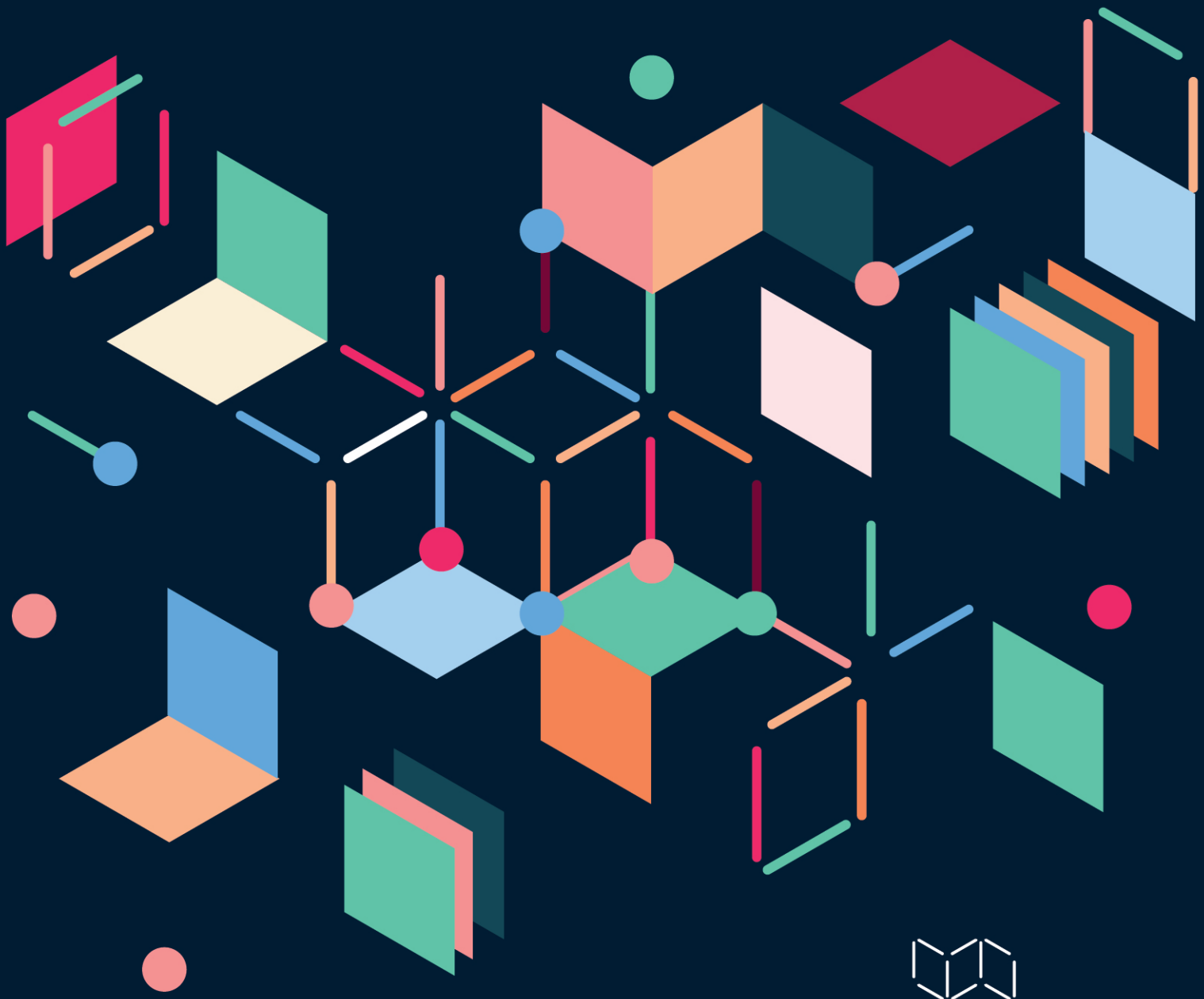
CRACKING THE FUTURE OF WORK

AUTOMATION AND LABOR PLATFORMS IN THE GLOBAL SOUTH



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FUTURE OF WORK IN THE GLOBAL SOUTH

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CONTENTS

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Ramiro Albrieu
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Investigator of FoWiGS

GENERAL INTRODUCTION

A confluence of technological innovations in Information and Communication Technologies (ICTs) is dramatically transforming the way goods and services are produced, consumed, and traded. What opportunities, challenges, and threats does the current industrial revolution pose for the world of work? And how do diverging outsets affect countries' possibilities to leverage these opportunities?

Although a vast amount of research attempts to answer these questions, it is hard to come up with a clear answer – and this is particularly true for developing countries. On the one hand, the future of work is not determined, but it is being built as new innovations unfold and society responds. On the other hand, recommendations aimed at creating high-quality jobs in the face of technological transformations are mainly based on the diagnoses of high-income countries. This makes sense because these countries are the most technologically advanced and, therefore, the first to confront technological dilemmas. They also lead the global production of research. However, as narratives accounting for the future of work phenomenon consolidate, it becomes clear that they may lack enough diversity to address developing countries' challenges and opportunities. It is time for the Global South to take a more significant role in the global debates on the future of work.

The primary goal of this book is, therefore, to examine new data and knowledge about the interplay between technological change and labor markets in the emerging world. We will analyze two trends that have started to permeate the Global South: automation and platform labor. The developing country perspective is a constant throughout the book and we hope it will contribute towards more inclusive, evidence-based, and truly global narratives on the future of work.

Technological innovation and the Global North/Global South divide

Be it a pleasure or burden, "work" has always been a central coordination device for humans, assigning different roles and identities to members of a community and creating, in turn, complex systems based on humankind's collaboration with different skillsets. From the time we first began to work, we have found ourselves surrounded by machines and technological devices: these are human-made arrangements of elements that help us fulfil our many roles. However crucial technology has been for progress, our relationship with these artificial arrangements has not been free of controversy. In this regard, people refer to machines as weapons for destruction as much as tools for construction.

One of the main fears associated with the emergence of "the machine" is related to the latent possibility to master Artificial General Intelligence (AGI). This implies developing technological devices that can fully replicate or even surpass a human being's physical and cognitive capacities. What tasks would be left up to workers if those fears were confirmed? Are we at the gates of large-scale obsolescence of people in production processes, and thus, of massive technological unemployment? Technological anxiety could be anchored in science fiction, where stories about out-of-control robots revolting and taking over society as a whole do not grow old. Ultimately, however, the concerns stem from placing humans and non-humans on a par, what the anthropologist Kathleen Richardson (2017) called "annihilation anxiety."

Even if they are time-resistant, fears of large-scale labor displacement have not been corroborated by history (Skidelsky, 2020). Instead, the use of technologies and artefacts for "doing new things" has endowed humans with a greater sense of agency to design their future. And, despite the unprecedented growth in population in the last few centuries, technology has led to improvements in economic

and social well-being that were previously unimaginable. In fact, as the sociologist Robert Nisbet (1994) emphasizes, the word "progress" as we understand it today is inseparable from the sequence of technological innovations in recent centuries (let alone "economic growth," an invention of the 20th century).

However, history also shows that technological innovation has generated different kinds of challenges and problems for labor markets. A pattern arising from all past technological revolutions is that, while everyone benefited from technological change, some did much more than others. Technological innovation creates winners and losers because it rewards early adopters at the expense of those who fail to move quickly in transforming their production processes. The categories of "developed" and "developing" countries, or "Global North" and "Global South," are closely related to technology-induced forking paths in terms of growth, development, and working conditions across countries and regions (Pritchett, 1997). Each industrial revolution catapulted the group of countries that dominated the technological scene into accelerated growth and massive development improvements. In the first industrial revolution in the 18th century, the United Kingdom and some regions in continental Europe led technological innovation applying steam power and outstripped the rest of the world in the race towards economic progress. The second industrial revolution at the turn of the 19th century enabled the United States to emerge as a global superpower thanks to the development and proliferation of the electricity-powered mass production systems. In the 1990s, the Information and Communication Technologies (ICTs) revolution fuelled the sudden take-off of several Asian economies, also known as the "Asian Miracles", which resulted in China contesting the United States' podium as the world's largest economy for the first time in over a century.

In contrast, most countries in Sub-Saharan Africa, Latin America, the Middle East and North Africa (MENA), and the rest of Asia have failed to transform global waves of

technological innovations into higher rates of growth and better jobs. These are the regions that we now call the Global South.

Both as cause and consequence of diverging growth and development paths, these countries developed a variety of arrangements for capital and labor to interact. The level of wages and benefits for workers, the stock of risk-management provisions, the quality of skilling schemes, and the cognitive content of jobs that characterize different labor markets are all correlated with the location of work. This association of developed economies with more reliable working arrangements is what the economist Branko Milanovic (2015) called citizenship premium, or, for Global South countries, citizenship penalty.

Detroit capitalism...

At the turn of the 20st century, the key features of the Global North labor markets could be summarized in what the political scientist Carles Boix calls Detroit capitalism, in reference to the city that became the world manufacturing center throughout the first half of the 19th century (Boix, 2019). Three main traits define Detroit capitalism:

- First, the features of the production system were such that it allowed for an increasing demand for semi-skilled workers. Mass production of physical goods in big firms matched an unprecedented growth in the workforce population, resulting in economies operating at near full employment levels. The economist Carl Frey, in his historical account of the relationship between technology and jobs, dubbed this period "the triumph of the middle class": the passage from a marked polarization between the income of capital owners (the rich) on the one side and workers (the poor) on the other, to a context where the economy "was able to generate sufficient opportunity

for blue-collar workers to attain middle-class lifestyle on the basis of nothing more than their wages." (Frey, 2019, p.221).

- Second, working arrangements took the form of long-term, stable contracts, which incentivized workers and management to engage in bets for distant futures. These would take the form, for instance, of firm investments in human capital that allowed workers to pursue "inside-the-firm" careers. As posed by sociologist Richard Sennett, this structured future allowed people to form a life narrative and social relations within the institution (Sennett, 2007). This stability, in turn, enabled governments to put in place comprehensive systems aimed at managing the different types of risks that people face along their lives, including those related to health, unemployment and retirement. These risk-sharing institutions that are associated with employments rather than workers constitute a central piece of 20th-century labor markets.

- Third, as part of the same ecosystem, the entire education system was designed to meet the demands of a relatively routine-intensive type of employment, such as operations and processing data and information management, and even punctuality and discipline. The set of skills and knowledge that a person needed to enter and succeed in the labor market could be codified in a relatively fixed curriculum. The birth of mass production came hand in hand with the origin and subsequent expansion of formal education institutions.

These large factories belong to the set of organizations and institutions that formed the 20th-century capitalism. To Max Weber, these institutions gave birth to the kind of bureaucracy that he described as an iron cage. In this cage, it was possible to find refuge, that is, loss compensation in the face of adverse events, or even the possibility of building an identity associated with a person's job). Still, it could also feel like a prison as each worker's contribution was reduced

to performing a standardized task within a far more complex production process that was unknown to them.

... and Mumbai capitalism

In the Global South, these iron cages have been the exception rather than the rule. The features of Detroit capitalism apply to only a fraction of the labor market. “Mumbai capitalism” (the name of any big city in the Global South will serve here) would be a better analogy to portray the heterogeneity with which developing labor markets evolved in the past, and the key differences with those in the Global North:

- First, in Global South countries, the economic structure is fragmented into two well-differentiated segments: a dynamic sector where workers operate under the conditions of the Detroit Capitalism and a stagnant sector populated by lower productivity jobs and inferior working conditions. W. Arthur Lewis, one of the greatest development economists of all times, called them "dual economies" (Lewis, 1954). In his words, in a dual economy a modern and industrial capitalist sector coexists with a low productivity and traditional sector (may it be agriculture or low productivity urban services). The resulting heterogeneity in the labor markets can hardly be called "a triumph of the middle class".

- Second, informality is pervasive in the Global South. In these countries, formal long-term contracts are a rarity. According to ILO data, in North America 90% of workers are in standard employment relationships and receive a wage or salary for their work. In sub-Saharan Africa, this percentage drops to 18%, as other mostly informal working arrangements prevail. Moreover, while in the United States or Sweden the proportion of the labor force contributing to at least one social security scheme is 100%, in Egypt it is 47%, and 26% in Peru.

- Lastly, the Global South has failed to develop proper institutions for learning. According to the evidence of Barro and Lee (2015), by 2010 the enrolment ratios in primary education in both the North and the South were close to 100%. However, the gaps are very large in the secondary and tertiary levels, with the enrolment rates in the latter reaching 73% in advanced economies and only 26% in developing economies. The gaps between the Global North and the Global South are equally significant – or even more important – with regard to the quality of human capital formation. Overall, many of the countries in Latin America and sub-Saharan Africa have failed to transform more schooling into more and better learning.

Global North narratives on the future of work

The ICTs revolution was the beginning of the end of the Detroit capitalism model as we knew it, and this trend accelerated in the past decade amid a new wave of exponential technological change also known as the Fourth Industrial Revolution (see Schwab, 2016). At the center of this new transformation is artificial intelligence (AI), defined as an intelligent system that takes human-level knowledge as input and uses that information to automate and multiply tasks that were previously performed by people (Taddy, 2019). Two of the main technological deployments fuelled by AI technology that deeply affect the labor market are the subject of this book: (a) the automation of tasks in the production process and (b) the mediation of labor supply and demand through digital platforms. In both cases, heated debates have emerged in academia, policy circles, and public opinion about the impacts of such developments.

In the case of automation, two opposite narratives took the scene. On the one hand, there is what the economic historian Aaron Benanav (2020) called "the automation discourse." This narrative rests on the anxieties and fears that have to do with the impacts of rapid technological change. It is based on

three propositions. First, workers are being displaced by new technologies, giving rise to what Keynes called "technological unemployment." Second, the automation process will be lengthy. And third, the new social equilibrium will imply moving from a wage economy to another mediated by the application of the Universal Basic Income (UBI). On the other hand, a more optimistic counter-narrative closely related to advanced economies' current and past performance is gaining attention in academic and policy circles (see Albrieu et al., 2018; Grimshaw, 2020). The narrative borrows from the influential work of the economists Daron Acemoglu and Pascual Restrepo (see 2016; 2019) to state that technological change and automation have become exponential. However, if history is any guide, more jobs will be created rather than destroyed in the long run. These longer-term benefits notwithstanding, some short-run frictions must be addressed, particularly regarding income polarization and the need for reskilling.

Regarding the platform economy, an older and more optimistic narrative is battling a newer and more pessimistic one. The first one is based on what the NYU professor Arun Sundararajan calls "crowd-based capitalism" (Sundararajan, 2016). According to this narrative, this new platform-mediated capitalism is highly beneficial to workers because it can eliminate the negative effects of the iron cage while maintaining its benefits. For example, the quantity and heterogeneity of users (the crowd) reduce informational asymmetries and lower transaction costs, resulting in better working conditions. The second narrative depicts an entirely different picture. As the sociologist Jaime Woodcock and the economic geographer Mark Graham explain, "the so-called standard employment relationship is being undermined through fragmented work and increased casualization. Activities that were previously considered to be a formal or standard job can be mediated through platforms to try to bypass rules, standards, and traditions that have protected working standards" (Woodcok and Graham, 2020, p 5). Under these conditions, it is not clear whether platform mediated jobs will ultimately benefit workers.

Raw material for building Global South narratives

Are these narratives representative of the challenges and opportunities facing workers in the Global South, particularly for those living under the rules of Mumbai capitalism? The short answer is: we do not know. As in many other topics of global interest, the critical inputs for developing narratives and policy frameworks – data and knowledge – are generated mainly in the Global North and thus largely reflect Global North concerns, views, and methodologies.

With these gaps in mind, the Future of Work in the Global South (FoWiGS) Initiative was launched in 2017. The goal of FoWiGS is to provide Global South policymakers with context-specific and data-driven frameworks that contribute to the creation of high-quality jobs amid the fourth industrial revolution. This book aims to enrich the future of work debates with evidence from the Global South. Developing countries face specific challenges that standard narratives have not yet managed to include as part of a truly global view on how technology and labor markets interact. As the research agenda is still under construction, these pieces of research can be understood as raw material to kick-start a discussion that should continue to grow.

The first section of the book deals with the automation hypothesis. It has two chapters: "New technologies and the future of jobs in Latin America" by Irene Brambilla, Andrés César, Guillermo Falcone, Leonardo Gasparini, and "Inequality at risk of automation? Gender Differences in Routine Tasks Intensity in Developing Country Labor Markets" by Janneke Pieters, Ana Kujundzic, Rulof Burger, and Joel Gondwe. In both chapters, the authors challenge the standard methodological assumption stating that like occupations are performed equally in different countries, regardless of their development stage and specific characteristics. They use household level data from Global South countries (OECD's

PIAAC survey and the World Bank's STEP survey), and they present fresh perspectives on technology and jobs in the Global South about crucial issues, such as the "hollowing out" debate. Several Global South specific elements emerge from their work: First, the main risk for developing countries at this point has more to do with being trapped in old technologies rather than suffering from exponential technological change. Second, it is essential to go granular in terms of what "technology" means in practice. Robotization, for example, results in jobs and wage dynamics that differ greatly from those fueled by the increasing use of ICTs in routine tasks in the production process. Third, the risks associated with the implementation of new technologies target women, even after controlling for occupation, education, and ethnicity.

The second section of the book is dedicated to digital platforms. It has three chapters: "Future of Work in the Global South: Digital Labor, New Opportunities and Challenges" by Diego Aguilar, Joaquín Gonzalez, Aileen Agüero, and Roxana Barrantes; "Fairwork in the Platform Economy: A Global South Perspective" by Pitso Tsibolane, Maria Belen Albornoz, Arturo Arriagada, Treviliana Eka Putri, Jean-Paul Van Belle, Henry Chavez, Richard Heeks, Kelle Howson, Macarena Bonhomme, Jorge Leyton, Francisco Ibáñez, Louise Bezuidenhout, Mark Graham; and "Online Work and Women in India: The Opportunities and Limits of Digital Entrepreneurship" by Urvashi Aneja. As in the case of automation, these chapters provide new evidence to rethink the relationship between technology and jobs when considering Global South contexts. Neither the optimistic nor the pessimistic narrative seems to fit these contexts. First, platform work may not compete against formal work in the Global South but it does absorb mostly informal work. Therefore, it should not be framed as a substitute activity for formality. Second, unlike what we can see in rich countries, digital labor does not harm Global South workers' income; quite the opposite. Third, platforms are not neutral when it comes to gender: they can provide economic benefits for women but, as long as we are able to move away from current

stereotypes, this may be at the cost of perpetuating existing gender roles where women use the flexibility of platforms to comply with household work. Fourth, working conditions in the platform economy across Global South regions show a great deal of heterogeneity, pointing to the crucial role that country or region-specific factors play in determining whether or not technological innovation and job quality move together.

Eliminating blind spots about what we know on the future of work in the Global South requires far-reaching investments in new research and new data. This implies engaging in a double cross-fertilization process, i.e., crossing different themes – such as, skills, technology, labor market regulations, demography – and different regions, not only Global North and Global South as monolithic entities but also acknowledging the heterogeneities within these groups. They are key narratives and policy guidelines that could align different stakeholders to create better jobs in the Global South.

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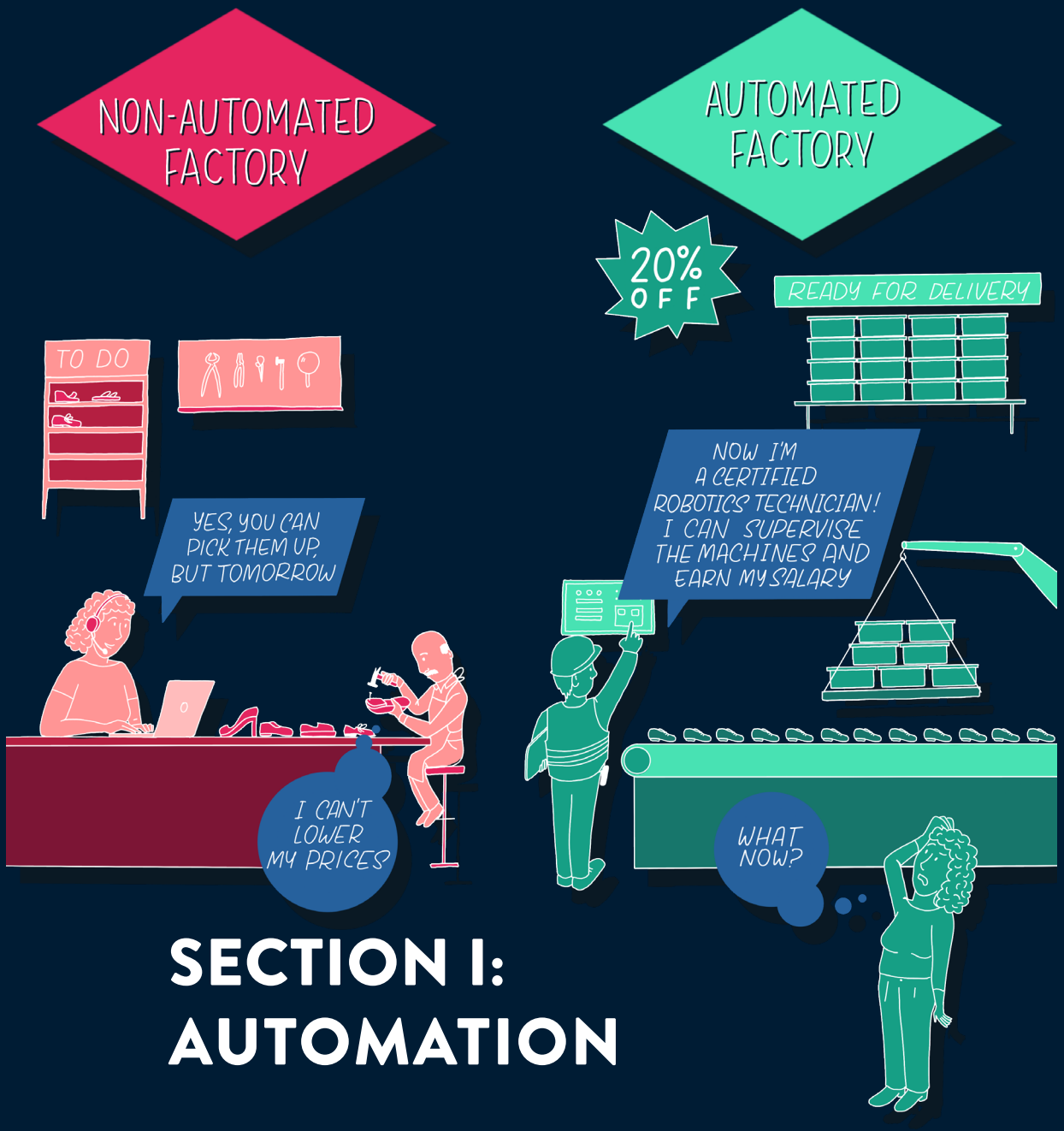
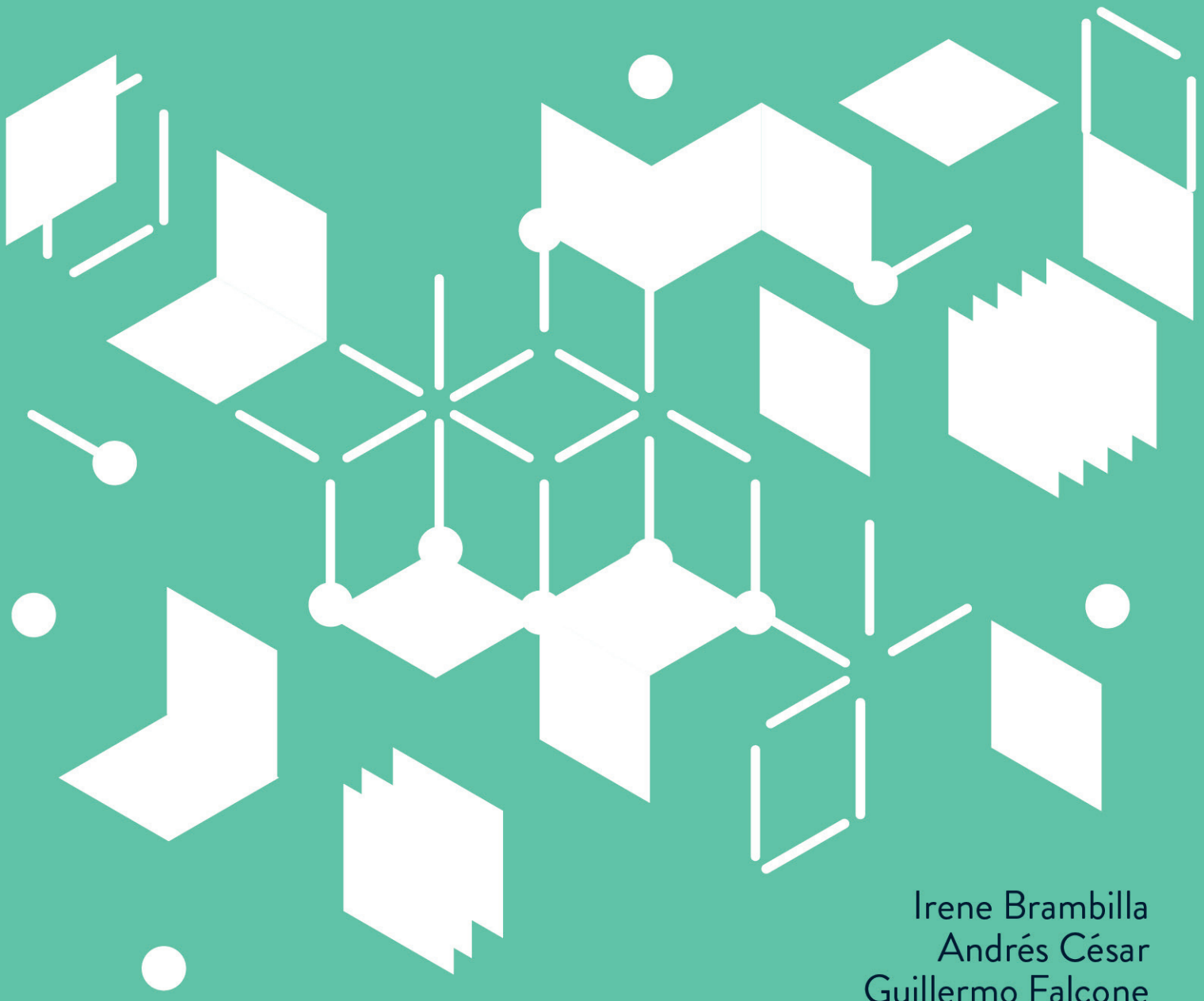


SECTION I: AUTOMATION

1. NEW TECHNOLOGIES AND THE FUTURE OF JOBS IN LATIN AMERICA



Irene Brambilla
Andrés César
Guillermo Falcone
Leonardo Gasparini

INTRODUCTION

Technological change affects the structure of labor markets. As new technologies become available we can see increases in productivity, changes in firm dynamics, and factor reallocation across industries, firms, and occupations. Returns to labor are affected as demand and supply for different types of workers rise or fall.

The interactions between technology and labor markets are complex and operate through several mechanisms. Jobs that imply working in complement with technology see their productivity, demand, and wages rise. Examples of such workers cover a large range of occupations, such as IT technicians, truck drivers using a GPS system, or a textile worker using a programmable cutting machine. In contrast, workers that are substitutable by technology may find themselves facing wage reductions or displacement by technology, with resulting negative effects on employment and even poverty. In turn, firms that successfully invest in technology adoption become more productive and grow, creating new occupations, demanding more labor of all types, and possibly overcoming the negative displacement effects on workers.

In sum, as with any major structural change, technology adoption benefits some workers while it may harm others. Unskilled workers have typically been signaled as having been harmed by technology since the early skilled-biased technological change literature of Katz and Murphy (1992), Bound and Johnson (1992) and Card and Lemieux (2001). This literature finds that technology is complementary with skilled labor, therefore positively affecting the relative demand and wage of skilled workers at the expense of the unskilled.

In the last two decades, technology adoption has taken the form of automation. Robots and computers are able to fully

[1]All authors are from CEDLAS—UNLP and CONICET.
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replace workers in some tasks. They can be programed to perform routine tasks almost without the participation of a human input. Everyday examples are vending machines, airline computer check-ins, and subway card scan gates. Automation and digitalization are able to replace labor routine tasks that follow well designed, easily automated rules based on algorithms.

This concern has been examined by the task-based approach of Autor, Levy and Murnane (2003) and Acemoglu and Autor (2011), who argue that the complementarity or substitutability between technology and labor does not occur at the worker category level but rather depends on how susceptible different tasks are for automation. In this line, occupations that involve creative-thinking, problem-solving, interpersonal skills, and that are not repetitive are not susceptible to codification by a computer and, thus, less prone to automation. In contrast, tasks that are repetitive may be more susceptible to technology instead of workers, creating negative effects on employment for workers with skills that are compatible with routine occupations. These effects may be particularly pervasive in the short and medium run, when adjustment of labor markets is slow.

The proliferation of computers and robotics opens the door to a new range of occupations that can be replaced by technology. In fact, for developed countries, many authors argue that tasks performed by workers in the middle of the skills distribution are more likely to be replaced by machines, thus leading to the polarization hypothesis (Autor et al., 2003; Spitz-Oener, 2006; Goos and Manning, 2007; Autor and Dorn, 2013; Goos, Manning and Salomons, 2014; Michaels, Natraj and Van Reenen, 2014). In developed countries, labor routine tasks are heavily concentrated in the middle of the skills distribution, and hence employment has been increasingly concentrated in high-wage occupations and low-wage occupations, at the expense of traditionally middle-skill jobs.

The literature for developed countries is extensive. However, not so much is known about the effects of new technologies in developing countries. A regional study led by the World Bank looks at several case studies of digital technology adoption in Latin America (see Dutz, Almeida and Packard, 2018 for a survey). Brambilla, César, Falcone, and Gasparini (2021a) look at the impact of robot adoption. Based on the task-based hypothesis, Brambilla et al. (2021b, 2021c) and Gasparini, Brambilla, César, Falcone and Lombardo (2021) study employment and routinization, while Messina and Silva (2017), Maloney and Molina (2018) and Das and Hilgenstock (2018) study the polarization hypothesis.

In this chapter we present an empirical analysis of the impact of new automation technologies on employment, wages, and its distributional consequences in Latin America based on Brambilla et al. (2021a, 2021b, 2021c) and Gasparini et al. (2021). Our analysis builds upon three focal and complementary topics that study the consequences of automation from different angles, with different combinations of data, and with different empirical strategies. The first topic is the potential replacement of workers by robots and its impact on welfare. We construct measures of robot adoption and study their effects on employment, wages, poverty, and income distribution. The second topic is the task-based approach. We build an index of routinization based on the description of tasks performed by each occupation. We identify workers that perform routine tasks and study how employment and wages have evolved according to their degree of routinization. Finally, the third topic deals with what the future holds for workers in Latin America. Based on job characteristics, we analyze the risks of being displaced by technology in the near future for different demographic groups.

Throughout this chapter we use harmonized microdata from the SEDLAC database (a joint collaboration between CEDLAS-UNLP and the World Bank) for the six largest Latin American economies—Argentina, Brazil, Chile,

Colombia, Mexico and Peru, which represent 79% of total population and 86% of total GDP of the region—for the period 1992-2016. This large sample allows us to provide a global perspective of the structure of jobs in Latin America.

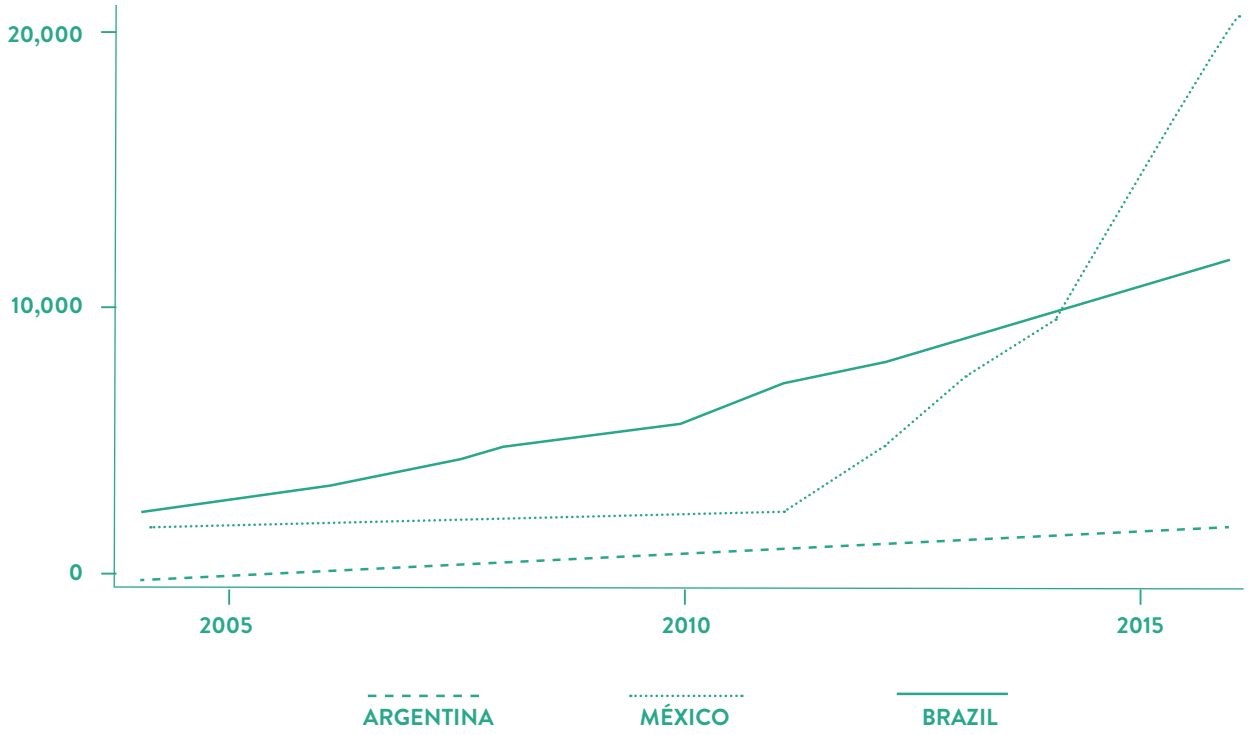
The chapter is organized in several sections, with Sections 2, 3, and 4 studying the effects of robot adoption, the tasks-based approach, and the future risks for jobs in Latin America, respectively. Section 5 concludes.

HUMANS VS. ROBOTS

During the last 15 years, robot adoption has made a big jump in Latin America. Figure 1.1 shows the total number of industrial robots in Argentina, Mexico and Brazil.[2] These data are compiled by the International Federation of Robotics. In Argentina robot adoption jumps from virtually zero in 2005 to 2,000 in 2016. During those same 11 years, robots increase from 1,900 to 11,000 in Brazil, and from 3,000 to a whopping 20,000 in Mexico. Robots are a particular form of technology adoption, but the figure shows a clear trend in the large and very recent increase in automation in Latin America's largest economies.

[2] In this section we work with these three countries given that the other countries (Chile, Colombia and Peru) have a relatively low adoption of robotics.

FIGURE 1.1
EVOLUTION OF THE STOCK OF ROBOTS



Source: Authors' calculations based on International Federation of Robotics (IFR)
Note: The vertical axis shows the number of industrial robots according to the definition of the IFR.

The increase in public interest in robotics and automation has led economists to examine the impact of industrial robots and automation on labor market outcomes, such as employment and wage inequality. Graetz and Michaels (2018) study the effects of industrial robots across 17 developed countries from 1993 to 2007 and find that robots increased labor productivity while reducing the employment share of low-skilled workers. Acemoglu and Restrepo (2020) analyze the effects of the increase in industrial robot adoption between 1990 and 2007 on US labor markets. In Latin America, Brambilla et al. (2021a) study the impact of robot penetration in Argentina, Brazil, and Mexico at the district level. In this section we summarize this approach.

Focusing on districts as we do in Brambilla et al. (2021a) allows us to study how local labor markets are affected by varying degrees of exposure to robots. We construct measures of worker exposure to robots, defined as the stock of industrial

robots per thousands of workers, at the district level, for the years 2004—2016. This measure is based on information on the stock of robots collected by the International Federation of Robotics, combined with data from household surveys that provide information about industry of occupation. Household surveys data for the period 2004—2016 for the three countries come from: Encuesta Permanente de Hogares (EPH) in Argentina, Pesquisa Nacional por Amostra de Domicilios (PNAD) in Brazil, and Encuesta Nacional de Ingresos y Gastos de los Hogares (ENIGH) in Mexico. These data allow us to study the evolution of relevant outcomes at the local labor market level, such as the unemployment rate, average labor income, inequality, and poverty.

The International Federation of Robotics provides data on robots at the industry level, not at the district level. However, within countries, different districts experienced heterogeneous exposure to industrial robots according to their initial distribution of employment across industries. Industries like automotive, metal products, rubber and plastic products, and industrial machinery adopted industrial robots at a rate well above the average, making local labor markets specialized in these industries highly exposed to automation. On the other hand, local labor markets with a large share of industries like textiles, wood and furniture, or paper products remain much less exposed to the penetration of robots.

We define district robot penetration *(RP)* in district i and year t as a weighted average of robots per worker in each industry k, given by

$$RP_{it} = \sum_k \theta_{ki} \; Robots/Workers_{kt}$$

where θ is the share of industry *k* in total employment in district *i* in the initial year of data. The employment weights are computed from information from the household surveys. From the household surveys we also compute district level outcomes of interest, such as unemployment, informality, wages, poverty and inequality.

We then run district-level regressions to estimate the effect of robot penetration on labor market outcomes. The regression equation is

$$y_{it}=\beta_0 + \beta_1 \ RP_{it} +\alpha_i+\alpha_t+\varepsilon_{it}$$

where y are the outcome variables (unemployment, wages, poverty, inequality), the parameters α are district and time fixed effects, and ε is an error term. The coefficient of interest is β_1, which captures the impact of robot penetration on the labor market variables. Because the regression includes district and year fixed effects, the impact of robot penetration is estimatedbased on differences in robot penetration that occur withindistricts across time. Robot penetration is potentially an endogenous variable as labor market conditions may have an impact on firms' decisions to invest in robotics. To account for this issue we follow an instrumental variable approach similar to Acemoglu and Restrepo (2020). For more details see Brambilla et al., (2021a).

Tables 1.1 and 1.2 report the results on labor market outcomes and on welfare. Each cell corresponds to a regression and reports the coefficient β_1. Horizontal panels correspond to different outcome variables, whereas different controls are included across columns to account for different trends across districts based on initial characteristics.

TABLE 1.1
THE IMPACT OF ROBOTS ON JOB MARKET OUTCOMES

	(1)	(2)	(3)
Panel A: Unemployment rate			
Robot penetration	0.031**	0.029**	0.029**
	(0.013)	(0.013)	(0.013)
Panel B: Informality rate			
Robot penetration	0.101**	0.103**	0.114**
	(0.049)	(0.026)	(0.049)
Panel C: Log average labor income			
Robot penetration	-0.267***	-0.280***	-0.261***
	(0.100)	(0.100)	(0.096)
Panel D: Log average wage			
Robot penetration			
	-0.168	-0.199	-0.151
	(0.155)	(0.139)	(0.136)
Observations	963	963	963
PT Unemployment x Year FE	YES	YES	YES
PT Employment x Year FE	NO	YES	YES
PT RTC x Year FE	NO	NO	YES

Source: Authors' calculations based on IFR and national household surveys.
Note: All regressions include year and district fixed effects.
Robust standard errors in parenthesis.
Significance at the 1, 5 and 10 percent levels are denoted by ***, ** and * Columns (1) to (3) differ in that they control for different initial trends.

In Table 1.1, panel A, we present the results on the unemployment rate. The unemployment rate is the share of individuals in the labor force that have been actively looking for a job in the last month and have not found one. Results show that indeed there is a positive and significant effect of robot adoption on unemployment. An increase in the ratio of robots to workers of 0.10 results in an increase in district-level unemployment that ranges from 0.29 to 0.31 percentage points.[3]

In Panel B we report the results for labor informality. The informality rate is the share of employed individuals that are not contributing to a pension fund. The informality rate goes up as a result of exposure to robots, which implies a loss

[3] The average change in the robots to workers ratio during the studied period was 0.12.

in job quality among individuals that do not lose their jobs due to robots. The estimated coefficient for informalityis approximately almost four times larger in magnitude than thecoefficient for unemployment, which is in line with recent evidence for developing countries pointing out that the informal sector can work as a buffer for displaced workers. In the absence of a large informal sector that is able to absorb part of the displaced labor force, the effect of robots and technological change on unemployment would be much larger. Similar arguments have been made for the effects of trade and globalization (Dix-Carneiro, Goldberg, Meghir and Ulyssea, 2021; César, Falcone and Gasparini, 2021).

Panel C presents the effect on total labor income. Note that the expected direction of this effect is not straightforward. On the one hand, robots can displace workers from their original jobs to lower-productivity, lower-paying jobs. This idea is in line with our previous results for informality, where robot-displaced workers reallocate to informal jobs. On the other hand, as robots tend to displace unskilled workers, who on average have lower earnings, the average labor income of the district could go up. We find that the impact is indeed negative and statistically significant. The implication is that robot-displaced workers reallocate to lower-paying jobs. Similar results are shown in Panel D for the hourly wage, although coefficients are lower in magnitude and imprecisely estimated. Given that our identification strategy works with average outcome variables at the district level, we cannot follow the career path of individuals to actually confirm this hypothesis. However, we can follow outcome variables for specific groups of individuals and test this idea. We will come back to this in the next subsection.

TABLE 1.2
THE IMPACT OF ROBOTS ON WELFARE

	(1)	(2)	(3)
Panel A: Poverty headcount (FGT 0)			
Robot penetration	0.360***	0.349***	0.303***
	(0.081)	(0.077)	(0.070)
Panel B: Poverty gap (FGT 1)			
Robot penetration	0.222***	0.217***	0.175***
	(0.049)	(0.047)	(0.042)
Panel C: Interquantile ratio (p75/p25)			
Robot penetration	0.505*	0.504*	0.495*
	(0.297)	(0.296)	(0.267)
Observations	963	963	963
PT Unemployment x Year FE	YES	YES	YES
PT Employment x Year FE	NO	YES	YES
PT RTC x Year FE	NO	NO	YES

Source: Authors' calculations based on IFR and national household surveys.
Note: All regressions include year and district fixed effects.
Robust standard errors in parenthesis.
Significance at the 1, 5 and 10 percent levels are denoted by ***, ** and * Columns (1) to (3) differ in that they control for different initial trends.

