Information Problem in Labour Market and Big Data: Colombian Case

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Information Problem in Labour Market and Big Data: Colombian Case[1] [2]

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Abstract

This working paper discusses the concepts and theoretical framework to analyse the labour market, based on the information found on online job portals. Based on a model with imperfect information (which seems more appropriate to describe Colombian labour market outcomes), the first section explains how skill mismatches can arise and their consequences for informality and unemployment rates. In second section, presents evidence that skill shortages, unemployment and informality are highly occurring phenomena in Colombia; and, it is argued that workers, educational and training providers and the government can do little to address these issues because of a lack of proper information to monitor and identify employers' requirements and possible skill shortages at an occupational level. In section 3 the concept of Big Data is introduced, with its advantages and limitations outlined for labour market analysis, this section explains the limitations and caveats to be considered when online vacancy data are used for economic analysis.

Key words: Skill, Skill shortages, big data, online job portals, informality, unemployment.

JEL classification: J24

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1. The Labour Market and Skill Mismatches

1.1 Introduction

The labour market can be defined as a "place" (not necessarily a physical place) where employers (the "demand") and workers (the "supply") interact with each other. The dynamic of this labour market is relevant for an economy as it determines different socio-economic outputs, such as productivity, unemployment, wages, and poverty, among others. Provided the labour market influences various outcomes and different disciplines (e.g. sociology, economy, etc.) address these issues, this working paper narrows and discusses labour market definitions and the theoretical framework adopted to analyse labour demand based on the information found on online job portals.

The next section explains what is understood in the academic literature in economics by labour supply and labour demand, and the possible ways to measure these concepts statistically. Moreover, the informal economy is defined and highlighted as a key issue, especially in Latin American countries such as Colombia. Subsequently, the concept of skills is introduced and its possible implications for unemployment and the informal economy. With these basic definitions outlined, the third section of this working paper describes a labour market and its main outcomes, such as unemployment, wages, etc., under the assumption of perfect competition.

However, the assumptions of perfect competition are substantial and might not be appropriate for different economies such as the Colombian economy. Consequently, it is necessary to consider labour market failures, for example imperfect information, that might appropriately explain the comparatively high rates of informal economy and unemployment levels in Colombia. Thus, the fourth section focuses on explaining how imperfect information might increase skill mismatching, and, consequently, it might create labour market segmentation between formal and informal workers along with a comparatively high unemployment rate. Furthermore, it is highlighted that failures of information might be one of the leading causes of high unemployment and informality rates; especially in developing countries such as Colombia.

