	(0.3080)	(0.1549)	(0.1066)	(0.2890)	(0.1539)	(0.1061)	(0.2916)
Observations	24,816	24,816	24,816	24,061	24,061	24,061	24,816	24,816	24,816	24,816	24,816	24,816
Country			Yes			Yes			Yes			Yes
Rural			Yes			Yes			Yes			Yes
R-squared			0.3413			0.3483			0.3429			0.3414

Wald test	55738.59	50547.00	55928.65	55112.48
p-value	0.0000	0.0000	0.0000	0.0000
AIC	121.000.000	113.000.000	120.000.000	121.000.000
BIC	121.000.000	113.000.000	120.000.000	121.000.000
Accuracy Cross Validation	82.19%	81.06%	82.24%	82.19%

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Appendix 3: Extended and interaction models

	Model 5			Model 6			Model 7			Model 8			Model 9		
	Baseline model with DFPI and DSI			Baseline model with DAI, DFPI and DSI			Interaction DAI and Incomes			Interaction DFPI and Incomes			Interaction DSI and Incomes		
	Increase	Decrease	IDK	Increase	Decrease	IDK	Increase	Decrease	IDK	Increase	Decrease	IDK	Increase	Decrease	IDK
DAI				0.0941** (0.0377)	-0.1239*** (0.0306)	0.1174* (0.0698)	0.1535* (0.0878)	-0.2158*** (0.0711)	0.0065 (0.1530)						
DFPI	0.2027*** (0.0407)	0.0334 (0.0267)	0.0703 (0.0762)	0.1789*** (0.0417)	0.0601** (0.0290)	0.0553 (0.0784)				0.1572** (0.0622)	-0.0052 (0.0552)	0.0252 (0.0644)			
DSI	-0.0493 (0.0592)	-0.0346 (0.0375)	0.0415 (0.1712)	-0.0260 (0.0593)	-0.0333 (0.0379)	0.1124 (0.1746)							0.0178 (0.1177)	-0.0472 (0.0765)	-0.1558 (0.1282)
Salary_I	2.2434*** (0.1768)	-0.8962*** (0.2032)	-0.9566** (0.4837)	2.2112*** (0.1822)	-0.8839*** (0.2054)	-0.8277* (0.4766)	2.2653*** (0.1872)	-0.8366*** (0.2034)	-0.7430* (0.4101)	2.2185*** (0.1793)	-0.9165*** (0.2139)	-0.9500* (0.4985)	2.3975*** (0.1751)	-0.8812*** (0.2028)	-0.9702** (0.4716)
Salary_H	-0.9721*** (0.1613)	-1.4431*** (0.1045)	-2.7343*** (0.3134)	-1.0333*** (0.1684)	-1.4802*** (0.1091)	-2.5748*** (0.3272)	-0.8671*** (0.1680)	-1.4353*** (0.1087)	-2.5628*** (0.3180)	-0.9496*** (0.1596)	-1.4720*** (0.1053)	-2.7547*** (0.3095)	-0.8628*** (0.1570)	-1.4315*** (0.1019)	-2.7287*** (0.3060)
Salary_D	-0.0360 (0.1754)	1.3994*** (0.0977)	-0.7579* (0.3955)	-0.0831 (0.1810)	1.3474*** (0.1021)	-0.5874 (0.3942)	0.0293 (0.1815)	1.4050*** (0.1047)	-0.6139* (0.3500)	-0.0059 (0.1772)	1.4418*** (0.1025)	-0.7396** (0.3760)	0.0531 (0.1751)	1.4240*** (0.0969)	-0.8979*** (0.3198)