Table 1.2 shows the results for poverty and inequality. We report the effects on two Foster-Greer-Thorbecke indexes: The headcount ratio (FGT0, in Panel A), defined as the share of individuals with income below the poverty line of US$5.5 per day; and the poverty gap index (FGT1, in Panel B), defined as the average deviation with respect to the poverty line. The coefficients are positive and statistically significant in all specifications for the two indexes, implying that the adoption of robots has had a pervasive effect on poverty at the local level. The impact on the headcount ratio ranges from 3 to 3.6 percentage points for an increase of 0.10 in the robot to workers ratio.

We find similar results for income inequality. They are displayed in Panel C. We compute the ratio of percentiles 75th to 25th. Inequality increases as a result of exposure to robots. Given that most districts reduced poverty and inequality during the period studied, our estimates suggest that districts that experienced a faster growth in the adoption

of robotics reduced poverty and inequality at a slower rate than less exposed districts. The increases in poverty and inequality are linked to the increases in unemployment and labor informality.

Looking at different demographic groups

Not all jobs are equally affected by robot adoption. Differences across jobs are partially captured by worker characteristics in the household surveys. We thus estimate the impact of robot adoption for different demographic groups. We focus on two characteristics: education and gender; and two outcome variables: unemployment and informality.

TABLE 1.3
THE IMPACT OF ROBOTS BY DEMOGRAPHIC GROUPS

By skills	All (1)	Low Skilled (2)	Mid Skilled (3)	Highly Skilled (3)
Panel A: Unemployment rate				
Robot penetration	0.029**	0.020	0.062***	-0.005
	(0.013)	(0.015)	(0.019)	(0.011)
Panel B: Informality rate				
Robot penetration	0.114**	0.057	0.034	0.018
	(0.049)	(0.060)	(0.052)	(0.039)
By gender	**All (1)**	**Female (2)**	**Male (3)**	
Panel C: Unemployment rate				
Robot penetration	0.029**	0.017	0.037***	
	(0.013)	(0.020)	(0.013)	
Panel D: Informality rate				
Robot penetration	0.114**	0.132**	0.097**	
	(0.049)	(0.062)	(0.044)	
Observations	963	963	963	963
PT Unemployment x Year FE	YES	YES	YES	YES
PT Employment x Year FE	YES	YES	YES	YES
PT RTC x Year FE	YES	YES	YES	YES

Source: Authors' calculations based on IFR and national household surveys.
Note: All regressions include year and district fixed effects.
Robust standard errors in parenthesis.
Significance at the 1, 5 and 10 percent levels are denoted by ***, ** and *.
Regression specifications are analogous to column 3 of Tables 1 and 2.

We split the working age population by skill level and by gender and run our baseline regression equation separately for each group. The results are in Table 1.3. Panels A and B split workers into three skill groups: low-skilled level (no high school degree), medium-skill level (high school degree), and highly-skilled (additional education after high school). For purposes of comparison, column (1) reproduces the results on unemployment and informality for all workers pooled together (from Table 1, column 3), while columns (2) to (4) show the results for the different skill groups. Unemployment rates increase only for medium-skilled workers. These results are in line with the task-based approach literature, which finds that new technologies have a larger impact on employment in the middle of the skill distribution (Autor, Levy and Murnane, 2003; Spitz-Oener, 2006; Goos and Manning, 2007; Goos et al., 2014; Michaels et al., 2014). The informality rate increases for all groups but it is imprecisely estimated. The point estimate is largest for the low-skilled group.

Panels C and D split workers by gender. Estimated coefficients show that unemployment increases among male workers. This result can be partially explained by the fact that men are relatively more concentrated in occupations that perform manual tasks in the industrial sector, which present a high penetration of robots relative to the service sector.

Summing up, we find that during the last two decades, districts that were more exposed to the adoption of robots have had a worse performance (relatively to less exposed districts) in terms of unemployment, informality, earnings, poverty and inequality. Our results also support the idea that the unemployment costs generated by the new technologies are relatively concentrated in the middle of the skills distribution. Finally, we also show that these costs were more intense for men relative to women.

ROUTINIZATION AND FLEXIBILITY: THE TASK-BASED APPROACH

A large share of the literature on the effects of technology on labor markets has highlighted that workers performing routine repetitive tasks are by definition at a higher risk of being replaced by digitization or automation than workers that perform tasks that require creativity, problem solving, and interpersonal communication. This is called the task-based approach.

Most empirical work that follows or tests the task-based hypothesis is based on surveys of occupational characteristics, namely the Dictionary of Occupational Titles (DOT) and the Occupational Information Network (O*NET). These are US surveys that compile information on tasks performed by workers in each occupation, their frequency and their importance as part of their jobs. Depending on their nature, repetitive tasks can be identified (Autor, Katz and Kearney, 2006, 2008). Spitz-Oener (2006) groups tasks into five categories: routine manual, routine cognitive, non-routine manual, non-routine analytical, non-routine interactive. Indexes of routine task content are built at the occupation level by aggregating individual responses about how often they perform each task, combined with the nature of each task.

Brambilla et al., (2021b, 2021d) and Gasparini et al., (2021) follow a similar approach based on occupation and skills surveys from Latin America. The surveys come from the Programme for the International Assessment of Adult Competencies (PIAAC) conducted by the OECD in several countries since 2011. In Latin America it is available for Chile (2014-2015), Ecuador, Mexico, and Peru (2017). In this section we report related results using the same databases.

The PIAAC survey includes demographic information, the occupation of each worker, and several questions related to job tasks. We are interested in tasks that allow us to quantify the degree of routinization of each occupation. Tasks that require creative thinking, problem solving and personal abilities are flexible and more prone to be complementary with new technologies, whereas activities that are repetitive or follow a defined pattern are more prone to be codified and replaced by automation technologies. We consider the main following questions/tasks: *Do you manage or supervise other people? Do you plan the activities of other workers? Are you confronted with complex problems? Do you write articles or reports?* Because of their nature, these tasks cannot be automatized and require a human input. Importantly, they are unambiguously related to the job performed and not to the characteristics of the working environment, and they have high variability in responses across individuals. For each individual in the survey we define a flexibility index (F1). The index is a dummy variable that is equal to one when the individual replies that he performs at least one of the four tasks often or very often.[4]

TABLE 1.4
FLEXIBLE TASKS

	Latin America (1)	High-income (2)	All countries (3)
Supervising	0.11	0.12	0.12
Planning	0.24	0.28	0.27
Solving problems	0.29	0.32	0.31
Written output	0.28	0.3	0.3
Flexibility index F1	0.54	0.59	0.58
Observations	13157	57950	71107

Source: Authors' calculations based on PIAAC.
Note: Sample includes employed individuals between 16 and 65 years of age.
Table shows the percentage of individuals that perform each flexible task often and the average flexibility index F1.

[4] Individuals respond with a number between 1 and 5 meaning:
1 = never;
2 = less than once a month;
3 = less than once a week;
4 = at least once a week;
5 = every day.

Table 1.4 reports the percentage of workers performing each flexible task and the average value of the flexibility indexes F1. In the first column we show the average for the four Latin American economies for which PIAAC surveys are available (Chile, Ecuador, Mexico, and Peru). In Latin America (column 1), 11 percent of the workers report supervising others often or very often, 24 percent of the workers report planning activities for other workers, 31 percent of the workers report solving problems, and 30 percent of the workers report producing written output. For comparison purposes in column (2) we present the same statistics for high-income countries for which PIAAC surveys are available, while column (3) shows statistics for the pool of all countries. In high-income countries, a slightly higher percentage of workers reports performing each flexible task, while the flexibility index is 5 percentage points higher.

Gender-oriented tasks

To study workers that are potentially harmed by automation, we conduct descriptive regression exercises to identify gender differences and other demographic characteristics of workers performing flexible tasks. Our regression specification takes the form

$$F_{jc}=\delta_0+x_{jc}'\delta_1+\alpha_c+\varepsilon_{jc}$$

where *F* is the flexibility index (dummy variable that takes the value of one for individuals that perform at least one flexible task at work) for individual j in country *c*, *x* are individual characteristics including gender, education level and whether the person uses a computer at work, α are country-fixed effects and ε is an error term. We split workers into two skill groups: low or medium skilled are those workers with a high school diploma or less, whereas highly skilled are workers with some education beyond high school.

TABLE 1.5
PROBABILITY OF PERFORMING FLEXIBLE TASKS

	Flexibility index F1	
	(1)	(2)
Female	-0.081*** (0.007)	-0.068*** (0.007)
Low/medium skilled	-0.126*** (0.008)	-0.064*** (0.009)
Age 25-40	0.060*** (0.011)	0.049*** (0.011)
Age 41-65	0.058*** (0.011)	0.040*** (0.011)
Computer use	0.288*** (0.008)	0.210*** (0.009)
R-squared	0.125	0.165
Observations	13,157	13,157

Source: Authors' calculations based on PIAAC.
Note: Column (2) includes occupation fixed effects.
Robust standard errors in parenthesis.
Significance at the 1, 5 and 10 percent levels are denoted by ***, ** and *.

Table 1.5, column (1), shows that females are 8 percentage points less likely to perform at least one flexible task than men, and that low- and medium-skilled workers are 12 percentage points less likely to perform flexible tasks than workers with higher education. Workers in the age groups 25—40 and 41—65 are more likely to perform flexible tasks than their younger counterparts. Computer use at work correlates very highly with flexibility: it is associated with a 28 percentage point increase in the probability of performing at least one flexible task. These are descriptive results that explain differences in the cross-section of workers and have no predictive interpretation.

Column (2) controls for occupation fixed effects. Differential probabilities of performing flexible tasks for females and less-educated workers are slightly reduced when controlling for occupation fixed effects, which suggests that part of these gaps are driven by the occupational structure itself. However, large differences between men and women and

between low/medium-skilled and highly-skilled workers remain even after controlling for occupation. This means that even within occupations, tasks vary by gender and education level. Coefficients on age and computer use are also reduced after controlling for occupation fixed effects.

TABLE 1.6
PROBABILITY OF PERFORMING FLEXIBLE TASKS

	Supervising (1)	Planning (2)	Solving problems (3)	Written output (4)
Female	-0.019* (0.010)	-0.041*** (0.014)	-0.055*** (0.015)	-0.029** (0.014)
Low/medium skilled	-0.023 (0.017)	-0.052** (0.021)	-0.075*** (0.022)	-0.058*** (0.022)
Computer use	0.094*** (0.015)	0.146*** (0.019)	0.098*** (0.019)	0.205*** (0.019)
R-squared	0.145	0.138	0.094	0.258
Observations	13,157	13,157	13,157	13,157

Source: Authors' calculations based on PIAAC.
Note: All regressions control for age and country--ocupation fixed effects.
Robust standard errors in parenthesis.
Significance at the 1, 5 and 10 percent levels are denoted by ***, ** and *.

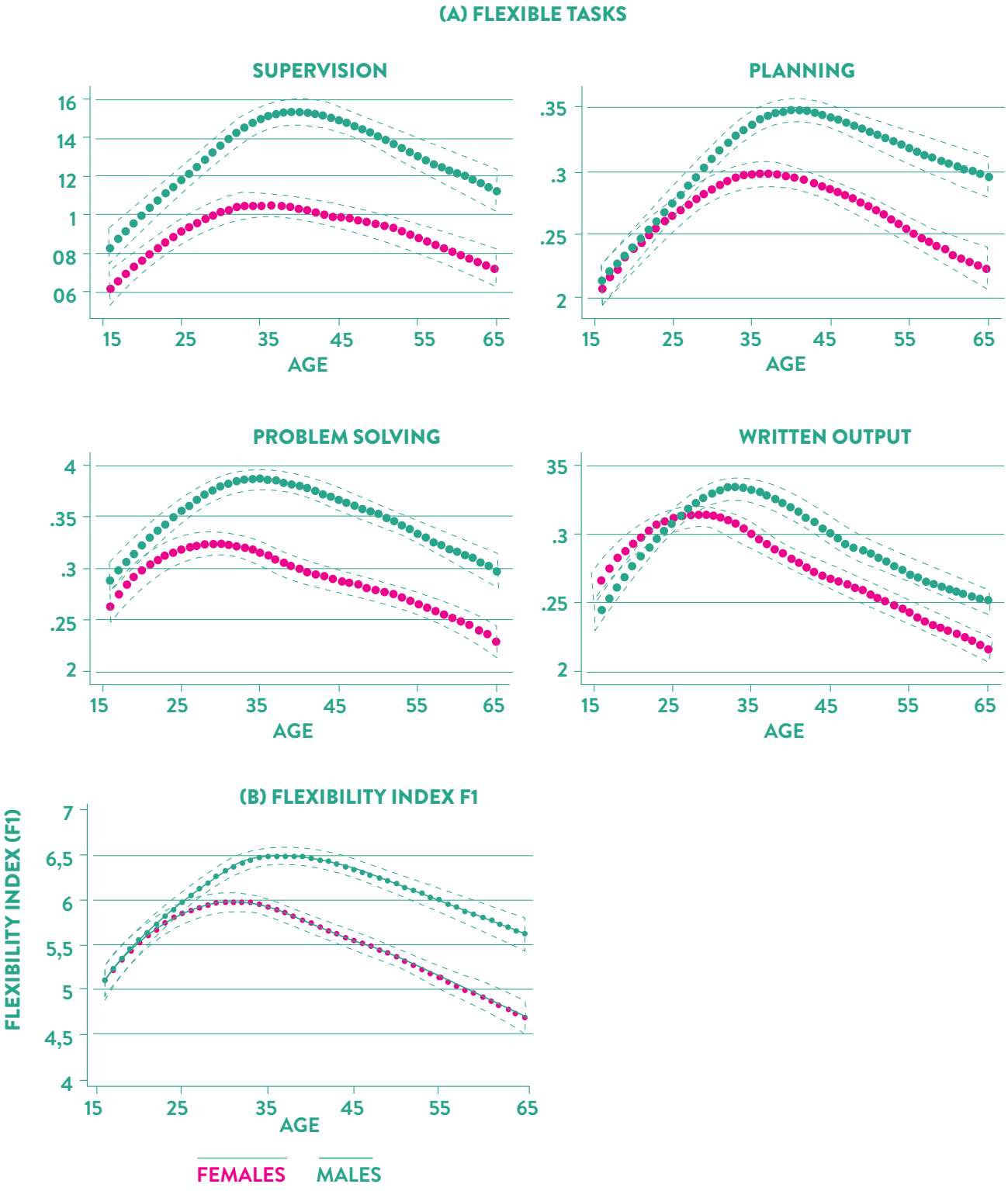
Table 1.6 shows the results for each separate task component of the probability index, one per column. All columns control for occupation fixed effects and for age groups (not shown). In line with previous findings, estimated coefficients for females and less-educated workers are negative and statistically significant for all four flexible tasks. Computer use correlates positively with each task.

These results show that the current division of tasks in the labor market is characterized by women that are less likely than men to perform flexible tasks even after controlling for occupation, education and computer use. Women are 2 percentage points less likely than males to supervise other workers, 4 percentage points less likely to plan the activities of other workers, 5 percent less likely to solve problems

and 3 percent less likely to produce written output. Note that the results in the previous section show that men are more likely than women to become unemployed because of robot penetration. These are complementary results. While robots may be more likely to replace male workers in manual manufacturing occupations, flexible tasks are defined by a broader range of activities, including routine cognitive jobs.

FIGURE 1.2

PROBABILITY OF PERFORMING FLEXIBLE TASKS BY GENDER



Source: Authors' calculations based on PIAAC.
Note: Panel (a) shows the probability of performing each flexible task by age and skill level.
Panel (b) shows the probabilityof performing at least one flexible task (index F1).

Figure 1.2 plots the conditional probability of men and women performing flexible tasks separately (conditional on age). There are two important facts in Figure 1.2. One is that the probability of performing each flexible task has an inverted U-shape both for men and women. The increasing part of the curve corresponds to very young workers and reflects changes along the career paths of individuals. Young workers are early entrants into the labor market, with low experience, lower responsibilities and usually in charge of repetitive tasks. As their job tenure increases, so does the probability of performing flexible tasks. The decreasing part of the inverted U curve reflects changes across cohorts. Formal and informal education has increased throughout generations, implying that middle-aged generations could be more likely to perform more tasks than their older counterparts.

The second fact is that gender differences are not significant for very young workers, with the exception of those supervising others. The gender gap increases at around 25 years of age. At this point, workers with a college education or higher are joining the labor market. The gender-based selection of occupations might play a role as educated men have a higher participation in professional and associated occupations and thus exhibit a higher probability of performing flexible tasks. Likewise, motherhood might also play a role in shaping women's career paths, affecting the chance of reaching managerial and top rank positions and, hence, contributing to vertical gender segregation.

Routine task content indexes

We know the occupation of each individual in the PIAAC survey. We use the information related to job tasks to define a routine task content index (RTC) at the occupation level, which represents the percentage of workers in each occupation that do not perform any of the four flexible activities often. For a better statistical representation and to minimize matching errors with household surveys,

occupations are defined at the 2-digit level, which gives us a total of 40 occupations, and we pool together PIAAC surveys for Chile, Ecuador, Mexico and Peru. For occupation h, the RTC index is defined as one minus the average of the flexibility indexes F1 for individual j in occupation h. That is,

$$RTC_{\mathrm{h}} = 1 - \frac{1}{\bar{n}_h} \sum_{j \in h} F_{1j}$$

where n is the number of individuals in each occupation. The index captures the percentage of individuals within an occupation that perform mostly routine tasks. The lower the RTC of an occupation, the higher the possibilities of complementarity with new technologies. In contrast, the higher the RTC of an occupation, the higher the chances of substitutability by labor-saving automation technologies. A similar approach is used by Autor et al., (2003) and Autor et al., (2006, 2008). For our purposes, our measure has an obvious advantage: it is constructed from information on actual tasks performed by Latin American workers.

FIGURE 1.3
INDEX OF ROUTINIZATION BY OCCUPATION

Source: Authors' calculations based on PIAAC.
Note: The vertical axis shows the RTC index for each occupation.

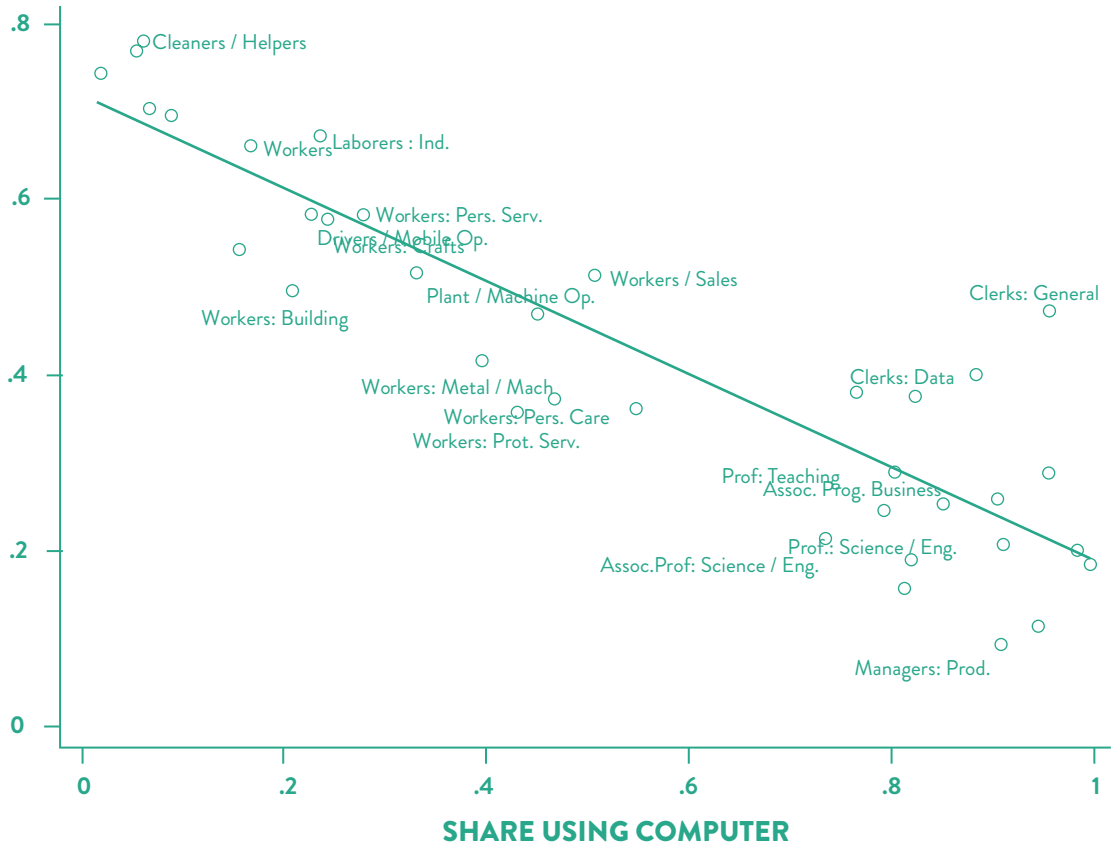
TABLE 1.7
INDEX OF ROUTINIZATION BY OCCUPATION

OCCUPATION	RTC
Chief Executives, Senior Officials and Legislators	0.189
Administrative and Commercial Managers	0.113
Production and Specialized Services Managers	0.091
Hospitality, Retail and Other Services Managers	0.157
Science and Engineering Professionals	0.207
Health Professionals	0.244
Teaching Professionals	0.286
Business and Administration Professionals	0.200
Information and Communications Technology Professionals	0.184
Legal, Social and Cultural Professionals	0.254
Science and Engineering Associate Professionals	0.211
Health Associate Professionals	0.383
Business and Administration Associate Professionals	0.260
Legal, Social, Cultural and Related Associate Professionals	0.282
Information and Communications Technicians	0.290
General and Keyboard Clerks	0.475
Customer Services Clerks	0.400
Numerical and Material Recording Clerks	0.377
Other Clerical Support Workers	0.397
Personal Services Workers	0.582
Sales Workers	0.513
Personal Care Workers	0.379
Protective Services Workers	0.359
Market-oriented Skilled Agricultural Workers	0.659
Market-oriented Skilled Forestry, Fishery and Hunting Workers	0.542
Subsistence Farmers, Fishers, Hunters and Gatherers	0.743
Building and Related Trades Workers (excluding Electricians)	0.494
Metal, Machinery and Related Trades Workers	0.416
Handicraft and Printing Workers	0.466
Electrical and Electronic Trades Workers	0.363
Food Processing, Woodworking, Garment and Other Craft and Related Trades Workers	0.579
Stationary Plant and Machine Operators	0.520
Assemblers	0.569
Drivers and Mobile Plant Operators	0.583
Cleaners and Helpers	0.780
Agricultural, Forestry and Fishery Labourers	0.772
Labourers in Mining, Construction, Manufacturing and Transport	0.667
Food Preparation Assistants	0.696
Street and Related Sales and Services Workers	0.702
Refuse Workers and Other Elementary Workers	0.668

Source: Authors' calculations based on PIACC.

Figure 1.3 plots RTC indexes by occupation at the 2-digit level. Occupations are defined following the ISCO08 classification. Substantial variation exists in routinization across occupations, ranging from 0.09 to 0.78. Table 1.7 provides the complete list of occupations and RTC indexes. Highly flexible occupations (low RTC index) include highly skilled cognitive occupations, such as managers, engineers, professors, and doctors. In the middle of the flexibility range there are occupations related to the provision of services, such as child care, personal care, personal services, security, electrical repairs, customer services, sales, and secretaries. It also includes middle-skilled jobs in manufacturing, construction and transport, such as welders, mechanics, builders, machine operators, assemblers, and drivers. Most tasks in these jobs require job-specific knowledge, practical experience and, in the case of services, interpersonal abilities. Occupations with a high routine content (a high RTC index) are low-skilled jobs in agriculture, industry or services, such as day laborers, elementary workers, assistants, street sellers, cleaners, and helpers. Most of these jobs involve manual tasks related to essential activities, such as cropping and farming, food preparation, cleaning, and community tasks that are physically intensive and very repetitive.

FIGURE 1.4
CORRELATION RTC AND COMPUTER USE



Linear coef: -0.53; SE:0.04

Source: Authors' calculations based on PIAAC.
Note: Each observation corresponds to an occupation.
The horizontal axis shows the share of employees who uses a computer.
The vertical axis shows the RTC index of the occupation.
Only occupations with a total share above 2.5 percent are shown in the graph.

Figure 1.4 plots the correlation between routinization and computer use across occupations. The vertical axis shows the RTC index of each occupation, while the horizontal axis reports the share of individuals in each occupation that uses a computer at work (computed from the PIAAC surveys). We see a strong negative correlation between the two. The correlation coefficient is −0.89 and the Pearson rank correlation coefficient is −0.85. Workers in routine occupations are less likely to use a computer at work.

Routinization indexes can also be computed at the industry level, as individuals in the PIAAC survey report their industry of affiliation. The heterogeneity in the degree of routinization

across occupations translates into large differences in RTC across economic sectors, given that industries differ in their occupational structure. The complete list of industries with their RTC index is presented in Table A1 in the Appendix. Construction, Transportation, Restaurants & Hotels, Domestic Services and Agriculture are the sectors with the highest degrees of routinization. At the other extreme are Finance, Teaching, and Health & Social Services, where automatization is less viable.

Routinization across countries

In order to explore the labor market implications of automation we rely on microdata for the period 2004–2019 from the official national household surveys of the six largest Latin American economies: Encuesta Permanente de Hogares (EPH) in Argentina, Pesquisa Nacional por Amostra de Domicilios (PNAD) in Brazil, Encuesta de Caracterización Socioeconómica Nacional (CASEN) in Chile, Gran Encuesta Integrada de Hogares (GEIH) in Colombia, Encuesta Nacional de Ingresos y Gastos de los Hogares (ENIGH) in Mexico, and Encuesta Nacional de Hogares (ENAHO) in Peru. Surveys were processed following the protocol of the Socioeconomic Database for Latin America and the Caribbean (SEDLAC), a joint project between CEDLAS at the Universidad Nacional de La Plata and the World Bank. Household surveys are not uniform across Latin American countries and in most cases not even within a country over time. The issue of comparability is of a great concern. Owing to that situation, we make all possible efforts to make statistics comparable across countries and over time by using similar definitions of variables in each country/year, and by applying consistent methods to process the data. Also, note that Latin American countries do not use a common system of occupation codes. Countries use different versions of the ISCO classification or even their own codes. In order to obtain a common classification, we converted the occupation codes of each country to the two-digit ISCO 08 classification using official crosswalks.

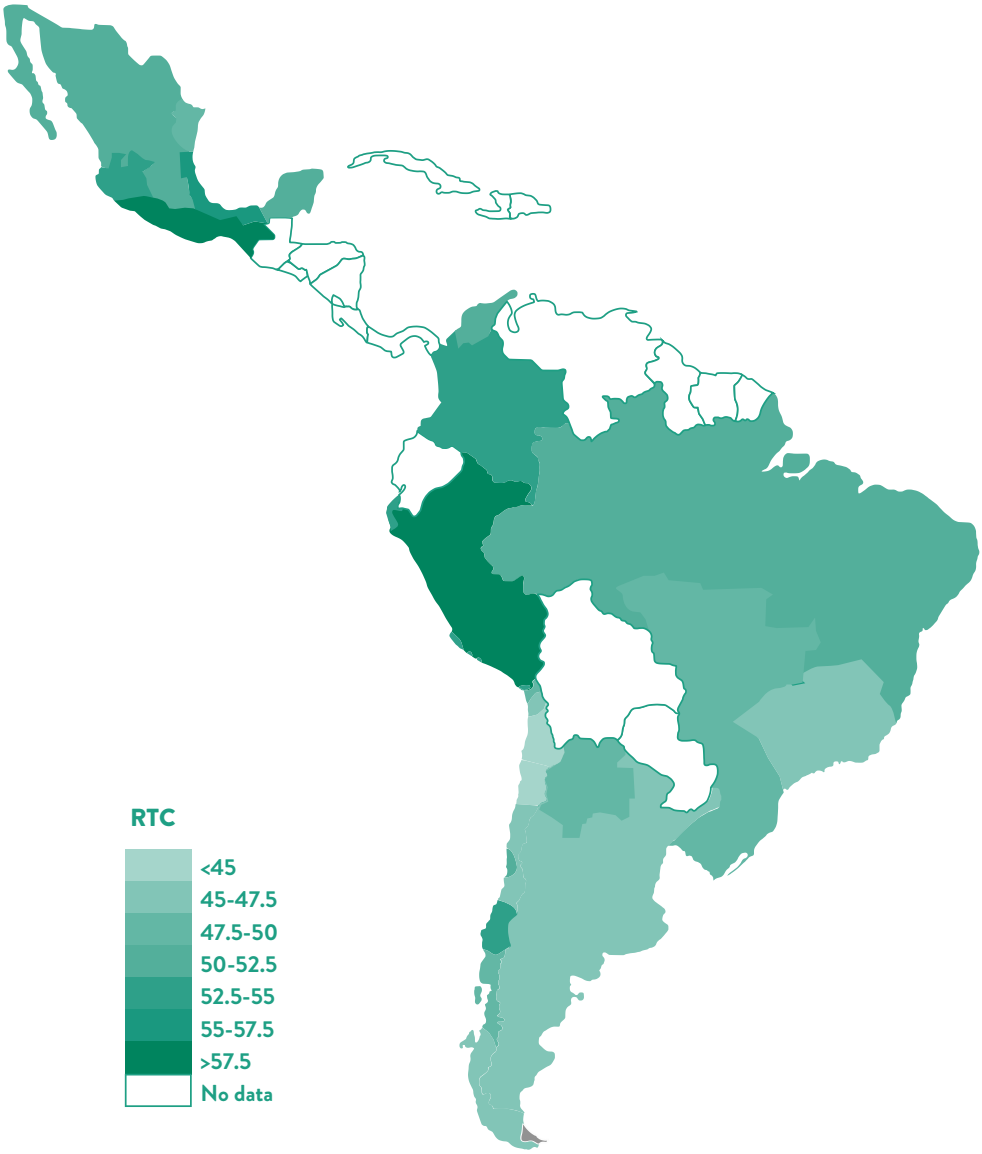
We start with a simple characterization of the working population in Latin America in terms of the degree of routinization of their occupation. Individuals in the household surveys describe their occupation. We can thus impute an RTC index to each individual based on the RTC indexes computed from the PIAAC surveys for each occupation.

FIGURE 1.5
INDEX OF ROUTINIZATION BY COUNTRY

Source: Authors' calculations based on PIACC and national household surveys of late 2010s.
Note: The vertical axis shows the RTC index for each country.

Figure 1.5 shows the routinization index at the country level, averaged across individuals in the household surveys for the later years of our sample (sampling weights are used to compute the average). The mean value for the RTC index in the six largest Latin American economies is 0.505. We can see a great deal of heterogeneity in the degree of routinization across countries: from 0.471 in Argentina to 0.554 in Peru. Keep in mind that since RTC at the task level is fixed (due to data limitations), differences in the RTC levels across countries capture different national occupational structures. In that sense, Argentina, Chile and Brazil have occupational structures that imply RTC values below the regional mean, whereas the employment structures of Colombia, Mexico and Peru are more biased toward higher routine occupations.

FIGURE 1.6
INDEX OF ROUTINIZATION BY REGION



Source: Authors' calculations based on PIACC and national household surveys of late 2010s.

There are also significant differences in the degree of routinization within countries. Figure 1.6 shows the average routinization index by region (defined as territorial divisions within countries). In all countries the degree of routinization is somewhat higher in the poorest regions: NOA and NEA in Argentina; Norte and Nordeste in Brazil; Maule, Araucanía and Coquimbo in Chile; Pacífica and Atlántica in Colombia; Sur in Mexico and the rural areas and Selva in Peru. Table A2 in the Appendix provides a full list of routinization indexes by region.

Evolution of the employment structure and wages

We now turn to labor market implications of routinization and automation. We focus on the period 2004–2019 for Argentina, Brazil, Chile, Colombia, Mexico and Peru and consider three time windows: the mid-2000s, the early 2010s and the late 2010s. In order to gain power we combine information for different years in each window. The first window includes years around 2005, the second one around 2011 and the third one around 2017. To simplify, we sometimes refer to these windows as 2005, 2011 and 2017. For example, in Argentina the mid-2000s include surveys for 2004, 2005 and 2006, the early 2010s include 2010, 2011 and 2012 and the late 2010s include 2016, 2017 and 2018.

The Latin American economies experienced significant changes over the two decades under analysis. In particular, South American economic growth was robust in the 2000s and weaker or nonexistent in the 2010s. Per capita GDP grew at an annual 3.6 percent in Colombia in the second half of the 2000s, and slowed down to 2.1 percent in the 2010s. In Chile the deceleration went from 3.6 to 1.6 percent and in Peru from 5.6 to 2.9 percent. The contrast was starker for Argentina and Brazil: they suffered recessions in the 2010s

(the growth rates in both decades were 3.9 and -0.7 percent in Argentina, and 3 and -1 percent in Brazil). Mexico is the only country in our sample with a different pattern: per capita GDP grew at 0.4 percent in the mid-2000s and mildly sped up to 1.4 percent in the 2010s.

FIGURE 1.7

GROWTH RATE IN NUMBER OF WORKERS BY QUINTILES OF RTC

Source: Authors' calculations based on PIACC and national household surveys.
Note: Occupations in the horizontal axis are sorted by quintiles of the RTC index.
The vertical axis shows the growth in number of employed individuals.

We now describe changes in the structure of employment on routinization and wages of occupations. In Figure 1.7 occupations are sorted on the horizontal axis by quintiles of the degree of routinization estimated by RTC1. In both periods the change in employment is decreasing in the RTC quintiles. In the 2000s gains in jobs were generalized but less significant among those occupations with high RTC. While the number of workers in occupations with the lowest risk of automation (bottom quintile of RTC) grew 30 percent in the 2000s, the increase was much more modest in high routine task occupations: 7 percent. In the 2010s this asymmetric pattern was similar, although the changes in employment were lower. In fact, the number of workers in occupations in the top RTC quintile went down by -0.2 percent.

To explore these results more formally we run a regression at the occupation-country level that takes the following form

$$g_{hct} = \alpha + \beta 1.\ RTC_{\ h}.D_{1t} + \beta_2.RTC_h.D_{2t} + \vartheta_c + \vartheta_t + \varepsilon_{hct}$$

where g_{ict} is the growth rate in employment in occupation *h* and country *c* during period *t*, *RTC* is the routine task content of occupation h, and *D1* and *D2* are dummy variables for the 2000s (the window 2005-2011) and the 2010s (2011-2017). The variables ϑ are country and year fixed effects, and ε is an error term. The interaction of the RTC index and the time period dummy variables captures the differential effect of routinization on employment growth across the two decades.

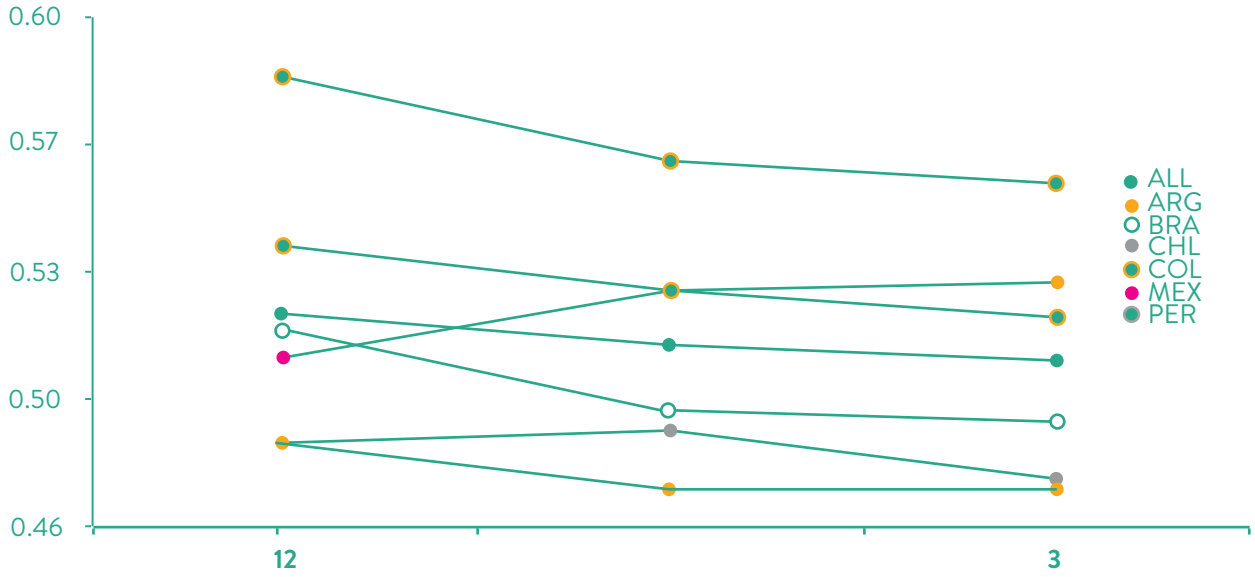
TABLE 1.8
EMPLOYMENT GROWTH

	EMPLOYMENT GROWTH		
	2000s (1)	2010s (2)	All (3)
Panel A RTC	--0.306** (0.106)	-0.246* (0.109)	-0.512** (0.143)
OBS.	182	182	182
R-SQUARED	0.075	0.148	0.100
Panel B LOG WAGES 2005	0.124** (0.0368)	0.0803* (0.0367)	0.197*** (0.0354)
OBS.	181	181	181
R-SQUARED	0.096	0.143	0.118

Source: Authors' calculations based on PIAAC and national household surveys.
Note: All regressions include country fixed effects.
Note: Robust standard errors clustered at the country level in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.

Table 1.8, Panel A displays the results. The first two columns correspond to coefficients β_1 and β_2. The estimates are in line with the above discussion. Changes in total employment have been decreasing in the routine task content of the occupation. The relationship is stronger and more statistically significant in the 2000s as compared to the 2010s. A 10 percentage point difference in RTC across occupations is associated with a 3 percentage point relative decrease in employment during the first time period, and a 2.5 percentage point decrease during the second time period. Column (3) redefines time periods to consider the growth rates between the early 2000s and the late 2010s. In this case only one coefficient is estimated. The estimate is again negative and statistically significant. Note that the growth rates are not annualized and the coefficient of column (3) is roughly the sum of coefficients in columns (1) and (2).

FIGURE 1.8
EVOLUTION OF ROUTINIZATION IN LATIN AMERICA

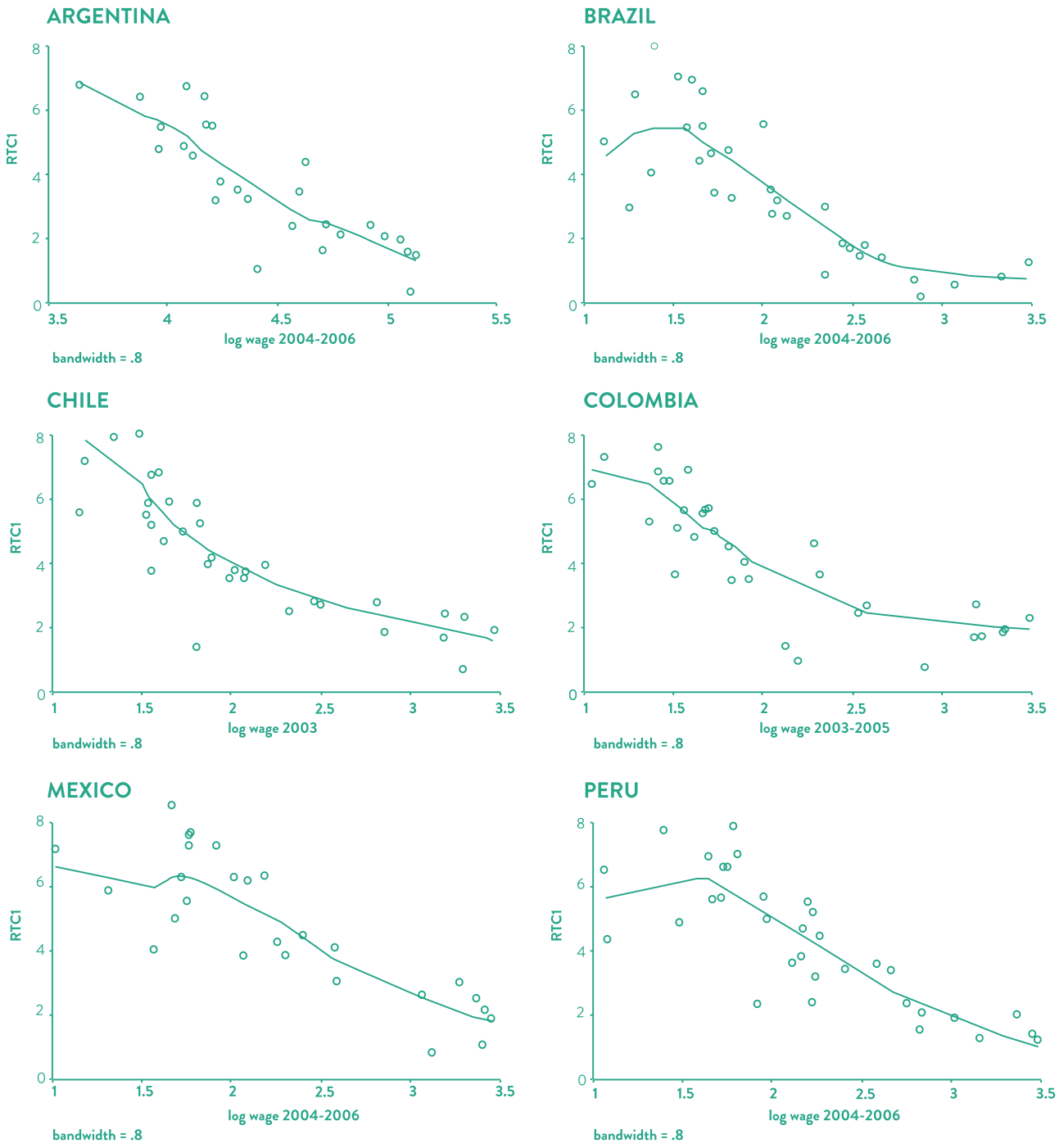


Source: Authors' calculations based on PIAAC and national household surveys.
Note: The horizontal axis shows time periods.
The vertical axis shows the average RTC index por each country and for Latin America.

