

Formal and Informal Employment in Pakistan: An Empirical Investigation

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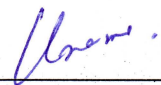
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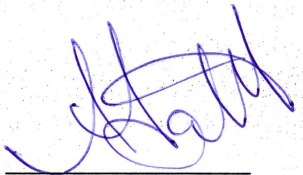
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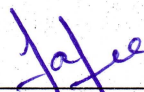
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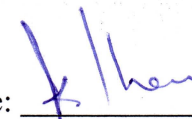
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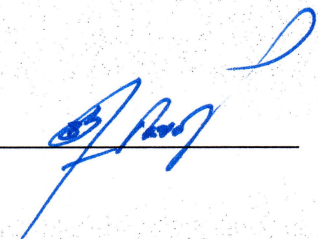
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Abstract

The three essays of this dissertation discuss the substantial phenomenon of formal and informal employment in Pakistan.

The first essay elaborates on the participation determinants of workers in the formal and informal sectors of the labor market. The motivational factors of workers in selecting a sector are observed at the individual and household level. A theoretical model that presents worker behavior in sector participation is followed. An aggregate time-series dataset is used for the period 1984–2015. The autoregressive distributed lag (ARDL) model is applied for estimating the analysis. The results propose that workers with a high level of motivational factors will enter the formal sector, while workers possessing low levels of motivational factors will engage in the informal sector. In the case of households, the results suggest that spouses with low motivational factors will work in the informal sector when the head of the household works in the formal sector. The concluding remark is that motivational factors play a role in sector selection for workers in the labor market of Pakistan. Policies are recommended to resolve these factors that force workers to contribute to the informal sector.

The second essay scrutinizes the influence of core labor standards on informal and formal employment levels in the Pakistani economy. A core labor standards index for Pakistan is constructed using principal component analysis (PCA) to check the strength of labor standards enforcement in the economy. The time period for the aggregate time-series dataset is taken from 1982–2017. The ARDL co-integration model is used to estimate the long-run relationship between core labor standards and both types of employment. The results show that the relationship between core labor standards and informal employment is negative, which illustrates the reduction in informal employment under the effective enforcement of labor standards. Formal employment presents a positive relationship with core labor standards, which elaborates the existence of labor standards in the formal sector. The conclusion of this analysis is that the effective enforcement of core labor standards supports the economy in moving from informality to formality. The recommended policies help to enhance the strength and implementation of labor standards in the economy.

The third essay elaborates on the influence of core labor standards on the economic growth of Pakistan in the presence of informal sector employment. For this purpose, the human capital augmented Solow growth model proposed by Mankiw et al. (1992) is extended by adding core labor standards and informal employment. An aggregate time-series dataset is used for the time period 1999–2017. To resolve the endogeneity problem, the non-linear two stage least square instrumental variable (NLTSLS-IV) approach is applied to estimate the growth model. The estimated outcome shows a positive relationship between core labor standards and economic growth. The relationship between the growth rate of both formal and informal employment is positive with economic growth. The conclusion is that the enforcement of core labor standards increases economic productivity by protecting worker rights and will ultimately enhance economic growth. Policymakers should consider the phenomenon of labor standards enforcement in economic growth policies.

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First and foremost, I would like to thank ALLAH Almighty for providing me the strength and energy to complete this thesis. I bow in front of him in gratitude for all His blessings. I pay my heartiest tributes to the Holy Prophet Muhammad (Peace Be Upon Him) - an ideal personality to follow.

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Afshan Muneer

Dedication

I dedicate this thesis to my beloved parents

Muhammad Munir and **Razia Munir**

and my son

Muhammad Asharim Ahsan

May ALLAH bless them (Amin).

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Introduction to the Dissertation

Over previous generations, speedy population growth and slow economic growth have created burgeoning urban slums and large labor surpluses in the labor market (Pisani and Patrick, 2002). Young workers tend to be engaged in uncontrolled, untaxed, and illegal sectors instead of acquiring employment in the formal sector. Under the labor market segmentation hypothesis, this is usually construed as evidence that developing nations have segmented labor markets because the barriers to entry hinder certain groups from participating in the formal sector (Amaral and Quintin, 2006). The formal sector encompasses legally organized and registered firm activities,¹ whereas the informal sector possesses a dynamic entrepreneurial character (Funkhouser, 1996). The barriers to the formal sector are related to the human and social capital capability of workers and affect their labor earnings. Labor earnings reflect workers' living standards (Spring, 2009).