Business_I	1.8118*** (0.2076)	-0.9278*** (0.2842)	-0.5967 (0.5250)	1.8273*** (0.1968)	-0.8520*** (0.2831)	-0.5336 (0.5475)	1.8434*** (0.2011)	-0.8907*** (0.2798)	-0.3752 (0.4706)	1.8070*** (0.2109)	-0.8980*** (0.2937)	-0.7638 (0.6746)	1.9041*** (0.2043)	-0.9438*** (0.2864)	-0.5427 (0.6171)
Business_H	-0.7161*** (0.1614)	-0.6358*** (0.1352)	-0.6586 (0.4850)	-0.7705*** (0.1612)	-0.6507*** (0.1355)	-0.6089 (0.4895)	-0.8439*** (0.1727)	-0.6576*** (0.1357)	-0.8076** (0.3685)	-0.7288*** (0.1645)	-0.6488*** (0.1332)	-0.6781 (0.4844)	-0.7079*** (0.1619)	-0.6478*** (0.1334)	-0.6554 (0.4422)
Business_D	0.1562 (0.1649)	1.3486*** (0.0934)	-0.7675** (0.3408)	0.1378 (0.1687)	1.3597*** (0.0941)	-0.7452** (0.3763)	0.2005 (0.1697)	1.3686*** (0.0949)	-0.6985* (0.3627)	0.1345 (0.1688)	1.3542*** (0.0941)	-0.7427** (0.3405)	0.2142 (0.1614)	1.3687*** (0.0911)	-0.7645** (0.3499)
Agriculture_I	1.0762*** (0.3418)	-1.4753*** (0.3804)	1.4527 (1.1159)	0.9608*** (0.3390)	-1.4680*** (0.3914)	1.5037 (1.0861)	1.1255*** (0.3634)	-1.0941*** (0.3654)	1.6375* (0.9790)	1.1624*** (0.3305)	-1.2604*** (0.3603)	1.6041 (1.1615)	0.9791*** (0.3671)	-1.5547*** (0.3824)	1.5563 (1.1786)
Agriculture_H	-0.5548* (0.3219)	-0.7173*** (0.1926)	-2.0006*** (0.5121)	-0.5085* (0.3055)	-0.6406*** (0.1960)	-1.8730*** (0.5546)	-0.5193* (0.3121)	-0.6831*** (0.1783)	-1.9942*** (0.5645)	-0.5342* (0.3195)	-0.6926*** (0.1884)	-2.0946*** (0.5523)	-0.6224* (0.3400)	-0.7156*** (0.1952)	-2.1707*** (0.5272)
Agriculture_D	0.1671 (0.3082)	0.7015*** (0.1890)	-0.6768** (0.3298)	0.1418 (0.3139)	0.6941*** (0.1976)	-0.7204* (0.3738)	0.2717 (0.2882)	0.8520*** (0.1868)	-0.9904** (0.4613)	0.2119 (0.2868)	0.8153*** (0.1728)	-0.5748* (0.3330)	0.1752 (0.3148)	0.6881*** (0.1838)	-0.6654* (0.3548)

Transfers_I	0.7857*** (0.1875)	-0.0288 (0.1909)	0.6515 (0.6344)	0.8687*** (0.1929)	-0.1501 (0.1998)	0.1909 (0.6396)	0.8833*** (0.1918)	-0.0900 (0.2278)	0.0640 (0.6423)	0.7698*** (0.1902)	-0.0999 (0.2227)	0.3819 (0.5860)	0.7273*** (0.1875)	-0.0610 (0.1815)	0.6321 (0.6098)
Transfers_H	-0.4095** (0.1864)	-0.2753** (0.1206)	-0.6169 (0.5746)	-0.2095 (0.1908)	-0.2737** (0.1254)	-0.8117 (0.5100)	-0.2112 (0.1854)	-0.3132** (0.1422)	-0.8853 (0.5770)	-0.4118** (0.1907)	-0.2425* (0.1305)	-0.7205 (0.5718)	-0.4879*** (0.1795)	-0.2774** (0.1191)	-0.8125 (0.6015)
Transfers_D	-0.0146 (0.4915)	-0.0131 (0.2138)	-4.1932*** (0.9615)	0.1171 (0.5609)	-0.0807 (0.2256)	-4.0153*** (0.9846)	-0.1857 (0.3843)	-0.0634 (0.3090)	-4.3646*** (0.8370)	-0.0301 (0.4813)	-0.0698 (0.2095)	-4.6387*** (0.9606)	0.0050 (0.4753)	0.0105 (0.2146)	-4.0984*** (0.9017)