As a result of the asymmetric changes in employment, the overall degree of routinization has decreased in the Latin American economies over the last two decades. Figure 8 depicts these changes, with country-level RTC indexes on the vertical axis. The fall was more marked in the 2000s than in the 2010s: the average RTC index for Latin America fell from 0.518 to 0.510 between 2005 and 2011 and then to 0.505 in 2017. This is a consequence of changes in the employment structure toward occupations with a lower degree of routinization. Mexico is the only country that experienced a different pattern: the increase in routinization, only noticeable in the 2000s, could mainly have been the consequence of US firms outsourcing the more routine tasks.

In recent decades a very active line of research explores changes in the structure of jobs by skills. The typical analysis implies assessing changes in employment by occupations classified by initial wages as rough measures of skills. We perform a similar analysis with our data for Latin America and relate the change in the structure of employment on initial wages by occupation.

FIGURE 1.9
RTC AND INITIAL WAGES BY OCCUPATION



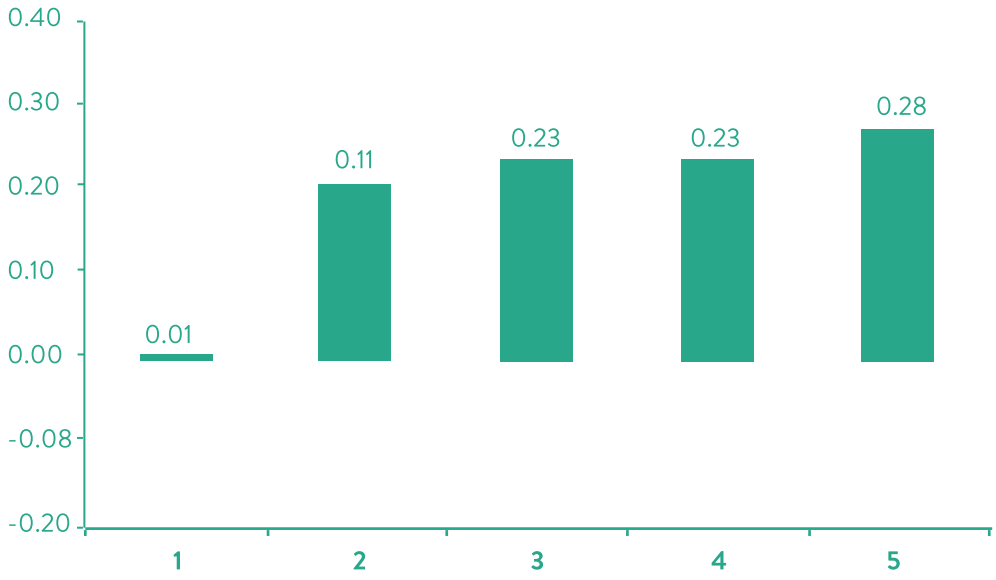
Source: Authors' calculations based on national household surveys and PIACC.
Note: Graphs plot the relation between the average occupation-level wage in the early 2000s and the RTC index.

We first show that the RTC index and skills are negatively correlated. In Figure 1.9 we plot the occupation-level RTC index of routinization on the mean log hourly wage in the initial period (around 2005). Wages are deflated by the national CPIs of each country in order to make them comparable over time. The relationship is clearly decreasing in all countries: high-wage jobs are those with lower routine task content. The mean correlation coefficient for our sample of six countries is -0.831. The correlation coefficients are also very high when computed with the median instead of the mean, and restricting the sample to full-time workers (not shown).

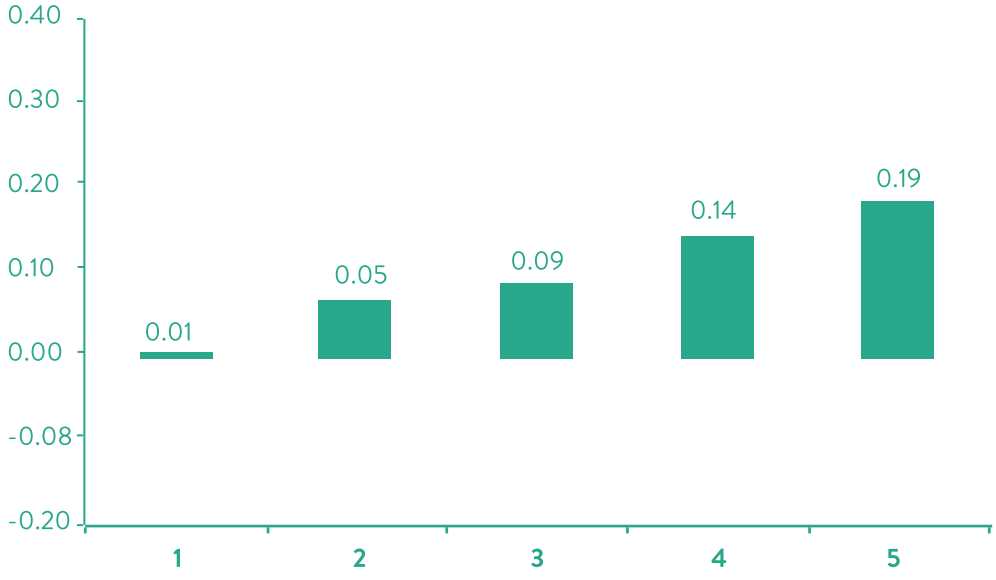
FIGURE 1.10

GROWTH RATE IN NUMBER OF WORKERS BY QUINTILES OF INITIAL WAGE

The 2000s



The 2010s



Source: Authors' calculations based on PIACC and national household surveys.
Note: Occupations in the horizontal axis are sorted by quintiles of the initial occupation wage.
The vertical axis shows the growth in number of employed individuals.

In Figure 1.10 occupations are sorted on the horizontal axis by quintiles of the initial wage. This figure is analogous to Figure 1.7. Given the close negative relationship between routinization and initial wage, results are not surprising. Growth in employment is increasing in the initial wage quintile during the last two decades.

Table 1.8, Panel B, displays the results for a linear regression of employment growth on initial wage, analogous to Panel A. The results confirm the positive association. Occupations with initial wages that are 10 percent higher relative to other occupations experienced relative increases in employment of 1.2 and 0.8 percentage points in the 2000s and 2010s (columns 1 and 2). Results are consistent when we pool both periods together in column (3).

These patterns provide no support for the polarization hypothesis that has been discussed for industrialized countries, according to which employment is increasingly concentrated in high-wage occupations and low-wage occupations at the expense of traditionally middle-wage jobs. The evidence is in line with other studies that find little evidence of polarization based on routinization in developing countries (Das and Hilgenstock, 2018; Maloney and Molina, 2016; Messina and Silva, 2017).

FIGURE 1.11
GROWTH RATE IN MEAN REAL WAGES BY DEGREE OF ROUTINIZATION

Source: Authors' calculations based on PIAAC and national household surveys.
Note: Each observation corresponds to an occupation.
The horizontal axis shows the RTC index.
The vertical axis shows the change in the average occupation wage.

We also explore changes in wages across occupations characterized by different degrees of routinization. In general, we saw gains in real wages over the period under analysis. In Figure 1.11 we plot changes in the mean log wage for full-time workers and the degree of routinization of their occupations. Interestingly, gains were larger among those occupations

with a higher degree of routinization. The increasing pattern is particularly clear in the period of economic expansion—the 2000s—when wages increased in real terms. Instead, the pattern becomes weaker in the 2010s, when real wages became sluggish. In sum, the evidence suggests that when the economy was growing and real wages were increasing, unskilled low-wage workers in high-RTC occupations managed to earn higher wage raises than the rest. Instead, in periods of stagnation there were few changes in the structure of relative wages.

THE FUTURE OF JOBS IN LATIN AMERICA

What does the future hold for jobs in Latin America? Workers' vulnerability to automation in the near future can be characterized as a function of the exposure to routinization of the tasks that they perform and the potential automation of their occupation. Frey and Osborne (2017) and Arntz et al., (2016, 2020) develop two different measures of risk of future automation. In this section we discuss the findings of Brambilla et al., (2021c). We rely on the indicators of risk of automation by occupation and combine them with household surveys from Latin America.

The measure of risk of automation of Frey and Osborne is computed from the 2010 version of O*NET, a database of information on the task content of 903 occupations in the US, constructed from the assessments of labor market analysts, experts, and workers. Frey and Osborne assign a probability of automation to each occupation. In order to do that, they asked machine learning researchers to classify some occupations as being either automatable or not, based on the reported task content, and they imputed the automatability to the remaining occupations based on a model of the occupation's automatability of some attributes

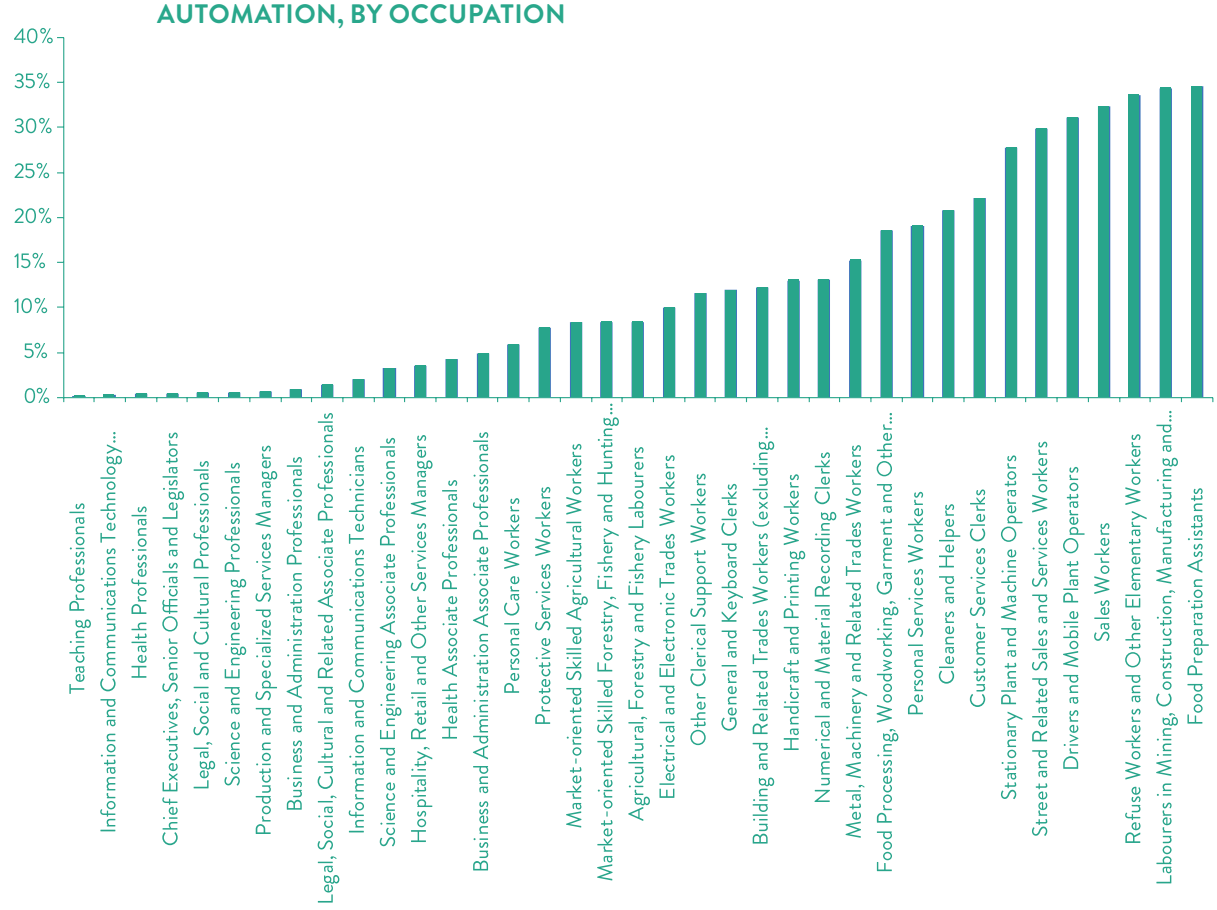
(e.g., manual dexterity, originality, and social perceptiveness). The model returns an estimate of the automation potential. The Frey and Osborne approach assumes that occupations are homogeneous in terms of tasks. This is, however, a strong assumption since workers with the same occupation usually conduct different tasks and thus may be differently exposed to automation, depending on the tasks performed. In reaction to this concern, Arntz et al., (2016, 2017) follow a task-based instead of an occupation-based approach by focusing on what people actually do in their jobs rather than relying on occupational descriptions of jobs.[5]

We work with the two indicators of the risk of automation and refer to them as Alternative 1—the one proposed by Arntz et al., (2016, 2020) focusing on tasks—and Alternative 2—the one by Frey and Osborne (2017) focusing on occupations. Although they imply very different estimations for the overall degree of automatability, both indicators are conceptually similar and they are highly correlated across occupations.

Note that these two automatability indicators refer to what theoretically could be automated in the future, given the projections about the technology. This must not be equated with job losses. The fact that automation is technically feasible for a task performed by some workers does not necessarily imply that all of these workers will actually be replaced by automated devices. The decision to utilize automation technologies or workers is ultimately based on economic considerations.

[5] Other authors have followed the Frey and Osborne approach but use different sources to assess the automation probabilities. Vermeulen et al., (2018) construct an expert assessment with inputs from roboticists, whereas Manyika et al., (2017) use a machine-learning algorithm to score the more than 2,000 work activities in relation to 18 performance capabilities. Josten and Lordan (2019) introduce an alternative classification of automatable occupations based on patent data from Google Patents. They argue that patents activity is a better proxy to identify the jobs that will be automatable in the near future. The authors take the non-automatable jobs defined by Autor and Dorn (2013) and assess the chances of becoming automatable in the near future based on patent activity in the area. Josten and Lordan (2019) find that 47 percent of all current jobs in the US are automatable in the coming decade, an estimate that is similar to that of FO. The authors stress that the jobs with less risk of automation are those that involve abstract, strategic or creative thinking with high interactions with people.

FIGURE 1.12
PROPORTION OF JOBS WITH HIGH RISK OF AUTOMATION, BY OCCUPATION



Source: Authors' calculations based on Arntz et al (2016, 2020).

According to this task-based index, there is substantial heterogeneity in the future risk of automation across occupations. Figure 1.12 plots the proportion of jobs at risk within each occupation for the Arntz et al., index. While the risk of automation in the near future is negligible for teaching, health, information and communication professionals, the risk is high for clerks, machine operators, sales workers, drivers, construction workers, and food preparation assistants. Around 30 percent of the jobs in these groups are severely threatened to be replaced by machines.

Our analysis combines the occupation based risk of automation with worker characteristics drawn from national household surveys in Latin America. We impute the risk of automation to workers in Latin America based on the

occupations in the household surveys. As in Section 2, we work with household surveys for the six largest Latin American economies: Argentina, Brazil, Colombia, Chile, Mexico and Peru. We carry out the analysis based on the latest available household surveys for each country. In order to gain power, whenever possible we consider a window that includes years 2016, 2017 and 2018. Overall, we use data on more than 2 million workers in the six largest economies of the region.

TABLE 1.9
PROPORTION OF JOBS WITH FUTURE HIGH RISK OF AUTOMATION

	(1)	(2)
Argentina	16.3%	59.9%
Brazil	16.3%	59.7%
Chile	15.4%	57.0%
Colombia	17.0%	63.5%
Mexico	18.4%	64.2%
Peru	16.8%	67.6%
Latin America	16.7%	62.0%

Source: Authors' calculations based on Arntz et al (2016, 2020), Frey and Osborne (2017) and national household surveys.
Note: Table shows the proportion of jobs at high risk of automation in the future based on alternatives 1 (Arntz et al) and 2 (Frey and Osborne).

Table 1.9 shows the average risk for each country and the region as a whole based on the aggregation of individuals in the household survey. Given the occupation structure of workers in the six largest Latin American economies, the overall risk of automation is 16.7% under Alternative 1. This value is higher than the OECD mean computed in Arntz et al., (2016) (9% of automatable jobs). In fact, the minimum value in our sample (15.4% in Chile) is higher than the maximum in the OECD countries (12% in Austria). This gap

with the industrialized economies is driven by an occupation structure in Latin America biased towards low- and middle-skill jobs, more vulnerable to the threat of automation in the near future. Although some heterogeneity exists across countries in Latin America, the differences are not large. The proportion of jobs with a high risk of automation ranges from 15.4% in Chile to 18.4% in Mexico.

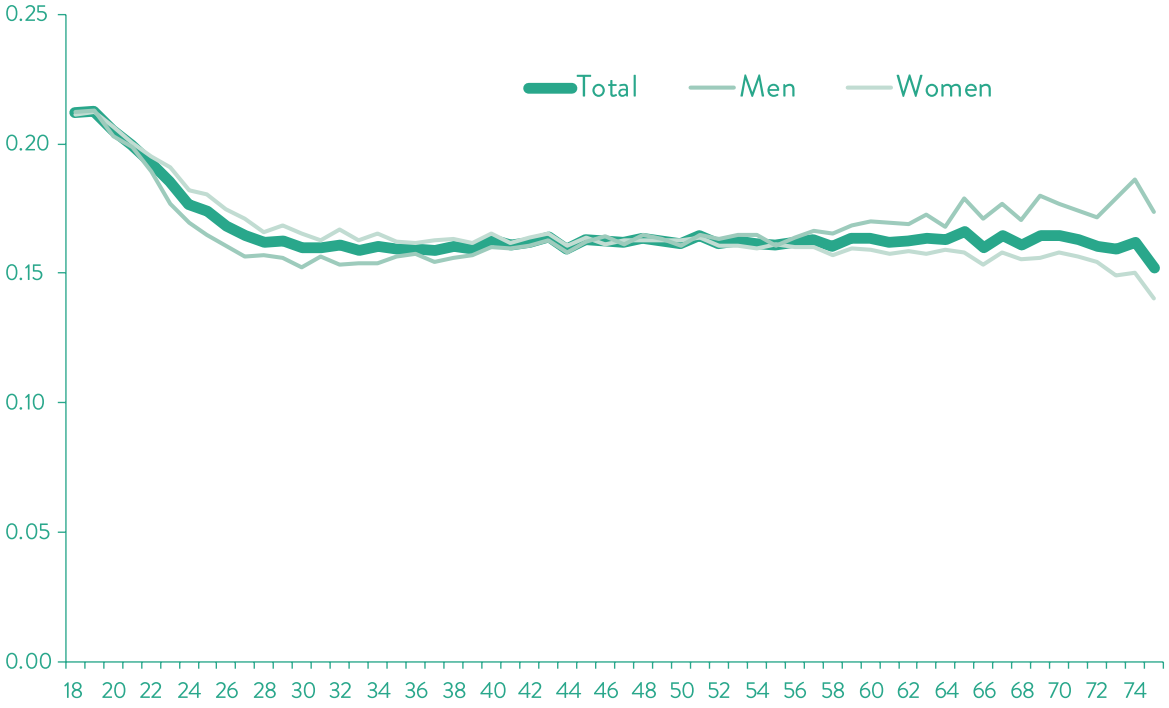
The overall risk of automation is on average 62% under Alternative 2. The values for all Latin American countries in our sample are significantly higher than the index reported for the US by Frey and Osborne (2017) 47%. The significant differences with the estimates from Alternative 1 are driven by the difference between the task vs. occupation indicators, as was discussed above. In any case, it is more relevant to analyze the structure of the jobs at risk than the mean probability of automation.

Who are at risk of losing their jobs to automation?

Figures 1.13 and 1.14 plot the risk of automation by age, gender, and years of education based on risk Alternative 1 (Arntz et al.,). These results are driven by differences in the occupational structure across demographic groups. Figure 1.13 shows that the risk of automation is higher for very young workers. The proportion of jobs at risk falls with age until around age 30. From that point on it virtually stays flat. This pattern also holds when using Alternative 2 to define potential for automatability (not shown). According to these results, the prospect of automation poses a special threat on the jobs of young workers. This fact adds to the concerns over the job perspectives of youngsters, a group with the highest unemployment rates in the region.

FIGURE 1.13

PROPORTION OF JOBS WITH HIGH RISK OF AUTOMATION, BY GENDER AND AGE



Source: Authors' calculations based on Arntz et al (2016, 2020) and national household surveys.

TABLE 1.10
FUTURE RISK OF AUTOMATION BY GENDER

	High risk of automation	
	A1	A2
Females	16.5%	60.2%
Males	16.8%	63.3%
Total	16.7%	62.0%

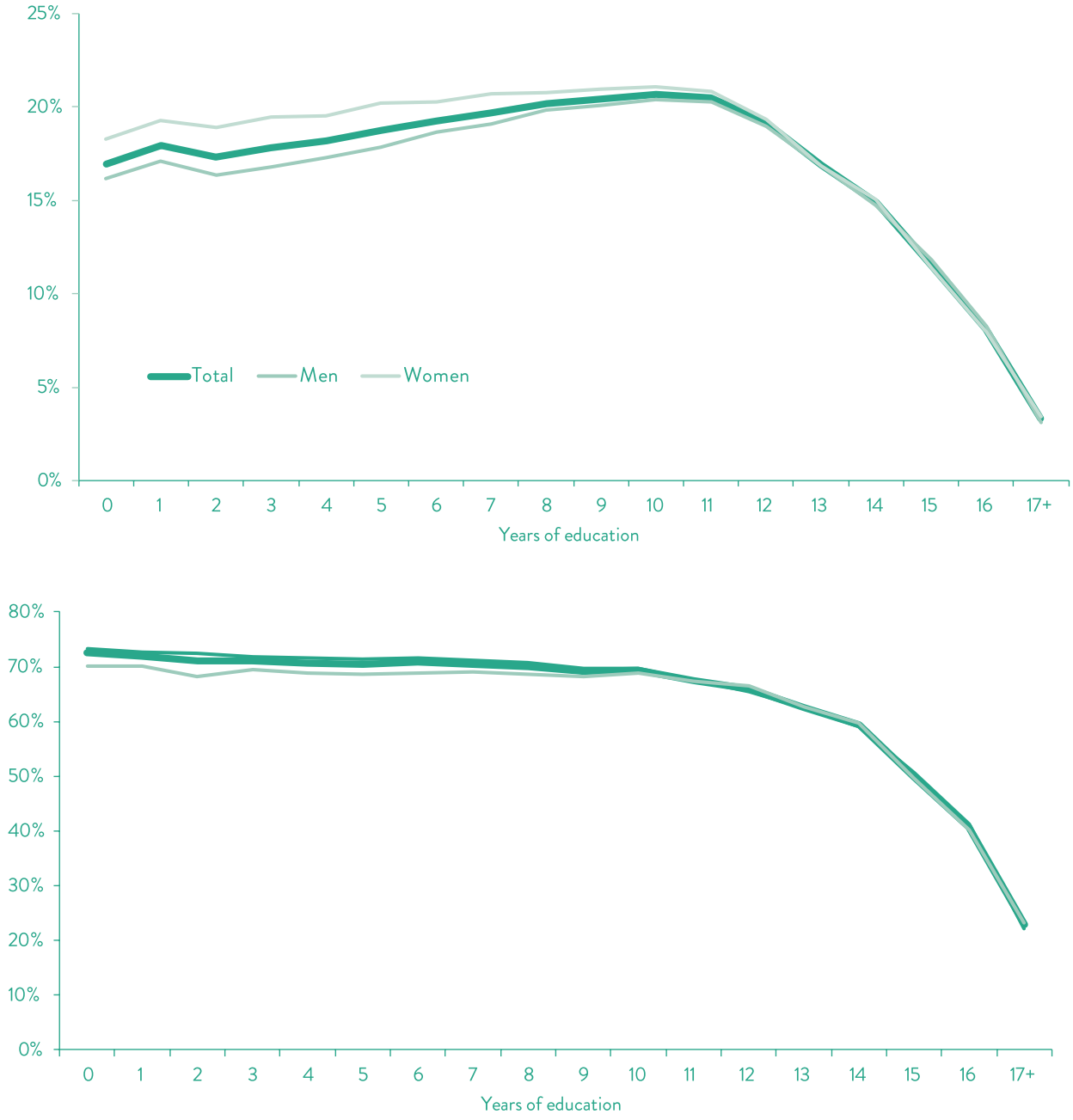
Source: Authors' calculations based on Arntz et al (2016, 2020), Frey and Osborne (2017) and national household surveys.

For young workers, the threat of automation is slightly larger for men than for women. Between 40 and 50 years of age, the sign of the gender gap is reversed, and women face more risk than men.[6] Table 9 reports the average gender gap across all ages. On average, the risk of automation is slightly higher for male (16.8%) than for female (16.5%) workers, under Alternative 1. This narrow gender gap also holds under Alternative 2 (63.3% for males and 60.2% for women).

[6] Consider that differences across demographic variables, including age and gender, are derived solely from differences in the occupational structure.

FIGURE 1.14

PROPORTION OF JOBS WITH HIGH RISK OF AUTOMATION, BY YEARS OF EDUCATION



Source: Authors' calculations based on Arntz et al (2016, 2020) and national household surveys.

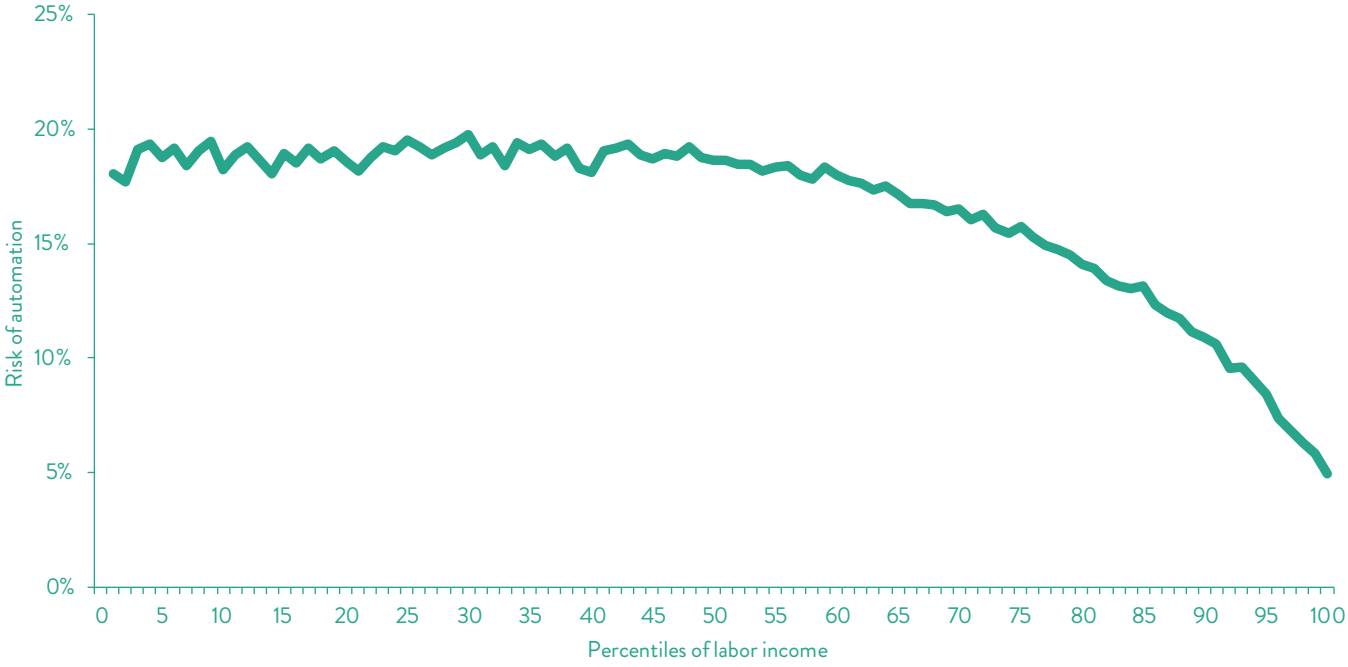
Despite the much-commented increase in the perspectives of computerization in some high-skilled occupations, the risk of automation is still considerably higher in low- and medium-skilled jobs that involve routine-intense tasks. Figure 1.14 shows the results for the six largest Latin American economies. The proportion of jobs with a high risk of automation is high for those with less than complete secondary education. More than a third of workers in Latin America are in this low-skilled group for which the risk of automation is around 18%. Automation risk peaks at 11 years of education. From that point on automatability dramatically falls with years of education. For those in the high-skilled group, with 17 or more years of formal education, the risk of automation is just around 3 percent. The dramatic fall in automatability for high-skilled workers is similar when using Alternative 2, and also consistent with patterns found elsewhere (Arntz et al. 2016).

Interestingly, Figure 1.14, top panel, suggests that under Alternative 1 semi-skilled workers would be most affected by the ongoing process of automation. The risk of automation is also high for the unskilled (18.4%) but somewhat lower than for the semiskilled (19.5%).[7] The risk plummets for the skilled (9.4%). This pattern resembles the polarization story found in developed economies by Autor and Dorn (2013), Goos et al. (2014), and Autor (2019), among others: recent technological change replaces labor routine tasks that are more heavily concentrated in the middle of the skills distribution. In the previous section we do not find evidence that Latin America experienced such a pattern in the past. Figure 1.14 suggests that it might happen in the future, given the new perspectives for automation.[8]

[7] Semi-skilled are defined as those workers with 9 to 13 years of education. The rest of the groups are defined accordingly.

[8] The evidence for polarization is, however, not conclusive. In fact, under Alternative 2 the risk of automation is always decreasing in years of education. The difference with Alternative 1 may be driven by low-skilled occupations that, although in general could be automated, include some tasks that are more difficult for machines. These tasks, considered in Alternative 1, are ignored by the FO methodology in Alternative 2.

FIGURE 1.15
PROPORTION OF JOBS WITH HIGH RISK OF AUTOMATION, BY EARNINGS PERCENTILES



Source: Authors' calculations based on Arntz et al (2016, 2020) and national household surveys.
Note: The horizontal axis shows percentiles of labor income.

Figure 1.15 depicts the risk of automation by labor income percentile. The threat is high for the first four deciles of the income distribution and slowly starts to decrease, showing that low-income workers are the most vulnerable. The risk plummets for the richest 20 percent. These results are not surprising given that labor earnings correlate with skills.

Impact on income inequality

We find that the ongoing process of automation is likely to affect the structure of employment. In particular, unskilled and semi-skilled workers are likely to bear a disproportionate share of the adjustment costs since the automatability of their occupations is higher compared to skilled workers.

Assessing the impact of the risks of automation on income distribution is a highly speculative endeavor. Even if we could estimate which workers are more likely to be directly affected by automation, it is almost impossible to estimate the general-equilibrium effects of such a major shock on the economy. Workers replaced by machines could become unemployed, find a job in the same firm doing a different task, or end up employed in another sector of the economy. And, of course, the implications could extend beyond workers initially affected by the introduction of robots and computers: the whole labor market will be impacted in ways that are difficult to predict.

In this section we carry out two very simple yet illustrative exercises. First, we compute changes in the labor income distribution assuming a proportional fall in earnings only for those workers initially affected by automation. Second, we estimate changes in the household per capita income distribution arising from the combined effect of two sources: (i) a change in earnings according to the previous exercise and (ii) a change in capital income after the replacement of workers by machines.

TABLE 1.10

SIMULATED IMPACT OF AUTOMATION ON INCOME DISTRIBUTION (LABOR INCOME)

BETA	ARG	BRA	CHL	COL	MEX	PER	Average
1	40.6	50.3	46.4	47.9	49.9	47.0	47.0
0.75	41.4	51.3	47.4	48.8	50.7	47.7	47.9
0.5	43.1	53.0	49.2	50.5	52.4	49.2	49.6
0.25	46.0	55.5	51.8	53.3	55.2	52.0	52.3
0	50.2	59.2	55.3	57.4	59.7	56.6	56.4

Source: Authors' calculations.
Note: Table shows Gini coefficients of the earnings distribution for alternative values of Beta.
In each row earnings of workers affected by automation are equal to a factor Beta of their earnings before automation.

The first exercise is extremely simple. We focus on the initial partial-equilibrium effect of the technological change and assume that only earnings of workers directly affected by automation are modified. In addition, to simplify we assume that the earnings fall is similar (in proportional terms) for all affected workers. Therefore, the wage after automation is equal to a factor B of the wage before automation. What would the increase be in earnings inequality in that simple scenario? Table 10 shows the Gini coefficient for alternative values of β and for each country.[9] For instance, the original Gini (β=1) for the period 2016-2018 in Argentina is 40.6. A 25% reduction in the wages of workers affected directly by automation (β=0.75) would increase the Gini coefficient to 41.4 (a 2% increase in inequality). Instead, if the fall is 50%, the Gini would rise to 43.1 (a 6% increase in inequality); whereas, if automation drives workers to permanent unemployment (i.e., setting β=0), the Gini would dramatically increase to 50.2 (a 24% increase). The magnitude of the changes is similar in the rest of the Latin American countries.

[9] To compute the results of the table we proceed as follows. Suppose the probability of automation of a given job j is pj and that a given person i working in that job has a sample weight in the survey of mi. Then, we assume that pj.mi workers similar to i are fully affected by automation while (1-pj).mi workers similar to i are not affected at all.

TABLE 1.12
SIMULATED IMPACT OF AUTOMATION ON INCOME DISTRIBUTION (TOTAL INCOME)

		BETA				
		1	0.75	0.5	0.25	0
Mean original Gini	45.6					
Top percentile - 100%		52.1	53.3	55.6	60.3	74.8
Top percentile - 50%		49.0	49.7	51.2	54.9	69.4
Capital income - 100%		53.6	55.3	58.0	63.4	77.5
Capital income - 50%		49.7	50.7	52.5	56.7	71.5
Income - 100%		46.9	47.1	47.6	49.7	63.0
Income - 50%		46.3	46.3	46.8	48.8	62.2

Source: Authors' calculations.
Note: Table shows Gini coefficients of the household per capita income distribution for alternative values of Beta.
In each column earnings of workers affected by automation are equal to a factor Beta of their earnings before automation.
Each panel displays the results for an alternative assumption on the distribution of the increase in capital income after automation.
Panel 1: the increase in capital income goes to the top percentile of the household per capita income distribution.
Panel 2: the increase in capital income is distributed proportional to capital income.
Panel 3: the increase in capital income is distributed proportional to per capita income.
In each panel we make two alternative assumptions regarding the size of the increase in capital income after automation: 100% or 50% of the earnings of displaced workers.
Figures correspond to the mean of the six countries included in the study.

The second exercise adds the likely increase in capital income due to automation. We assume that the introduction of robots implies an increase in capital income for the amount of the wages of the displaced workers. We also consider an alternative where the increase in capital income is just 50% of the saved wages.[10] We consider three alternatives in order to assign those rents: (i) to the top percentile of the household

[10] Note that the amount of these rents may be independent of the reduction in earnings for the displaced workers. For instance, capitalists could obtain rents for the same amount of the replaced wages, and, at the same time, the displaced workers could find other jobs and ultimately not suffer any wage loss. This is possible because automation implies an increase in overall productivity and income.

per capita income distribution (as proposed by Koru, 2019), (ii) proportional to capital income, and (iii) proportional to household per capita income. Table 1.12 shows the results. The mean original Gini coefficient for the household per capita income distribution in the six largest Latin American economies is 45.6. If for instance automation reduces the earnings of affected workers by 25% while the capital incomes from automation go to the top percentile, then the Gini coefficient will increase to 53.3: a substantial jump in inequality of almost 8 Gini points (17%). The increase is even larger if rents are distributed as the current distribution of capital income: the Gini will rise almost 10 points to 55.3. The increase is smaller, although still economically relevant, if rents are just 50% of the replaced wages, or if rents are distributed as the current total income distribution. We can conclude from the results in Table 1.12 that at least the direct partial-equilibrium effect of automation on inequality could be very sizeable, especially without some mechanism that allows the proceeds of the technological advances to be distributed throughout the population.

CONCLUSIONS

This is not the first time that automation and new technologies threaten a large number of jobs. A well-known case is the first industrial revolution when machines replaced textile artisans. Certainly, technological change affects some jobs and tasks in specific industries and undermines some employment opportunities. However, firms also create new tasks as others are automated, leading to a structural transformation that involves both job creation and job destruction. Moreover, as countries become richer and more productive, they increase the demand for goods and services, which also creates new jobs. In the long run, the most important determinant of unemployment and labor market dynamics seems to be the general level of demand for goods and services.

We should think about new technologies as a great opportunity to boost productivity and welfare, while taking into account that, like any disruptive shock, new technologies bring about enormous distributive consequences. While some people have the required education and skills to complement technology to create value, others do not. Wages may also grow differently because industries incorporate technologies at different rates, and labor is not perfectly mobile across sectors, regions, or occupations, at least in the short run. These frictions may create human capital losses with long lasting effects for specific groups. In this context, the key policy challenge is to smooth the transition to new jobs for the displaced workers, to take into account the distributive effects, and to promote the acquisition of skills required by the new economic environment.

To address these concerns, policy makers need to understand the scope of substitution and complementarity between jobs and new technologies, trying to identify the specific characteristics of winners and losers. We know that computers can substitute for many routine and codifiable tasks but far from handle tasks that require problem-solving, intuition, creativity and communications ability, usually performed by workers with high education and analytical capacity (e.g., professionals, technicians, and managers). This chapter sheds light on which groups are more threatened by technology in Latin America.

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APPENDIX

This appendix provides full lists of routinization indexes by occupation, industry and region. Occupation and industry level indexes are computed from the PIAAC surveys. Region level indexes are computed from PIAAC surveys and household surveys by imputing occupation level RTC indexes to each individual in the household surveys.

TABLE A1
INDICES OF ROUTINIZATION BY INDUSTRY

INDUSTRY	RTC1
Agriculture & forestry	0.683
Domestic servants	0.646
Fishing	0.573
Restaurants & hotels	0.542
Transportation & communications	0.519
Construction	0.503
Commerce	0.500
Other services	0.490
Manufacturing	0.487
Mining & quarrying	0.461
Utilities	0.414
Business services	0.396
Public administration	0.389
Health & social services	0.366
Teaching	0.339
Finance	0.334
Extra-territorial organizations	0.315

Source: Authors' calculations based on PIAAC and national household surveys.
Note: mean value across Argentina, Brazil, Chile, Colombia, Mexico and Peru.

TABLE A2
INDICES OF ROUTINIZATION BY REGION

COUNTRY	REGION	RTC1
Argentina	GBA	0.470
	PAMPEANA	0.469
	CUYO	0.472
	NOA	0.479
	PATAGONIA	0.461
	NEA	0.475
Brazil	NORTE	0.518
	NORDESTE	0.517
	SUDESTE	0.472
	SUR	0.483
	CENTRO-OESTE	0.491

COUNTRY	REGION	RTC1
Chile	TARAPACÁ	0.471
	ANTOFAGASTA	0.444
	ATACAMA	0.470
	COQUIMBO	0.516
	VALPARAÍSO	0.488
	LIBERTADOR GRAL. B. O'HIGGINS	0.533
	MAULE	0.538
	BIOBÍO	0.496
	ARAUCANÍA	0.497
	LOS LAGOS	0.488
	AYSÉN DEL GRAL. CARLOS IBÁÑEZ	0.458
	MAGALLANES Y DE LA ANTÁRTICA	0.443
	REGION METROPOLITANA DE SANTIAGO	0.445
Colombia	ATLÁNTICA	0.523
	ORIENTAL	0.532
	CENTRAL	0.525
	PACÍFICA	0.541
	SANTA FE DE BOGOTÁ	0.456
México	NOROESTE	0.508
	NORTE	0.519
	NORESTE	0.492
	CENTRO-OCCIDENTE	0.532
	CENTRO-ESTE	0.510
	SUR	0.587
	ORIENTE	0.566
	PENINSULA DE YUCATAN	0.520
Perú	COSTA URBANA	0.533
	SIERRA URBANA	0.530
	SELVA URBANA	0.547
	COSTA RURAL	0.661
	SIERRA RURAL	0.677
	SELVA RURAL	0.679
	LIMA METROPOLI TANA	0.477

Source: Authors' calculations based on PIAAC and national household surveys and PIACC surveys.

2 • INEQUALITY AT RISK OF AUTOMATION? GENDER DIFFERENCES IN ROUTINE TASKS INTENSITY IN DEVELOPING COUNTRY LABOR MARKETS

Janneke Pieters
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Technological change can have profound impacts on the labor market. Decades of research have made it clear that technological change produces winners and losers. Machines can replace some types of work that humans do, while new technologies increase human's productivity in other types of work. For a long time, highly educated workers benefitted from increased demand for their labor due to skill-biased technological change, while the losers were concentrated at the bottom of the wage distribution Katz and Autor, 1999; Goldin and Katz, 2007, 2010; Kijima, 2006. Currently, however, labor markets seem to be affected by a different type of technological change, the so-called routine-biased technological change (RBTC).

RBTC is a process whereby new technologies are used to automate routine tasks that were otherwise done by human workers (e.g., Katz and Autor, 1999; Goldin and Katz, 2007, 2010; Kijima, 2006). Because different jobs consist of different combinations of tasks, some workers are more exposed to the "risk of automation" than others (e.g., Frey and Osborne, 2017). In particular, RBTC is expected to reduce labor demand in jobs with a high routine task intensity.

This chapter studies the risk of automation in developing country labor markets, with a particular focus on differences between men and women. Given the pervasiveness of gender occupational segregation, there may be important gender differences in the risk of automation. Understanding these differences is important to ensure progress towards equitable development and gender inclusion in the face of new technological advances. Our objective is to describe the gender gap in the routine task intensity of jobs in developing countries and to explore the role of occupational segregation and several worker characteristics in accounting for the gender gap.