1.2 Basic definitions

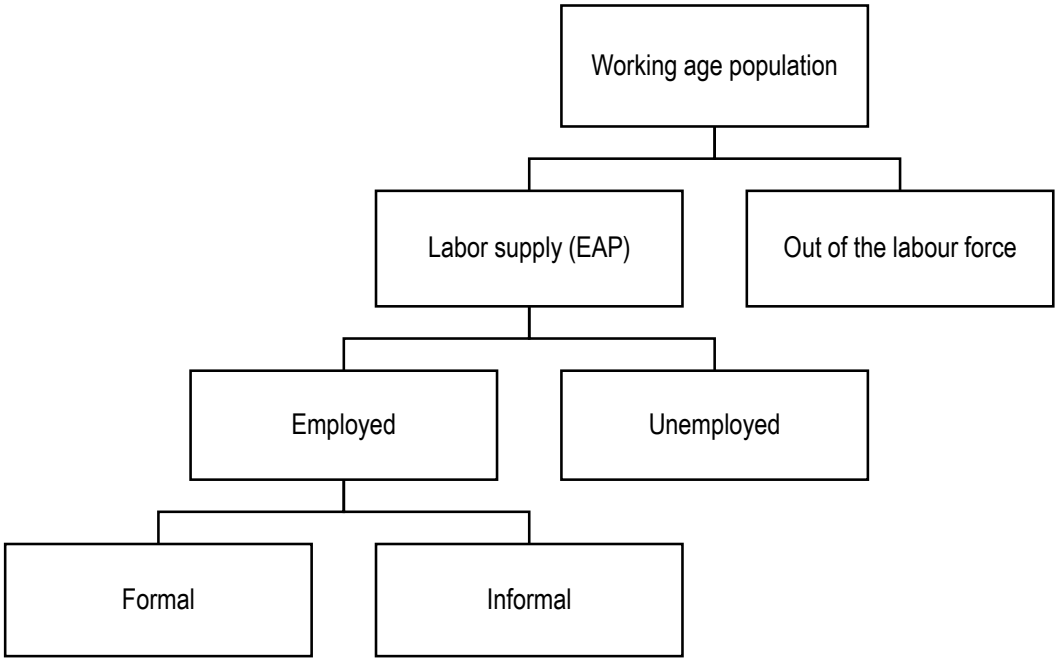
Comparable to other markets (e.g. financial markets, physical consumer markets, etc.), the labour market is composed of supply and demand (Cahuc et al. 2014). The merchandise to be exchanged consists of "labour services" that represent human activities (distinguished by numbers of workers or hours of work); these human activities are one of the inputs in the production of goods and services (ILO, 2018). Consequently, the dynamic between supply and demand have various implications for a range of individuals, for instance, people with different characteristics (i.e. skills), employers that create job offers with certain requirements, and the government, among others. Thus, this section explains who composes the labour demand and the labour supply (e.g. unemployed, formal and informal workers) and the relevance of skills in the labour market outcomes.

1.2.1 Labour Supply

In a basic economic model, people or households possess a limited quantity of "labour" that they can offer in the labour market in order to have an income to acquire goods and services (Cahuc et al. 2014). Therefore, the labour supply or labour force is composed of people who offer their "labour". As shown in Figure 1.1, the labour supply (or the Economically Active Population [EAP]) is composed of: 1) people who do not have a job but are looking for one (unemployed); and 2) people who are part of the working age population hired by employers (employed) and the self-employed (ILO, 2017a).

For statistical purposes—according to the International Labour Organization (ILO)—all working-age people that did not participate in the production of goods and services for at least one hour in the reference week because they did not need to, cannot or are not interested in earning a labour income, and are considered out of the labour force (or inactive) (ILO, 2017a). An unemployed individual is a person without work that has sought a job during the last four weeks and is available for work within the next fortnight; or is currently without a job but has accepted a job to start in the next fortnight. An employed individual is employed when he/she has worked for at least one paid or unpaid hour in the reference week (one week before the survey is conducted). These employed and unemployed individuals are considered as the labour force (EAP).

Figure 1.1: Labour market structure



1.2.2 Labour demand

In contrast, companies or establishments require "labour services" as an input to produce goods and services in the private and public sector. Consequently, labour demand refers to the demand for workers (or hours of work) in an economy. This demand consists of the level of employment (satisfied labour demand) plus the number of available job vacancies which equates to the labour required but not filled by an employee over a certain period (unsatisfied labour demand or unmet demand) (Farm and Sweden, 2003; Williams, 2004).

In this sense, a job vacancy is defined as a "paid post that is newly created, unoccupied, or about to become vacant:

a) for which the employer is taking active steps and is prepared to take further steps to find a suitable candidate from outside the enterprise concerned; and
b) which the employer intends to fill either immediately or within a specific period" (Eurostat, 2017).

Therefore, the total number of vacancies in an economy is determined by the number of unfilled job openings and, additionally, the number of jobs that are temporary filled by internal substitutes (Farm and Sweden, 2003).

To conclude this subsection, the classic economic model (Cahuc et al. 2014) describes the labour market in the following way: people (or households) offer a certain quantity of their "labour" at a certain level of labour price (wages) in order to generate income and acquire different goods and services available in other markets. Establishments in this model require a certain quantity of "labour" at a certain level of labour price (wages) to produce goods and services, and while some workers have a job and are employed, others are looking for one and are unemployed. Nevertheless, as shown in Figure 1.1, the fact that people are working does not imply that they are working in regulated and good working conditions (e.g. informal economy).