NGO_I	0.7966 (0.7893)	-1.1360 (1.2442)	-0.2401 (1.0187)	0.8816 (0.8281)	-1.2170 (1.3217)	-0.0278 (1.0448)	1.1107* (0.6000)	0.5869 (0.7803)	0.8813 (0.9601)	0.8080 (0.7457)	-0.9409 (0.9869)	0.0411 (1.0043)	0.7355 (0.8157)	-1.2846 (1.3481)	-0.3833 (1.2204)
NGO_H	0.7371 (0.5639)	-0.1999 (0.5052)	-3.9206*** (1.1356)	-0.7035 (0.6212)	-0.7921* (0.4588)	-3.5792*** (1.1462)	-0.4615 (0.6618)	-0.5537 (0.3580)	-3.1705*** (1.0866)	0.9359 (0.5720)	0.0995 (0.5140)	-3.5421*** (1.1455)	0.6667 (0.5855)	-0.4346 (0.4546)	-3.9868*** (1.0914)
NGO_D	0.8803 (0.5417)	0.8901 (0.5467)	0.7044 (0.5468)	0.8961* (0.5414)	0.7723 (0.5707)	0.6360 (0.5901)	1.3379** (0.6395)	1.7356** (0.6996)	0.6633 (0.8046)	1.0366* (0.5636)	1.1525* (0.6220)	0.8542 (0.6498)	0.9817* (0.5526)	0.9438* (0.5570)	0.5433 (0.6172)
Remittances_I	0.5719 (0.3803)	-1.0206** (0.4135)	-0.7309 (0.5134)	0.8036** (0.3864)	-0.6289 (0.4060)	-0.4600 (0.5576)	0.8376** (0.3500)	-0.4926 (0.3803)	-0.7031 (0.5623)	0.5984 (0.3667)	-1.0673*** (0.3961)	-1.3540** (0.5985)	0.6555* (0.3813)	-0.9723** (0.3948)	-1.4428** (0.6185)
Remittances_H	-0.3705 (0.2604)	-0.5975** (0.2915)	0.8777 (1.0893)	-0.4902* (0.2574)	-0.7860*** (0.2819)	0.9897 (1.1148)	-0.3997 (0.2615)	-0.7846*** (0.2953)	0.9828 (0.9746)	-0.3958 (0.2617)	-0.6553** (0.2952)	0.8239 (1.1283)	-0.3113 (0.2571)	-0.5556** (0.2716)	0.4571 (0.8516)
Remittances_D	0.1073 (0.3098)	0.1195 (0.2011)	-0.6073** (0.2907)	0.1239 (0.3264)	0.0706 (0.2061)	-0.6163* (0.3271)	0.1563 (0.3020)	0.0925 (0.2249)	-0.6863** (0.3060)	0.1765 (0.3015)	0.1358 (0.2025)	-0.5995* (0.3136)	0.1452 (0.3207)	0.1387 (0.2119)	-0.6269* (0.3342)
Internal_I	0.8918** (0.4423)	-0.3673 (0.3299)	-0.2279 (0.7352)	0.7873* (0.4455)	-0.2345 (0.3306)	-0.2304 (0.7581)	0.7801* (0.4075)	-0.2954 (0.3229)	-0.4525 (0.8143)	0.8938** (0.4286)	-0.4225 (0.3310)	-0.2187 (0.7358)	0.9193** (0.4419)	-0.3438 (0.3263)	-0.1589 (0.7064)
Internal_H	-0.4347* (0.2291)	-0.6522*** (0.1706)	-1.5813*** (0.5180)	-0.3620 (0.2449)	-0.5611*** (0.1696)	-1.3101** (0.5443)	-0.3242 (0.2358)	-0.6410*** (0.1736)	-1.9168*** (0.5902)	-0.3505 (0.2267)	-0.5138*** (0.1690)	-1.6208*** (0.5347)	-0.4865** (0.2279)	-0.6694*** (0.1733)	-1.4082*** (0.4825)
Internal_D	-0.6285* (0.3253)	0.0492 (0.1767)	-1.7165*** (0.3570)	-0.5495* (0.3234)	0.0157 (0.1792)	-1.7129*** (0.3586)	-0.5651 (0.3587)	0.1006 (0.1727)	-1.8801*** (0.3736)	-0.7230** (0.3208)	0.0290 (0.1812)	-1.7632*** (0.3953)	-0.6936** (0.3166)	0.0469 (0.1830)	-1.8437*** (0.3917)