We use individual-level harmonized survey data representative of urban labor markets in 13 low- and middle-income countries to document that the lowest-paid occupations

are most routine intensive, and that women's jobs are more routine task intensive than men's. Women report higher routine task intensity than men within the same 1-digit occupational groups. We further show that gender differences in occupational choice across 2-digit occupations, as well as differences in human capital and ethnicity, account for just a small part of the gender gap in routine task intensity. These findings contribute to an understanding of gender inequalities in developing country labor markets, and how this relates to the potential impact of automation technologies. While there may currently be little incentive for employers to invest in the automation of routine tasks, given the low cost of labor, the continued decline in the cost of automation may lead to increased automation in the future, in which case the impact would be concentrated among women and low-wage workers.

GENDER AND ROUTINE BIASED TECHNOLOGICAL CHANGE

Over the past decades, many high-income countries have experienced a process of job polarization – employment growth has been concentrated in occupations with low and high wages, while occupations in the middle of the wage distribution saw slower employment growth. Evidence from various studies indicates this phenomenon can be explained by RBTC, whereby new technologies are used to automate routine tasks, which no longer need to be performed by workers (Autor et al., 2003; Acemoglu and Autor, 2011; Goos et al., 2014).[1] Because jobs in the middle of the wage distribution tend to consist of a relatively high share of routine tasks, RBTC reduces the demand for workers in middle-skilled jobs.[2]

[1] The research on job polarization builds on the so-called task-based approach (Autor et al., 2003), which considers occupations as a collection of tasks that can be classified into routine and non-routine tasks. As Autor (2013) describes, an important advantage of the approach is that we can focus on a relatively limited set of tasks to describe the nature of work across many hundreds (or thousands) of occupations.

[2] These are jobs that pay around the median wage such as clerical and accounting jobs, plant and machine operators, and other related repetitive-motion middle-skilled occupations.

In the same way, new technologies can lead to substantial changes in developing countries' occupational structure. The empirical evidence for job polarization in developing countries is limited,[3] which could reflect differences in the occupational structure in developing countries, compared to high-income countries. Das and Hilgenstock (2018) analyze routine task intensity for 85 developed and developing country labor markets since 1960. They find developing country workers are less exposed to routinization, reflecting the low relative price of labor and the concentration of employment in manual in-person tasks. Still, exposure has increased since the 1990s due to structural change and globalization.

Like many other studies, Das and Hilgenstock (2018) use a Routine Task Intensity (RTI) measure constructed by Autor and Dorn (2013) based on US data describing the task content of occupations in the US economy.[4] There are two important drawbacks to this approach. First, the task content of jobs in developing countries may differ from that in the US – for example due to differences in the costs and availability of non-labor inputs. Using recently collected data on skills and work tasks across a range of countries (the same data used in this chapter), Dicarlo et al., (2016) show that the skill content of occupations is similar across developing countries, but differs between developing countries and the US. Lewandowski et al., (2019) compare task intensity measures based on survey data from 42 developed and developing countries and find sizable cross-country differences in task content, even within the same occupational group. Lewandowski et al., (2020) further show that within the same occupations, jobs in low- and middle-income countries are more routine intensive than in high-income countries. This implies that for analysis of developing country labor markets, using US-based data on the task content of occupations may lead to distorted results.

[3] Job polarization has been documented for Brazil, Colombia and Mexico during the early 2000s (Almeida et al., 2017; Ariza and Bara, 2020), with evidence of job polarization being restricted to only a subset of countries. However, cross-country studies have produced mixed findings (Fu et al., 2021; Longmuir et al., 2020), with evidence of job polarization being restricted to only a subset of countries.

[4] These are the US Department of Labor's Dictionary of Occupational Titles.

Second, occupation-level RTI measures mask considerable variation in task intensity across workers within the same occupation (Arnzt et al., 2017). Since within-occupation gender differences in jobs are potentially important for understanding gender gaps in routine intensity (as documented for Germany by Black and Spitz-Oener, 2010), individual-level job task measures are important to arrive at an accurate picture of gender differences in the risk of automation.

To date, only a handful of studies have looked at differences in job tasks between male and female workers. Black and Spitz-Oener (2008, 2010) investigate the implications of task polarization for German men and women. In the 1970s, women were over-represented in occupations that intensively involved routine tasks. In the decades that followed, women experienced larger reductions in their jobs' routine task content compared to men. This led to greater job polarization for women and at the same time accounted for a substantial part of the closing of the gender wage gap during the 1980s and 1990s (Black and Spitz-Oener, 2010).

Brussevich et al., (2019) analyze individual level job tasks for 30 advanced and emerging economies. They document that women's jobs are more routine task intensive compared to men's, on average, and that the gender gap in routine intensity is negatively correlated with female labor force participation, while it is positively correlated with the manufacturing share of GDP. Furthermore, they find that women's routine intensity exceeds men's within each 2-digit ISCO occupation. Looking at changes over the period 1994-2016, they note that women have disproportionately moved out of clerical and elementary occupations towards services and professional jobs. While women have thus increasingly selected into low-routine jobs, they are still more exposed to the risk of automation. Cortes and Pan (2019) reach a similar conclusion from US census and survey data for the period 1980-2017, using 3-digit occupation-level task measures from Autor and Dorn (2013). Changes in the occupational

structure of men and women contributed substantially to a closing of the gender gap in routine intensity, partly because women raised their educational profile. It seems women were better able to adapt to automation-related changes in the labor market, although it remains unclear to what extent automation (as opposed to changes in secular demand, norms, and other factors) is responsible for the observed occupational shifts.

MEASURING ROUTINE TASK INTENSITY

The analyses in this chapter are based on the World Bank's Skills Toward Employment and Productivity (STEP) data, an initiative to measure specific work tasks in low- and middle-income countries. The STEP project includes household-based surveys and employer-based surveys to assess both the supply of and demand for occupational skills. The surveys have been implemented in 18 countries so far. We analyze the 13 countries for which household survey data was collected (one cross-sectional survey in each country) between 2012 and 2017: Armenia, Bolivia, Colombia, Georgia, Ghana, Kenya, North Macedonia, Philippines, Sri Lanka, Ukraine, Vietnam, and Yunnan province of China.[5] The survey's target population consists of non-institutionalized adults 15 to 64 years of age living in private dwellings in urban areas.[6] The household surveys collect background information of all household members age six and older and more detailed information, including employment history, skills, and occupational tasks, for one individual respondent who is randomly selected among all adult household members. Individuals who were unemployed or working in armed forces occupations in the year preceding the survey are excluded from our sample of workers used in the analysis.[7]

[7] Self-employed and unpaid family workers are included.
[6] Sample sizes range from 2,989 observations in Sri Lanka to 4,009 observations in Macedonia (see Pierre et al., 2014 for technical details on the STEP surveys).
[5] The remaining five countries, where only the employer-based survey was conducted, are not included in the analysis (Albania, Azerbaijan, Bosnia & Herzegovina, Kosovo, and Serbia).

To measure the risk of automation for men and women, we construct an RTI index. As previously stated, our methodology builds on the task-based framework pioneered by Autor et al., (2003), where jobs are classified according to their task requirements and the set of skills required to accomplish these tasks. Since the original RTI measure was created to describe the task content of occupations in the US economy, we first selected the appropriate STEP survey items that best capture the five US Dictionary of Occupational Titles (DOT) task measures used in Autor et al. (2003). We follow the approach of Lo Bello et al. (2019) but with some adjustments. The mapping of survey items to three task categories (abstract, routine, and manual) is summarized in Table 2.1.[8]

The STEP task variables are measured at different scales; so, to construct the composite RTI index, we standardize each variable using sampling weights to have a mean of zero and a unit standard deviation. The standardized variables within each task category are then summed, and the sum is again standardized to obtain three task indexes that vary at the individual worker level. For example, the individual-level task index for the abstract category is the standardized sum of five standardized variables ("Thinking at work," "Learning at work," "Contact with clients/suppliers," "Formal presentation to clients," and "Supervising co-workers"). Standardization is always done within countries since we analyze each country separately in our subsequent analyses.

The RTI index is calculated as:

$$RTI = R - (A + M) \qquad (1)$$

where R, A, and M are the Routine, Abstract, and Manual task indexes. The RTI index varies at the individual worker level and is increasing in R and decreasing in A and M. In other words, the higher the value of RTI, the more routine

[8] Autor et al., (2003) map DOT task variables onto five task categories: non-routine analytical, non-routine interpersonal, routine cognitive, routine manual, and non-routine manual. Following Autor et al., (2006), we collapse these five categories to three aggregates: abstract (non-routine analytical and interpersonal), routine (routine cognitive and routine manual), and manual (non-routine manual).

intense the job is. To obtain the occupational-level RTI index, we calculate the average of the individual-level RTI indexes for each 1-digit ISCO-08 occupational group using sampling weights.

The occupation-level RTI index and its three components for the 13 STEP countries are reported in Appendix Tables A3-A15. Mean RTI values by country and occupation are plotted in Figure 2.1. The first thing that stands out is that in almost all countries, the RTI index is highest for low-paying elementary occupations while it is lowest for high-paying managerial and professional occupations. The low RTI among managerial and professional occupations is in line with what has been observed in the US and most EU countries (Autor and Dorn, 2013; Goos et al., 2014). However, unlike in the US and Europe, where the middle-wage occupations (clerical workers, craft and related trades workers, and machine operators and assemblers) are the most routine-intensive, we find that routine-intensity is highest in low-paying elementary occupations. Although there is some heterogeneity across STEP countries, there is a strong negative correlation between occupation-level RTI and earnings.[9]

[9] The correlation between occupational earnings (standardized within country) and the RTI index, pooling all STEP countries, is -0.60. The relationship is shown in Appendix Figure A1.

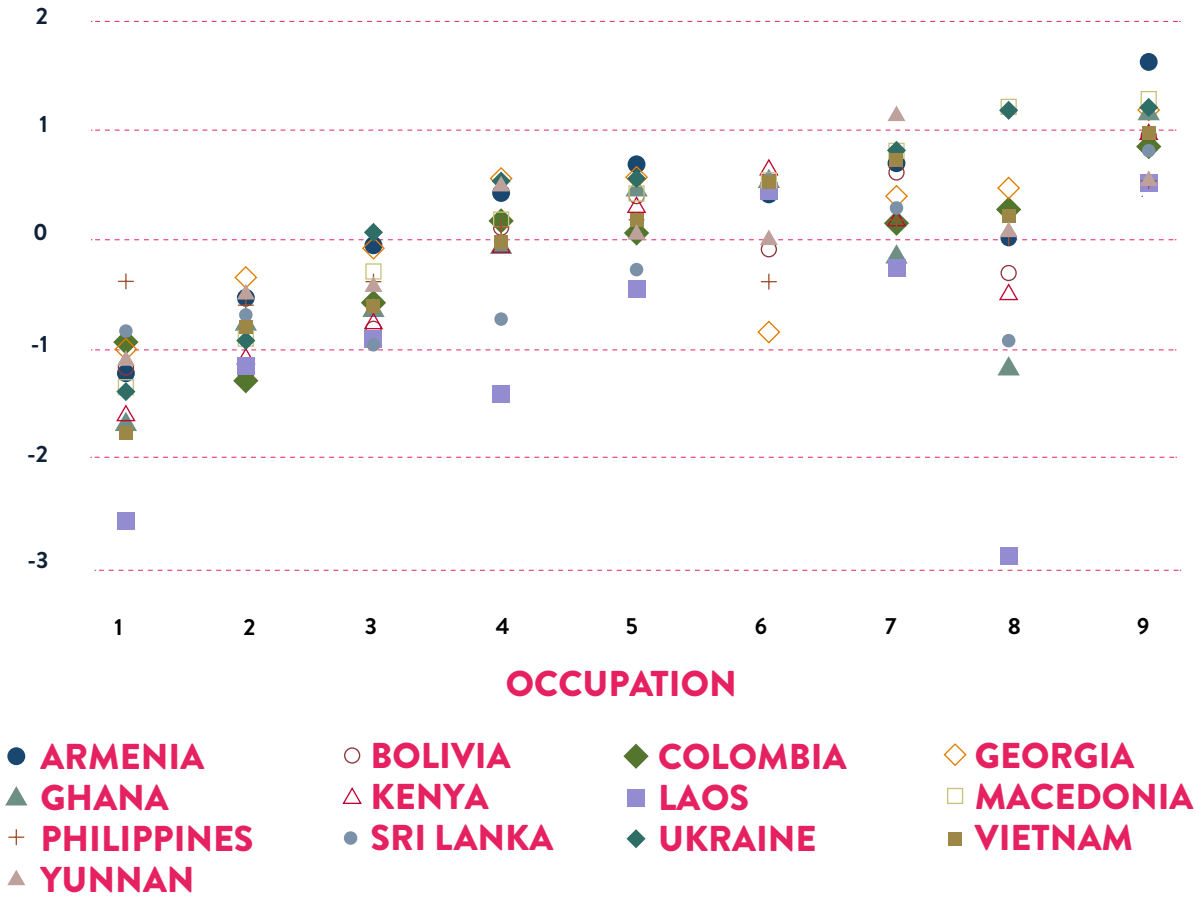
TABLE 2.1
STEP SURVEY ITEM PER TASK CATEGORY

Task category	STEP survey item	Variable name	Variable type
Abstract (non-routine analytical and interactive)	Thinking at work	m5b_q09 (Wave 1) m5b_q10 (Wave 2) m6b_q10 (Wave 3)	Categorical (1-5)
	Learning at work	m5b_q15 (Wave 1) m5b_q17 (Wave 2) m6b_q17 (Wave 3)	Categorical (1-5)
	Contact with clients/suppliers	m5b_q04*m5b_q05 (Wave 1) m5b_q05*m5b_q06 (Wave 2) m6b_q05*m6b_q06 (Wave 3)	Categorical (0-10)
	Formal presentation to clients	m5b_q10 (Wave 1) m5b_q12 (Wave 2) m6b_q12 (Wave 3)	Binary
	Supervising co-workers	m5b_q11 (Wave 1) m5b_q13 (Wave 2) m6b_q13 (Wave 3)	Binary
Routine (routine cognitive and manual skills)	Routine math tasks	m5a_q18_1—m5a_q18_4 (Wave 1 & 2) m6a_q13_1—m6a_q13_4 (Wave 3)	Categorical (0-4)
	Operate	m5b_q08 (Wave 1) m5b_q09 (Wave 2) m6b_q09 (Wave 3)	Binary
	Autonomy at work	m5b_q12 (Wave 1) m5b_q14 (Wave 2) m6b_q14 (Wave 3)	Categorical (1-10)
	Repetitiveness at work	m5b_q14 (Wave 1) m5b_q16 (Wave 2) m6b_q16 (Wave 3)	Categorical (1-4)
Manual (non-routine manual skills)	Driving	m5b_q06 (Wave 1) m5b_q07 (Wave 2) m6b_q07 (Wave 3)	Binary
	Repair	m5b_q07 (Wave 1) m5b_q08 (Wave 2) m6b_q08 (Wave 3)	Binary

Source: Authors' elaboration/calculation.
Note: Wave 1 countries are Bolivia, Colombia, Laos, Sri Lanka, Ukraine, Vietnam, and Yunnan province of China. Wave 2 countries are Armenia, Georgia, Ghana, Kenya, and Macedonia. Wave 3 country is the Philippines.

Gasparini et al., (2021) document a similar pattern across six Latin American countries with higher routine intensity in lower paying occupations. If RTI is predictive of a negative employment effect due to RBTC, this pattern suggests RBTC will be associated with declining demand for labor in low-wage occupations, rather than polarization of employment. Indeed, some recent studies find no evidence of polarization in developing countries (e.g., Das and Hilgenstock, 2018; Maloney and Molina, 2016).

FIGURE 2.1
ROUTINE TASK INTENSITY INDEX, BY COUNTRY AND OCCUPATION



Source: Authors' elaboration/calculation.
Note: Mean Routine Task Intensity index by occupation, for 13 STEP countries. Occupational codes indicate: 1 Managers, 2 Professionals, 3 Technicians and Associate Professionals, 4 Clerical Support Workers, 5 Services and Sales Workers, 6 Skilled Agricultural, Forestry and Fishery Workers, 7 Craft and Related Trades Workers, 8 Plant and Machine Operators and Assemblers, 9 Elementary Occupations.

The data further reveal that within most country-occupation cells, women have a higher RTI than men. Table 2.2 and Figure 2.4 show the average task index measures by country and gender (pooling across occupations). Women have a higher RTI index than men in all countries except the Philippines. Although the Routine task index (column 2 in Table 2.2) is lower for women than for men in every country, the gender difference in the Manual task index (column 4) is much greater and men's high manual task intensity reduces their RTI index. Conversely, the low Manual task index of women's jobs is driving up women's RTI index. The gender gap in the Abstract task index is negative in most countries as well, indicating that women's jobs involve fewer abstract tasks than men's jobs, but it is positive in the three former Soviet Union countries (Armenia, Georgia, and Ukraine) and the Philippines.

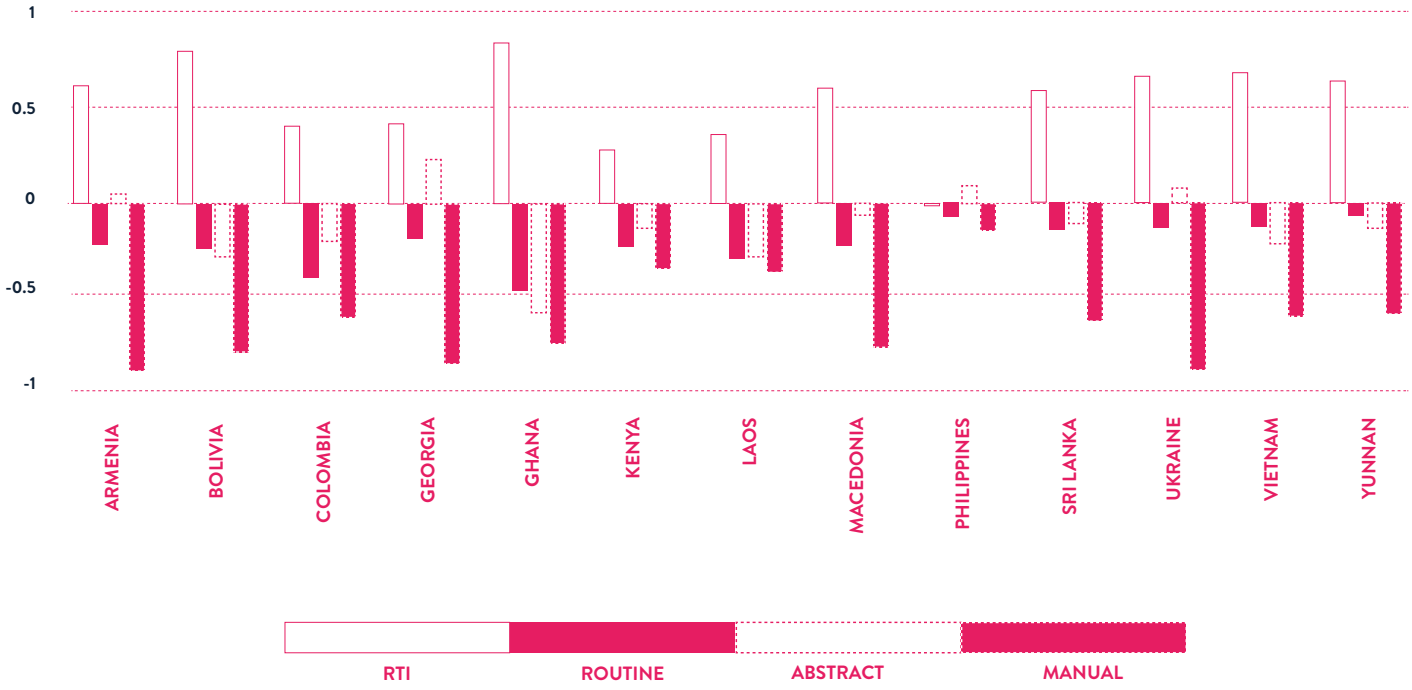
TABLE 2.2
AVERAGE TASK INTENSITY MEASURES ACROSS ALL WORKERS, BY COUNTRY AND GENDER

	Obs.	RTI index (1)	Routine task index (2)	Abstract task index (3)	Manual task index (4)
Armenia Male	373	-0.37	0.13	-0.03	0.53
Female	626	0.25	-0.08	0.02	-0.35
Bolivia Male	814	-0.44	0.13	0.15	0.42
Female	943	0.37	-0.10	-0.12	-0.35
Colombia Male	847	-0.21	0.20	0.10	0.31
Female	869	0.20	-0.19	-0.09	-0.29
Georgia Male	351	-0.26	0.11	-0.14	0.51
Female	582	0.17	-0.07	0.09	-0.33
Ghana Male	962	-0.47	0.25	0.32	0.41
Female	1171	0.37	-0.20	-0.25	-0.32
Kenya Male	1339	-0.12	0.09	0.06	0.15
Female	1022	0.15	-0.12	-0.07	-0.20
Laos Male	918	-0.18	0.15	0.15	0.19
Female	1267	0.17	0.14	-0.14	0.18
Macedonia Male	990	-0.29	0.11	0.03	0.37
Female	820	0.31	-0.12	-0.03	-0.39

Philippines Male	1007	0.01	0.03	-0.04	0.06
Female	681	-0.01	-0.04	0.05	-0.09
Sri Lanka Male	912	-0.24	0.06	0.05	0.25
Female	647	0.35	-0.09	-0.07	-0.37
Ukraine Male	421	-0.40	0.08	-0.05	0.53
Female	713	0.26	-0.05	0.03	-0.34
Vietnam Male	973	-0.39	0.07	0.12	0.34
Female	1359	0.29	-0.05	-0.19	-0.25
Yunnan Male	639	-0.30	0.04	0.06	0.27
Female	605	0.34	-0.04	-0.07	-0.31

Source: World Bank STEP household surveys and authors' calculations.
Note: RTI Index = Routine task index – (Abstract task index + Manual task index).

FIGURE 2.2
GENDER GAP IN TASK INTENSITY



Source: World Bank STEP household surveys and authors' calculations.
Note: Gender gaps measured as female mean index - male mean index. RTI = Routine – (Abstract + Manual).

Women's higher RTI index in the STEP countries is in line with similar patterns across 30 advanced and emerging economies analyzed by Brussevich et al., (2019). Similarly, based on PIAAC data for 24 countries, Brambilla et al., (2021) show that women are less likely to perform abstract tasks (or what they label flexible tasks) than men.

DECOMPOSITION ANALYSIS

In 12 out of 13 countries included in our analysis, women's routine-task intensity of work exceeds men's, and this also holds within most country-occupation pairs. To assess the role of occupational segregation in accounting for gender differences in routine-task intensity, we start with a simple decomposition analysis. We classify each worker with an RTI score above the own-country median RTI as *high-RTI*. The Gender RTI Gap (GRG) is then defined as the fraction of female *high-RTI* workers minus the fraction of male *high-RTI* workers. We decompose the GRG into a between-occupation and a within-occupation component using the nine 1-digit ISCO-08 occupational groups:

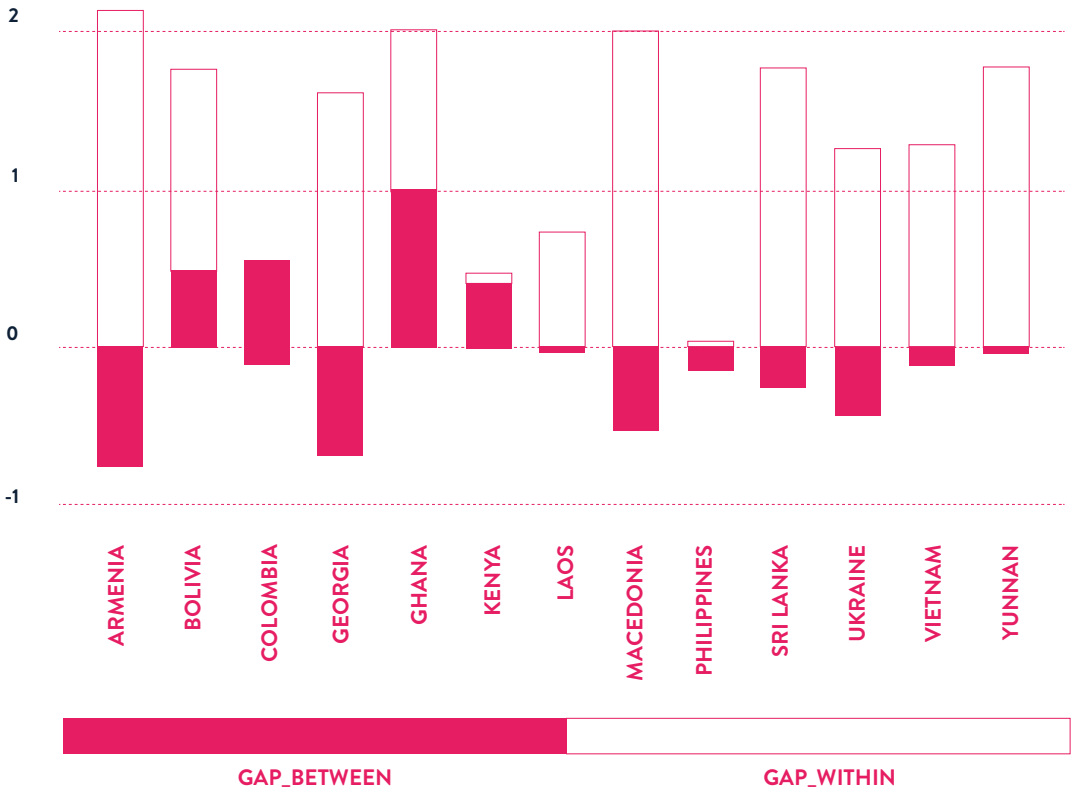
$$GRG = R^f - R^m = \sum_j \left\{ \frac{(R_j^f + R_j^m)}{2} \times \left(\frac{F_j}{F} - \frac{M_j}{M} \right) \right\} + \sum_j \left\{ \left(\frac{F_j}{F} + \frac{M_j}{M} \right) \times (R_j^f - R_j^m) \right\} \quad (2)$$

In equation (2), R is the share of *high-RTI* jobs in employment, superscripts f and m indicate gender, subscript j indicates occupation, F is the number of female workers, and M is the number of male workers. The first term on the right-hand side captures the between-occupation component and is the sum across occupations of the average share of *high-RTI* jobs within the occupation, multiplied by the gender gap in the occupation's share of employment. The between-occupation term gets larger as women are increasingly overrepresented in occupations with an above-average share of *high-RTI* workers. The second term captures the within-occupation component and is the sum across occupations of each occupation's average share in total female and male employment, multiplied by the gender gap in the within-occupation share of *high-RTI* jobs.

Figure 2.3 summarizes the contribution of the between-occupation and the within-occupation component to the overall gender RTI gap, which ranges from -.01 to .22. Since women's jobs are, on average, more routine task intensive than

men's, it is no surprise that the gender RTI gap is positive in all countries, with the exception of the Philippines. In 10 out of 13 countries, the gender gap is almost entirely accounted for by within-occupational gender differences. In Bolivia and Ghana, the between-occupation component accounts for about one third to one half of the total gender gap, while in Kenya it explains almost the entire gap.[10]

FIGURE 2.3
DECOMPOSITION OF THE GENDER RTI GAP



Source: Authors' elaboration/calculation.
Note: Gender RTI gap is the gender gap in the share of workers with an RTI index above the country median RTI. Source: World Bank STEP household surveys and authors' calculations. See equation (2) in the main text.

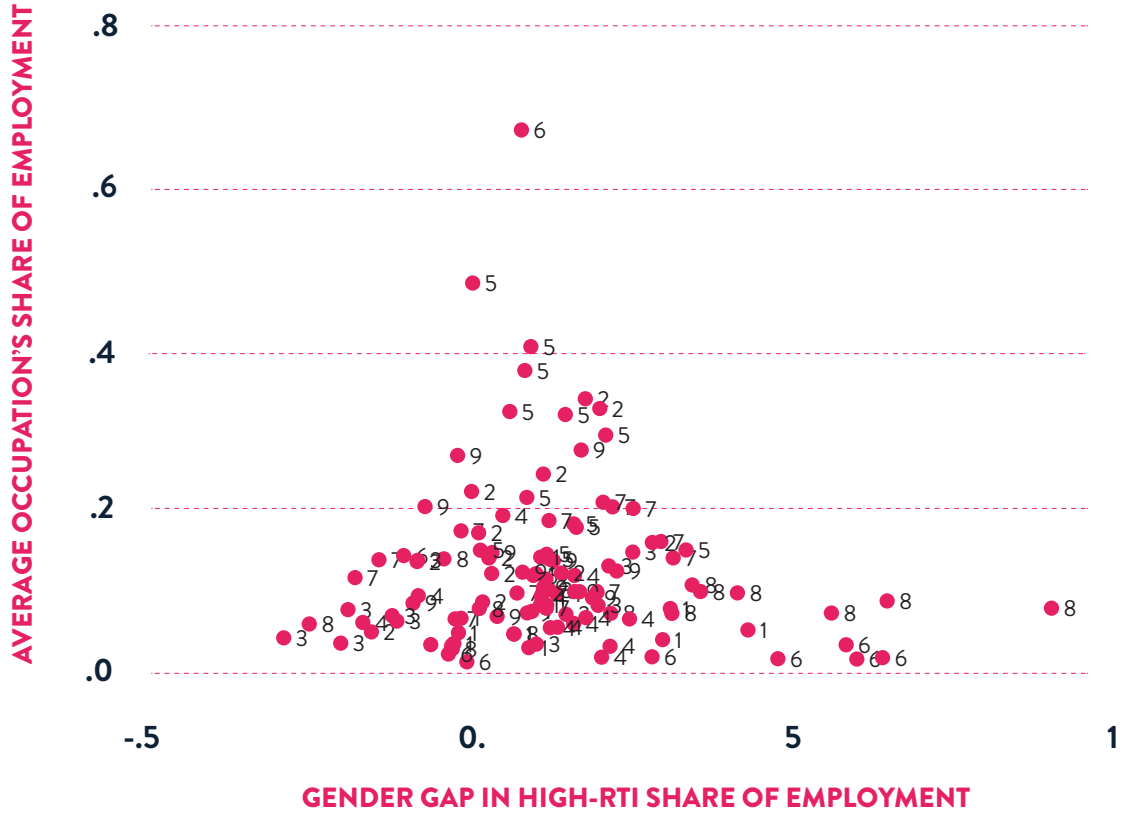
The fact that the between-occupation contribution is very small or even negative in most countries indicates that occupational segregation cannot explain why women's jobs are more routine task intensive. While we rely on a rather aggregate grouping of occupations, it is still remarkable that

[10] In Kenya, the gender RTI gap is driven mainly by the overrepresentation of women among Service and Sales Workers, as well as Elementary Workers, both of which have a relatively high fraction of *high-RTI* jobs.

differential sorting into these groups explains so little of the gender RTI gap. Further analysis of the data (not reported here) shows that in most of the STEP country labor markets, women are overrepresented among Professionals, Services and Sales Workers, and – to a lesser extent – Clerical Support Workers. While the latter two are somewhat above average in terms of their high-RTI share of workers in most countries, Professionals' RTI is below average, and hence women's overrepresentation in these occupations does not contribute (much) to the overall gender RTI gap. Exceptions are Bolivia, Ghana and Kenya where the between-occupation component is driven by a very high overrepresentation of women among Services and Sales Workers. We further see that in most countries, men are overrepresented among Craft and Related Trades Workers and Plant and Machine Operators and Assemblers, of which the former contains a relatively high share of high-RTI workers. Finally, while Elementary Workers have the highest RTI, women are only slightly overrepresented in this occupation in some of the countries.

The gender RTI gap is thus largely driven by women having more routine-intensive jobs then men within the same 1-digit occupational group. The within component is not driven by specific occupations, but rather reflects the fact that women have more routine-intensive jobs within most of the country-occupation pairs. This is further illustrated in Figure 2.4, which shows the relationship between each occupation's share in total employment and the gender RTI gap within the occupation. The gender RTI gap is positive in most country-occupations, including those that account for a large fraction of total employment (such as Services and Sales Workers and Craft and Related Trades Workers) but also most of the smaller occupations.

FIGURE 2.4
EMPLOYMENT SHARE AND GENDER RTI GAPS WITHIN OCCUPATION



Source: Authors' elaboration/calculation.
Note: Each point represents one country-occupation pair. Labels indicate the 1-digit ISCO group: 1 Managers, 2 Professionals, 3 Technicians and Associate Professionals, 4 Clerical Support Workers, 5 Services and Sales Workers, 6 Skilled Agricultural, Forestry and Fishery Workers, 7 Craft and Related Trades Workers, 8 Plant and Machine Operators and Assemblers, 9 Elementary Occupations.

Figure A2 in the Appendix reports decomposition results based on more detailed, 2-digit occupational groups.[11] The results should be interpreted with caution, since sample sizes in some occupations are very small, but by and large we see that in most countries at least half of the gender RTI gap is still accounted for by within-occupation differences. Colombia is an exception. Here, between-occupation differences explain the entire gender RTI gap.

[11] This analysis excludes the Philippines, for which 2-digit occupation codes are not available.

CAPITAL, OCCUPATIONAL SORTING, AND THE GENDER GAP IN ROUTINE INTENSITY

To further assess the gender difference in routine-intensity, we regress individuals' RTI index on a *Female* dummy and then add, consecutively, educational attainment (less than high-school, high-school, or more than high-school), work experience (measured as age minus years of education minus six) and its square, ethnicity (an indicator for bilingual or non-native speaker), and occupation. In the regression analysis we use 2-digit occupation dummies. Since 2-digit codes are not included in the data for the Philippines, we exclude this country from the regression analyses.

Estimation results for each country are reported in Appendix Tables A-16 to A-26. Figure 2.5 below summarizes the main findings by plotting the estimated *Female* coefficient for three specifications, by country. Model 1 refers to the specification with no control variables (capturing the unconditional gender gap in the RTI index); in Model 4 we control for education, experience and ethnicity; and in Model 5 we additionally control for 2-digit occupation. Changes in the *Female* coefficient estimate across specifications indicate to what extent human capital variables and occupational sorting account for the unconditional gender gap in the RTI index.

FIGURE 2.5

ESTIMATED GENDER GAP IN RTI INDEX ACROSS MODEL SPECIFICATIONS, BY COUNTRY

Source: Authors' elaboration/calculation.

Note: Estimated coefficients and 95% confidence interval for Female dummy in OLS regressions where the individual RTI index is the dependent variable. Model 1 refers to the specification with no control variables; in Model 4 we control for education, experience, and ethnic group; in Model 5 we additionally control for 2-digit occupation.

The unconditional gender gap, i.e., the *Female* coefficient estimate in Model 1, is significantly positive in all countries and ranges between .27 in Kenya and .81 in Bolivia, reflecting women's higher routine-task intensity that we also reported in Table 2.2. When we include control variables for education, experience, and ethnicity, the estimated gender gap does not decline substantially – it even increases in 7 out of 12 countries. This indicates that women's higher routine-intensity is not accounted for by gender differences in workers' human capital or ethnicity. Results for Laos are a bit different. Here, inclusion of the same control variables reduces the coefficient estimate for *Female* from .36 to .25.

Controlling for 2-digit occupation (Model 5) reduces the *Female* coefficient in nine of the 12 countries. The effect is most pronounced in Bolivia, Colombia, and Ghana. In Colombia and Laos, the coefficient is no longer statistically significant, indicating that conditional on human capital, ethnic group, and occupational sorting, there is no significant gender difference in RTI. In the other ten countries, women's jobs are significantly more routine-intensive than men's, even conditional on human capital, ethnicity, and 2-digit occupation.

Finally, it is worth noting that in Armenia, Georgia, and Ukraine, however, controlling for occupations leads to an increase in the *Female* coefficient. In these countries, gender differences in occupational sorting have a downward effect on the gender gap in routine-intensity. Within 2-digit occupations, however, women's routine-intensity far exceeds men's.

CONCLUSIONS

The objective of this chapter was to describe the gender gap in the routine task intensity of jobs in developing country labor markets and to explore the role of occupational segregation and worker characteristics in accounting for the gender gap. Using individual-level harmonized survey data across 13 low- and middle-income countries, we find that women report a higher routine-intensity of their jobs than men. Although men report doing more routine tasks than women, they report even more manual tasks, and this reduces men's relative routine task intensity (RTI).

A decomposition analysis shows that in most countries, the gender RTI gap is largely driven by women doing more routine-intensive work then men *within* the same 1-digit occupational group. This is not driven by specific occupations but reflects the fact that women have more routine-intensive jobs within most country-occupation pairs. Gender differences in occupational choice across 2-digit occupations do account for a part of the gender gap in RTI, but in most countries the contribution is still limited. Differences in human capital and ethnicity also explain little. With the exception of Colombia and Laos, there remains a substantial and statistically significant gender gap in routine task intensity that is unaccounted for by key worker characteristics and occupational choice. These findings are in line with similar evidence for 30 advanced and emerging economies documented by Brussevich et al. (2019).

An important limitation of this study is that we have harmonized data across a limited number of countries, representing only the urban labor markets within those countries, and capturing only one point in time. Nonetheless, we believe that documenting the gender difference in routine-intensity across these low- and middle-income countries contributes to an understanding of gender inequalities in developing countries, in particular related to potential future impacts of new technologies. More research will be needed to

assess how automation will affect these labor markets and at what pace the adoption of automation technologies is likely to happen. Since we find that the most routine-intensive occupations are also the lowest paid occupations (in line with other evidence for developing economies documented by Das and Hilgenstock, 2018; Gasparini et al., 2021; Maloney and Molina, 2016), there may be little incentive for employers to invest in the automation of routine tasks. But if they do, this will affect women more than men and will have a disproportionate impact on low-wage workers, which is an important difference with the job polarization documented in the US and Europe.

Our findings imply that aggregate occupation-level measures of occupational task content mask significant gender differences. An important question remains to what extent gender differences in *reporting* of job tasks play a role in the gender routine-intensity differences. While individual level measures of occupational tasks are valuable, they may be less reliable than expert-based measures as used in O*Net. Future work could also explore cross-country differences in income, sectoral structure, and female labor force participation, as well as employer's gender biases, to learn more about the nature of gender task segregation in low- and middle-income countries.

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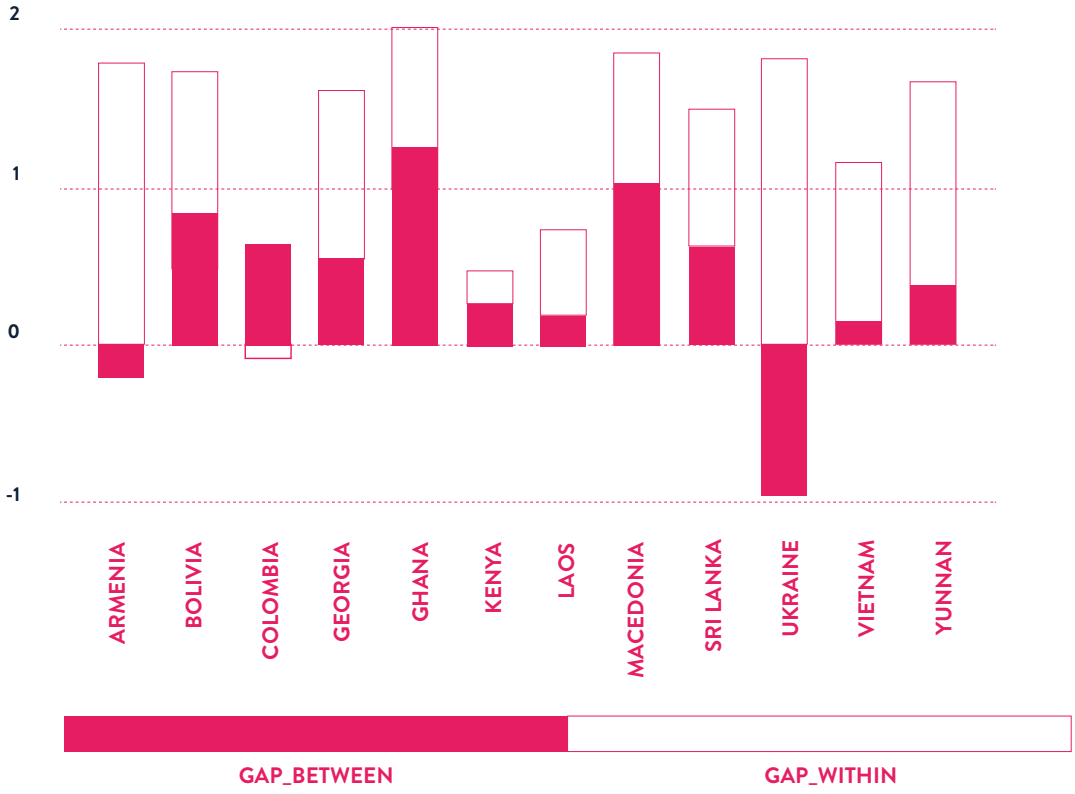
APPENDIX

FIGURE A1
EARNINGS AND ROUTINE INTENSITY BY COUNTRY-OCCUPATION PAIRS

Source: Authors' elaboration/calculation.
Note: Estimated coefficients and 95% confidence interval for Female dummy in OLS regressions where the individual RTI index is the dependent variable.
Model 1 refers to the specification with no control variables; in Model 4 we control for education, experience, and ethnic group; in Model 5 we additionally control for 2-digit occupation.

FIGURE A2

DECOMPOSITION OF THE GENDER RTI GAP BASED ON 2-DIGIT OCCUPATIONS



Source: Authors' elaboration/calculation.
Note: Gender RTI gap is the gender gap in the share of workers with an RTI index above the country median RTI. Source: World Bank STEP household surveys and authors' calculations. See equation (2) in the main text.