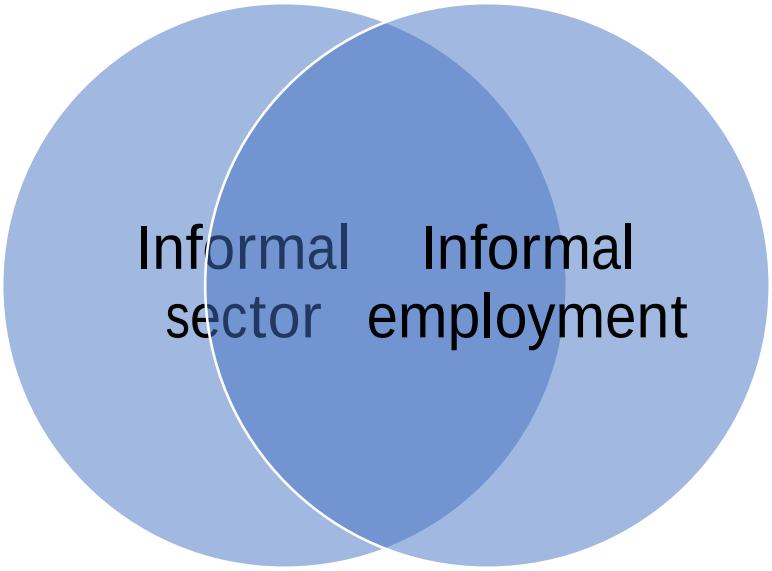
1.2.3 Informal economy

To measure the informal economy, the ILO (2003) recommends making a distinction between the informal sector and informal employment. On the one hand, the informal sector is an enterprise-based definition which considers people working in units that have "informal" characteristics regarding their unregistered and/or unincorporated legal status, small size, the non-registration of their employees, their lack of formal labour relations, without bookkeeping practices, and the under-payment/non-payment of taxes, among others. On the other hand, informal employment is a job-based definition and covers individuals whose main job lacks basic legal and social protections (or employment benefits). For example, a lack of social protection, no income taxation, and so forth[3].

The above sector and informal employment definitions highlight different aspects of an informal economy, and can be used for various public policy targets such as payroll taxes, social protection, among others (ILO, 2003). Consequently, it is possible that people work informally for enterprises that operate in the formal economy or workers might have formal jobs (e.g. with social security) for enterprises in the informal sector (see Figure 1.2).

[3] It is necessary to clarify that both these informal economy concepts do not refer directly to underground, illegal production and non-market production.

Figure 1.2: Composition of informal economy



Based upon the ILO's recommendations, countries such as Colombia in national household surveys consider the following individuals to be informal workers: private employees and workers based in establishments, businesses or companies that occupy up to five people (in all their agencies and branches), including the employer and/or partner; unpaid family workers; domestic employees; self-employed workers, except independent professionals; while government employees are excluded from this definition (Hussmanns, 2004). Evidently, Colombia's household surveys classify informal workers according to the concept of the informal sector[4].

This way of measuring informality has some limitations. As mentioned above, informal employees may be formally working in large factories and, in consequence, the way that Colombia measures informality might underestimate the phenomenon (ILO, 2012a). However, using a measure employed by the statistics office of Colombia (DANE) to calculate informality via social security contributions (pensions) and firm size, Bernal (2009) found that—at least for

[4] Even though the official informality statistic is based on the concept of the informal sector, it is possible to calculate informality using an informal employment approach (e.g. pension and/or health contributions, among other benefits). Moreover, Colombia excludes agricultural activities from its official informal sector statistics, since including such activities requires developing a more robust definition; especially regarding jobs held by own-account workers, and members of producers' cooperatives in the agricultural industry (ILO, 2003).

the Colombian case—the size of the informal sector is remarkably similar between the social security and firm size informality measurements. The same author found workers who pay for social security contributions (pension and/or health) are less likely to belong to small firms.