Salary_I*Index							0.0860 (0.1190)	-0.0198 (0.1799)	0.0031 (0.2069)	0.1784* (0.1013)	0.1700 (0.1370)	0.1648 (0.1539)	-0.0595 (0.1502)	0.1504 (0.1504)	0.0597 (0.2481)
Salary_H*Index							-0.2521** (0.1078)	-0.0849 (0.0806)	-0.1918 (0.2583)	-0.1781* (0.0933)	-0.2396*** (0.0652)	0.0397 (0.0933)	0.1313 (0.1341)	0.1463* (0.0872)	0.3471 (0.2132)
Salary_D*Index							0.0277	0.1603**	0.2718	0.1540*	0.1300*	0.2657**	0.0598	0.0744	0.6890***

			(0.1185)	(0.0795)	(0.1791)	(0.0914)	(0.0691)	(0.1159)	(0.1660)	(0.0845)	(0.2317)
Business_I*Index			0.1216	-0.3907	0.0322	-0.0334	-0.1863	0.0647	-0.1098	0.0568	-0.1694
			(0.1368)	(0.2466)	(0.2858)	(0.1268)	(0.1642)	(0.1368)	(0.1446)	(0.2164)	(0.3641)
Business_H*Index			0.1850*	0.0196	0.3906*	0.0761	-0.0047	0.1330	-0.0397	-0.1243	-0.3633
			(0.1083)	(0.0973)	(0.2190)	(0.1033)	(0.0799)	(0.1068)	(0.1331)	(0.1005)	(0.5695)
Business_D*Index			0.0267	0.1558**	-0.1721	0.1089	0.0974	0.0668	-0.3804**	-0.2491***	-0.2496
			(0.1228)	(0.0698)	(0.2378)	(0.0918)	(0.0625)	(0.0964)	(0.1542)	(0.0770)	(0.2212)
Agliculture_I*Index			0.3048	0.5658**	1.0310***	0.0444	0.3002	0.0722	0.5552*	0.7600**	0.4488
			(0.2543)	(0.2388)	(0.3174)	(0.1925)	(0.1830)	(0.1939)	(0.3159)	(0.3062)	(0.3216)
Agliculture_H*Index			0.0075	-0.0045	-0.0156	0.0691	0.1631	0.2169*	0.5145**	0.2856*	0.4161
			(0.1038)	(0.1344)	(0.2681)	(0.1569)	(0.1078)	(0.1218)	(0.2481)	(0.1531)	(0.3162)
Agliculture_D*Index			0.5028**	0.2853	-0.1716	0.2187	0.2459*	0.1670	0.4721**	0.4570***	0.2709
			(0.2141)	(0.1737)	(0.3220)	(0.1755)	(0.1400)	(0.1423)	(0.2153)	(0.1472)	(0.3047)
Transfers_I*Index ⁺			-0.0032	0.0939	-0.3930*	-0.0111	-0.1478	-0.5517	-0.2314	-0.3915**	-0.1469
			(0.1435)	(0.1928)	(0.2294)	(0.1591)	(0.1867)	(0.3392)	(0.1725)	(0.1788)	(0.3928)
Transfers_H*Index			0.4037**	-0.0351	-0.1151	-0.0027	0.0953	-0.2400	-0.2613	0.0577	-0.7849*
			(0.1846)	(0.1206)	(0.2261)	(0.1471)	(0.1033)	(0.4767)	(0.2069)	(0.1177)	(0.4126)
Transfers_D*Index			-0.5482	-0.0391	-0.6260	-0.0898	-0.1144	-0.8190***	-0.4670	-0.1272	-0.8075
			(0.4699)	(0.2498)	(0.4090)	(0.1834)	(0.1353)	(0.2665)	(0.3590)	(0.1667)	(0.5762)
NGO_I*Index			-0.0918	1.5040*	1.3256*	-0.6396	-1.3749	-0.1731	-0.3664	0.4530	0.0546
			(0.7716)	(0.8848)	(0.7980)	(0.5351)	(0.9362)	(0.2779)	(0.5345)	(0.7014)	(1.1973)