TABLE A1
ARMENIA-TASK MEASURES OF MAJOR OCCUPATION GROUPS BY GENDER

	RTI index	Routine task index	Abstract task index	Manual task index
MANAGERS				
All	-1.34	-0.09	0.77	0.48
Male	-1.97	-0.05	0.92	0.99
Female	-0.37	-0.15	0.53	-0.30
PROFESSIONALS				
All	-0.61	-0.16	0.49	-0.04
Male	-1.42	-0.10	0.58	0.73
Female	-0.35	-0.17	0.46	-0.29
TECHNICIANS AND ASSOCIATE PROFESSIONALS				
All	-0.13	0.03	0.20	-0.04
Male	-0.45	0.04	0.13	0.36
Female	0.13	0.02	0.25	-0.36
CLERICAL SUPPORT WORKERS				
All	0.33	0.15	0.03	-0.21
Male	-0.78	0.02	0.29	0.51
Female	0.58	0.19	-0.03	-0.36

SERVICE AND SALES WORKERS	0.63	0.01	-0.40	-0.25
All	0.38	-0.05	-0.43	0.01
Male	0.81	0.01	-0.38	-0.42
Female	0.35	-0.76	-1.08	-0.03
SKILLED AGRICULTURAL, FORESTRY AND FISHERY WORKERS	-1.01	-1.13	-0.57	0.45
All	2.19	-0.25	-1.76	-0.68
Male	0.67	0.38	-0.52	0.23
Female	0.51	0.44	-0.43	0.36
CRAFT AND RELATED TRADES WORKERS	1.44	0.06	-0.98	-0.40
All	-0.05	0.45	-0.53	1.03
Male	-0.14	0.47	-0.51	1.12
Female	1.80	0.11	-1.01	-0.68
PLANT AND MACHINE OPERATORS AND ASSEMBLERS	1.58	-0.10	-1.28	-0.41
All	1.92	0.57	-1.08	0.28
Male	1.47	-0.32	-1.34	-0.45
Female				
ELEMENTARY OCCUPATIONS				
All				
Male				
Female				

Source: Authors' elaboration/calculation.

TABLE A2
BOLIVIA-TASK MEASURES OF MAJOR OCCUPATION GROUPS BY GENDER

	RTI index	Routine task index	Abstract task index	Manual task index
MANAGERS				
All	-1.28	0.18	1.22	0.24
Male	-1.71	0.22	1.39	0.54
Female	-0.46	0.09	0.90	-0.35
PROFESSIONALS				
All	-1.33	-0.24	1.04	0.06
Male	-1.59	-0.17	0.93	0.49
Female	-1.15	-0.30	1.12	-0.27
TECHNICIANS AND ASSOCIATE PROFESSIONALS				
All	-0.92	0.09	0.56	0.45
Male	-1.12	0.12	0.42	0.82
Female	-0.62	0.05	0.77	-0.10
CLERICAL SUPPORT WORKERS				
All	0.01	0.24	0.45	-0.22
Male	-0.16	0.25	0.54	-0.12
Female	0.18	0.22	0.37	-0.32

SERVICE AND SALES WORKERS	0.33	-0.16	-0.25	-0.24
All	-0.27	-0.17	-0.07	0.17
Male	0.53	-0.15	-0.31	-0.38
Female				
SKILLED AGRICULTURAL, FORESTRY AND FISHERY WORKERS	-0.17	-0.37	-0.19	-0.01
All	-0.53	-0.30	0.02	0.22
Male	0.52	-0.50	-0.58	-0.44
Female				
CRAFT AND RELATED TRADES WORKERS	0.59	0.26	-0.25	-0.08
All	0.19	0.33	-0.04	0.18
Male	1.13	0.16	-0.53	-0.43
Female				
PLANT AND MACHINE OPERATORS AND ASSEMBLERS	-0.41	0.41	-0.45	1.27
All	-0.53	0.42	-0.47	1.42
Male	0.47	0.33	-0.36	0.22
Female				
ELEMENTARY OCCUPATIONS	0.89	-0.19	-0.84	-0.23
All	0.68	0.01	-0.70	0.04
Male	1.02	-0.31	-0.93	-0.40
Female				

Source: Authors' elaboration/calculation.

TABLE A3
COLOMBIA-TASK MEASURES OF MAJOR OCCUPATION GROUPS BY GENDER

	RTI index	Routine task index	Abstract task index	Manual task index
MANAGERS				
All	-1.04	0.18	0.70	0.53
Male	-1.12	0.26	0.68	0.70
Female	-0.96	0.09	0.72	0.33
PROFESSIONALS				
All	-1.39	-0.49	1.13	-0.23
Male	-1.56	-0.41	1.23	-0.09
Female	-1.27	-0.55	1.05	-0.33
TECHNICIANS AND ASSOCIATE PROFESSIONALS				
All	-0.67	0.19	0.66	0.19
Male	-0.78	0.34	0.68	0.44
Female	-0.42	-0.16	0.63	-0.37
CLERICAL SUPPORT WORKERS				
All	0.07	0.26	0.30	-0.11
Male	0.14	0.34	0.11	0.09
Female	0.01	0.20	0.44	-0.25

SERVICE AND SALES WORKERS	-0.02	-0.17	-0.06	-0.09
All	-0.63	-0.13	0.13	0.37
Male	0.28	-0.19	-0.16	-0.31
Female				
CRAFT AND RELATED TRADES WORKERS	0.11	0.25	0.10	0.05
All	0.09	0.57	0.21	0.27
Male	0.13	-0.19	-0.06	-0.26
Female				
PLANT AND MACHINE OPERATORS AND ASSEMBLERS	0.19	0.56	-0.36	0.73
All	-0.21	0.54	-0.26	1.01
Male	1.73	0.63	-0.75	-0.35
Female				
ELEMENTARY OCCUPATIONS	0.79	-0.20	-0.74	-0.25
All	0.80	0.03	-0.62	-0.16
Male	0.78	-0.39	-0.84	-0.33
Female				

Source: Authors' elaboration/calculation.

TABLE A4
GEORGIA-TASK MEASURES OF MAJOR OCCUPATION GROUPS BY GENDER

	RTI index	Routine task index	Abstract task index	Manual task index
MANAGERS				
All	-1.11	0.03	0.68	0.46
Male	-1.31	0.17	0.62	0.86
Female	-0.88	-0.13	0.75	0.01
PROFESSIONALS				
All	-0.42	-0.21	0.44	-0.23
Male	-1.30	-0.31	0.55	0.43
Female	-0.19	-0.18	0.41	-0.39
TECHNICIANS AND ASSOCIATE PROFESSIONALS				
All	-0.16	0.35	0.30	0.20
Male	-0.46	0.38	0.21	0.63
Female	0.11	0.31	0.38	-0.18
CLERICAL SUPPORT WORKERS				
All	0.47	0.02	-0.20	-0.26
Male	0.21	0.52	-0.29	0.60
Female	0.52	-0.08	-0.18	-0.42

SERVICE AND SALES WORKERS	0.51	0.01	-0.31	-0.24
All	0.30	-0.10	-0.44	0.04
Male	0.64	0.08	-0.21	-0.32
Female				
SKILLED AGRICULTURAL, FORESTRY AND FISHERY WORKERS	-0.95	-0.15	-0.29	1.09
All	-1.12	-0.09	-0.19	1.22
Male	1.12	-0.88	-1.56	-0.44
Female				
CRAFT AND RELATED TRADES WORKERS	0.36	0.30	-0.56	0.50
All	0.31	0.34	-0.59	0.62
Male	064	0.14	-0.43	-0.06
Female				
PLANT AND MACHINE OPERATORS AND ASSEMBLERS	0.40	0.41	-0.73	0.74
All	0.18	0.30	-0.71	0.83
Male	3.12	1.74	-0.93	-0.44
Female				
ELEMENTARY OCCUPATIONS	1.13	-0.07	-1.04	-0.16
All	0.96	0.28	-0.92	0.24
Male	1.24	-0.29	-1.12	-0.41
Female				

Source: Authors' elaboration/calculation.

TABLE A5
GHANA—TASK MEASURES OF MAJOR OCCUPATION GROUPS BY GENDER

	RTI index	Routine task index	Abstract task index	Manual task index
MANAGERS				
All	-1.82	0.44	1.22	1.04
Male	-2.06	0.60	1.45	1.20
Female	-0.87	-0.20	0.30	0.37
PROFESSIONALS				
All	-0.86	0.28	1.16	-0.02
Male	-1.04	0.24	1.16	0.12
Female	-0.53	0.36	1.16	-0.27
TECHNICIANS AND ASSOCIATE PROFESSIONALS				
All	-0.75	0.43	0.83	0.35
Male	-0.67	0.64	0.75	0.56
Female	-1.02	-0.28	1.11	-0.37
CLERICAL SUPPORT WORKERS				
All	-0.18	0.38	0.62	-0.07
Male	-0.62	0.28	0.73	0.17
Female	0.24	0.46	0.52	-0.29

SERVICE AND SALES WORKERS	0.39	-0.22	-0.36	-0.25
All	0.00	0.08	-0.07	0.15
Male	0.49	-0.29	-0.43	-0.35
Female	0.47	-0.42	-0.60	-0.29
SKILLED AGRICULTURAL, FORESTRY AND FISHERY WORKERS	0.42	-0.35	-0.53	-0.24
All	0.54	-0.53	-0.70	-0.37
Male	-0.21	0.17	0.19	0.19
Female	-0.79	0.40	0.51	0.68
CRAFT AND RELATED TRADES WORKERS	0.33	-0.05	-0.11	-0.27
All	-1.31	0.52	0.07	1.76
Male	-1.31	0.52	0.07	1.76
Female	-	-	-	-
PLANT AND MACHINE OPERATORS AND ASSEMBLERS	1.09	0.23	-0.67	-0.19
All	1.13	0.55	-0.50	-0.08
Male	1.05	-0.22	-0.91	-0.35
Female				
ELEMENTARY OCCUPATIONS				
All				
Male				
Female				

Source: Authors' elaboration/calculation.

TABLE A6
KENYA—TASK MEASURES OF MAJOR OCCUPATION GROUPS BY GENDER

	RTI index	Routine task index	Abstract task index	Manual task index
MANAGERS				
All	-1.74	0.01	1.13	0.61
Male	-1.73	0.10	1.29	0.54
Female	-1.75	-0.10	0.96	0.69
PROFESSIONALS				
All	-1.19	0.11	1.02	0.27
Male	-1.48	0.04	1.03	0.48
Female	-0.67	0.23	1.00	-0.10
TECHNICIANS AND ASSOCIATE PROFESSIONALS				
All	-0.87	0.19	0.69	0.37
Male	-0.81	0.25	0.65	0.41
Female	-1.02	0.03	0.78	0.27
CLERICAL SUPPORT WORKERS				
All	-0.18	0.03	0.14	0.06
Male	-0.44	0.09	0.32	0.21
Female	0.13	-0.05	-0.07	-0.11

SERVICE AND SALES WORKERS	0.23	-0.13	-0.13	-0.23
All	0.18	-0.12	-0.16	-0.13
Male	0.27	-0.15	-0.10	-0.32
Female				
SKILLED AGRICULTURAL, FORESTRY AND FISHERY WORKERS	0.58	-0.38	-0.84	-0.12
All	0.58	-0.19	-0.73	-0.04
Male	0.58	-0.75	-1.05	-0.28
Female				
CRAFT AND RELATED TRADES WORKERS	0.13	0.46	0.13	0.20
All	0.25	0.61	0.09	0.27
Male	-0.24	-0.02	0.27	-0.04
Female				
PLANT AND MACHINE OPERATORS AND ASSEMBLERS	-0.61	0.58	-0.14	1.33
All	-0.64	0.60	-0.09	1.33
Male	-0.48	0.47	-0.40	1.34
Female				
ELEMENTARY OCCUPATIONS	0.90	-0.21	-0.85	-0.26
All	0.84	-0.12	-0.77	-0.19
Male	0.96	-0.30	-0.93	-0.33
Female				

Source: Authors' elaboration/calculation.

TABLE A7
LAOS—TASK MEASURES OF MAJOR OCCUPATION GROUPS BY GENDER

	RTI index	Routine task index	Abstract task index	Manual task index
MANAGERS				
All	-2.73	0.11	1.80	1.04
Male	-3.41	0.12	2.06	1.48
Female	-0.85	0.08	1.09	-0.16
PROFESSIONALS				
All	-1.25	0.37	1.59	0.04
Male	-1.19	0.50	1.55	0.15
Female	-1.32	0.21	1.64	-0.11
TECHNICIANS AND ASSOCIATE PROFESSIONALS				
All	-1.01	0.48	1.31	0.19
Male	-1.53	0.55	1.55	0.53
Female	-0.44	0.42	1.04	-0.19
CLERICAL SUPPORT WORKERS				
All	-1.56	0.38	1.45	0.49
Male	-2.44	-0.05	1.72	0.68
Female	-0.92	0.70	1.26	0.35

SERVICE AND SALES WORKERS	-0.54	0.03	0.46	0.12
All	-1.33	0.17	0.82	0.67
Male	-0.25	-0.02	0.32	-0.09
Female	0.39	-0.10	-0.31	-0.17
SKILLED AGRICULTURAL, FORESTRY AND FISHERY WORKERS	0.35	0.04	-0.19	-0.12
All	0.42	-0.24	-0.43	-0.23
Male	-0.32	0.36	0.17	0.50
Female	-0.65	0.80	0.41	1.04
CRAFT AND RELATED TRADES WORKERS	-0.01	-0.05	-0.05	0.00
All	-3.07	-0.06	0.23	2.79
Male	-3.55	0.14	0.27	3.42
Female	-0.79	-1.01	0.02	-0.24
PLANT AND MACHINE OPERATORS AND ASSEMBLERS	0.44	0.22	-0.10	-0.13
All	0.28	0.33	0.13	-0.08
Male	0.71	0.05	-0.46	-0.20
Female				
ELEMENTARY OCCUPATIONS				
All				
Male				
Female				

Source: Authors' elaboration/calculation.

TABLE A8

MACEDONIA—TASK MEASURES OF MAJOR OCCUPATION GROUPS BY GENDER

	RTI index	Routine task index	Abstract task index	Manual task index
MANAGERS				
All	-1.47	-0.26	0.70	0.51
Male	-1.76	-0.17	0.75	0.83
Female	-1.05	-0.38	0.62	0.05
PROFESSIONALS				
All	-1.00	-0.32	0.69	-0.01
Male	-1.44	-0.30	0.77	0.36
Female	-0.69	-0.33	0.64	-0.27
TECHNICIANS AND ASSOCIATE PROFESSIONALS				
All	-0.38	0.11	0.30	0.18
Male	-0.92	0.23	0.42	0.73
Female	0.08	0.00	0.20	-0.28
CLERICAL SUPPORT WORKERS				
All	0.08	-0.07	0.05	-0.20
Male	-0.15	0.12	0.05	0.22
Female	0.25	-0.20	0.05	-0.50

SERVICE AND SALES WORKERS	0.36	-0.01	-0.24	-0.13
All	0.07	0.00	-0.28	0.21
Male	0.65	-0.02	-0.19	-0.48
Female	0.48	-0.25	-0.95	0.22
SKILLED AGRICULTURAL, FORESTRY AND FISHERY WORKERS	0.04	-0.12	-0.75	0.58
All	1.59	-0.55	-1.45	-0.69
Male	0.79	0.40	-0.41	0.02
Female	0.46	0.41	-0.26	0.21
CRAFT AND RELATED TRADES WORKERS	1.90	0.35	-0.93	-0.62
All	1.16	0.34	-0.77	-0.06
Male	0.57	0.37	-0.55	0.36
Female	2.00	0.28	-1.08	-0.65
PLANT AND MACHINE OPERATORS AND ASSEMBLERS	1.23	0.02	-0.97	-0.25
All	0.94	0.28	-0.78	0.12
Male	1.51	-0.22	-1.14	-0.58
Female				
ELEMENTARY OCCUPATIONS				
All				
Male				
Female				

Source: Authors' elaboration/calculation.

TABLE A9

PHILIPPINES—TASK MEASURES OF MAJOR OCCUPATION GROUPS BY GENDER

	RTI index	Routine task index	Abstract task index	Manual task index
MANAGERS				
All	-0.47	-0.25	0.61	-0.40
Male	-0.61	-0.32	0.64	-0.35
Female	-0.31	-0.18	0.58	-0.45
PROFESSIONALS				
All	-0.68	-0.16	0.78	-0.26
Male	-0.62	-0.12	0.75	-0.26
Female	-0.77	-0.23	0.82	-0.28
TECHNICIANS AND ASSOCIATE PROFESSIONALS				
All	-0.47	-0.23	0.50	-0.26
Male	-0.37	-0.30	0.32	-0.25
Female	-0.61	-0.13	0.75	-0.27
CLERICAL SUPPORT WORKERS				
All	0.01	0.04	0.02	0.00
Male	-0.21	0.04	0.14	0.11
Female	0.33	0.03	-0.14	-0.15

SERVICE AND SALES WORKERS	0.11	0.09	-0.16	0.15
All	0.09	0.10	-0.24	0.26
Male	0.14	0.08	-0.05	-0.01
Female				
SKILLED AGRICULTURAL, FORESTRY AND FISHERY WORKERS	-0.47	0.31	0.67	0.11
All	-0.47	0.31	0.67	0.11
Male	-	-	-	-
Female				
CRAFT AND RELATED TRADES WORKERS	0.14	-0.11	-0.24	-0.01
All	0.34	0.04	-0.38	0.08
Male	-0.15	-0.32	-0.03	-0.13
Female				
PLANT AND MACHINE OPERATORS AND ASSEMBLERS	-0.07	-0.18	-0.22	0.11
All	-0.12	-0.16	-0.23	0.20
Male	0.00	-0.21	-0.20	-0.01
Female				
ELEMENTARY OCCUPATIONS	0.46	0.27	-0.35	0.16
All	0.48	0.30	-0.36	0.17
Male	0.44	0.23	-0.34	0.13
Female				

Source: Authors' elaboration/calculation.

TABLE A10

SRI LANKA—TASK MEASURES OF MAJOR OCCUPATION GROUPS BY GENDER

	RTI index	Routine task index	Abstract task index	Manual task index
MANAGERS				
All	-0.94	0.04	0.54	0.44
Male	-1.38	0.13	0.75	0.76
Female	0.27	-0.21	-0.05	-0.42
PROFESSIONALS				
All	-0.77	0.20	1.06	-0.08
Male	-1.25	0.15	1.13	0.26
Female	-0.54	0.23	1.02	-0.25
TECHNICIANS AND ASSOCIATE PROFESSIONALS				
All	-1.07	-0.24	0.68	0.15
Male	-0.99	-0.37	0.69	-0.07
Female	-1.22	0.01	0.67	0.57
CLERICAL SUPPORT WORKERS				
All	-0.86	0.15	0.67	0.33
Male	-1.05	0.18	0.73	0.49
Female	-0.63	0.12	0.60	0.14

SERVICE AND SALES WORKERS	-0.36	-0.04	0.20	0.12
All	-0.50	0.01	0.17	0.34
Male	-0.14	-0.10	0.24	-0.20
Female				
SKILLED AGRICULTURAL, FORESTRY AND FISHERY WORKERS	0.49	-0.39	-0.45	-0.43
All	0.50	-0.28	-0.47	-0.31
Male	0.48	-0.51	-0.44	-0.56
Female				
CRAFT AND RELATED TRADES WORKERS	0.25	0.32	0.05	0.01
All	0.00	0.34	0.14	0.19
Male	0.79	0.27	-0.14	-0.39
Female				
PLANT AND MACHINE OPERATORS AND ASSEMBLERS	-1.04	0.12	-0.09	1.25
All	-1.40	0.07	0.00	1.46
Male	2.02	0.55	-0.89	-0.57
Female				
ELEMENTARY OCCUPATIONS	0.75	-0.16	-0.56	-0.34
All	0.58	-0.04	-0.44	-0.18
Male	0.96	-0.31	-0.72	-0.55
Female				

Source: Authors' elaboration/calculation.

TABLE A11

UKRAINE—TASK MEASURES OF MAJOR OCCUPATION GROUPS BY GENDER

	RTI index	Routine task index	Abstract task index	Manual task index
MANAGERS				
All	-1.51	-0.26	0.81	0.44
Male	-2.25	-0.21	0.80	1.24
Female	-0.81	-0.31	0.82	-0.32
PROFESSIONALS				
All	-1.01	-0.28	0.74	-0.01
Male	-1.51	-0.09	0.61	0.82
Female	-0.83	-0.35	0.79	-0.31
TECHNICIANS AND ASSOCIATE PROFESSIONALS				
All	-0.01	-0.09	0.13	-0.22
Male	-0.19	-0.07	0.08	0.04
Female	0.06	-0.11	0.16	-0.33
CLERICAL SUPPORT WORKERS				
All	0.45	0.01	-0.29	-0.15
Male	0.16	0.66	-0.01	0.51
Female	0.49	-0.09	-0.33	-0.24

SERVICE AND SALES WORKERS	0.50	0.01	-0.27	-0.22
All	-0.77	-0.26	0.09	0.42
Male	0.92	0.10	-0.38	-0.43
Female				
CRAFT AND RELATED TRADES WORKERS	0.79	0.39	-0.49	0.08
All	0.57	0.39	-0.43	0.25
Male	1.33	0.37	-0.64	-0.32
Female				
PLANT AND MACHINE OPERATORS AND ASSEMBLERS	1.13	0.89	-0.69	0.45
All	0.27	0.56	-0.57	0.87
Male	2.49	1.41	-0.88	-0.20
Female				
ELEMENTARY OCCUPATIONS	1.16	-0.25	-1.08	-0.33
All	0.82	-0.35	-1.06	-0.11
Male	1.35	-0.20	-1.09	-0.46
Female				

Source: Authors' elaboration/calculation.

TABLE A12

VIETNAM—TASK MEASURES OF MAJOR OCCUPATION GROUPS BY GENDER

	RTI index	Routine task index	Abstract task index	Manual task index
MANAGERS				
All	-1.90	0.03	1.16	0.77
Male	-2.24	-0.08	1.17	0.99
Female	-1.15	0.26	1.14	0.28
PROFESSIONALS				
All	-0.88	0.07	0.84	0.11
Male	-1.15	0.25	0.93	0.48
Female	-0.72	-0.05	0.79	-0.12
TECHNICIANS AND ASSOCIATE PROFESSIONALS				
All	-0.71	-0.04	0.53	0.14
Male	-1.19	0.06	0.75	0.50
Female	-0.42	-0.10	0.40	-0.07
CLERICAL SUPPORT WORKERS				
All	-0.13	-0.01	0.19	-0.07
Male	-0.52	-0.09	0.10	0.33
Female	0.08	0.03	0.24	-0.29

SERVICE AND SALES WORKERS	0.11	-0.24	-0.16	-0.19
All	-0.30	-0.25	-0.01	0.06
Male	0.33	-0.23	-0.24	-0.33
Female				
SKILLED AGRICULTURAL, FORESTRY AND FISHERY WORKERS	0.46	0.05	-0.53	0.12
All	0.48	0.03	-0.40	-0.05
Male	0.41	0.12	-1.01	0.72
Female				
CRAFT AND RELATED TRADES WORKERS	0.70	0.45	-0.28	0.03
All	0.13	0.49	-0.01	0.37
Male	1.28	0.41	-0.55	-0.32
Female				
PLANT AND MACHINE OPERATORS AND ASSEMBLERS	0.13	0.55	-0.50	0.91
All	-0.39	0.45	-0.33	1.17
Male	1.85	0.86	-1.06	0.07
Female				
ELEMENTARY OCCUPATIONS	0.92	-0.16	-0.79	-0.29
All	0.81	-0.13	-0.74	-0.19
Male	0.98	-0.17	-0.81	-0.34
Female				

Source: Authors' elaboration/calculation.

TABLE A13

YUNNAN (CHINA)—TASK MEASURES OF MAJOR OCCUPATION GROUPS BY GENDER

	RTI index	Routine task index	Abstract task index	Manual task index
MANAGERS				
All	-1.22	-0.18	0.69	0.35
Male	-1.32	-0.12	0.71	0.49
Female	-1.05	-0.27	0.65	0.13
PROFESSIONALS				
All	-0.58	-0.03	0.57	-0.02
Male	-1.20	-0.15	0.72	0.33
Female	-0.11	0.07	0.46	-0.29
TECHNICIANS AND ASSOCIATE PROFESSIONALS				
All	-0.52	-0.12	0.43	-0.03
Male	-0.90	-0.20	0.42	0.28
Female	-0.08	-0.02	0.45	-0.39
CLERICAL SUPPORT WORKERS				
All	0.40	0.11	-0.11	-0.18
Male	0.11	0.32	0.02	0.20
Female	0.56	-0.01	-0.18	-0.40

SERVICE AND SALES WORKERS	-0.03	-0.09	-0.05	-0.02
All	-0.34	-0.13	0.02	0.19
Male	0.34	-0.05	-0.12	-0.26
Female				
SKILLED AGRICULTURAL, FORESTRY AND FISHERY WORKERS	-0.08	-0.88	-0.85	0.05
All	-0.68	-1.02	-0.75	0.40
Male	0.98	-0.63	-1.04	-0.57
Female				
CRAFT AND RELATED TRADES WORKERS	1.12	0.84	-0.34	0.07
All	1.10	1.01	-0.27	0.18
Male	1.17	0.33	-0.55	-0.29
Female				
PLANT AND MACHINE OPERATORS AND ASSEMBLERS	-0.02	0.30	-0.41	0.73
All	-0.07	0.32	-0.48	0.87
Male	0.15	0.24	-0.20	0.29
Female				
ELEMENTARY OCCUPATIONS	0.46	-0.27	-0.43	-0.30
All	-0.08	-0.27	-0.10	-0.09
Male	1.06	-0.27	-0.80	-0.53
Female				

Source: Authors' elaboration/calculation.

TABLE A14
ARMENIA - OLS REGRESSIONS OF RTI INDEX

	(1)	(2)	(3)	(4)	(5)
Female	0.62*** (0.15)	0.74*** (0.14)	0.74*** (0.14)	0.74*** (0.14)	0.83*** (0.15)
Less than high-school		0.90*** (0.31)	0.82*** (0.31)	0.81** (0.31)	0.23 (0.31)
More than high-school		-0.69*** (0.13)	-0.70*** (0.13)	-0.69*** (0.13)	-0.13 (0.12)
Experience			-0.01 (0.02)	-0.01 (0.02)	-0.03** (0.02)
Experience squared			0.00** (0.00)	0.00** (0.00)	0.00*** (0.00)
Bilingual or non-native speaker				-0.19 (0.16)	-0.07 (0.15)
2-digit occupation	No	No	No	No	Yes
Mean RTI	0.00	0.00	-0.00	-0.00	-0.00
N	989.00	988.00	972.00	972.00	972.00
R-squared	0.03	0.08	0.10	0.10	0.28

Source: Authors' elaboration/calculation.
Notes: Standard errors are in parentheses. All models include a constant and simultaneously control for weighting, clustering, and stratification. Native speaking male high-school graduates are the reference group. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

TABLE A15
BOLIVIA - OLS REGRESSIONS OF RTI INDEX

	(1)	(2)	(3)	(4)	(5)
Female	0.81*** (0.12)	0.76*** (0.11)	0.78*** (0.12)	0.78*** (0.12)	0.54*** (0.12)
Less than high-school		0.04 (0.13)	0.08 (0.14)	0.09 (0.14)	-0.03 (0.14)
More than high-school		-1.04*** (0.14)	-0.99*** (0.14)	-0.99*** (0.14)	-0.51*** (0.16)
Experience			-0.04** (0.02)	-0.04** (0.02)	-0.03* (0.01)
Experience squared			0.00** (0.00)	0.00** (0.00)	0.00* (0.00)
Bilingual or non-native speaker				-0.05 (0.12)	-0.09 (0.12)
2-digit occupation	No	No	No	No	Yes
Mean RTI	-0.00	-0.01	-0.01	-0.01	-0.01
N	1757.00	1745.00	1745.00	1735.00	1735.00
R-squared	0.05	0.14	0.15	0.15	0.34

Source: Authors' elaboration/calculation.
Notes: Standard errors are in parentheses. All models include a constant and simultaneously control for weighting, clustering, and stratification. Native speaking male high-school graduates are the reference group. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

TABLE A16
COLOMBIA - OLS REGRESSIONS OF RTI INDEX

	(1)	(2)	(3)	(4)	(5)
Female	0.41*** (0.06)	0.41*** (0.08)	0.41*** (0.08)	0.42*** (0.08)	0.21 (0.13)
Less than high-school		-0.07 (0.07)	0.06 (0.08)	0.02 (0.09)	0.04 (0.08)
More than high-school		-0.84*** (0.06)	-0.83*** (0.07)	-0.83*** (0.07)	-0.31** (0.10)
Experience			-0.03* (0.02)	-0.04* (0.02)	-0.03* (0.01)
Experience squared			0.00 (0.00)	0.00* (0.00)	0.00 (0.00)
Bilingual or non-native speaker				1.99*** (0.19)	1.66*** (0.47)
2-digit occupation	No	No	No	No	Yes
Mean RTI	-0.00	-0.01	-0.01	-0.01	-0.01
N	1716.00	1704.00	1704.00	1704.00	1704.00
R-squared	0.01	0.06	0.07	0.07	0.28

Source: Authors' elaboration/calculation.
Notes: Standard errors are in parentheses. All models include a constant and simultaneously control for weighting, clustering, and stratification. Native speaking male high-school graduates are the reference group. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

TABLE A17
GEORGIA - OLS REGRESSIONS OF RTI INDEX

	(1)	(2)	(3)	(4)	(5)
Female	0.42*** (0.15)	0.51*** (0.15)	0.49*** (0.15)	0.49*** (0.15)	0.67*** (0.16)
Less than high-school		0.36 (0.34)	0.37 (0.34)	0.32 (0.34)	-0.22 (0.34)
More than high-school		-0.66*** (0.16)	-0.69*** (0.16)	-0.68*** (0.16)	-0.31* (0.18)
Experience			0.03** (0.02)	0.03* (0.02)	0.03 (0.02)
Experience squared			-0.00 (0.00)	-0.00 (0.00)	-0.00 (0.00)
Bilingual or non-native speaker				0.19 (0.27)	0.18 (0.27)
2-digit occupation	No	No	No	No	Yes
Mean RTI	-0.00	0.00	-0.00	-0.00	-0.00
N	933.00	933.00	932.00	932.00	932.00
R-squared	0.01	0.04	0.05	0.05	0.22

Source: Authors' elaboration/calculation.
Notes: Standard errors are in parentheses. All models include a constant and simultaneously control for weighting and clustering. Native speaking male high-school graduates are the reference group. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

TABLE A18
GHANA - OLS REGRESSIONS OF RTI INDEX

	(1)	(2)	(3)	(4)	(5)
Female	0.85*** (0.09)	0.77*** (0.10)	0.78*** (0.10)	0.78*** (0.10)	0.44*** (0.10)
Less than high-school		0.23 (0.14)	0.40*** (0.14)	0.40*** (0.14)	0.08 (0.14)
More than high-school		-0.98*** (0.19)	-0.92*** (0.18)	-0.92*** (0.18)	-0.67*** (0.18)
Experience			-0.05*** (0.01)	-0.05*** (0.01)	-0.03*** (0.01)
Experience squared			0.00*** (0.00)	0.00*** (0.00)	0.00*** (0.00)
Bilingual or non-native speaker				-0.01 (0.10)	-0.01 (0.08)
2-digit occupation	No	No	No	No	Yes
Mean RTI	0.00	-0.05	-0.05	-0.05	-0.05
N	2133.00	1895.00	1895.00	1892.00	1892.00
R-squared	0.07	0.12	0.13	0.13	0.31

Source: Authors' elaboration/calculation.
Notes: Standard errors are in parentheses. All models include a constant and simultaneously control for weighting, clustering, and stratification. Native speaking male high-school graduates are the reference group. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

TABLE A19
KENYA - OLS REGRESSIONS OF RTI INDEX

	(1)	(2)	(3)	(4)	(5)
Female	0.27*** (0.08)	0.25*** (0.08)	0.23*** (0.08)	0.24*** (0.08)	0.21*** (0.08)
Less than high-school		0.46*** (0.10)	0.56*** (0.10)	0.55*** (0.10)	0.35*** (0.10)
More than high-school		-0.91*** (0.13)	-0.94*** (0.13)	-0.94*** (0.13)	-0.48*** (0.13)
Experience			-0.04*** (0.01)	-0.04*** (0.01)	-0.05*** (0.01)
Experience squared			0.00** (0.00)	0.00** (0.00)	0.00*** (0.00)
Bilingual or non-native speaker				0.11 (0.11)	0.13 (0.11)
2-digit occupation	No	No	No	No	Yes
Mean RTI	0.00	-0.07	-0.06	-0.06	-0.06
N	2361.00	2150.00	2134.00	2131.00	2131.00
R-squared	0.01	0.10	0.11	0.11	0.28

Source: Authors' elaboration/calculation.
Notes: Standard errors are in parentheses. All models include a constant and simultaneously control for weighting, clustering, and stratification. Native speaking male high-school graduates are the reference group. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

TABLE A20
LAOS - OLS REGRESSIONS OF RTI INDEX

	(1)	(2)	(3)	(4)	(5)
Female	0.36*** (0.12)	0.32** (0.13)	0.23* (0.12)	0.25* (0.13)	0.14 (0.12)
Less than high-school		0.46** (0.18)	0.75*** (0.19)	0.75*** (0.19)	0.42*** (0.15)
More than high-school		-0.85*** (0.23)	-0.92*** (0.22)	-0.90*** (0.22)	-0.36* (0.19)
Experience			-0.05*** (0.02)	-0.05*** (0.02)	-0.04*** (0.01)
Experience squared			0.00* (0.00)	0.00* (0.00)	0.00 (0.00)
Bilingual or non-native speaker				0.11 (0.16)	-0.05 (0.13)
2-digit occupation	No	No	No	No	Yes
Mean RTI	-0.00	-0.05	-0.05	-0.05	-0.05
N	2185.00	2004.00	2004.00	2004.00	2004.00
R-squared	0.01	0.10	0.13	0.13	0.28

Source: Authors' elaboration/calculation.
Notes: Standard errors are in parentheses. All models include a constant and simultaneously control for weighting, clustering, and stratification. Native speaking male high-school graduates are the reference group. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

TABLE A21
MACEDONIA - OLS REGRESSIONS OF RTI INDEX

	(1)	(2)	(3)	(4)	(5)
Female	0.60*** (0.11)	0.75*** (0.10)	0.77*** (0.10)	0.74*** (0.10)	0.66*** (0.10)
Less than high-school		0.84*** (0.17)	0.79*** (0.17)	0.88*** (0.17)	0.32** (0.15)
More than high-school		-1.33*** (0.10)	-1.38*** (0.10)	-1.38*** (0.10)	-0.60*** (0.12)
Experience			-0.05*** (0.02)	-0.05*** (0.02)	-0.05*** (0.01)
Experience squared			0.00*** (0.00)	0.00*** (0.00)	0.00*** (0.00)
Bilingual or non-native speaker				-0.36*** (0.14)	-0.21* (0.12)
2-digit occupation	No	No	No	No	Yes
Mean RTI	0.00	-0.00	-0.00	0.00	0.00
N	1810.00	1809.00	1809.00	1808.00	1808.00
R-squared	0.02	0.17	0.18	0.18	0.34

Source: Authors' elaboration/calculation.
Notes: Standard errors are in parentheses. All models include a constant and simultaneously control for weighting and clustering. Native speaking male high-school graduates are the reference group. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

TABLE A22
SRI LANKA - OLS REGRESSIONS OF RTI INDEX

	(1)	(2)	(3)	(4)	(5)
Female	0.59*** (0.10)	0.69*** (0.09)	0.70*** (0.09)	0.70*** (0.09)	0.53*** (0.10)
Less than high-school		0.83*** (0.11)	0.77*** (0.13)	0.77*** (0.13)	0.38*** (0.13)
More than high-school		-0.52*** (0.17)	-0.51*** (0.17)	-0.50*** (0.16)	-0.33** (0.15)
Experience			-0.02 (0.02)	-0.02 (0.02)	-0.01 (0.02)
Experience squared			0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Bilingual or non-native speaker				0.06 (0.15)	0.01 (0.14)
2-digit occupation	No	No	No	No	Yes
Mean RTI	0.00	-0.01	-0.01	-0.01	-0.01
N	1559.00	1545.00	1543.00	1540.00	1540.00
R-squared	0.03	0.13	0.13	0.13	0.27

Source: Authors' elaboration/calculation.
Notes: Standard errors are in parentheses. All models include a constant and simultaneously control for weighting, clustering, and stratification. Native speaking male high-school graduates are the reference group. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

TABLE A23
VIETNAM - OLS REGRESSIONS OF RTI INDEX

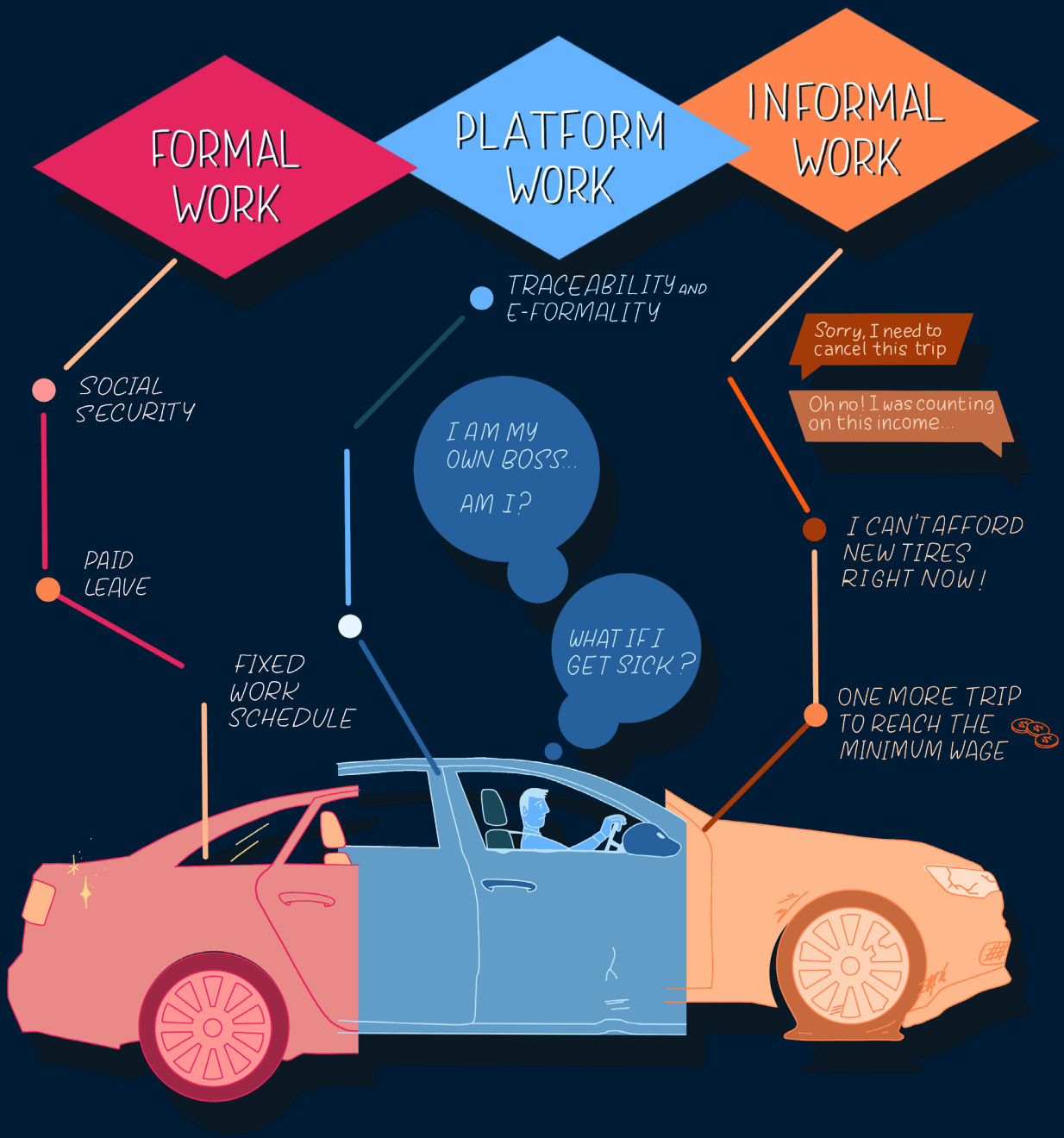
	(1)	(2)	(3)	(4)	(5)
Female	0.68*** (0.08)	0.68*** (0.08)	0.67*** (0.08)	0.68*** (0.08)	0.54*** (0.08)
Less than high-school		0.56*** (0.10)	0.60*** (0.10)	0.58*** (0.11)	0.28*** (0.10)
More than high-school		-0.86*** (0.11)	-0.90*** (0.12)	-0.90*** (0.12)	-0.32*** (0.12)
Experience			-0.03** (0.01)	-0.03** (0.01)	-0.02** (0.01)
Experience squared			0.00** (0.00)	0.00** (0.00)	0.00** (0.00)
Bilingual or non-native speaker				0.15 (0.15)	0.28** (0.12)
2-digit occupation	No	No	No	No	Yes
Mean RTI	0.00	-0.00	-0.00	-0.00	-0.00
N	2332.00	2321.00	2321.00	2319.00	2319.00
R-squared	0.04	0.15	0.15	0.15	0.29

Source: Authors' elaboration/calculation.
Notes: Standard errors are in parentheses. All models include a constant and simultaneously control for weighting, clustering, and stratification. Native speaking male high-school graduates are the reference group.
* p < 0.1, ** p < 0.05, *** p < 0.01.

TABLE A24
YUNNAN PROVINCE (CHINA) - OLS REGRESSIONS OF RTI INDEX

	(1)	(2)	(3)	(4)	(5)
Female	0.64*** (0.10)	0.72*** (0.10)	0.81*** (0.10)	0.80*** (0.10)	0.73*** (0.11)
Less than high-school		0.81*** (0.10)	0.69*** (0.12)	0.68*** (0.12)	0.48*** (0.12)
More than high-school		-0.37 (0.89)	-0.43 (0.80)	-0.47 (0.81)	-0.40 (0.74)
Experience			-0.08*** (0.01)	-0.08*** (0.01)	-0.08*** (0.01)
Experience squared			0.00*** (0.00)	0.00*** (0.00)	0.00*** (0.00)
Bilingual or non-native speaker				-0.25 (0.17)	-0.20 (0.15)
2-digit occupation	No	No	No	No	Yes
Mean RTI	0.00	-0.01	-0.01	-0.01	-0.01
N	1244.00	1238.00	1238.00	1238.00	1238.00
R-squared	0.03	0.08	0.12	0.12	0.24

Source: Authors' elaboration/calculation.
Notes: Standard errors are in parentheses. All models include a constant and simultaneously control for weighting and clustering. Native speaking male high-school graduates are the reference group. * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.