In addition, the ILO (2011) studied 47 medium and low-income countries and concluded that almost all workers employed by the informal sector are also in informal employment. This result suggests that criteria based on firm size (in the informal sector) are a suitable approach to calculate the informality issue, at least for the Colombian case.

The magnitude of the informal economy problem depends on different processes. On one side, there is an "exclusion" process. More specifically, workers and companies would prefer formal jobs with state mandatory benefits; however, some barriers restrict agents' access to the formal economy. These restrictions or barriers can take different forms, such as excessive taxation or lack of certain workers' characteristics (e.g. skills), that make it difficult to enter the formal economy. This framework suggests that informal firms and workers are a disadvantaged group.

On the other side, some workers and firms voluntary choose to remain in the informal economy, based on their preferences for working, and the net benefit of being in the informal versus the formal economy. To belong to the formal economy, workers and firms need to incur certain costs, such as tax revenue, health and work insurance, and in return the state must provide benefits, such as health care, access to credit, etc. However, these benefits might not compensate for the cost of formality (such as tax revenue). Thus, the informal economy can be an "escape" for workers and firms to avoid the formal economy and its failures related to the provision of services (Perry, 2007). These facts highlight that the benefits of being in the formal economy are not enough to move some agents into the formal economy.

Informal economy is, usually, a term that describes individuals working in unregulated jobs, and is associated with inadequate working conditions, a lack of social security, lower productivity, limited access to the financial system, etc. As Perry (2007) pointed out, the size of the informal economy is relevant because it affects a country's productivity and growth. Informal firms might experience more barriers to access credit, broaden their sale markets and innovate, which might reduce their potential productivity. For instance, the lack of social protection and other work risks might result in a lower incentive for establishments to invest in human capital (see Section 1.4), and lead to lower worker productivity.

The informal economy, along with unemployment, is considered one of the most important indicators to measure the well-being in the labour market (ILO, 2015; Mondragón et al. 2010). Both phenomena are prevalent in Latin America economies, and reflect the high degree of labour supply underutilization. This result reveals the inability of the Latin America economies to generate "quality" employment for those persons who want to work and can work (ILO, 2017b). For these reasons, it is essential to measure and consider the informal economy in the analysis of any country's labour market, especially in countries such as Colombia where the informality rate is comparatively high, at around 49.4% in 2016 (DANE, 2017a) (See section 2).

To conclude this subsection, the informal economy is a relevant phenomenon which affects different socio-economic outcomes, such as productivity, social protections etc. This high incidence of the informal economy in Latin American countries such as Colombia makes it an important factor to be considered in Colombian labour market analysis. However, this term might cover a variety of activities that can be measured in different but correlated ways. Despite some limitations, the Colombian literature suggests that a valid criterion to classify workers into informality is based on company size— which is the one adopted in the official Colombian labour market statistics and this paper.

Related to unemployment, the informal economy phenomenon might arise due to an extended number of factors: rigid wages, comparatively high non-wage costs, technological shocks, and discrimination (e.g. gender preferences), are examples of such factors, and a vast body of theoretical frameworks have been developed to analyse the role of these elements. One of these theoretical frameworks stresses the importance of skills on the labour market outcomes such as unemployment and informal economy. Individuals possess different labour characteristics that make them more or less productive for specific jobs (Albrecht et al. 2007), so while companies hire labour with different attributes to perform different tasks and produce their products, the misallocation between the skills possessed by workers and the skills demanded by employers might influence unemployment and informality rates.

This framework might be appropriated in a context such as Colombia where there is a comparatively high portion of companies complaining about the skills possessed by the labour supply, and at the same time there is a high proportion of workers desiring formal jobs (section

2 provides a detailed discussion of the Colombian context). Thus, worker skills are important for an economy (the following subsection defines this concept in more detail).