NGO_H*Index			0.1861	0.2042	0.3837	0.4199	0.5497*	0.4471	-0.0197	-0.8195**	-0.5575
			(0.2908)	(0.3037)	(0.3638)	(0.3393)	(0.2855)	(0.2962)	(0.3800)	(0.4165)	(0.3729)
NGO_D*Index			0.9700**	1.0301***	0.0764	0.5573	0.5180	0.6017	0.3667	0.1115	0.5063
			(0.4277)	(0.3867)	(0.5138)	(0.3803)	(0.3941)	(0.4076)	(0.2807)	(0.2270)	(0.3238)
Remittances_I*Index			-0.5126**	0.0686	-0.9912**	-0.2907**	-0.2028	0.0494	0.1588	-0.0628	0.5277**
			(0.2389)	(0.2641)	(0.4482)	(0.1260)	(0.1655)	(0.1302)	(0.1919)	(0.2387)	(0.2314)
Remittances_H*Index			0.2888*	0.0479	0.9205***	-0.0145	-0.1871*	-0.0585	-0.1089	-0.1885	0.3786
			(0.1655)	(0.2039)	(0.3065)	(0.0978)	(0.1118)	(0.0931)	(0.2045)	(0.2679)	(0.3253)

Remittances_D*Index							-0.2555 (0.1995)	-0.1031 (0.1915)	-0.2864 (0.2337)	-0.1826** (0.0894)	-0.0399 (0.0910)	-0.0617 (0.0935)	-0.0056 (0.1419)	0.0138 (0.1002)	0.0941 (0.1356)
Internal_I*Index							-0.3028 (0.3280)	0.3823 (0.2379)	0.0031 (0.5671)	-0.1324 (0.2883)	0.1287 (0.2597)	-0.3073 (0.1904)	-0.3255 (0.2952)	-0.4260** (0.1956)	-0.3716 (0.2422)
Internal_H*Index							-0.4091*** (0.1430)	-0.2297** (0.0965)	-1.2916** (0.5884)	0.4141*** (0.1506)	0.4782*** (0.1025)	-0.1447 (0.5184)	0.1992 (0.2006)	-0.0261 (0.1494)	-0.2636 (0.3011)
Internal_D*Index							0.4297* (0.2226)	0.1372 (0.1304)	-0.4556* (0.2423)	0.0856 (0.1303)	-0.0683 (0.0970)	0.0238 (0.1094)	0.3432 (0.2222)	0.0271 (0.1512)	0.1398 (0.2304)
Constant	-1.5942*** (0.1557)	-0.4990*** (0.1066)	-2.3914*** (0.2870)	-1.5530*** (0.1634)	-0.4388*** (0.1132)	-2.6931*** (0.2985)	-1.6588*** (0.1627)	-0.4856*** (0.1145)	-2.7066*** (0.3167)	-1.6023*** (0.1565)	-0.5126*** (0.1094)	-2.4051*** (0.2842)	-1.6693*** (0.1535)	-0.5190*** (0.1063)	-2.3961*** (0.2779)
Observations	24,816	24,816	24,816	24,061	24,061	24,061	24,061	24,061	24,061	24,816	24,816	24,816	24,816	24,816	24,816
Country			Yes			Yes			Yes			Yes			Yes
Rural			Yes			Yes			Yes			Yes			Yes
R-squared			0.3430			0.3497			0.3559			0.3485			0.3458
Wald Test			55546.31			49266.56			5174.14			58972.46			58275.69
p-value			0.0000			0.0000			0.0000			0.0000			0.0000
AIC			120.000.000			131.000.000			111.000.000			119.000.000			120.000.000
BIC			120.000.000			131.000.000			111.000.000			119.000.000			120.000.000
Accuracy Cross Validation			82.23%			81.13%			80.95%			82.10%			82.14%

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

+ Index denotes the index used in the model