SECTION II: LABOR PLATFORMS

3. FUTURE OF WORK IN THE GLOBAL SOUTH: DIGITAL LABOR, NEW OPPORTUNITIES AND CHALLENGES

Diego Aguilar
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More than one billion people will enter the job market in less than three years, most of whom come from low- and lower-middle-income countries of the Global South (ILO, 2018b); however, structural unemployment in many countries, especially amongst the youth, will expand (ILO, 2017; OECD, 2014). Moreover, increases in access to the Internet have led to the emergence of a new world of work (*digital labor*), with major international institutions suggesting that workers could compete in a frictionless global marketplace through online platforms (ILO, 2018a; S4YE, 2018). In this context, digital labor and related phenomena can potentially offer an alternative to traditional employment under these global conditions (ILO, 2018b; Gillwald et al., 2018; World Bank, 2016).

While Information and Communications Technologies (ICT) have the potential to contribute to the attainment of sustainable development goals of equality and social inclusion, paradoxically, as more people are connected and use the Internet more productively, digital inequality increases not only between those offline and online but also between those passively consuming the Internet and those who are more active for purposes of entrepreneurialism and innovation or to enhance their well-being. This new labor market segment offers benefits, such as autonomy, flexibility, and time management. Some studies highlight microwork as an opportunity for job creation, particularly for traditionally excluded minorities, such as, women, youths, the poor, racial minorities, and people that live in rural areas (Rossotto et al., 2012; Maselli et al., 2016). However, online workers are exposed to risks like social isolation, a lack of work-life balance, discrimination, predatory intermediaries, and even basic Internet threats to security and privacy (Bukht and Heeks 2018). As a result, digitization processes that significantly affect the nature of work will have long-lasting impacts on development outcomes, such as participation in labor markets, the level of wages, and the possibility to choose flexible work schedules. Yet, these impacts have not been broadly studied, particularly in the Global South.

* Based on Gonzalez (2021) and Aguilar et al. (2021).
* We thank José Burneo for his capable research assistance.

In this context, this chapter aims to contribute to a better understanding of the implications of changes in the nature of work (*digital labor*) for selected developing countries in Africa, Asia, and Latin America, especially among marginalized groups, to foster equitable growth and inclusive social development. We do this in a twofold way. Firstly, we discuss results from a quantitative study that aimed at identifying the characteristics of digital workers, as well as the main barriers to digital labor market participation, focusing on the differences between men and women. We also analyze the determinants of entry decisions into the digital labor market, and the main drivers of the gender pay gap between male and female digital workers, and between females outside and inside the digital labor market.

Secondly, we reflect on some of those findings by examining results from a qualitative study conducted in Lima among drivers and delivery people currently working on some of these platforms.

The results from the quantitative analysis show that gender inequalities are not limited to the 'connected' and 'unconnected' categories; they also exist among those who are already online, spotlighting the second level of the digital divide. Observable characteristics in men and women, such as level of education or experience, only explain a small part of the gender pay gap, while the other part can be attributed to discrimination and social values. The qualitative study provided an improved view on the workers' perspective of this subject, shedding light on other relevant variables including their degrees of agency, work stability, investment in means of production, platform-worker communications and soft control mechanisms (e.g., algorithms and income multipliers), as well as some that are particularly relevant to the gender pay gap, such as increased exposure to a series of work-related risks.

The chapter is organized as follows. The first part, Platform Economy and Gender Issues in the Global South, provides a

general overall of the issues related to the challenges posed by the digital economy in the Global South. Te following part, Overall Lens: Top-down Evidence, presents the results from a quantitative study carried out with nationally representative surveys from 21 countries in Africa, Asia, and Latin America.[3] Section 4 presents and reflects on a series of interviews conducted in Lima, Peru with platform workers in taxi-riding and home-delivery sections.

PLATFORM ECONOMY AND GENDER ISSUES IN THE GLOBAL SOUTH

The growth of the digital economy[4] in developing countries has been hindered by digital exclusion and digital inequality. The digital divide remains a critical problem: involvement in the digital economy typically requires not only Internet access but also digital skills and literacy. Even considering inflated supply-side figures, roughly half the planet's population is not yet connected (UNCTAD, 2017); moreover, this group is disproportionately constituted by the world's traditionally excluded minorities in developing countries.

In particular, in the labor sector, despite increasing global workforce participation rates, traditionally excluded populations are still at a disadvantage in terms of their share in employment, wages, and working conditions (ILO, 2018a). Today's labor market is still marked by pervasive inequality; according to Blau and Kahn (2017) women work in occupations that differ from those of men and are paid less for apparently the same personal and job characteristics; and those in the Global North earn more than workers in the Global South. Furthermore, a significant percentage of the female global workforce earns their livelihood in the informal economy as "dependent" wage earners and self-employed entrepreneurs

[3] See http://afteraccess.net/

[4] Following Bukht and Heeks (2017) and Broughton et al., (2018), we define the digital economy as the exchange of labor for money between individuals or companies via digital platforms that actively facilitate matching between providers and customers on a short-term and payment basis

in a wide range of workplaces (ILO, 2016). Young people encounter serious problems in their worklife, with three out of four youths worldwide engaged in informal employment. They face high rates of poverty and are exposed to non-standard, informal, and less secure forms of employment with a lack of social and legal protection, and limited opportunities for training (ILO, 2020). In this context, digital platforms offering the opportunity to find potential employers and clients and to perform income-generating activities constitute an important tool, especially for disadvantaged populations in places where job opportunities are very limited or simply do not exist.

According to Graham et al. (2020), a digital labor platform can be defined as a set of digital resources—including services and content—that enable value-creating interactions between consumers and individual service-providing workers. Gig work and new virtual job opportunities include writing, graphic design, data entry, transcriptions, social media marketing, translating online content into other languages, website curation, e-hailing, and online delivery (Wood et al., 2019; Graham et al., 2017). Common online digital labor platforms include Amazon Mechanical Turk, which enables workers to choose and perform simple tasks through a digital platform, report directly through the online platform, and receive payments in exchange. Other microwork online platforms include Samasource and Juna (Graham et al., 2017; Ford et al., 2015; World Bank, 2015; Horton, 2010). Note the distinction between online gig work—which is transacted and delivered via digital platforms because the product of work is digital information and can circulate on the Internet—and non-online gig work, where the product or service must be provided locally, such as Uber or Airbnb (Graham et al., 2017).

Online tasks vary according to type, targeted workers, and compensation (Broughton et al., 2018). Several factors have been identified as drivers or determinants of participation in the digital labor market: payment or reward, digital skills, awareness, access to the Internet or devices and electricity availability (Gillwald et al., 2018; Mtsweni and Burge, 2014).

Despite the potential benefits that can be derived from digital labor platforms, several barriers hinder populations of developing countries from taking advantage of this global resource. The majority of the online digital platforms that are available are hosted and accessed only through the Internet. This creates an access challenge for many countries where Internet penetration is low. For instance, less than a third (28%) of individuals 15 years and older in Africa use the Internet (Gillwald et al., 2018). Furthermore, people living in developing countries do not have devices such as computers and laptops which are necessary for meaningful participation in the digital labor market and are restricted to tasks that can be performed on smartphones, such as e-hailing and online delivery with very limited coding, tagging, and categorization of content (Gillwald et al., 2018).

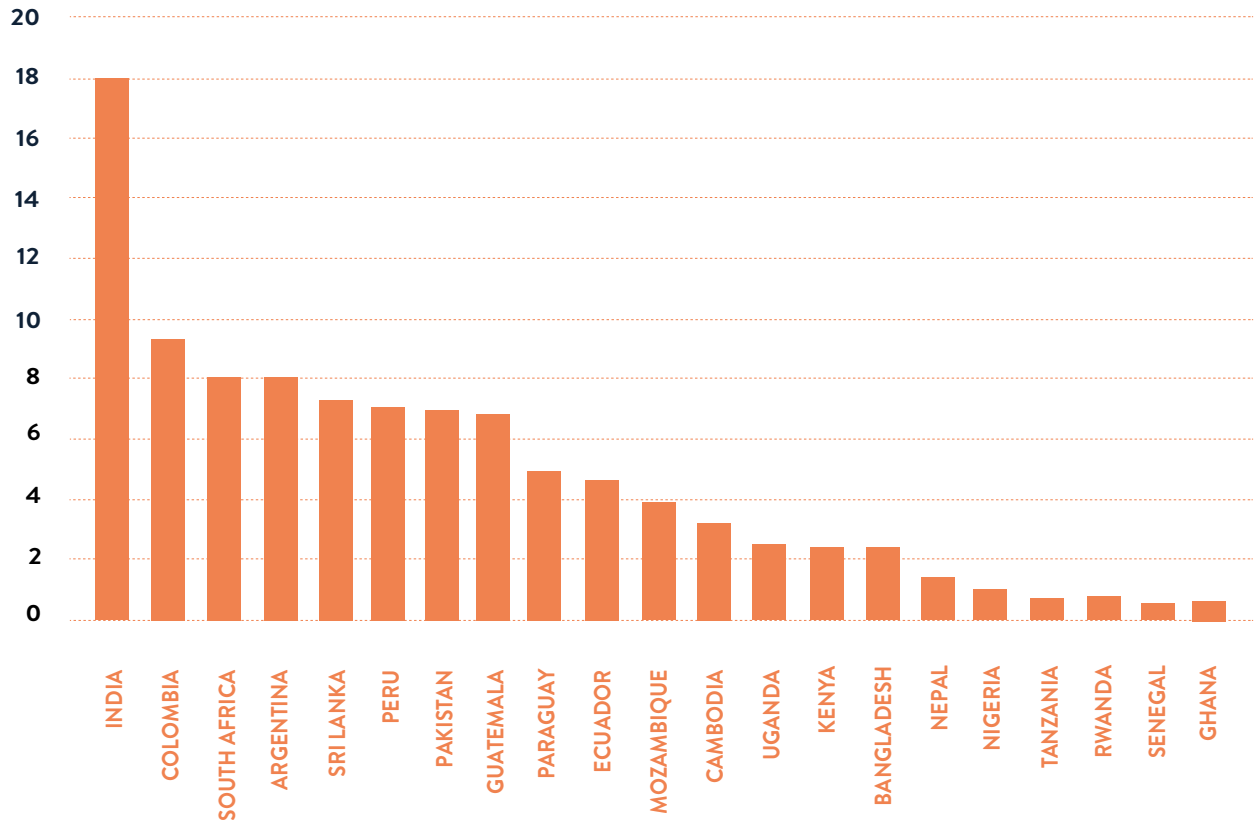
Digital labor platforms depend on ICT infrastructure. However, in many developing countries the majority of rural areas have yet to be connected and cannot participate in the digital economy (Roomaney et al., 2018; Barrantes et al., 2020). Other barriers identified by the literature include a lack of ICT education, digital skills, and the non-visibility of digital labor platforms in developing countries. As a result, populations in these areas are unaware of the opportunities available online (IADB, 2018; Roomaney et al., 2018). Furthermore, the majority of people in developing countries are financially excluded (Gillwald et al., 2018) and the lack of payment mechanisms is a significant problem that is affecting the growth of online work in developing countries (Galperin and Alarcon, 2018).

The existing literature shows that online labor platforms compound market frictions that result in inferior labor outcomes for the poor, particularly for women, ethnic minorities, and other disadvantaged groups (Galperin and Greppi, 2017). While there is evidence that digital labor platforms might exacerbate historical inequalities, most of the studies have remained descriptive and fail to quantify these disparities. Hence, much more research is pending about the connection between new forms of digital labor and traditional

employment, and the distributional impact of these changes on relevant development outcomes.

Even though online platforms could potentially provide much-needed jobs to the majority of unemployed people in developing countries, their potential is hampered by low levels of Internet penetration, especially in Africa and Asia. For instance, the survey shows that countries with the lowest Internet penetration have the lowest uptake of microwork among the surveyed countries. Senegal and Ghana, two of the African countries with the lowest level of Internet use, have the fewest micro-workers among the surveyed countries at 0.5% of the sample used for the analysis (see Figure 3.1).

FIGURE 3.1
DISTRIBUTION OF DIGITAL WORKERS BY COUNTRY (% DIGITAL WORKERS)



Source: Authors' calculations based on After Access data.

However, in some countries, like India, the rise of bots and Artificial Intelligence (AI) has generated new job opportunities in established industries. These new technologies have not only had a positive impact on knowledge-intensive sectors like medicine, education, and other professional services, but they have also created jobs for informal workers who use digital technologies to perform virtual work locally and globally. This is evidenced by an exponential growth in the number of digitally driven start-ups in India (ICRIER, 2017). Among the surveyed countries, India has the largest share of digital workers (18%), followed by Colombia (9%), and South Africa and Argentina (8%) of the sample used for the analysis.

There are noticeable differences between men and women in the type of digital work being performed. The most noticeable differences lie in ride-sourcing, which is preferred by 29% of men compared to only 20% of women. Other differences, while less remarkable, pertain to cleaning tasks in which 30% of women engage in these activities, compared to 21% in the case of men. Of the main reasons for securing work through digital platforms, the most important one for women is control over their schedules owing to childcare, school, and/or other obligations, as well as to gaining work experience for future job opportunities. Both men and women cited "fill in gaps or fluctuations in other sources of income".

As digital labor tends to be perceived as complementary to a main occupation, we were able to determine whether that were the case for our respondents. Fifteen percent of the women reported unpaid housework (mostly housewives) as their main occupation, compared to only 5% of the men. This indicates that women may be engaging in the digital economy while still doing house-related activities. The percentage of paid occupations (such as employed and independent occupations) is higher among men, whereas more women reported unpaid occupations (unemployed and unpaid family worker). Finally, men have more job experience, thus reinforcing gender penalties found in the literature about gender inequalities in the labor market.

Among the countries surveyed, the socioeconomic differences between men and women were negligible, except for those who participate in the digital economy. Men tend to earn more than female workers. Additionally, women who participate in the digital economy earn more than those females who do not.

OVERALL LENS: TOP-DOWN EVIDENCE

Our overall lens pertains to what we learnt from the quantitative evidence collected in 21 countries from Africa (9), Asia (7), and Latin America (6).[5] The following discussion explains our findings related to: the decision to participate in the digital labor market, the gender pay gap in the digital economy, and the digital economy's effect on women's earnings.

The decision to participate in the digital economy

In the 21 countries surveyed, this decision responds mainly to digital skills, i.e., the years of experience using the Internet and the workers' ability to solve technical problems by themselves. This shows that digital exclusion and inequality issues are not limited to the 'connected' and 'unconnected' but are also present among those who are already online, which could be termed the second level of the digital divide. In addition, the availability of devices, more specifically computers or laptops, is a critical determinant of participation in the digital labor market. Individuals who own computers are more likely to participate in digital work than those who do not have

[5] Countries include Kenya, Mozambique, Ghana, Nigeria, Rwanda, South Africa, Tanzania, Uganda, and Senegal in Africa; Pakistan, India, Bangladesh, Cambodia, Lesotho, Sri Lanka, and Nepal in Asia; and Argentina, Colombia, Ecuador, Guatemala, Paraguay, and Peru in Latin America. We used regression analysis to obtain quantitative results, specifying appropriate models to address the research questions and the endogeneity issues involved. The complete paper can be found at https://olatics.net/wp-content/uploads/2018/02/Future-of-Work-in-the-Global-South.pdf.

them, and having a smartphone does not play a key role in securing work through digital platforms. These issues should be further analyzed considering conditionalities on particular digital jobs. For instance, to secure work through digital ride-sourcing platforms, the individual must have access to a vehicle (car, motorcycle, etc.). This is also true for digital delivery platforms.[6]

Furthermore, our results show that digital work and formal labor (being employed) are not complementary activities but rather substitute ones: the probability of individuals who are unpaid houseworkers, unemployed and independent with employees working on digital platforms is higher than for those who are occupied. This suggests that digital work is more likely to be the first incursion into the labor market for these people and, as such, a way to obtain experience that could be shown later on when applying for other types of work or jobs, as stated by 41% of the people in the sample. Hence, individuals with formal employment contracts are less likely to participate in these platforms because the rewards are lower and risky.

Finally, similar to Gillwald et al. (2018), digital inequalities tend to build on and exacerbate historical social disparities. For instance, those with higher levels of education are more likely to participate in the digital labor market, whilst being female decreases the probability of participation in the digital labor market by 9%; living in rural areas is also associated with a lower probability of participation in this new labor market.

The Gender Pay Gap in the Digital Economy

The quantitative data allows us to estimate the gender pay gap.[7] Our results from developing countries are consistent with the existing literature (Blau and Kahn, 2017) that

[6] Unfortunately, the After Access survey does not include a question to identify the name of the ride-sourcing, delivery, online tasks, and cleaning digital platform used, which would make it possible to consider the conditionalities mentioned above.

[7] To quantify the gender pay gap in the online economy, we use the Blinder-Oaxaca decomposition (Blinder, 1973; Oaxaca, 1973). This allows us to study digital labor market outcomes by groups – male and female – also separating possible differences in characteristics between the two groups and differences that are not measured and thus called "unobservable".

shows that digital technologies tend to build on the existing inequalities between males and females, which put women at a disadvantage, earning on average USD 407/month less than men who share their characteristics. These results indicate that even after surpassing connection barriers (i.e., Internet access), females still face different challenges in the digital labor market. These results are consistent with the findings of Gillwald et al. (2018), who conclude that women are less likely to be hired in the digital labor market because of existing patriarchal values and norms which exclude them from most market labor segments.

The gender pay gap is further divided into two components. Firstly, the explained component reflects the changes in women's income if they had the same characteristics as men. Results show that by adjusting women's endowments such as education level or work experience to the same levels of men, the female mean income would increase by about 22%. Let us explore this issue further. When women have similar characteristics to men, the income difference is accounted for by differentials in occupation (being an independent worker with employees or unpaid family worker, and labor experience), ICT assets (having a computer or laptop), social capital (socializing with their social networks) and socioeconomic characteristics (education level).

Secondly, a large percentage of income differences between men and women are accounted for by a component, which is usually attributed to gender stereotypes and discrimination. Indeed, this component also captures all potential effects of differences in variables that were not measured, say, motivation, self-value of working, etc.

Digital economy effects on women's pay

Both men and women show no difference in the characteristics that determine their willingness to participate in the digital economy, except for occupation and education level, which

means that education does play a role in men's decision to participate in the digital economy, while it does not in women's. Also, participating in the digital labor market is a substitute for formal labor occupations for females, but not for men.

Regarding the impact on income levels, our data confirm the substitution between formal labor and digital labor as an income source generator. For those who do not participate in digital labor markets, the income level is affected by the work category (unpaid houseworker, employed, independent, unpaid family worker). This is not true for those who participate, i.e., there are no other sources of income for women if they are securing work through digital platforms. Conversely, microwork is a complementary income source for men. Finally, for women, the education level is a relevant variable, inducing increases in earnings. The effect is stronger for those who participate in the digital labor market while it plays a reduced role for men.

In addition to analyzing the determinants of securing work through digital platforms and differentiating the impact on income by regimes, it is important to know what the real gains from participating in the digital labor market are. For women who do participate, securing work through digital platforms represents an average increase of USD 74 in monthly income; and for women who do not participate, working through digital platforms would have a potential average increase in their income of USD 127/month.

EVIDENCE FROM THE FIELD: DIGITAL ECONOMY WORKERS IN LIMA, PERU

In an effort to enrich our quantitative results with qualitative evidence, we conducted several interviews with drivers

and delivery workers in Lima, Peru, to collect information regarding income and employment benefits, as well as the representations and assessments that the drivers have regarding their working conditions. Our respondents worked in platforms, which will be called B, C, R, and U.

Characteristics of our interviewees

The five delivery men interviewed are young people between ages 20 and 30 years, and only one of the drivers was a woman.[8] In fact, several of the respondents stated that few women worked in the R Application. The interviewees confirmed the presence of a significant number of Venezuelans participating in this platform, and it is evident in the drivers' posts in their Facebook groups. It is interesting to note that all those interviewed entered the home delivery business less than two years ago.

Unlike the drivers of home delivery applications, the seven interviewees who work or worked in taxi applications are Peruvians over 30 years old, and five of them are over 40. As in home delivery applications, women represent a minority.

Differences in the trajectory of ride drivers as compared to home delivery workers are evident. Because taxi platforms have been on the market for a longer time, most of those interviewed have been working in the field for more than two years. Many of them have previous experience as taxi drivers or carriers of another kind. In fact, among the oldest interviewees are taxi drivers whose trajectory dates back to the 1990s. These people have not radically changed their occupations, thus joining platforms related to activities that they had previously carried out.

[8] Similar findings were reported by Carrión and Ticona (2020), and Dinegro (2020).

The application processes

The application and admission processes vary according to the category of the platform, presenting greater heterogeneity in the case of taxi applications. These processes only share the requirements of the documents related to the vehicle and its driver, including a criminal record certificate, which is similar to what Hidalgo and Valencia (2019) found in Quito, Ecuador. In both types of platforms, it has been possible to identify a tendency to admit a greater number of drivers in recent years, reducing in some cases the thoroughness of the evaluation filters. This may be linked to their rapid growth, with a greater amount of manpower required to meet the growing demand. However, this fact alone does not explain all the changes in the application process. These changes are criticized and considered arbitrary by some of the interviewees who have been working for a longer time on the platforms for whom the selection criteria of applicants are completely unknown.

Labor relationship and benefits

The lack of a proper contractual link between platforms and drivers seems to put the latter in a precarious situation in all cases. On the one hand, there is no explicit mechanism that guarantees continuity over time. On the other, the non-monetary benefits they receive are minimal and are not necessarily fully met by the company. In addition, as independent workers, they are responsible for providing all the necessary inputs to perform the services, including the payments for the purchase and maintenance. As can be seen, the "independence" of the drivers ends up playing against them, causing them to have to incur additional expenses from which the company is exempted. The case of the R application stands out, offering the least amount of non-salary benefits and presenting an environment in which drivers are forced to make continuous payments for the renewal of their inputs.

Risk management and labor mistreatment

According to Graham et al. (2020), an essential component of fair work on digital platforms should be the mitigation of the risks that workers may face.

Drivers of taxi applications and home delivery in Peru are continually exposed to a series of risks due to the nature of their work. They are also victims of discrimination and aggression, which in some cases can become physical. Faced with this situation, very few platforms have implemented prevention mechanisms. The support provided to drivers is usually null when they suffer an incident. It is the driver that, in addition to not being able to work for a period of time, must cover the necessary expenses. This situation is aggravated in the case of the R application, where workers can be sanctioned in an apparently arbitrary way. All of this contributes to a sense of instability as all workers are deemed expendable.

Income

One of the most debated aspects of the business model behind digital platforms is the amount of money that workers can actually earn. Digital platforms are characterized for not providing a fixed salary or a base payment to their workers, but rather for giving them remuneration relative to the number of tasks performed. In many cases, the ultimate amount depends on factors like the supply of workforce and the effective demand for it within a platform. According to some experts in economic development, this modality allows many people to earn higher incomes than they could obtain in other types of activities, including formal jobs (Graham et al., 2018). However, other research shows how the income of taxi application drivers can be dramatically affected (Chen, 2018a).

The information drawn from the interviews is that drivers of taxi applications and home delivery may be relatively well paid. However, they consider the mechanisms to estimate the payments and the amount they can acquire unsatisfactory. The rates stipulated by the platforms have been reduced over time, which progressively reduces the income that they may receive. In this way, as in other cases studied, digital platforms dramatically affect the income of workers to the point that it is much more profitable to perform tasks outside of these platforms, particularly for taxi drivers.

Keep in mind that driver's income largely depends on factors that they cannot control. The final rates are calculated by algorithms that are not completely known by the drivers, which include factors, such as the user's requirements, the provisions of the company and the demand for the service at a certain time and place. On the other hand, factors such as, worker's efforts, their expenses to reach the customer and start the service are not taken into account. Demand is another important factor, which determines the number of tasks finally performed by the driver. Faced with all this, drivers can develop strategies to increase their earnings. Even so, that much of the earnings depends on external factors that are not completely predictable or known puts drivers in a situation of constant instability and uncertainty.

Schedule flexibility

Flexibility in working hours constitutes another critical point in the online gig economy. This is a central component of "autonomy" that does not occur with other types of jobs, where all employees are assigned a fixed schedule.

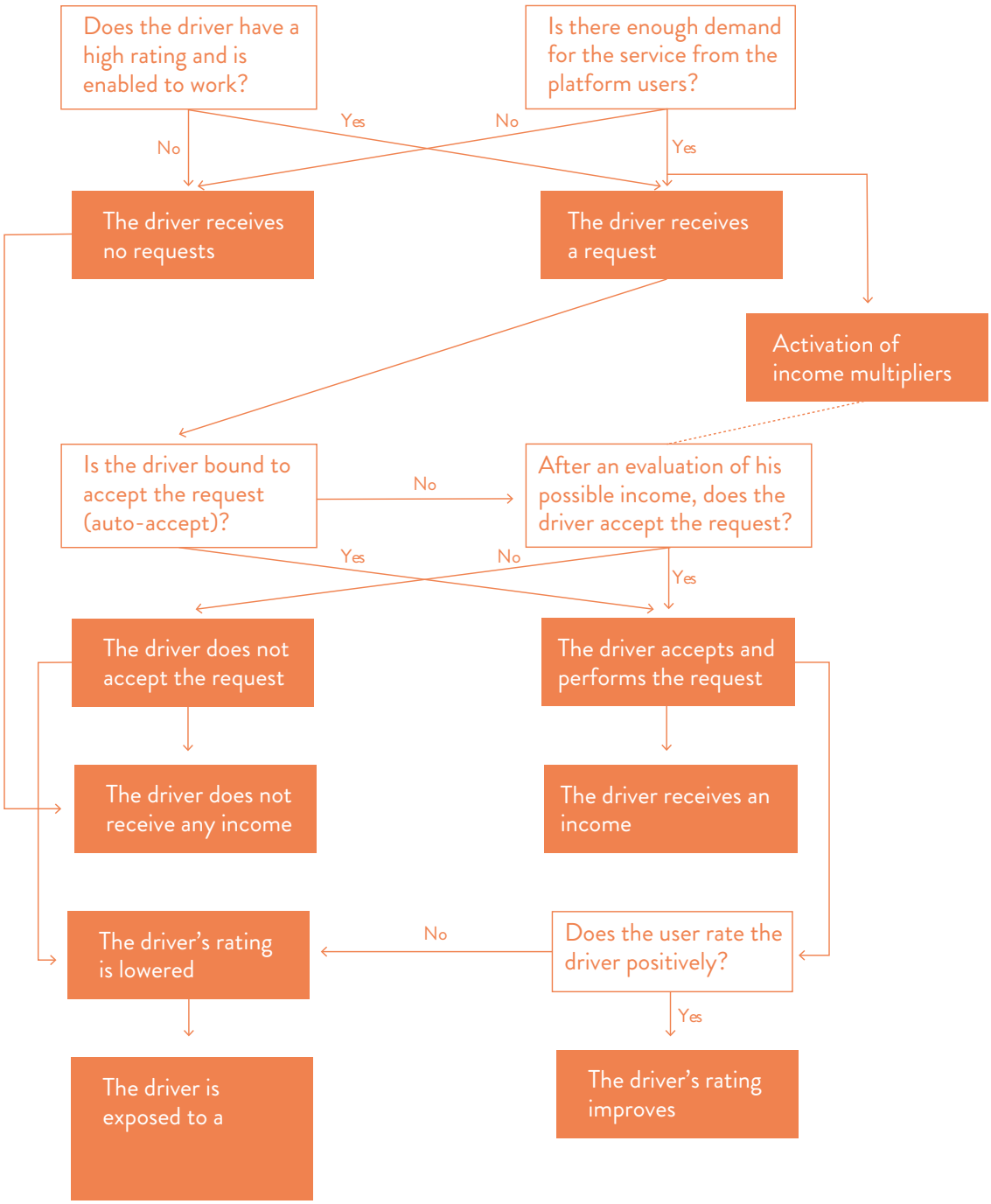
The managers of some of the taxi and home delivery platforms in Peru point out the advantage of allowing their drivers to obtain additional income when they are off duty. This statement contrasts with the reality of many workers, who

depend on platform related activities as their main income source. For them, companies indeed guarantee a certain level of flexibility in schedules. However, this autonomy is highly limited by a series of "soft" and direct control mechanisms that compel many drivers to stay connected at certain times of the day.

The drivers are the ones who finally decide when to connect and which trips to accept, and they consider their own interests when deciding. However, as is evident in Figure 3.2, this choice is only possible by virtue of a series of factors over which the driver has little to no control but must take into account. Also consider that the decision to reject a trip can have negative consequences for the driver (reduction of qualification or disqualification), while continued acceptance is encouraged and even rewarded. These factors are decisively influenced by company policies and the level of demand for the platform, mediated by a series of algorithms. As a result, some kind of "soft control" over worker's choices and behavior is exercised by the digital platforms. The interviewees are more or less aware of this situation.

Of course, it is possible to draw a parallel between these conditions and those of an independent taxi driver. Indeed, the number of trips that "street" taxi drivers complete also depends on a series of factors that they cannot control, among which the level of demand for the service at the time and destination stand out. However, when working on a digital platform, these conditions not only end up being institutionalized but are also mediated by digital platforms and their algorithms of which the worker is unaware.

FIGURE 3.2
DECISION TREE: ASSIGNMENT, ACCEPTANCE, QUALIFICATION



Source: Prepared by the authors.
*With regard to the R application, a series of criteria are added to the user's positive rating (service acceptation, finalization and required time).

Gender differences

The interviewees point out, contrary to what the existing literature suggests and our own findings presented in the previous section, that there is no significant gender gap in income. According to their point of view, income depends more on the number of trips completed and on a fee calculation mechanism that does not discriminate by gender. In principle, both men and women can earn the same amount, and factors such as the driver's experience are considered more relevant.

In fact, drivers who work with taxi applications indicated that their status as women gives them certain comparative advantages over men. For example, several users feel safer when they are transported by women,[9] and prefer them to transport their children.[10] Drivers can take advantage of this situation to obtain more private clients, whose relationship is no longer mediated by the platform.

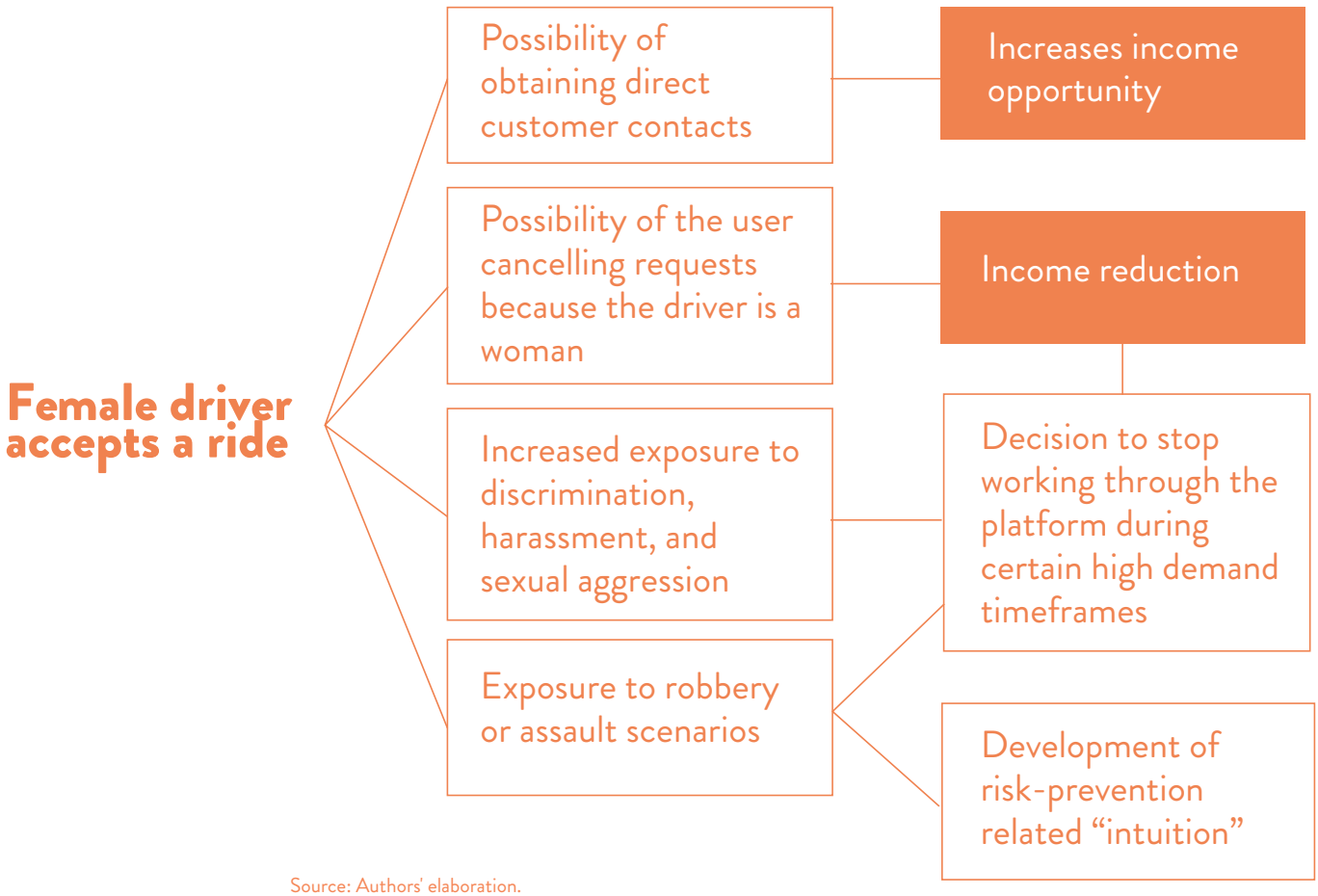
Among the interviewees who work in home delivery platforms, these advantages are not mentioned. Women in both types of platforms could experience a series of difficulties in the performance of their activities. For them it would be difficult to lift very heavy objects, which would make it difficult to carry out activities such as moving large orders, lifting passenger suitcases, or changing tires on a vehicle. In the case of home delivery platforms, this situation is aggravated by the fact that many drivers are cyclists and must carry the order on their backs. On the other hand, there is a general perception that women are more exposed to risky situations than men when traveling at certain hours or in certain areas of Lima. This would motivate many female drivers to stop working with some applications (or not to work with them at all) and not to drive at night, which is a more profitable time.

In this way, gender has a significant impact on work on digital taxi platforms and home delivery. The interviewees do not initially identify a significant gender gap between the income

[9] This explains the existence of digital platforms for women-only rides.
[10] One of our interviewees explained that women also transport school children.

of men and women. On the contrary, women discuss possible advantages. However, they do point out a series of factors that hinder the work of women regarding gender stereotypes and additional risks women face in a macho society, such as Peru's. As graph 2 shows, these factors play an important role in women's decision to stop driving at certain hours, in particular areas, or with some platforms. Directly or indirectly, they have a negative impact on the income of several drivers.

FIGURE 3.3
DECOMPOSITION OF THE GENDER RTI GAP



Source: Authors' elaboration.

CONCLUSIONS

Despite the potential benefits that can be derived from digital labor platforms as an alternative to finding and performing income-generating activities, there are several barriers for populations in developing countries to take advantage of this global resource. This chapter characterizes digital workers of the Global South, with special attention to gender aspects and social inequalities. Both quantitative and qualitative approaches were used to tackle these issues:

Firstly, we presented the results of a quantitative exercise using a database comprised of nationally representative surveys from 9 countries in Africa, 7 in South East Asia, and 6 in Latin America. Our focus targeted the decision to participate in the digital labor market, the gender pay gap in the digital economy, and the digital economy's effect on women's earnings.

The results show the importance of digital skills in the decision to participate, particularly the number of years of experience using the Internet and the self-assessed ability to solve Internet-related problems. Just being online does not suffice to participate in the digital online labor market.

Regarding the gender pay gap, the results show that gender inequalities are not limited to the 'connected' and 'unconnected', but they are also present among those who are already online, showing a second level of the digital divide. Observable characteristics in men and women, such as, occupation, education level or age, only explain 6% of the gender pay gap; even if the work experience between men and women were identical, this explanation for the gender pay gap would only decrease by 0.8%; if the education level were the same for men and women, it would decrease by 79%, and by 9% in the case of equal social capital. This analysis opens the door to consider the impact of other variables to explain the gender pay gap, such as discrimination and social values, as is suggested in the literature.

Moreover, the results justify the call for the design of differentiated public policies for men and women. We find positive impacts of securing work through digital platforms on income levels and potential increases in income. Nevertheless, the income premium for securing work through digital platforms is higher for women than for men, but the potential gain for women is 14% less than the income gains for men.

Secondly, we conducted a series of interviews with taxi drivers and home-delivery platform workers in Lima, Peru. The information gathered allows us to better define the nature of the work of drivers in this important segment of the platform economy. It is a new type of work, which can be classified as face-to-face work requested through digital platforms. For various reasons, it is disruptive compared to previously existing formal work modalities, and even informal work.

The work of drivers on digital platforms is also characterized by a degree of subordination vis-à-vis companies and their algorithms. Within this dynamic, they are granted some freedom in choosing their schedules, a flexibility that is not so common in formal work. Although the payments, the qualifications and the suspensions respond to the accomplishment of particular tasks, these are built over time and question the degree of flexibility actually allowed.

The evidence shows that workers perceive their job to be precarious, quite similar findings to that posed by other studies carried out in the country and in Latin America (Carrión and Ticona, 2020; Dinegro, 2020; Hidalgo and Valencia, 2019). Certainly, the platforms guaranteed economic income that was higher than what drivers had previously received, giving drivers autonomy and flexibility, but job instability as well, given the constant threat of suspension or disqualification. The fact that income and penalties depend largely on criteria that cannot be controlled by a driver merely increases the instability of their work.

The work of drivers on digital platforms is also precarious due to the lack of access to non-monetary employment benefits. They do not receive insurance, bonuses, pensions, or other guaranteed benefits that are typical of a formal job. Nor do the platforms provide them with the means of production to carry out the service, but only the means by which to secure customers. All this represents an investment that must be assumed by each driver. Workers also experience continuous exposure to accidents, assaults, illnesses, and discrimination, for which companies do not take any responsibility or cover expenses.

Of course, some may argue that these working conditions represent an improvement compared to other types of informal or semi-formal work in Peru, as in other developing countries (see, for example, Hidalgo and Valencia, 2019) as compared to those in the northern hemisphere. It could also be argued that the working conditions of taxi drivers were already precarious before the arrival of the platforms and that they have brought together previously dispersed informal workers (Randolph and Dewan, 2018), allowing them to access a larger number of services. However, this does not justify the precariousness of the job offered, or the lack of economic stability, or non-monetary benefits.

Our research findings question the concept of the online gig economy, which has been used to characterize these jobs in the platform economy (Graham et al., 2020). This term refers to independent and temporary hiring in which platforms and workers would participate, and which would be reduced to the performance of a specific task, in an on-off type of availability by people interested in participating. If so, this would accommodate people on a temporary basis who wish to earn some income in their free time. However, our research reflects the reality of drivers who spend most of the day on these platforms, which represent their main sources of income and with which they have established a medium- or even long-term link. For them, this type of work is not gig-like, but assumes a more permanent character. This fact, however, is not sufficiently recognized.

It is also possible to question the alleged autonomy of drivers as one of the main benefits identified by the experts who promote this type of platform. Indeed, as was already mentioned, the digital platforms studied offer some flexibility in schedules and decision-making capacity, a fact that does not occur in formal jobs. However, drivers have been subjected to different types of mechanisms to control schedules and behaviors (rating and penalty systems, income multipliers and enhancers). Some of these are mediated and managed by algorithms, leading to a 'soft' control of behavior (Rosenblat and Stark, 2016), while others involve a more direct exercise of power. Therefore, it is key to understand that there are asymmetries in access to information and in the decision-making agency, which show that drivers and companies do not hold similar agency-power but rather engage in a hierarchical relationship. Together, these mechanisms lead to a loss of worker autonomy and the emergence of power relations within the framework of their activities. It is possible to speak of subordination and of "false self-employment", especially for drivers for whom the platforms are their only source of income. Their autonomy is fully maintained, however, in their obligation to provide the greater share of the means of production.

Likewise, our results show that there is a marked asymmetry of power between workers, on the one hand, and personnel hired by digital platforms, "allied" stores and clients on the other, the latter having the power to sanction or qualify drivers according to their own criteria. In some cases mentioned by the interviewees, this can lead to drivers being coerced to act against their interests (for example, making payments or desisting from protesting). On the other hand, the users of the application (and the "partner" stores) depend on the qualification of both the drivers and the digital platforms themselves. The latter tend to favor them in cases of reports and complaints about drivers.

Despite this, there is agreement with other studies (Chen, 2018b; Negri, 2020) in stating that the drivers of digital platforms maintain a certain level of agency. They can develop

strategies to circumvent some of the platform's rules, or use them to earn more income. In addition, it is important to consider that their interests are not necessarily opposed to those of the platforms, and that not all of their guidelines are problematized or criticized.

Within this general framework, it is important to distinguish differences within a heterogeneous set of digital platform drivers. This research shows that gender is a relevant factor, constituting a qualitative component that affects the experiences of drivers. Women are subjected to forms of aggression and discrimination that are not experienced by their male counterparts, despite offering the same service. They are associated with gender stereotypes and the values of a sexist society such as Peru's. These experiences and the emotions they generate in women do not directly influence their income, which is governed by the same rules as those of men. Instead, they do it indirectly, through the decision that the drivers themselves make not to work with any application, with certain applications or at certain hours. Still, women do have some opportunities, which they can use to increase their income.