1.2.4 Skills

Skills are a relevant factor that have strong implications for employment outcomes such as productivity, wages, job satisfaction, turnover rates, unemployment, informal economy, etc. (Acemoglu, and Autor, 2011; Kankaraš et al. 2016). However, the skills concept can be understood and interpreted from different perspectives: social constructionist, positivist, and ethnomethodological, among others (Attewell, 1990; Green, 2011; Warhurst et al. 2017). Additionally, there are multiple skill typologies (e.g. workers' skills and skills as attributes of jobs). Thus, this section discusses the skill definition adopted in this paper to analyse labour demand based on online job portal information.

1.2.4.1 Defining skills

Each school of thinking emphasises the importance of different elements that should be considered by the concept of "skill". Within the social constructionist school, for instance, skills are a complex construction of job tasks, labour supply and demand, and certain social conditions (Vallas, 1990). Consequently, skills are defined by the tasks associated with each job, together with the capacity to restrict a number of people into a profession or career. The more time it takes to train for a profession, the dedicated effort involved creates a perception that the job requires higher skills (Attewell, 1990). Therefore, as Gambin et al. (2016) pointed out, from a social constructionist perspective social "norms" and task complexity determine what a valued skill means. This approach is part of an ongoing, subjective and extended debate in which it is difficult to delimit what social processes might affect the construction of skill in a particular society. Consequently, the social constructionist school often finds it challenging to generalise and compare skills between different societies or groups (Green, 2011).

The ethnomethodological and positivist approaches emphasises other aspects. On the one hand, the former points out that any human activity is complex and the required skills to carry out those activities are multifaceted. When a task is easy to carry out it is considered "unskilled". Consequently, what the observer takes for granted (easy to carry out) will determine the skill complexity of a certain task and, thus, generalisations of about skills are difficult to make with an

ethnomethodological method. On the other hand, positivism states that skills are objective attributes of individuals or jobs which are independent of the observer. This view focuses on obtaining uniform skill measures to provide the most precise skills indicator for positivist-based research (Attewell, 1990).

Even though there are different ways to approach how to define "skills", most perspectives agree that the concept of skills is strongly related to the task complexity required to carry out a particular job. In concordance with Green (2011, p.11): "all skills are social qualities, yet are rooted in real, objective, processes not in perceptions". Thus, this paper interprets skills as attributes of people or jobs which are required to perform certain tasks in the labour market. Consequently, in this document, skill refers to any measurable quality that makes a worker more productive in his/her job, which can be improved through training and development (Green, 2011). Simply put, according to Gambin et al. (2016) a skill refers to "the ability to carry out the task that comprises a particular job".

This perspective might be particularly helpful to ease the operationalization of skills into quantitative measurements (to provide easily measured variables), and to enable policymakers and researchers to obtain precise quantitative results to produce straightforward public policy recommendations (Attewell, 1990)—which is also one of the main objectives of this paper. However, this positivist viewpoint has some limitations; for instance, to measure a skill with a variable such as years of education could be considered reductionist. As will be discussed in the next subsection, variables such as education might fail to properly measure skill acquisition and job performance (Attewell, 1990). Consequently, the challenge of this positivist school of thought, and, hence, in this paper, is to find a set of indicators sufficiently reliable and valid that measure individuals' skills and skills mismatches—be it imperfectly.

Despite the limitations which are present in all schools of thinking, a positivist perspective (frequently presented in economic studies) is adopted in this paper in order to provide imperfect but sufficiently reliable and valid indicators for public policy recommendations regarding skills within vacancy data on online job portals. This definition of "skills" still encompasses many elements such as qualifications, competences, education, and aptitudes, among others (Green, 2011), which can be measured by different indicators depending on the typology used and the tools available to measure those qualities (skills). The economic literature has used a variety of

proxies to measure the different dimension of skills in the labour market, some of which are limited because while some typologies overlap others do not make a clear separation between skill categories (as will be explained in more detail in the next subsection).