Preparing for the future of work demands a rearrangement of gender roles and the closing of existing gaps. The technological revolution must be accompanied by an educational transformation and technical training in order to adequately respond to the new labor market demands. These policies will drive the development of greater autonomy for women, which will have a significant impact on economic growth and development by improving income levels and reducing current levels of inequality. The scope of labor policies and institutions considering the role of new technologies is relevant for the equal exercise of rights regarding the new market labor scene. Labor policies must be articulated with the development of new legislation and programs that facilitate and encourage the balance between work and family demands that male and female workers face in order to have a positive impact on women's income and time distribution.

Although effective legislation is a necessary condition to achieve equal opportunities in the digital labor market, it is insufficient without effective labor inspection services that eliminate discrimination in paid work using surveillance mechanisms to ensure equal compensation for men and women, expanding opportunities for hiring and promoting women, and compliance with labor regulations and rights. On the other hand, to reduce gender inequalities in the labor market, public policies must promote the formalization of work and diminish the attractiveness of the informal economy. Furthermore, Global South countries face the challenge of undertaking reforms to end the prolongation of policies that deliberately use women's labor at a lower market value (lowest paying jobs) to boost the economy and to obtain competitive advantages.

Finally, in order to reduce labor market gender disparities and take advantage of the new opportunities that will arise with the fourth technological revolution, public policies will have to enable the transitions between the school or university and the labor market, combine different job demands, reduce gender stereotypes, and promote greater female participation in STEM areas. There is also an urgency to design human capital training and technological innovation programs that anticipate the demands of the labor market (centered on digital skills), reverse the existing imbalance, and improve women's skills and employability levels. Additionally, it is essential to promote reinsertion and reorientation policies that allow women to return to the labor market and/or to change job tasks at different stages of their lives, without this implying a high degree of risk for their future career and salary.

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4. FAIRWORK IN THE PLATFORM ECONOMY: A GLOBAL SOUTH PERSPECTIVE

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The gig economy denotes work that is performed on digital labour platforms which mediate labour transactions between clients and service providers. We divide the gig economy into two broad categories. The first constitutes geographically-tethered gig work – services that must be performed in a certain location, such as ride-hailing, delivery, cleaning, care work, and beauty services. The second is cloudwork – or work that can be performed remotely online, such as data processing. AI training, translation and transcription, as well as design and consulting. Common features of the gig economy include the fact that labour usually takes place outside a traditional employment relationship, with platforms contractually classifying workers as independent contractors rather than employees.

Digital platforms have become the basis of work for millions of workers in countries of the Global South: both crowdwork platforms based on digital services (e.g. Upwork, Freelancer) and location-based platforms based on physical services (e.g. Uber, Domestly) (Hunt and Machingura, 2016; Heeks, 2017). The digital qualities of platforms – the way in which they function as intermediaries between two other parties; their low marginal costs and easy scalability; and the organisation of work through digital, largely anonymous processes (Huws 2017; Schmidt, 2017) – have been associated with both positive and negative work outcomes. They have created new employment opportunities in the Global South; they enable labour market participation for those previously excluded; and they can introduce greater objectivity into work management (D'Cruz and Noronha, 2016; Surie and Koduganti, 2016).

Conversely, reports indicate problems relating to the three domains of decent work: employment context, employment, and work conditions (Heeks, 2017). Collective organisation / bargaining, let alone union recognition, have been difficult due to the often-dispersed and flexible nature of platform work, and the often-hostile attitude of platforms (Lehdonvirta, 2016). Individual and collective employment rights, such as minimum pay and protection against unfair dismissal or

maximum hours are often missing; protection for trade union membership and bargaining rights do not apply; and social protections – health insurance, paid leave, unemployment benefits, and pensions – are absent (Codagnone et al., 2016).

This lack of employment and wider rights derives significantly from a key employment domain issue: the classification of platform workers as self-employed contractors rather than as employees, transferring onto workers the risks of fluctuation in labour demand while still denying them the real autonomy attributed to entrepreneurs (Fredman, 1997; Fudge, 2016). Alongside short-term instability and the uncertainty of platform work, this also makes it very difficult for platform workers to create any kind of career development trajectory in the platform economy (Graham et al., 2017).

As a result of the lack of collective organisation and individual rights, developing country platform workers report experiencing discrimination and ill-treatment at the hands of both platforms and clients (Hunt and Machingura, 2016; Martin et al., 2016); receiving wholly inadequate compensation, particularly considering that many of the costs of employment are loaded onto the worker, not the platform (Berg, 2016); working unsocial and over-long hours in order to serve client or platform demands (Margaryan, 2016); and having to work in unsafe conditions (Schmidt, 2017). Cutting across, we also find evidence of lower earnings, and greater discrimination or even exclusion from particular platform work along dimensions of gender and race (Beerepoot and Lambregts, 2015, Adams and Berg, 2017).

The dangers posed by the spread of platform work have been recognised in the past five years: that this particular type of asymmetric, de-institutionalised structure and its precarious employment may grow to become the "new normal". As a result, a number of countervailing actions are seeking to push platform work towards decent work standards. These include attempts to organise platform workers, legal challenges to employment status, policy position statements and the

development of ethical guidelines or criteria for platform work (Du Toit, 2017; Graham anf Shaw, 2017).

Global standards exist that either incorporate the ILO decent work conventions (e.g. ISO 26000, the Global Reporting Initiative) or are more directly based on those conventions (e.g. SA8000, the Ethical Trading Initiative Base Code). But an analysis of these has shown them to mismatch the specific requirements of decent work in the platform economy, given the impact of digitality and other platform work features (Heeks, 2017).

In what follows, we first introduce the Fairwork project, discussing its conception, the underlying theory of change and the methodology used to score gig economy platforms. The bulk of the chapter consists of four Global South country case studies where the Fairwork project was applied: Chile, South Africa, Indonesia and Ecuador. For each country, we briefly sketch a background on how the gig economy has developed. Then, we assess and rate some major gig platforms in the country using the methodology (except in Indonesia where the ratings have not yet been finalized). This is followed by a topical discussion of the findings and specific issues relevant to each country. We close with some reflections on the findings across the four countries and conclude with some remaining challenges.

INTRODUCING THE FAIRWORK PROJECT

The conception

Empirical work is needed to fill the knowledge gaps identified above. We are lacking an evidence base for both the benefits and decent work shortfalls of platform work in a wider variety of developing countries, giving due emphasis to the relative numbers employed in digital and physical gig work. And practical engagement is also needed, providing leverage points within the platform value chain that enable workers and other stakeholders to improve work standards: driving up minimum pay levels, reducing onerous working hours, removing workers from unsafe environments, etc. The Fairwork project seeks to provide that combination of evidence base and practical engagement, while also being sensitive to another area that has been little explored: the specific contextual factors that shape platform work. These include national and local legislation and regulation, the formal and informal institutions of labour markets, and the particular ownership and strategies of the platforms involved.

The Fairwork project was established in 2018, based at the Oxford Internet Institute in partnership with the Universities of Manchester, Cape Town, the Western Cape, and the International Institute of Information Technology Bangalore. The Fairwork Foundation initially embarked on two research projects (one funded by Germany's Federal Ministry for Economic Cooperation and Development, GIZ, and one by the UK's Global Challenges Research Fund, GCRF) to develop and disseminate its own specific decent platform work standards, as well as developing a platform rating framework. These two projects were started in South Africa and India. Empirical data has been collected in South Africa about the concerns, perceptions and experiences of workers in order to inform the Fairwork rating framework.

However, a number of burning issues remained. Firstly, the empirical and action research results were limited to two countries and it was debatable whether the same holds for other Global South countries. Secondly, there was a need to test the applicability and validity of the decent platform work framework in other developing country contexts. Thirdly, there was a need to bring other researchers, practitioners and policy makers on board to give the Fairwork issues and principles more visibility globally and to engage stakeholders in developing countries early on in this debate.

This provided the momentum for this particular research project to address the demand for decent work standards in platform economy work in the Global South, and for means of delivering those standards through legal reforms, platform certification/rating schemes, and pressure from civil society and other stakeholders. Fairwork's collaborative network now extends to more than 20 countries.

The theory of change

Though the rapid rise of digital labour platforms has been facilitated by advancements in connectivity and expanding internet infrastructure, the labour relations produced by these platforms are not necessarily novel. The gig economy is characterised by the managerial drive to optimise and control ever more granular aspects of the labour process, first described by Frederick Taylor in 1911 (Taylor, 2004). Through opaque systems of algorithmic management, and incentives and penalties, platforms can exert control over how, when and where workers work, despite their contractual and rhetorical maintenance of workers' independence. Additionally, the gig economy usually involves piece-rate work, where workers are paid by unit of output, as opposed to receiving a wage or salary – a long standing practice in certain parts of the textile and agricultural sectors.

All of these factors contribute to a high level of worker vulnerability, precarity and the lack of structural power in the gig economy. Because of independent contractor classifications, most gig workers are not protected by labour regulations guaranteeing minimum wage, sick leave, pensions, and protection from unfair dismissal. Because gig workers tend to be atomised, isolated, and cast into competition with each other, their ability to collectively organise and improve their conditions is hampered. Gig workers usually carry both the costs and risks of their labour – for instance, ride hailing drivers cover their own fuel, car payments, insurance, etc. Piece-rate payments also mean gig workers might spend a high proportion of their labour time waiting or travelling between jobs – time that is unpaid. These workers are frequently in danger of falling below their local minimum wage after costs and waiting time. Finally, the most vulnerable or marginalised groups have long been overrepresented in insecure, low-wage work, and the gig economy provides a clear example of this. Migrant and minority workers make up a disproportionately high number of gig workers globally.

Platform companies tend to present the gig economy, and its current conditions and organisational forms, as the inevitable result of technological advancement. However, technology is imagined, built and deployed by humans in response to specific social motivations and conditions. The gig economy is not determined by inevitable technological development, but by how people with the power to do so construct and direct technological tools. That is simply to say, other versions of the digital economy are possible – fairer, more equitable and more democratic versions. In particular, digital platforms have been posited to hold the potential to unlock development outcomes in the Global South and to drive innovation which helps to overcome historical labour inequities between wealthy and poorer countries (Ledonvirta et al., 2014).

To achieve this, there is an urgent need for both national and global policy responses; however, it is clear that there are serious obstacles to regulating the gig economy. Therefore,

non-state mechanisms can play a role in shifting the conventions governing the global gig economy. This is the core goal of the Fairwork project. Fairwork is an action research project and a coalition of mostly academic researchers from the Global North and South, who are focused on creating a positive change through the research process.

Fairwork's theory of change centres on engagement and advocacy with four stakeholder groups. We consult and conduct research with platforms, policy makers and governments, consumers and gig workers and worker organisations. The core methodology of Fairwork research is based around five principles of fairness in the gig economy. These principles were developed through previous research, as well as ongoing stakeholder consultations with workers in several countries. The principles undergo a democratic review process every year to ensure that they remain relevant and sensitive to current issues facing gig workers. They are centred on the themes of fair pay, fair conditions, fair contracts, fair management, and fair representation.

Gig workers and their experiences have been seen as largely incidental to the innovation and disruption discourse characterising Silicon Valley platform capitalism. However, one of the core goals of the Fairwork project is to challenge these underpinning conventions and narratives which sustain unfairness in the gig economy, to empower stakeholders to institutionalise minimum benchmarks of fair gig work, and to build a fairer future of work for platform workers.

The methodology

Scoring platforms according to the Fairwork principles relies on a range of different data sources collected by the in-country research teams. These data include desk research, evidence submitted by the platforms and semi-structured interviews with both workers and management from each platform.

Desk research

The process begins with desk research to ascertain which platforms are currently operating in the country of study. From this list the largest and most influential platforms are selected to be part of the ranking process. If possible, more than one platform from each sector (i.e. e-hailing or food delivery) is included to allow for comparisons within each sector. The platforms included in the ranking process are both large international ones, as well as national/regional ones. Desk research also flags up any public information that could be used to score particular platforms (for instance, the provision of particular services to workers or ongoing disputes).

The desk research is also used to identify points of contact or ways to access workers. Once the list of platforms has been finalized, each platform is contacted to alert them about their inclusion in the annual ranking study and to provide them with information about the process. All platforms are asked to assist with evidence collection, as well as with contacting workers for interviews.

Platform interviews

The second method involves approaching platforms for evidence. Platform managers are invited to participate in semi-structured interviews, as well as to submit evidence for each of the Fairwork principles. This provides insights into the operation and business model of the platform, while also opening up a dialogue through which the platform could agree to implement changes based on the principles. In cases where platform managers do not agree to interviews, we limit our scoring strategy to evidence obtained through desk research and worker interviews.

Worker interviews

The third method is interviewing platform workers directly. A sample of 5-10 workers are interviewed for each platform. These interviews do not aim to build a representative sample. They instead seek to understand the processes of work and the ways these are carried out and managed. These interviews enable the Fairwork researchers to see copies of the contracts issued to workers, and learn about platform policies that pertain to workers. The interviews also allow the team to confirm or refute that policies or practices are really in place on the platform.

Workers are approached using a range of different channels. In 2021 this included having advertisements circulated directly by the platform to their workers, using Facebook advertisements to recruit, and snowball recruitment from prior interviews. Workers used a link to read a short synopsis of the interview process and the Fairwork project and to submit their phone number to enable contact. The mode of interviewing varied between countries – being either face to face or telephonic. Due to the lockdown restrictions arising from the COVID-19 pandemic all interviews in South Africa, for instance, were conducted telephonically using WhatsApp.

The interviews were semi-structured and made use of a series of questions relating to the 10 Fairwork (sub)principles. In order to qualify for the interviews, workers had to be over the age of 18 and have worked with the platform for more than two months. All interviews were recorded with the consent of the participants.

Putting it all together

This threefold approach provides a way to cross-check the claims made by platforms, while also providing the opportunity to collect both positive and negative evidence from multiple

sources. Final scores are collectively decided by a team of Fairwork researchers based on all three forms of information gathering. Points are only awarded if clear evidence exists on each threshold.

Each of the five Fairwork principles is broken down into two points: a basic point and a more advanced point that can only be awarded if the basic point has been fulfilled. Every platform receives a score out of 10. Platforms are only given a point when they can satisfactorily demonstrate their implementation of the principles. Failing to achieve a point does not necessarily mean that a platform does not comply with the principle in question. It simply means that the researchers were not – for whatever reason – able to evidence its compliance.

The scoring involves a series of stages. First, the in-country team collates the evidence and assigns preliminary scores. The collated evidence is then sent to external reviewers for independent scoring. These reviewers are both members of the Fairwork teams in other countries, as well as members of the core Oxford team. Once the external reviewers have assigned their scoring, all reviewers meet to discuss the scores and decide final scorings. These scores, as well as the justification for their being awarded or not, are then passed to the platforms for review. Platforms are then given the opportunity to submit further evidence to earn points that they were initially not awarded. If possible, the scores are then adjusted to include this additional evidence. These scores then form the final annual scoring that is published in the annual country Fairwork reports.

THE FAIRWORK PROJECT IN PRACTICE. FOUR CASE STUDIES FROM THE GLOBAL SOUTH

Chile

Evolution of the gig economy

The growth of digital work platforms has been highly favoured by structural conditions in Chile: a liberal economic history, high internet penetration, and a significant flow of migrant labour. In the following section, we will review some of these factors and the development of the gig economy in the country.

Chile underwent a drastic process of economic liberalisation during its military dictatorship in the 1980s, under the guidance of a group of young neoliberal economists. Although still debated, these policies were at least partially responsible for the economic boom following the return to democracy in the 1990s. At that time, Chile saw an average GDP growth of over 5% and an increase in access to credit, with a significant reduction in poverty from 38% in 1990 to 18.8% in 2003 (Larrañaga and Valenzuela, 2011).

Since the turn of the century, Chile has had one of the highest levels of internet penetration in Latin America. While the penetration rate was 13.7 internet accesses per 100 inhabitants in 2009, by 2019 this increased to 116.1 accesses, with smartphones and mobile devices accounting for 84.7% of total connections (SUBTEL, 2019a). As of June 2019, more than 25 million active cell phones were registered in the country, with 4G connections growing by more than 20% compared to the same period of 2018 (SUBTEL, 2019b). Similarly, the population has avidly incorporated new platforms and social networks into their daily lives. In 2008, Chile had the most Fotolog accounts, at 4.8 million and

that same year it created more than 4 million new profiles on Facebook (Baeza, 2009). This context has contributed to building the necessary devices and user infrastructure for a digital platform market.

This has favoured the rise of the gig economy, with more jobs, flexibility and independence. Notwithstanding, the promise of managing your own time, at your own pace, and being your own boss – presented as an advantage to workers – also brings with it various forms of precariousness, exhausting shifts, exposure to risky situations, and few guarantees from the applications. Users, for their part, do not see these risks clearly since they value the convenience, speed, and low prices of these platforms.

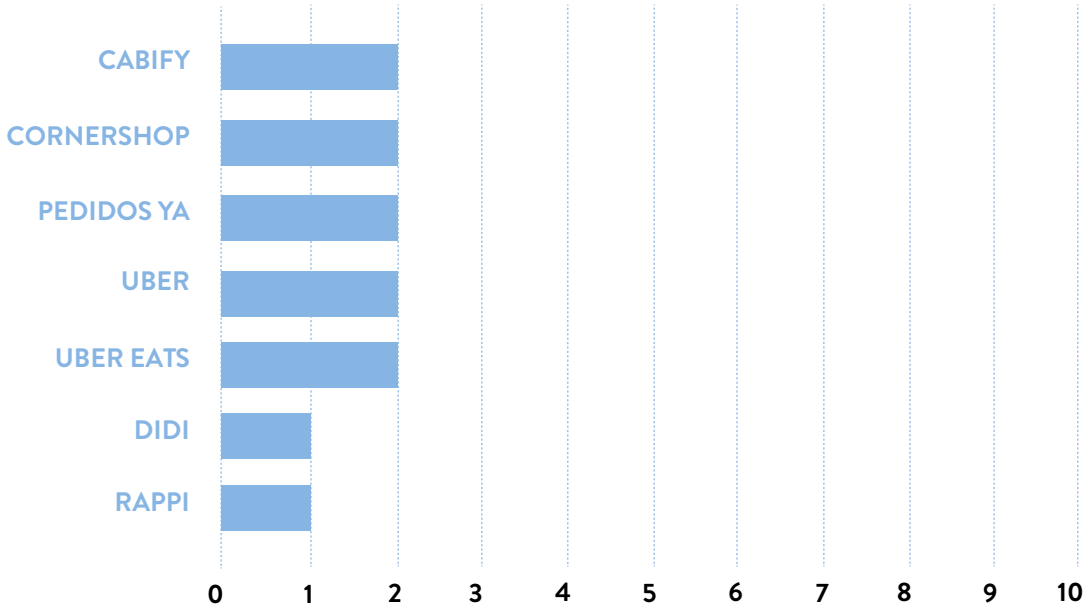
The assessment

One of the first major platforms in Chile was parcel and delivery application PedidosYa, present since 2010. While different transportation and parcel applications were gradually added, it was not until the arrival of Uber in 2014 that the gig economy saw significant growth, with Uber alone accounting for more than 70,000 "driver partners" and two million registered users by 2018. By that same year, a total of 200,000 drivers were working for various transportation applications (Comisión Nacional de Productividad, 2017). We include in our research Cornershop, a Chilean–Swedish development company founded in 2015, which found its niche in the parcel market, especially supermarket shopping. The true reach of these new platforms is difficult to pinpoint due to the difficulty of obtaining data from the companies behind the apps.

The 2021 Fairwork research in Chile examined the experience of workers for Uber, Cabify, DiDi, UberEats, Rappi, PedidosYa, and Cornershop. While these seven apps are among the most prominent, there are many other apps operating in Chile which may share similar working conditions and day-to-day

problems. The following figure shows the scores for the seven rated platforms. As can be seen, all platforms scored very low.

FIGURE 4.1
2021 FAIRWORK SCORES FOR CHILEAN PLATFORMS



Source: Authors' elaboration/calculation.

The ratings achieved by the platforms operating in Chile are very low, with no platform scoring more than two points out of ten. Uber, Cornershop, Cabify, PedidosYa, and Uber Eats all scored two points; Rappi and DiDi scored one.

Fair Pay: Workers were found to earn above the local minimum wage (in Chile, $326,500 pesos for a 45-hour workweek) before costs are considered. However, none of the platforms was able to evidence that they paid a fair wage after accounting for workers' expenses, such as gasoline, and the depreciation of the car, motorcycle or bicycle.

Fair Conditions: No platform was able to provide evidence of concrete and consistent policies aimed at protecting workers from any task-specific risks. Although all seven of the platforms we analysed implemented measures from the beginning of the pandemic (such as the provision of masks and gel), only

four were found to provide some form of financial support in cases where workers contracted COVID-19. Greater efforts are required in this area to match the risks faced by delivery workers and drivers in the course of their work.

Fair contracts: All agreements classify workers as independent contractors, either through an explicit clause in their contract (which normally includes a statement denying any type of regulation by labour law) or through the general framing of the clauses drafted. As a general rule, the contracts or terms and conditions drafted by the companies were found to be easily accessible to workers, both in terms of terminology and language, even though certain clauses were drafted in technical legal language. However, with the exception of one company (Cornershop), we could not find any instance in which platforms cannot unilaterally make changes in their terms, with differences regarding the manner of notifying and enforcing such changes.

Fair management: Only three of the seven platforms showed evidence of having clear communication channels with their workers through the chat or other communication systems in the applications themselves. There is no fluid and direct contact with managers or executives, and in most of the platforms, once workers are deactivated from the platform, they cannot appeal a decision. We could not find any information on the use of data and personal information of workers via the platforms.

Fair Representation: The principle of fair representation was not achieved by any of the platforms we analysed. None of them was found to recognize or facilitate the existence of workers' organizations to generate agreements and review existing working conditions. While associations of ride-hailing drivers and delivery riders exist, they are not formally recognized by the platforms. This leaves gig workers in Chile without mechanisms of formal representation or opportunities to either cooperate with each other or to influence decisions that impact the process of work.

Demands for greater regulation

A large part of Chile is unequally vulnerable, and tensions between different social groups – for example, local cab drivers intimidating transportation gig workers – are exacerbated by the lack of regulation for platforms, the delay in discussions on the matter, and its effects on the labour market.

Demands for greater regulation have come from competing industries without digital benefits and with barriers like inspections, license fees and policy requirements. License fees, tariffs and conditions for taxis are determined by the Ministry of Transportation and Communication, while platforms have their own set of rules and qualifications for their drivers, some of which are laxer. There is a perceived uneveness in regulation by formal workers, especially in the urban mobility field, where taxi drivers have been vocal about their discomfort to the point of intimidating or threatening local platform drivers. These demands have also come from the gig workers themselves, especially those in product delivery, who have gathered with their bicycles and backpacks to visibly protest the precarious situations and risks they take, (CNN Chile, 2019) even though demonstrations have cost many their jobs owing to retaliation by the companies.

At least three legal bills have currently been introduced to regulate these applications and grant rights to gig workers. This has become especially pressing in the context of the pandemic during which gig workers are exposed to new risks.

COVID-19

The economy has been shaken by the coronavirus and the restrictions it has imposed, putting several companies and the jobs of thousands of Chileans at risk. According to data from a longitudinal study by the Pontificia Universidad Católica de Chile, (Bravo and Castillo, 2021), July 2020 saw a drop in employment, from 58.2% to 42.4%, compared

to the previous year. The growth of the gig economy in the context of the global economic crisis of 2008 suggests that it is a possible strategy for labor reinsertion, even though digital platforms carry their own risks and new forms of precariousness (CEPAL, 2020).

During this dire time, urban mobility platforms like Uber or Cabify had to curtail operations during the most stringent stages of confinement. This intermittent activity has had economic consequences and left workers uncertain about their future. Meanwhile, delivery platforms provided displaced workers with the possibility for extra income, and offered their users access to some goods and services otherwise restricted by the stricter lockdown stages.

Already exposed to the dangers of theft and accidents, workers are now further at risk of COVID-19 infection as they go about their work. In response, some platforms have offered to cover the cost of disinfectant gel and face masks. Despite these new challenges, the new surge in demand has seen platforms saturated with new workers, many of whom are transfers from the formal industry.

South Africa

Evolution of the gig economy and the impact of COVID-19

2020 and 2021 have been challenging years for gig platform workers around the world. The national lockdowns have rapidly changed both work and personal practices, causing rapid expansions and contractions in many previously stable sectors of the economy. In South Africa the national lockdown measures caused significant disruptions that continue to persist within the gig economy. For example, the level 5 and 4 restrictions on movement in 2020 and 2021 significantly affected the e-hailing sector as South Africans ceased to make daily trips for either work or leisure. Moreover, the

extended alcohol bans and curfews that persisted into the lower lockdown stages[1] meant fewer evening customers and a longer impact on the earning potential of e-hailing drivers. In contrast, stay-at-home policies significantly increased food deliveries and online shopping, meaning that delivery gig workers were busier than in previous years.

The lockdown had a significant impact on gig workers offering in-person services. As public transport options were limited during some levels of lockdown, workers faced long and complicated commutes to jobs across the cities. Moreover, social distancing and COVID compliance could disrupt jobs when they entered private homes, such as handymen or domestic workers.

While COVID-19 posed serious challenges for gig workers, it was no less challenging for platform owners and managers. In addition to coping with rapidly changing demand, platforms had to quickly adapt systems to cope with changing regulations and requirements. The vast majority of platforms assessed in the South African 2021 ranking issued workers with COVID-19 information and some form of personal protective equipment (PPE). Moreover, a small number of platforms responded to the vulnerability of their workforces in novel and exciting ways.

Money4Jam (M4Jam) is a micro-task platform whose workforce is largely recruited from lower-income communities. The M4Jam "Jobbers", as they call their workers, earn small amounts of money reviewing local businesses, completing surveys and conducting other micro-tasks. Unsurprisingly, during the COVID-19 lockdown many of these job opportunities were unavailable. In recognition of the economic hardship caused by the loss of earnings, M4Jam partnered with the mobile telephone company CellC to provide educational opportunities and financial relief to Jobbers during lockdown (Cell C, 2020). Similarly, SweepSouth, a platform for domestic work, established their

[1] See COVID-19 Timeline 2019-2020. (2020) Retrieve from https://www.sahistory.org.za/article/covid-19- timeline-2019-2020.

SweepStars COVID fund to raise money for their workers[2] – many of whom were unable to work during the lockdown of 2020 and 2021. This fund differed from M4Jam's COVID response in that it also enabled regular customers to donate money directly to the fund or to specific workers. Both of these COVID-19 responses demonstrate how social responsibility can be actioned by gig platforms, and highlight the potential for these platforms to make significant contributions to offsetting the impact of national and international emergencies.

2021 also saw activities within the e-hailing sector with the continuation of legal action by South African Uber drivers against the Netherlands-registered company regarding their designation as independent contractors (Duncan, 2021). Prior attempts to extend basic labour protections and benefits to those working on the app within South Africa had ultimately been unsuccessful, with the judge ruling that there was no legal precedent for bringing action against a foreign-registered company (Pierre van der, Partner and Jordan Dias, 2018). The launch of a further class action suit in 2021 echoes similar legal challenges around the world.

The COVID-19 pandemic aside, gig workers in South Africa continue to face a number of persistent challenges. Personal safety is a problem that transcends the different sectors of the gig economy. Unfortunately, given the high crime rates in South Africa,[3] these issues are unlikely to go away. Moreover, the recognized crime inequality in neighbourhoods by race linked to social inequalities borne out of segregation and economic discrimination continue to be challenging (Breetzke 2018). Nonetheless, the recognition of these challenges has led many platforms to establish initiatives aimed at curtailing its impact. Uber and Bolt have introduced panic buttons for drivers, while MrD has the ability to block deliveries to high crime areas (UBER, 2020). Most of the platforms surveyed also had some kind of insurance for their workers, although the extent of coverage varied considerably.

[2] See Covid-19 - SweepSouth's Response. (2020) Retrieved from https://campaign.sweepsouth.com/covid-19- response/?utm_source=blog&utm_ medium=post&utm_campaign=21.09.2020.3rdAnnualReport

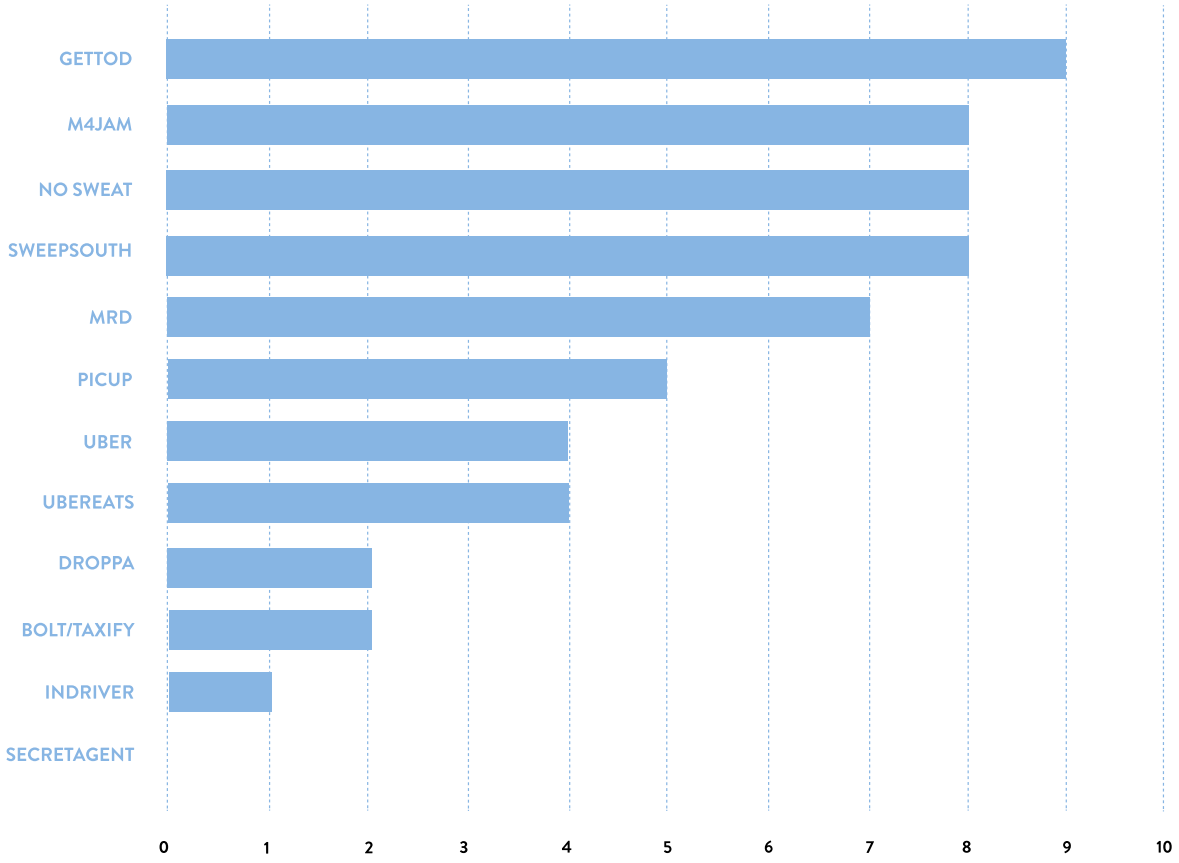
[3] See Crime Statistics - SAPS (South African Police Service). Retrieved from https://www.saps.gov.za/ services/crimestats.php

Many platforms are also taking issues of gender violence increasingly seriously. Bolt, for instance, has introduced an option for female passengers to request female drivers through their WomenOnly initiative. This is a positive step towards offsetting the danger to both women drivers and passengers within an e-hailing transaction, and for ensuring that platform workers are able to operate safely within their work environments.

The assessment

In June 2021 Fairwork South Africa released the scores for 12 highly visible platforms working in the country. These included a range of e-hailing, delivery and service-based platforms. Of the 12 included in the analysis, 8 were registered in South Africa (getTOD, M4Jam, NoSweat, SweepSouth, MrD, PicUp, Droppa and SecretAgent) and 4 were registered outside of South Africa (Uber, UberEats, Bolt, inDriver).

FIGURE 4.2
2021 FAIRWORK SCORES FOR SOUTH AFRICAN PLATAFORMS



Source: Authors' elaboration/calculation.

Fair Pay: Six of the platforms can evidence that workers' gross pay is at or above the minimum wage, which in 2021 was R21.69/hour. When assessing minimum wage, the scores took into account not only the amount paid by the platform to the worker for hours worked, but also the cost of providing task-specific equipment and pay work-related costs out of pocket. The scores also factored in waiting times between jobs. Adding in these additional costs – such as unpaid waiting times, travel costs, vehicles, petrol, mobile phone data and insurance – meant that the minimum wage point could not unequivocally be awarded to the other six platforms. When extending this net calculation to consider living wage (currently assessed at R41/hour for 2021), only three of platforms can evidence this

principle of fair pay, and we see workers often working very long hours to cover expenses.

Fair Conditions: Eight of the platforms are able to evidence some action that they take to protect workers from job-related risks. In particular, the majority of platforms were able to present some form of COVID-19 response, including providing personal protective equipment (PPE) to the workers free of charge. In contrast to previous years, solid evidence also showed that six platforms had made efforts to more actively improve working conditions. These included providing workers with loss-of-earnings compensation during the 2020 lockdowns, educational opportunities and affordable insurance.

Fair Contracts: Platforms in South Africa tend to do well when it comes to evidencing a basic level of fairness in their contracts: most platforms have clear and accessible terms and conditions, and eight platforms were awarded the point for fair contracts. An important criterion for awarding points for fair contracts was that the platforms recognized South African law as the legal system for addressing worker-related issues. As a result, some platforms registered in other countries were not able to gain this point. However, only four platforms were able to confirm that the employment status of their workers is clearly defined and that they do not unreasonably exclude liability on the part of the platform.

Fair management: Arbitrary termination or deactivation is a big concern for gig workers, who lack the recourse available to formal employees. That explains why we assess whether platforms have due process for decisions affecting workers. The Fairwork scoring system stipulates that platforms must include their policies for disciplinary actions and deactivation in their terms and conditions, as well as provide clear processes for workers to appeal decisions. In 2021 eight of the platforms had codified their deactivation policies, providing workers with greater recourse. We also encourage platforms to ensure that equity exists in the management process and that steps

are taken to be inclusive of marginalised or disadvantaged groups. These included a diverse range of activities, including internal review, active recruitment of previously marginalized communities and consciously extending income opportunities to the lowest-income communities in South Africa. In addition, a number of platforms have issued public statements in support of equality, diversity and inclusion.

Fair Representation: Being able to freely organise is a key workplace right in most countries. In the South African gig economy, much can still be done to improve conditions in this regard. Seven of the platforms could point to meaningful worker voice mechanisms. In addition, two platforms have published public statements committing themselves to recognising a collective body should one be organised by their workers.

As is evident from the 2021 scoring, many of the South African-based platforms did very well in the rankings. This was not only due to issues of in-country registration linked to Principle 4, but also through their social responsibility and responsiveness to the COVID-19 crisis. The ranking demonstrates not only the importance of national platforms in advancing fair working environments for gig platform workers, but also the potential for lessons from these platforms to inform larger international platform practices.

Indonesia

Evolution of the gig economy

Indonesia is home to 17,508 islands and a population of 270 million people. It currently ranks 4th in the total world population. While 6,000 islands are currently uninhabited, there are five major islands that are populated by most of its people, namely: Java, Sumatra, Borneo (or Kalimantan), Sulawesi, and New Guinea. Java island hosts 56% of the total Indonesian population (about 151.6 million people in

combination with Madura island), making it the most populous major island in the world. With the population density reaching 1,1117/km square, this underscores how heavily populated the island is, which also leads to several development issues, such as urban unemployment, rising inequality between urban and rural areas, severe traffic congestion in big cities, and several other environmental problems like floods and sinking cities. These demographic and geographical facts have posed an interesting insight about the dynamics of Indonesia as a case study, especially with the emergence of the gig economy that made some promises to alleviate these issues.

Among its 270 million population, it is estimated that there are about 196.7 million internet users in Indonesia, which accounts for 73.7% of the total population (APJII, 2020). This number highlights the relatively high number of internet penetration in the country. Out of 73.7% users, 78.2% and 77.6% use their mobile internet connection for shopping applications and map applications, respectively Kemp (2021), which may include on-demand applications like motorbike taxi applications, food deliveries, or goods deliveries. This large percentage has shown the salience of such online applications in Indonesians' everyday lives.

The gig economy and on-demand applications have emerged in Indonesia in recent years. Beginning with Uber in 2014 – although Uber later pulled its business out of Southeast Asia – the gig economy has been rapidly embraced by Indonesians. In 2014, Grab launched its first motorbike taxis. In 2015, Gojek also launched its three services: Goride (motorbike taxis), Gosend (goods deliveries), and Gomart (shopping). Since their inception, the on-demand transportation applications have been on the rise and widely used by the Indonesian urban population. Given that they do not only offer one service, but also several other services, they are becoming recognized as "super-apps". One application typically offers several services, such as food delivery, same day goods delivery, groceries, motorbike taxis, and car taxis.

In the transportation sector, Gojek and Grab are the leading companies in Indonesia and Southeast Asia. Both Gojek and Grab already have decacorn titles, where these startups are valued at over US$10 billion in the Southeast Asian market.[4] Grab first secured its decacorn title in 2018 while Gojek achieved the status in 2019. Southeast Asia presented an interesting case whereby the first and world-leading ride-hailing company, Uber, was unable to easily compete with local rivals like Grab and Gojek. In 2018, Uber left the region and sold its operations to its rival, Grab. In that same year, Gojek expanded its operations beyond Indonesia and entered Singapore, Philippines, Thailand, and Vietnam (Gojek, 2018). The recent merger of Gojek and Tokopedia, one of the big players in Indonesia's e-commerce platform, has been said to further boost Indonesia's digital economy where the two combined would contribute to at least 2% of Indonesia's total GDP (Rossa, 2019).

The boom of e-commerce has gone hand in hand with the rise of courier and delivery industries. The logistics industry has been an integral part of the e-commerce industry as they help delivery efficiency and reduce the delivery cost (Chum, 2020). To date, at least 123 logistic tech startups exist in Indonesia.[5] The combination of a large number of the population, rising internet penetration among Indonesian citizens, and a growing economy has made Indonesia a thriving market for the e-commerce and courier industry. The same day delivery feature, which is offered by various e-logistic companies like Paxel, Anter Aja, and NinjaExpress, has been very popular among Indonesian users, especially for food sellers in the e-commerce industry.

The emergence of these gig economies, especially in the transportation sector, has faced continuous challenges from the established workforces, such as the so-called "conventional" taxis. In 2016, traffic chaos and violence arose as thousands of taxi drivers held a protest against the online taxis in Jakarta (Freischlad, 2016). Online taxis are often hindered from taking orders in specific locations that are

[4] See the Complete List Of Unicorn Companies at https://www. cbinsights.com/research-unicorn-companies

[5] See the logistics tech startups in Indonesia at https://tracxn.com/explore/Logistics-Tech- Startups-in-Indonesia

considered to belong to the conventional taxis' area. These negative sentiments towards the online taxi drivers have resulted in conflicts that arise across the countries (Yantina, 2017). These conflicts subsided over time as conventional taxi companies have collaborated with the online taxi industries to offer their services and with the new government's regulations that sets the minimum tariff for online taxis (Kementerian Perhhngntnntnt Republik Indonesia, 2019). Government officials have also continuously praised the emergence of online taxi industries for their contribution to Indonesia's economy and even attributed these online taxi drivers to being the transportation heroes or *pahlawan transportasi* Kementerian Perhhngntnntnt Republik Indonesia. With a relatively low barrier to enter this type of job, online taxi driving is viewed as a promising occupation, and the media often publish and glorify the relatively high monthly income these drivers earn in comparison to the average employees in conventional industries. While no official numbers exist from the companies on how many people are working within this industry as online taxi drivers, Asosiasi Ojek Online estimates some 4 million online taxi drivers in Indonesia (Kumparan Tech, 2020).

The COVID-19 pandemic has, however, exposed the vulnerability of these occupations. For instance, limitations on physical movement made it very difficult for those working in the ride-hailing sector, especially two-wheeler drivers, to sustain their operations.

This ultimately forced drivers to return to their hometowns (mudik) because of the drastic drop in their income. Although some platforms have introduced special measures for workers regarding COVID-19, mainly regarding health and safety protection, they have not taken sufficient action to adequately protect workers, such as offering financial support. Ultimately, the platform's response to the crisis has further highlighted the legal vulnerability and lack of protection of gig workers already seen in the pre-COVID-19 era.

TABLE 4.1
INDONESIAN PLATFORMS SELECT FOR 2021 RATING

No	Sector	Company	Service
1	Transportation	Gojek	Gocar (Car Taxi)
2			Goride (Motorbike Taxi)
3		Grab	Grabcar (Car Taxi)
4			Grabbike (Motorbike Taxi)
5		Maxim	Maxim Car (Car Taxi)
6			Maxim Bike (Motorbike Taxi)
7	Courier-Delivery	Paxel	Paxel (Delivery service)
8		NinjaExpress	NinjaExpress (Delivery service)
9		Anteraja	Anteraja (Delivery service)

Source: Authors' elaboration/calculation.

The assessment

The 2021 Fairwork study in Indonesia assessed two sectors of the gig economy - the transport sector and courier delivery sector.

Issues and Vulnerability

Despite its promises, Indonesia's gig economies also have several problems that, if left unaddressed, might bring serious consequences for Indonesia's future workforce.

Take for example the issue of Worker's Classification under Indonesian Law. The usage of mitra or "partner" as the term that defines these worker's relations towards the company entails some issues. This is primarily related to the rights that workers can pursue from the company because they are not

defined as "employees". Under the Indonesian Labour Law No. 13/2003, an employment relation or relationship, defined as the relationship between an entrepreneur and a worker/ labourer based on a work/ employment agreement, which deals with aspects relating to the job (that the worker has to do), the worker's wage, and orders and instructions (that the worker has to carry out).

This regulation requires three key points to define this relation: job from the employers, fixed-wage, and orders and instructions (directly from the employers). Based on these three key points, companies argued that relationship between the platforms and workers, therefore, does not constitute an employment relationship. Since workers are paid by the percentage (i.e. 20% platforms: 80% workers in most online taxi sectors) and the orders are not given by the companies but independently chosen by workers, companies need not comply with the law. In the so-called partnership relations, the relation between worker and platform should be equal and is mutually beneficial for each party involved. However, Fairwork has seen little to almost zero bargaining power for the workers in comparison to the platforms.