Given the multiple skill typologies used even within the same economic discipline, it is necessary to discuss which are the most appropriate for this paper. The different typologies can be organised into two groups: those focused on the worker's skills and those which use a task-based approach.

1.2.4.2 Workers' skills

At an early stage, human capital theory stated that the necessary skills for working could be obtained with education (Becker, 1962; Mincer, 1958). In consequence, educational attainment is seen as a way to define skills. The educated worker is considered highly skilled and, thus, more productive if he/she accumulates more years of education and experience. Accordingly, increased human capital through education (the main source of scientific knowledge) is thought to increase employees' productivity in a range of tasks (Attewell, 1990; Becker, 1962).

Consequently, the accumulation of skills (in terms of knowledge) rather the use of skills towards particular jobs has been the focus of analysis for academics and policymakers. For example, Becker (1994) has pointed out that schooling fosters higher workforce productivity and has a positive impact on wages. Likewise, Psacharopoulos (1985; 2006) has shown the nonmarket benefits of schooling, such as lower crime rates, social cohesion among others, in advanced[5], intermediate[6], Latin American[7], Asian[8] and African[9] countries. The important point to take away from this research on schooling is that it is supposed to determine the results in the labour market, and other aspects of life outcomes.

However, the economic literature has found that education attainment only explains a relatively small fraction of the variance of life accomplishments between individuals. Indeed, Kautz et al. (2014, p.9) points out that adolescent (knowledge) test scores, in a best-case scenario, explain

[5] Australia, Canada, France, Germany, Japan, Sweden, the United Kingdom and the United States

[6] Cyprus, Greece, Iran and Portugal.

[7] Brazil, Chile, Colombia, Costa Rica, El Salvador, Guatemala, Mexico and Venezuela.

[8] Hong Kong, Malaysia, Pakistan, Singapore, South Korea, South Vietnam, Sri Lanka, Taiwan and Thailand

[9] Ethiopia, Kenya, Morocco and Tanzania.

just 17% of an individual's earning variability in later-life. Additionally, to measure skills by observing educational levels has several limitations.

Firstly, education attainment might be a weak indicator to measure knowledge levels. Education (or qualification) is acquired before people participate in the labour market; however, those qualifications might not be appropriate or might depreciate over time, compared to other skills learnt in the workplace[10].

Secondly, Becker (1994) recognises educational measures ignore some sources of learning, and Cunha and Heckman (2007) suggest that skill formation/acquisition occurs through a variety of processes and situations. For instance, skills can be acquired outside of schools, through on-the-job training (such as apprenticeships, coaching, etc.) and/or off-the-job training (such as lectures, simulations, etc.). Extended literature in labour economics shows the effects of job training on different outcomes. Bassanini et al. (2007, p.128) completed an exhaustive review of data resources (Continuing vocational training survey—CVTS, the International Adult Literacy Survey—IALS, among other data) for on-the-job training in Europe. The authors found evidence that on-the-job training has a positive correlation with private returns for employees and employers[11]. Likewise, Asplund (2004), Barrett et al. (1999) and Blundell et al. (1999), among others, extensively reviewed the different effects of off-the-job training on social and private outcomes. Most of the studies reviewed found a positive impact on social and private returns[12]. Hence, on-the-job and off-the-job training are relevant sources of knowledge for workers and employers which are not measured by education variables.

Thirdly, education variables do not take into account other skills generated via learning-by-doing in the production process. People continue to learn new skills and reinforce them through

[10] For instance, with the emergence of modern devices (e.g. computers) have been introduced in the labour market, along with new technologies to perform different jobs (such as programming, social media manager, and so forth), which, in general, were not taught by the educational system years ago. Thus, for some jobs, to be up-to-date and to be able to use these new technologies can be considered more valuable for the labour market compared to previous years spent in education.

[11] For instance, short on-the-job training increased hourly earnings by approximately 2% in Denmark and the UK, while in countries such as Portugal this increase was around 10% (Bassanini et al. 2007, p.128).

[12] Even if there are studies such as Black and Lynch's (1995) that found off-the-job training might have greater impacts on productivity than on-the-job training in US manufacturing industries.

repetition (Dehnbostel, 2002; Rutherford, 1992). From a theoretical perspective, Arrow (1962) demonstrates that technological charge (which is a key aspect for economic growth) can be endogenously determined via learning-by-doing processes. Different empirical studies show that these learning processes increases a firm's productivity. For instance, Bahk and Gort (1993) observe that in 15 industries in the US, leaning-by-doing generates skills (knowledge) and reduces the production costs of incumbent, established organisations. Similarly, Dasgupta and Stiglitz (1988) highlight that learning-by-doing implies economies of scale in the production of products, which increase a firm's productivity.

Finally, employers not only require cognitive and academic skills (qualifications) they also consider personal characteristics as important elements to perform a job. As Green (2011) and Grugulis et al. (2004) note, companies have labelled behavioural characteristics (e.g. reliability, responsibility, leadership, motivation, politeness, and compromise, among others.) as skills needed in the production process. It is not just the knowledge learnt through formal education, job training or learning-by-doing that produces more skilled workers, in addition personal characteristics, such as traits, attitudes and attitudes towards work, are also considered as skills (Grugulis et al. 2004; Kautz et al. 2014). Recent evidence in the economic literature shows that personal characteristics have direct implications for the labour market. For instance, Brunello and Schlotter (2011) and Lindqvist and Vestman (2011) note that wages tend to be higher for workers with higher non-cognitive skills, while people with low non-cognitive skills are significantly more likely to become unemployed. In contrast, when Cunningham and Villaseñor (2016) reviewed 27 studies about the skills-demand profiles of employers in developed and developing economies, they found a greater demand for socio-emotional[13] and higher-order

[13] Socio-emotional skills are behaviours, attitudes and traits that are considered necessary complements to cognitive skills in the production process.

cognitive skills[14] than for basic cognitive[15] or technical skills[16]. This evidence is remarkably consistent across the world regarding which skills are demanded by employers.

Due to the importance of workers' behavioural characteristics and to analyse these skills, broader typologies have been recently adapted to measure more of these skill dimensions. For instance, Green (2011) notes that contemporary approaches favour the categorisation of cognitive[17], physical and interactive skills[18] [19].

Other useful typologies for considering workers skills include "basic", "generic" or "specific" skills. The adoption of one or another of these typologies depends on the focus of each research study. Nonetheless, some typologies are not well defined or are inconsistent and should be avoided. This is the case for typologies such as "core" and "non-core" or "hard" and "soft" skills. The concept of "soft" skills might refer to work attitudes and social interaction (e.g. communication). This terminology leaves the wrong impression that "soft" characteristics are easier to learn, or less critical than "hard" skills. However, these terms are misleading because "hard" skills might be no more challenging to generate than "soft" skills, and, indeed, the inverse is also true and "soft" skills might have an important effect on different outcomes, compared to other cognitive or detailed technical skills (Cunningham and Villaseñor, 2016). Thus, these kind of typologies are not sufficiently precise and should not be considered for social analysis (Green, 2011).

However, even well-defined measures of workers' skills have limitations and these dimensions are not always easy to measure given their subjective nature. The categorisation of skill groups depends on a researcher's criteria and is constantly under debate. The important issue that can

[14] Higher-order cognitive skills comprise the capacity to deal with complex information processing. These tasks include such as critical thinking, application of knowledge, analysis, problem-solving, evaluation, oral and written communication, and adaptive learning.

[15] Basic cognitive skills comprise fundamental academic knowledge and comprehension, including literacy and mathematics.

[16] Technical skills are defined as the specific knowledge required to carry out an occupation.