The second issue to consider is gender. Women who work as motorbike drivers often face some difficulties and gender-based discrimination, which is manifested in the form of sexual harassment and gender-based order cancelation. In the case of motorbike taxi drivers, the physical proximity between drivers and passengers can give rise to opportunities for harassment.

> *"Yes, one day, there was this guy who sat very close to me. I want to throw my anger away, but I remember that customers are the 'king'. I want to push him away, but he always gets too close, it was very uncomfortable for me. [...] most often, I just want to get away with it and get to the destination as fast as possible. It is quite traumatic for me." (M, Goride driver)*

Aside from sexual harassment, women also experience another structural constraint in obtaining orders. The female drivers of Gojek, for example, experience a higher cancelation rate from their customers than their fellow male drivers. Platforms let customers cancel their order via the application under several circumstances, such as: 'driver is too far away', 'driver asks me to cancel', and some other technical issues. However, drawing on respondents' experience, some customers explicitly stated that they are disappointed knowing that the driver that is coming to pick them up is a woman.

> *"When they see us (picking up the customer), they go, 'You're a woman? I am sorry, I am not used to being on a ride with a woman, may I cancel (the order)?" (M, Goride driver)*

> *"Yes, many cancel their orders because (I am) a woman. It's almost every day, at least once a day (got cancellation due to being woman)." (N, Goride driver)*

Long working hours is also a concern. In a setting where workers are the breadwinners of the family, an expansion in working hours may also occur. While motorbike taxi drivers can earn income that is better than regular employees, workers often need to spend much more time on the job. In comparison to official full-time working hours, which is about eight hours per day, drivers often spend more than 12 hours a day on the road (including waiting hours). This can be extended to up to 20 hours a day. This fact signifies how:

> *"I give myself a day off only if my kids ask me to. If no one says anything, I will just go on and keep on working. I told my kids, 'Your mom works like this so that you can eat and have snacks'. But then, my kids replied, 'Well, if that is so, I would not eat and buy snacks anymore so that you can have a day off'. Because of that, now I tried not to overwork myself for the sake of my kids." (M, Goride driver)*

Finally, there is no official representative for workers on the platform that is equal to the type of worker union that

is established in the formal economy sector. Nonetheless, drivers establish their informal communities among drivers in specific areas of the city. Most of them have informal groups established on the WhatsApp group and also Facebook groups. These informal channels provide rooms or spaces for the drivers to voice their discontent. Through these channels, workers may also communicate and initiate collective actions, including demonstrations and strikes. However, workers signal hesitancy to join in demonstrations or protests due to the fear of being terminated by the companies. Some drivers also put their situation vis-à-vis platforms in the domain of gain, where the loss – signified by future risks and costs associated with protest – is too hard to handle.

> *"Some people also ask us to join a demonstration to demand our rights, but for me, they are just people who are not thankful for the job that platform already gave to us." (D, Gocar driver)*

Hence, in the community or the informal group, workers often only talk about their day to day lives and how they go about their day on the road.

In sum, based on the 2021 Fairwork findings, several issues need to be addressed. First, workers often need to work long hours every day to achieve the minimum wage in their region. Those who rely on the platforms for their main source of income often struggle to make ends meet. Second, these workers are still not covered in the current legislation. Therefore, workers are not entitled to paid leave, overtime payment, pensions, and other benefits that workers should receive. Lastly, some of our respondents were hesitant to join protests for several reasons. In part, this was due to reports of colleagues being suspended for joining a protest. Hence, workers have limited space to voice their concerns directly on the platform.

In looking at these issues, it becomes apparent that the government needs to set a standard that would ensure that

workers receive at least the minimum regional standard living wage without having to work overtime. The government should also include gig workers in their legal definition of "worker" so they are also able to receive employment benefits. Platforms, on the other hand, should recalibrate their incentives and order distribution systems that are fair to the workers. Lastly, customers must start using their power to pressure the platforms. This can be done by selectively using the platform that treats their "partners" better. Once this movement gains traction, other platforms will be forced to improve their policies to avoid losing more customers, which will eventually lead to a fair treatment for workers across platforms. As platforms have profited by the number of customers that use their applications, and in spite of the competition among the big players in this industry, the customers' voice matters.

Ecuador

The evolution of the gig economy

The Ecuadorian economy is highly dependent on extractive commodities and related activities (Burchardt et al., 2016). Since 2015, Ecuador has been facing an economic recession triggered by falling oil prices and rising public debt and trade deficits. This recession has increased unemployment and informality (Acosta and Cajas, 2018). Around the same time, companies such as Cabify, Uber, UberEats, Glovo and Rappi began operations in Ecuador. Under adverse economic conditions, the arrival of these ride-hailing and delivery online service platforms became a buoy, offering relatively easy and quick access to a daily source of revenue for both Ecuadorians losing their jobs and immigrants attempting to find jobs. Local platforms, like Mynkana, Ocre App, Encargos y Envíos, and Kiárame have emerged within the past two years.

As a new phenomenon, Ecuador's gig economy faces infrastructural barriers, such as financial inclusion factors, lack of regulation (Albán, 2017), and a general mistrust of

online payments (Dakduk and Dicarlo, 2020). As only 55 percent of the population have banking services, 9 percent have a credit card, and about 10 percent use online payments, this new economy is facing considerable financial constraints.

No official statistics exist on either the number of people working on these applications or the migrant population involved in such activities. Nonetheless, based on data gathered from public declarations, media reports and the interviews conducted for this research, we estimate that, before the pandemic, there were about 40,000 gig workers nationwide, which represented 1% of the under-employed population (El Telégrafo, 2019b; EL Universo, 2019; Freire, 2019; Becerra, 2019). This labour force represents about 1 percent of the underemployed population (Revista Gestión, 2020).

Gig workers face a difficult situation in relation to labour rights, volatile income, a lack of social benefits, and precarious and exploitative working conditions. According to platforms, workers are independent entrepreneurs who manage their own time and have no boss. This way, platforms are detached from any employment relationship. However, most gig workers do not have the freedom to decline work whenever they want because they are under strict control by platforms over their schedules, routes, and prices. When they choose to exercise such freedom, they become subject to disciplinary actions, such as account deactivation, lower ratings, and less work allocation. Since gig workers are not considered employees, they are only covered by social security benefits if they voluntarily contribute from their own earnings.

The assessment

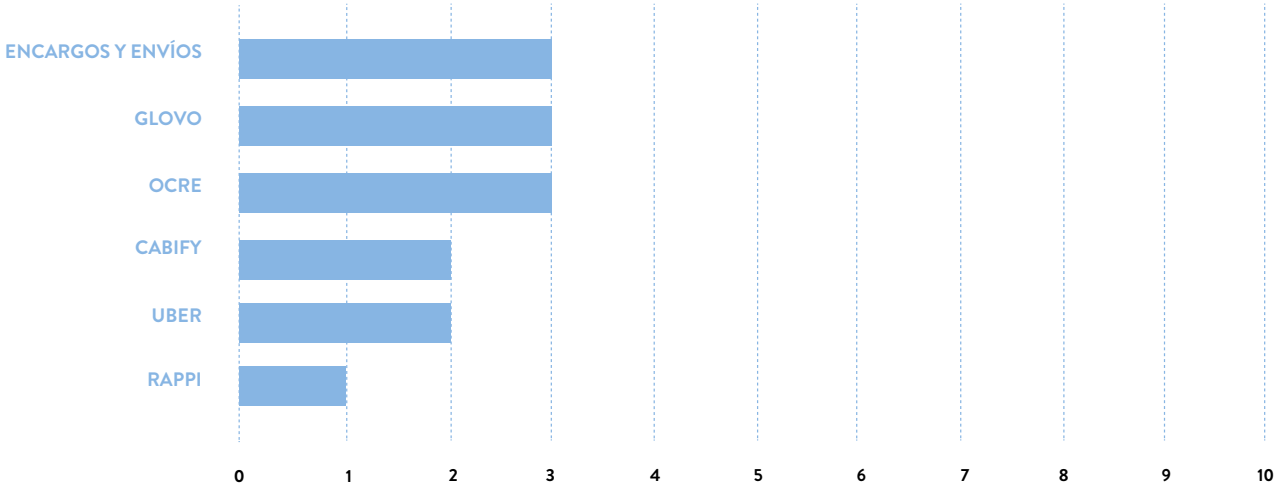
The 2021 Ecuadorian team scored six platforms – four international and two local companies. The ratings achieved by the platforms operating in Ecuador are very low, with no platform scoring more than three points out of ten. All platforms pay over the minimum wage (US$400). However,

once work-related costs are factored in, only two platforms could prove that their workers earn minimum wage. Only Glovo could demonstrate having adopted policies to protect workers from work-related risks and there was no evidence of platforms implementing measures to actively improve working conditions beyond mitigating task-specific risks. Uber, Glovo and Encargos y Envíos provided terms and conditions in a clear, transparent and accessible form, but most platforms offered contracts governed by overseas jurisdictions that limited workers' ability to assert their rights through local legal channels. No platform could be shown to allow due process for decisions affecting workers and there was no evidence of any platform having a documented process through which workers could express their voices collectively. None of the platforms was found to have recognised workers' organisations or be willing to acknowledge workers' collective voice, leaving them without institutional channels for representation.

Challenges

The gig economy raises a number of specific issues and challenges in developing countries such as Ecuador. Barely prepared for the techno-economic transformations introduced by the automation of the economy, these countries struggle not only to catch up with the technological infrastructure and capacities needed to deal with these new industries, but especially with the lack of regulation and institutional tools to frame and manage the development of these activities

FIGURE 4.3
2021 FAIRWORK SCORES FOR ECUADORIAN PLATAFORMS



Source: Authors' elaboration/calculation.

and their social and economic side effects. In such a context, companies can operate in grey zones regarding taxation and labour conditions (El Universo, 2020).

Historically characterised by a low level of enforcement of local regulations, the governments in countries like Ecuador need external incentives, such as international observance and cooperation, to develop such instruments and capacities. Even locally-owned platforms prefer to operate from foreign countries to avoid financial, labour, and taxation obstacles in Ecuador. This increases the risk of abuse of workers and prevents any regulation that considers local needs and expectations.

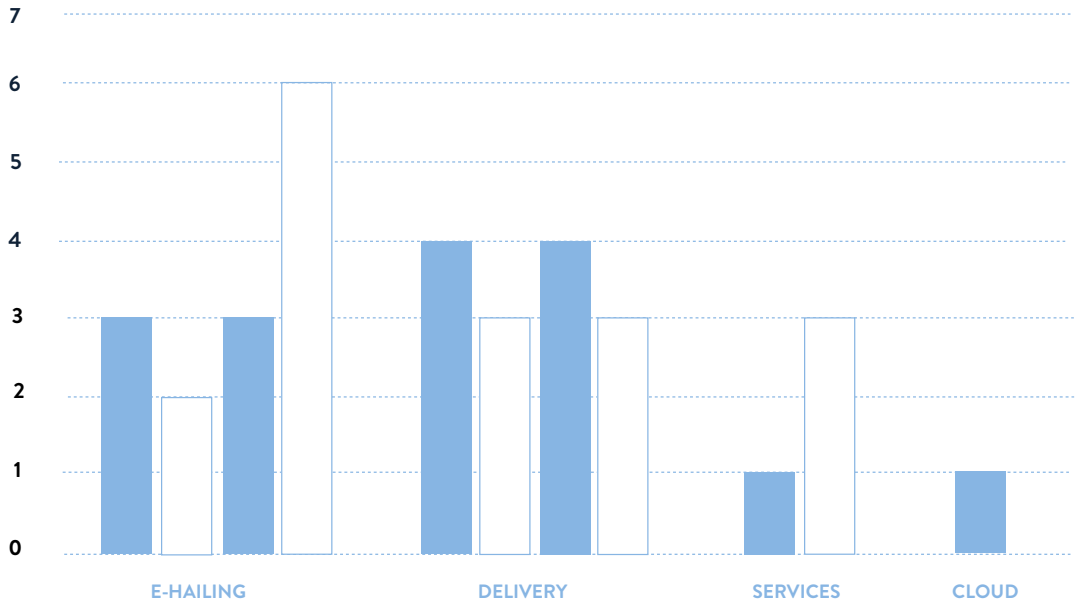
REFLECTIONS ON THE FAIRWORKFINDINGS ACROSS THE FOUR COUNTRIES

The reports from the four Global South countries reveal interesting parallels but also differences. What is clear is that the Global South provides fertile ground for gig working platforms: the high levels of unemployment; the rapid adoption and penetration of mobile phones; the steadily lowering costs of mobile data; a dominantly young, dynamic population, high levels of urbanisation, relatively elevated rates of social change; openness to technical innovation and a low level of regulation (when compared to many developed countries) can all be seen as factors for the proliferation of both international, global gig work platforms, such as Uber, Uber Eats and Cabify, and enablers for locally developed platforms. Some disablers are the still cost of data and the general lack of electronic payment means due to the low penetration of bank accounts, credit card ownership and the relatively low acceptance of mobile money systems.

Most of the gig platforms evaluated were in the e-hailing (transport) and delivery services. Location-based gig work services were investigated only in South Africa (3) and Ecuador (1) and only in South Africa were two cloud-work platforms investigated (Figure 4.4). In all cases, the one or two largest urban areas were selected for evaluation.

FIGURE 4.4

2021 FAIRWORK RATED PLATAFORM BY SERVICE TYPE/OPERATING INDUSTRY



Source: Authors' elaboration/calculation.

Although the legal and labour environments differ quite dramatically across the countries, we detected no or very little legal or statutory protection for the workers on these platforms, even though some of the countries have fairly well-developed labour legislation for employees. In general, platforms carefully devised their terms and conditions to avoid being subject to labour legislation. Also, platforms generally showed little support or encouragement for organised worker engagement or structured worker representation, even though workers in many cases sought to network with other workers through social media applications.

Scores vary dramatically: the South American platforms scored very low with the highest scores in Ecuador being 3 and only 2 in Chile out of a possible 10. By contrast, the South African scores were significantly higher, with several platforms scoring 8/10 and one – GetTOD, for artisanal services – even obtaining a 9/10 score. Interestingly, across all the countries,

locally developed/owned platforms generally scored higher than global platforms, such as Uber who is often based in the Global North. Additionally, these local platforms also seemed more willing to engage with the Fairwork researchers and considered changing their practices to enable fairer work conditions. Further research is still required to see if this pattern will hold in other countries and over time. On the other hand, in the future, perhaps global platforms can be put under pressure in their Global North bases or markets to enforce more ethical work practices globally. Uber has agreed to negotiate globally with the Fairwork team, perhaps acknowledging the increasing globalisation of Fairwork's research. Note also that practices of the global platforms do differ across different countries; for instance, Uber has implemented different (better) work practices in South Africa than in Latin America, which is partly responsible for their higher South African score.

Despite the large disparities between the Global South country cases – indeed it can perhaps be argued that there is more socio-legal-economic diversity among Global South countries themselves than between them and the Global North – there are common concerns for all workers. One notable recurrent problem is the gender issues with women workers reporting to have been subjected to harassment and safety concerns across all four countries. Overly long working hours – often 60 to 80 hours for e-hailing and delivery workers – are also reported across all countries despite much lower legal maximum worker hours being stipulated for employees in most jurisdictions. Finally, and perhaps not surprisingly, the impact of COVID-19 has been (and still is) quite severe across all four countries: the e-hailing sector in particular has seen serious hardships for many workers, exacerbated by their high capital investments. The delivery services has seen mixed impacts because the lockdowns have often seen a shift toward the normalization of a home-delivery system, although the attendant risk of exposure and infection by the workers was often not fully acknowledged by the platforms.

CONCLUSIONS

This FoWiGS Fairwork action research project provides important empirical evidence for both the benefits, as well as the precarious nature of gig platform labour across various countries in the Global South, namely, South Africa, Chile, Ecuador and Indonesia. While each country has a unique context that shapes the nature of the work produced by the various gig labour platforms, the evidence reveals levels of unfairness across the board regarding the pay, working conditions, contracts, management practices and gig worker representations. The sustained impact of the COVID-19 pandemic continues to present a significant challenge to Global South economies as gig workers' livelihoods remain vulnerable to health challenges, personal safety insecurities and varied pandemic-induced economic lockdowns. Gig workers continue to experience precarity as they are generally designated independent contractors rather than employees, leaving them highly vulnerable due to the lack of basic access to unemployment and health insurance benefits.

There also remains significant challenges regarding unfair and unequal pay which results in lower earnings coupled with greater discrimination or even exclusion from platform work along dimensions of gender and race, particularly in the Global South. Despite these challenges, several platforms are making innovative and positive strides to transform their businesses into fair and decent work providers. It remains important to critically analyse the national and local legislative and regulatory environments that continue to shape and guide gig platform work, particularly legislation over paid leave, overtime payment, pensions, and other employment benefits. Decent work on gig labour platforms will remain elusive if gig workers' right for freedom of association, as well as collective bargaining, is not adequately protected and guaranteed.

The Fairwork principles are a useful evaluative mechanism to assess how workers' experience their work in the gig economy.

The methodology is also a consistent yardstick that customers and platforms can rely on to understand successes and improvement areas of gig platform work. It is our considered view that the future of decent gig platform work requires all platforms to leverage the power of their organisational procurement, investment, and partnership policies to support fair platform work.

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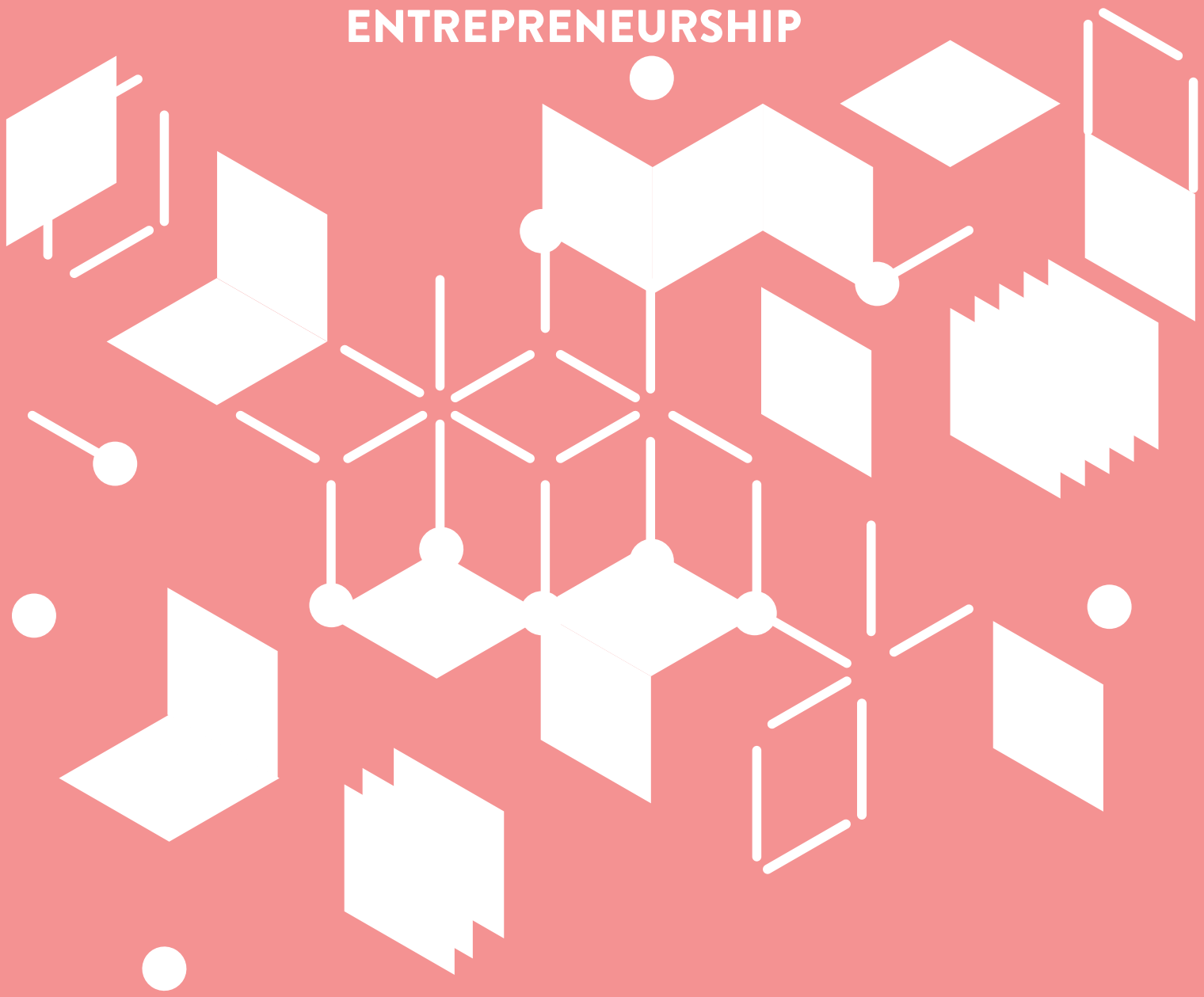
5. ONLINE WORK & WOMEN IN INDIA: THE OPPORTUNITIES AND LIMITS OF DIGITAL ENTREPRENEURSHIP



Urvashi Aneja

In recent years, the growth of digital platforms has enabled the creation of an online labour market in which clients and workers can directly connect with one another over digital platforms for the completion of specific tasks. This type ofwork is often referred to as "online outsourcing" or "online work" and includes both "freelance work," such as software programming or graphic design, and "crowd-work", where a specific task or work process is broken up into numerous smaller tasks and distributed to a geographically dispersed workforce. Workers on online platforms are typically regarded as independent contractors and are paid per task or assignment.

The iLabour project at the Oxford Internet Institute estimates that the demand for online work has grown by 11 percent annually over the last 5 years. It further estimates that in 2020, there were 163 million registered worker accounts, of which 19 million are active workers, and 5 million are full-time workers.[1] The demand for online work commonly originates from industrialised economies and most of the work is completed by workers in low- and middle-income countries (ILO, 2020).

The COVID-19 pandemic is expected to further contribute to the growth of the online labour market. Online outsourcing may be a way for companies to reduce costs and manage uncertainty; businesses are also becoming more accustomed to a remote workforce. Job loss and disruption have also contributed to an increase in the number of registered workers on online work platforms (Fairwork, 2021).

Many governments, development agencies, financial institutions and platform companies view online work on digital platforms as a new form of entrepreneurial activity that can enable positive development gains in the Global South. A common narrative is that digital platforms for online work can enable workers to access global markets, earn higher wages, and overcome the constraints of local labor markets (Graham, Hjorth and Lehdonvirta, 2017). Online work can

[1] Oxford Internet Institute. (2020). *Online Labour Index.* Retrieved from https://ilabour. oii.ox.ac.uk/online-labour-index/

be particularly advantageous for women as it can be done remotely and allows for flexible hours. [2]

Yet, online work on digital platforms also represents a form of "forced entrepreneurialism" – people often join these platforms because they are unable to find alternative jobs in domestic labor markets (Graham, Hjorth and Lehdonvirta, 2017). Many experience income volatility on online platforms, earn declining wages, and spend long hours trying to find suitable work. Broader social and cultural contexts also shape peoples' entrepreneurial capacities and opportunities. For example, women's access to education and digital infrastructure is often constrained by prevailing socio-cultural norms.

This chapter examines women's participation on digital platforms for online work in India. How do they experience entrepreneurialism on digital platforms? What motivates women to join online work platforms? What are the implications in terms of access to work, earnings, and financial autonomy? Is this a form of digitally enabled micro-entrepreneurialism and does it contribute to women's economic empowerment?

India has one of the lowest female labour force participation rates in the world. In 2019, just 21 percent of Indian women were counted within the labour force. Scholars have suggested that the rise in the number of women pursuing higher education has actually resulted in a decline in their labour force participation force participacion (Thakur, 2018). Given their educational achievements, female graduates have a preference for "white collar" jobs. Yet, there are not enough of these jobs available. However, as Ghose (2016) emphasizes, participation in education does not fully explain the declining labour force participation of working-age women, as the numbers for non-student working-age women have also shown a declining trend. One of the key reasons for women being unable to participate in paid work, he argues, is their unpaid care work burden.

[2] See, for example, Beerepor and Lambregts (2015); Bester, Van der Linden, A., Dewan, S. (2020); Cenfri and Melia (2020).

There is a small but growing body of literature on the platform economy in India. Much of this scholarship highlights the experiences of workers on location-based platforms and shows how gig work intersects with existing structures of informality and precarity.[3] A handful of studies examine online work specifically, highlighting how it can create new employment opportunities (Kathuria et al., 2018) and enable flexible work for women (Bandaranayake et al., 2020).

This chapter is based on a mixed-method research project. It aimed to establish baseline data on women's engagement on online work platforms in India and combine this with qualitative insights around the experiences and expectations of online work, and to examine the significance of online work for women's economic agency and empowerment in India.

Between September and October 2020, we conducted a survey, semi-structured interviews, and a remote focus group discussion with women on online work platforms in India. With the help of a survey agency, we administered a survey to 365 women registered on online platforms. For the survey, we did not restrict the interview base to any single platform. Women above 18, who earned an income through online work on either freelance or micro-work platforms and had been registered on the platform before March 2020, were recruited from among the survey agency's sample class. Of this sample of 365 women, 316 were engaged in online freelance work and 49 in micro-work.

Following this, we conducted 22 in-depth semi-structured interviews with women on online platforms and 1 focus group discussion. Due to considerations of anonymity, our interviewees were not drawn from the quantitative survey group. Instead, we recruited participants through posting a job on three online platforms – Upwork and Freelancer for freelance work, and Amazon Mechanical Turk (AMT) for micro-work. We also contacted workers through social media groups.

[3] See, for example, Surie, A and Koduganti, J (2018) The emerging nature of work in platform economy companies in Bengaluru, India: The case of Uber and Ola Cab drivers. *E-Journal of International and Comparative Labour Studies* 5 (3); Tandem Research 2020). *Digital labour in the gig economy.* USAID; Aneja, U., and Shridhar, A. (2019) 'Worker Wellbeing on Digital Work Platforms in India', Tandem Research.

DIGITAL PLATFORMS AND ONLINE WORKIN DEVELOPING COUNTRIES

Digital platforms can enable workers in LMICs to access new global markets for work. Demand for online work is driven largely from Global North countries, where wages are higher than local wage rates. Noting that 'catch-up development' often follows export sector growth, Melia (2020) argues that the export of IT services through online work platforms could also provide an opportunity for economic growth in LMICs. But, online labor markets also enable labor arbitrage, where clients are able to buy labour from wherever it is cheaper (Beerepoot and Lambergts, 2015). The downward pressure on wages is also because the current supply of labour is greater than the demand for online work (ILO, 2021).

Online work presents employment opportunities for those who may not be able to participate in traditional jobs. Women, in particular, are often constrained from accessing full-time work due to care commitments and socio-cultural gender norms.

Online work platforms can enable them to earn an income, improve their skills, while also fulfilling their care responsibilities. However, studies also note that economic exclusion and discrimination on online work platforms are based on gender, religion, and ethnicity. Women tend to earn less than men because they are unable to take on as much work due to care commitments (Adams-Prassl and Berg, 2017).

Emerging literature on online work has found that digital labour platforms engender precarious working conditions as workers are not provided with any safety nets like minimum wage guarantees, paid holidays, health benefits, or employer-funded pension plans or insurance (Berg et al., 2018). Workers

also experience income volatility and have little control over when they will have work or their working conditions. The absence of collective bargaining, the misclassification of workers as "independent contractors", stringent algorithmic control, and rampant worker monitoring can further weaken worker agency (ILO, 2021; Tandem Research, 2019).

At the same time, workers have to invest their own capital and time. In a study conducted by Newlands and Lutz on AMT workers in India and the US, they found that 85 percent of the sample in India reported having invested specifically for the purposes of crowd work. They spent between USD 29-43 on broadband internet, mobile data connection, computers, and accounts (Newlands and Lutz, 2020). Other studies have noted that workers spend a considerable amount of time looking for work, often with unsuccessful results.

Online work may be seen as a return to casual labour in industrialised economies. In LMICs, however, most of the workforce is already engaged in informal work, outside the protections of standard employment relationships. Accordingly, online work can be seen as reproducing and recasting informality, rather than contributing to the creation of additional non-standard forms of work. As Parthasarthy argues, "concerns about the precarious nature of digital gig work are equally true for locally available work in the vast informal sector, with gig work at least offering better monetary returns" (Parthasarathy, 2018).

ONLINE WORK PLATFORMS

For this study, we conducted semi-structured interviews with women on three online work platforms – Freelancer, Upwork, and Amazon Mechanical Turk. Our survey was not restricted to these three platforms, and workers were only asked to self-identify as working on either a freelance or

micro-work platform, or both. While this difference in the sample population poses methodological challenges for the robustness of our findings, it is important to note that a large proportion of Indian workers are engaged on these three platforms.

Freelancer & Upwork

In order to register as a worker on either platform, workers in India must use their real identities and submit identification documents, a photo, Permanent Account Number card, and bank account details. Workers must create a profile listing their skills and qualifications and they can start bidding on jobs once their IDs have been verified. This verification process was introduced recently. Long-term users who joined the platform in its early days were not required to submit their IDs at the time they joined but have recently been asked to complete this verification process. Clients, on the other hand, do not have to go through a similar verification process. They can start posting jobs after creating a profile on the platform. These differences lead to power and information asymmetries which often result in fraud and harassment, as a few women pointed out to us.

Workers can bid only on a limited number of jobs. They can browse job listings based on their area of expertise, bid on them and send a cover letter or a note to the client. Clients are then directed to their profiles which will usually list all the details added by the workers themselves. This includes their name, photograph, their rating, their skills, and the number of hours they have worked or the number of projects they have completed successfully. Crucially, clients can also see a worker's rating and reviews left by previous clients.

In theory, workers do not have to pay to use the platform and bid for jobs. However, in practice, workers must buy weekly or monthly subscriptions to increase the number of projects they can bid for. There are also subscriptions that make "premium" jobs visible to workers who subscribe. The platforms

offer workers paid courses to upgrade their skills and obtain certifications within the platform. Upon completion, they receive badges for certification that are made visible on their profiles next to their reviews and ratings. These certifications are valid only within the platform and cannot be migrated to other platforms, nor are they recognised in offline workplaces.

Amazon Mechanical Turk

In 2013 Amazon Mechanical Turk placed restrictions on new accounts being registered from Indian IP addresses. To create new accounts, workers had to use either virtual private networks (VPN) to conceal their location, or ask friends and acquaintances in other geographies to create accounts for them. These restrictions have led to a thriving black market where accounts are traded, sold, or rented. Accounts can be quite expensive. One woman we spoke to paid INR 10,000 (approx. USD 135) for an account while another paid INR 60,000 (approx. USD 800). Another rented an account from somebody and paid her 10 percent of her earnings as a fee.

Users who rent or buy existing AMT accounts must submit a PAN card 2 and bank account details to which the payments are routed. Once this is verified and approved they are registered as Turkers and are able to start accepting Human Intelligence Tasks (HITs). Four out of 7 of the respondents we interviewed could access their accounts in this way. The other three signed up on the platform while they were in university. Our research confirms findings in others where some users of AMT have been doing so for several years, usually starting in university and continuing intermittently as they enter the workforce (Berg et al., 2017).

The architecture of AMT limits interactions between workers and clients. There is no chat or messaging feature that allows for a two-way interaction for workers. Only requesters can initiate interaction through this feature. Requestors leave contact information in the HIT so that workers can respond

or seek clarification. Requesters can send high-performing Turkers a bonus and a note via the platform. Requestors can also leave feedback and ratings for Turkers on the platform. However, Turkers have no way to respond to these comments or ratings. If workers perform poorly, their work is often rejected and they are not paid. Consistent rejections and poor ratings could lead to account deactivation. Turkers have few avenues for grievance redressal and the women we interviewed stated that AMT usually ignores their complaints.

FINDINGS

Women from both urban centres and smaller towns participate in online work. Education qualifications do not differ greatly between freelance and micro-work platforms. Most of the women on freelance platforms have an undergraduate degree (46%), and many (29%) have a postgraduate degree or diploma. Similarly, most women who identified as doing micro-work had an undergraduate degree (49%) or higher (24%).

Most freelancers reported that they had previous work experience – 38% of the women surveyed were in full-time employment before they started working on the platform and 19% had a part-time job prior to using the platform. Similarly, most micro-workers had moved to online work from full-time (41%) or part-time work (33%). They held a wide range of jobs previously, as teachers, bank tellers, marketing and public relation executives, and jobs in the IT sector and public sector. Our interviews suggested that these jobs were in the formal sectors of the economy and many had access to employee-related formal social protection mechanisms.

Most women on freelance and micro-work platforms left their jobs after getting married or having children. Both the

survey and interviews suggest that for a large proportion of women, care responsibilities and family expectations were their main reasons for shifting to online work. Our survey suggested that more women from tier 2 towns cited this as their primary motivation. Some women said that online work gave them something to do with their time and offered a sense of personal fulfillment, while others mentioned that it helped set a good example for their children.

Most freelance survey participants reported an average monthly income below INR 20,000 per month (approx. USD 260) – 35% reported earning less than INR 10000 (approx. USD 130) and 32% earned between 10,000-20,000 (approx. USD 130-260). Most women reported income variation – 48% said their income varied "slightly" and 44% said that their income varied "a lot." Earnings for micro-workers typically range from INR 2500 (approx. USD 33) to INR 20000 (approx. USD 260) a month. Nearly 60% of survey respondents said that their income varied a lot.

The survey suggested that 52% of participants on freelance platforms said their income was adequate to cover their expenses on most months and only 18% said they needed financial support. However, most women interviewed often referred to online work as enabling additional "pocket money", which they spent on personal expenses, buying things for their children, or everyday household expenses. In almost all cases, their spouses were the primary breadwinners.

This discrepancy could be because of the different samples for the survey and interviews. It may also suggest that their earnings were enough to cover their additional expenses, but may not be adequate if it were the primary source of household income.

The micro-work platform revealed similar results – 43% said they were able to meet their expenses, and 24% said they needed financial support, although most women in the interviews said that they were supported by their husbands.

Some women chose to work on both freelance and micro-work platforms, filling the time between freelance gigs with shorter micro-work assignments. Some chose micro-work because it is quicker to find work and build a profile, and suited more target-oriented or goal-oriented income generation activities.

Interview participants who have been on freelance platforms for a number of years noted that it had also become harder to find high paying work on the platform; lower paying jobs like data entry and virtual assistance were common, but higher paid tasks such as content writing or marketing had become more difficult to find. Some were able to rely on repeat clients for work that interested them; others had to switch to tasks that were available. Micro-workers similarly noted that the amount of work had declined over the years and they had to spend much longer time searching for work.

Working hours differed, though most of the women we spoke with said they scheduled their work around their home and care commitments. Most freelancers reported working 3-4 hours during the week, and 6-7 hours on the weekend as their spouse was available for childcare. Most micro-workers worked late nights or early mornings as most jobs were from the US or UK.

During the interviews, many spoke of their struggle to find their first job on freelance platforms. Some said they offer to do the first job for free or at a very low rate to attract new clients. Most preferred assignments with a fixed rate rather than an hourly rate, as the latter sometimes required them to install software to monitor their hours. Several women paid a subscription fee to the freelance platform to receive more bids per month. Many felt that it was a 'numbers game' – the more jobs you bid for, the greater the chances of getting a job.

Reintermediation is also common on freelance platforms. Upwork allows workers with high ratings to establish an "agency". Agency "owners" can bid and deliver projects

through their own profile, but hire other workers on the platform to help complete the project. One of the women we spoke with had established such an agency and had invited her friends onto the platform and distributed the work among them. In other cases, reintermediation takes place informally. Successful bid winners pose as clients on the platform and hire other workers to complete the tasks.

Some micro-workers had installed special plug-ins in their browsers to get a notification when a new job became available, sharing such tips with social media groups. Many belonged to Telegram and Facebook groups through which they shared information with each other on available jobs. Turkers seemed to collaborate more with each other, compared with women on freelance platforms. But they also said that the work was isolating and contrasted it to friendships they enjoyed at their earlier, more traditional jobs.

Survey participants indicated that they had learnt new skills and were satisfied with their current work trajectories – 59% 'strongly agreed' that online work had helped them develop new skills. The interviews corroborated this. The women we spoke with said they took an active role in learning new skills through modules offered on the platform or other online tools. However, they also felt there were limited options for career progression on online platforms and that these skills would not be easily transferable to offline jobs. Most said they were happy to continue with online freelancing, though a few said they would like to return to traditional jobs if familial commitments permitted and if an "appropriate job" were available.

In contrast, on micro-work platforms, many pointed to the lack of opportunities for career and income advancement through micro-work, but also valued being able to engage on the platform as the need arose.

Women with college degrees are often engaged in work that is well below their skill level, particularly on micro-work platforms. For example, in our study, many of the women

engaged in micro-work were engineering or STEM graduates. In contrast, on freelance platforms there is a greater possibility for skill matching, but there are limited jobs and intense competition for those jobs.

Several women shared instances of harassment on the platform. Upon accepting a job listing, some said they had been asked to undress or engage in sexual activity during a client call. Others said they been asked to write or record pornographic material. Some said they had been tricked into making a payment to a client in order to accept a job offer.

LEARNINGS

At an individual and household level, online works seems to foster positive gains for women. Most are happy with their work and welcome an opportunity to be able to earn money while staying home. Some said they have learnt new skills and built new social networks.

Freelancers see a greater potential for career progression, have more control over their work, and are often able to match their online work with their interests and skills. Nevertheless, it takes longer to build a profile and client base and competition is intense, which results in some preferring micro-work platforms, or supplementing freelance work with micro-work. Micro-workers, however, have less autonomy over their work, express a greater sense of isolation, and recognise the limited opportunities for career progression. The design of the platform also makes a difference for women's agency and experience of work. Those on freelance platforms appreciate the opportunities for skill upgrading, certification opportunities, and direct engagement with clients, while those on micro-work platforms pointed to unfair practices, such as the rejection of work without explanation or pay and the lack of grievance redressal mechanisms.

But at a broader, structural level, the findings from our study raise questions about the extent to which online work platforms can enable development gains and economic empowerment for women.

The existing literature on online work already shows that only a small proportion of workers are active on online platforms and that demand for work far outstrips supply (ILO, 2021). Superstar effects are common, where most of the available work is completed by a small number of highly rated workers.[4] As women are likely to be able to only schedule online work around existing care commitments, they may not have the time required to find and complete enough work to build their profiles. For most interviewees, the income earned on online platforms was not a significant contribution to household income, but was referred to as "pocket money" to be spent on personal expenses or on their children.

Online work also falls firmly within the confines of existing gender roles. Gender roles and family expectations shape women's reasons for joining online work platforms, and the investments they are able to make in their work. Most join online work because of their care commitments, and these care commitments also shape how much time they can spend on their work. Offline patterns of gendered discrimination with regard to unequal pay and workplace harassment are also reproduced on digital platforms. The gender pay gap, for instance, persists because of women's inability to commit as many hours as men due to care work responsibilities. While online work platforms allow women to at least continue to work in some form, despite their family commitments, and even alter household and family dynamics, access to work on online platforms may not alter broader gender dynamics.

Online work does not seem to be enabling more women to access work and participate in the labor force, but it does provide an alternative option for those choosing to drop out of regular work. In this sense, rather than addressing issues around women's declining participation in the labor force, online work platforms represent the continuation of this trend.

[4] See, for example, Gomez,, Martens and Mueller-Langeret, (2017). Trade, Competition and Welfare in Global Online Labour Markets: A 'Gig Economy' Case Study. *SSRN Electronic Journal.* doi:10.2139/ssrn.3090929.

Some of the narratives on platform work, including some of our earlier work, highlighted how narratives that the platform economy is contributing to the in-formalisation of work in industrialised economies needs to be contextualised to developing country contexts where a large part of the labor force is already engaged in informal labor. However, this study provides a further corrective, or nuance, to that narrative, as women seem to be shifting out of formal sector jobs and into an informal type of work.

The study also suggests a reconsideration of arguments that suggest that online work, especially micro-work, can create work opportunities for low-skilled workers from low-income backgrounds. While the official barriers to entry may be low – an internet connection and digital literacy – in practice, the barriers are quite high. Most women have an undergraduate degree and many even have advanced university degrees or diplomas. In this sense, opportunities are also only available for a small sub-section of Indian society, even for simpler micro-work tasks.

Online platforms are enabling access to work. However, for this to translate into broader structural benefits that can address women's declining participation in the labor force, online work needs to be recognised as a formal category of work and the rights of women workers on these platforms need to be established and protected. Platforms should be mandated to allow workers to port their reputation data and skill certification on other platforms targeting interventions from governments, development agencies, and private sector companies that increase the demand for online work and help skilled women to meet that demand. Such interventions are part of a suite of policy pathways needed to enable better online work for women, but broader gender roles and norms will take more time to change. Women may have been more successful in challenging gender roles through traditional career paths that are better recognised, have more social status, have clearer goal posts for career progression, and allow women to reach new networks and experiences.

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ABOUT FOWIGS

ABOUT THE FOWIGS INITIATIVE

The Future of Work in the Global South is an initiative supported by the International Development Research Centre (IDRC) and coordinated by the Center for the Implementation of Public Policies Promoting Equity and Growth (CIPPEC). It aims at understanding the implications of technological change on jobs from a Global South perspective bringing data and knowledge to build evidence-based narratives and policy frameworks on the future of work in developing countries.

ABOUT CIPPEC

CIPPEC is an independent non-profit organization that works on building better public policies. We promote policies that would make Argentina more developed, more equal, with the same opportunities for all and solid and efficient public institutions. We want a fair, democratic and inclusive society, where everyone has the possibility to grow.

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As part of Canada's foreign affairs and development efforts, the International Development Research Centre (IDRC) champions and funds research and innovation within and alongside developing regions to drive global change. We invest in high quality-research in developing countries, share knowledge with researchers and policymakers for greater uptake and use, and mobilize our global alliances to build a more sustainable and inclusive world.

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