[17] Cognitive refers to areas where thinking activities such as reading, numeracy and IT, among others, are required

[18] Physical skills are task-related, referring to dexterity and strength; and interactive skills comprise all forms of communication, including emotional and aesthetic behaviour.

[19] For a more detail description of other typologies used to categorize the behavioural characteristics of workers see Green (2011).

be taken from this debate is to select typologies that do not lead to the misinterpretation of a study's results.

1.2.4.3 Skills as attributes of jobs

Alternatively, to the above workers' skills approach, other typologies focus on the attributes of jobs rather than the attributes of a person to measure job complexity. More complex activities require greater skills (Attewell, 1990; Green, 2011), such task-based typologies have become widely used in the labour market economic literature because these typologies provide a framework to describe processes and changes of job tasks, such as job polarization[20] and the effect of implemented new technologies in the occupational structure (Acemoglu and Autor, 2011; Autor and Dorn, 2012).

Occupation classifications appear to be the most common task-approach used in the economic literature. According to the ILO (2012b, p.59), an occupation can be defined as a "set of jobs whose main task and duties are characterised by a high degree of similarity". Occupational groups or titles are constructed by a group of experts who survey different workplaces and observe workers doing their jobs. For instance, the ILO consult different workers' and employers' organisations, specialised agencies and stakeholders to keep the International Standard Classification of Occupations (ISCO) updated (ILO, 2012b)[21].

Nevertheless, this occupation approach has limitations. Within occupations, skill levels or the kinds of skills being utilised can differ depending on the sector, the company size or by country (Dickerson et al. 2012). Moreover, occupation classifications are not updated as fast as labour market changes. For instance, the ISCO has been updated approximately every ten years; yet, among these processes and periods many changes in terms of skills can occur. So, prevailing occupation classifications can be found to be obsolete when analysing actual labour market skills.

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[20] Job polarization consists of a decline in the employment share of middle-skilled cognitive and manual jobs characterized by routine tasks.

[21] While different occupational classifications exist, like the SOC (Standard Occupational Classification) in the US, every system of classification agrees with the ILO's basic definition of an occupation. The main differences emerge in the grouping of each occupational category.

Another limitation worth considering, is that most occupation classifications do not take into account personal features, such as attitudes, traits and values. Occupation classifications describe the hierarchical structure of occupations and the tasks required within each one, thereby ignoring the personal characteristics of workers. An exception can be seen in the O*NET system in the US, which contains information on hundreds of standardised and occupation-specific descriptors. It describes occupations in terms of the knowledge, skills, and abilities required by workers, as well as how the work is performed in relation to tasks, work activities, and other descriptors (onetcenter.org, 2016).

Given the above labour market concepts such as supply, demand, unemployment, informal economy, and skills, among others, the literature has provided a theoretical framework with which to understand the labour market dynamics of interest for this paper. The following two sections present the main theoretical model for this study to explain why skill mismatches might arise, their relevance, and the consequences of this phenomenon on labour market outcomes such as unemployment and informality.

1.3 How the labour market works under perfect competition

This section describes a labour market and its main outcomes, such as unemployment, wages, etc., under the assumption of perfect competition. At an early stage, to analyse the matching problem between the demand for skills and the supply of skills, scholars in the field of economics have developed a basic theoretical framework based on the assumptions of perfect competition (Cahuc et al. 2014). A framework which outlines that employers are faced by a certain need for labour services (a derived demand, based upon the demand for their product) and these employers create job offers with certain requirements (skills), and that existing employees and new applicants with those characteristics accept the job when the wage offered is more than their reservation wage[22].

[22] Capelli (2015) points out that another theoretical framework exists to understand the relationship between labour supply and employer demand. Employers can select general skills at entry-level positions, and train their employees over a working lifetime to develop specific skill needs for the company. However, the same author notes that this approach has become less plausible in recent years because employers tend to hire applicants who already have the specific skills they require.

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