Informal sector employment is related to the labor market and influenced by various economic factors. The first factor is the decreasing share of the non-agriculture labor force in the economy, but the absolute number of employed persons increases in respective sectors (Hemmer and Mannel, 1989). The second factor is that economic shocks have permitted the significant extension of informal employment—reducing recession by creating informal jobs and allowing the informal sector to flourish. The third factor is the low level of employment in the formal sector under a low economic growth rate, which causes workers to turn to available informal opportunities for survival. The fourth factor is the labor force with a low level of human capital due to weaknesses in the economic welfare system—unskilled labor joins the informal sector (Fields, 1990). The fifth factor is migration from rural to urban areas due to the existence of industrialized units in urban areas that provide informal jobs. The sixth factor is that informal sector firms are associated with formal firms through distributional networks and subcontracting. In this way, informal firms survive in the sector and produce informal employment (Antunes and Cavalcanti, 2007).

¹ The distinction between the formal and informal sector is not always clear. Governments sometimes facilitate the informal sector through services, allowing small firms to flourish because they absorb the labor force better (Rauch, 1991).

As a market-based reform, the existence of the informal sector raises flexibility and labor market efficiency. However, it is related to the evasion of mandated protections for workers through subcontracting, and requires a transformation in the labor force composition. This behavior has linked the informal sector with core labor standards under global institutional laws. Certain labor standards have integrated with national and international laws for several decades. The labor forces of developing countries remain unprotected in comparison with the workforces of industrialized countries (Maloney, 1999).

Core labor standards signatories endorse these rights and execute general obligations to enjoy such rights and the prevention of non-state abuses. In the past, these labor rights were recognized only in developed countries and affected both formal and informal employment. Formal employment contraction in the sector is compensated by the slightly absorbed informal employment, but causes a surge in open unemployment levels (Galli and Kucera, 2004). Minimal labor standards are necessary to facilitate competent operations and endorse fair competition in the labor market (Krueger, 1996).

These labor standards exist as a determinant of economic growth in the existing literature. They have stemmed from the profound procedure of production reorganization, alterations in firm structure, technological innovation, and employment conditions (Benería, 2001). Developing countries grow under the circumstances of lower labor standards as compared to developed countries (Bazillier, 2008). Labor standards are restrained in their impact beyond their range of control and influence over the economy. The economy should manage mounting responses in the form of the informal sector to obtain the benefit of growth opportunities. The informal sector affects growth by escaping from taxes and using public infrastructure without supporting its maintenance. The better idea is requiring the establishment of better-quality regulations in a transparent and even-handed manner to tackle these informal activities (Loayza et al., 2005).

On the other side, the industrialization mechanisms in several developing countries have frequently driven significant growth responses. These bring forth the realization that the informal sector has the capability to provide employment as well as services and vital goods for a major portion of the population without government support (Hemmer and Mannel, 1989). The income received by workers in informal employment is very low in most parts of the developing world. Informal sector employment falls external to the government supervision sphere of the labor

market. These informal activities and production are hidden from gross domestic product (GDP) calculations and affect the economic growth rate, while developing countries grow with rising growth rates in the existence of expanded informal sectors in contrast to previous views (Heintz and Pollin, 2003). However, policymakers assign importance to informal sector employment when establishing welfare policies. Interaction between the formal and informal sectors is required to explain the interdependence of both sectors in the case of labor standards and economic growth. The insufficient consideration of these features while designing growth schemes may cause the loss of the dynamic qualities of the informal sector and the foundation of economic potential.

This dissertation aims to address the issues of formal and informal employment in the labor market. It consists of three essays to explain vital phenomena related to formal and informal sector employment in Pakistan. The first essay deals with the determinants of worker decisions to participate in Pakistan's informal sector. It analyzes the motivational factors that affect workers' decisions at the individual and household levels. In the existing literature, this type of analysis is missing in the context of Pakistan. Workers choose their sector (formal or informal) based on their own abilities and preferences. For this purpose, a two-section theoretical framework is explained by following Galiani and Weinschelbaum (2012) and De Paula and Scheinkman (2011). In the first section, the model expresses entrepreneur and worker decisional behavior at the individual level. The model shows the decisional behavior of informal workers on the base of formal workers.

The second section's analysis is carried out at the household level by incorporating the decision-making behavior of both the heads of households and their spouses. When the heads of households are employed in the formal sector, their spouses' decision to select a sector for work matters for the employment level of any sector. Spouses can participate in the formal or informal sector based on their human and financial capital. An aggregate time-series dataset is used for empirical estimation. The autoregressive distributed lag (ARDL) model is applied for estimating the analysis. The result proposes that individuals with a low level of motivational factors will enter the informal sector, while individuals possessing a high level of motivational factors will engage in the formal sector. In the case of households, the estimates suggest that spouses with low motivational factors will work in the informal sector when the head of the household works

in the formal sector. . The conclusion of this analysis is that motivational factors perform a sufficient role in sector selection for workers in the labor market of Pakistan. The recommended policies resolve these factors that force workers to participate to the informal sector.

The second essay highlights the role of the core labor standards index (CLSI) in informal and formal employment in Pakistan's labor market. The methodological part represents the core labor standards as explained in the International Labour Organization (ILO) Declaration on Fundamental Principles and the Right at Work (1998), and describes the labor standards index. The structure of the CLSI is also depicted in the methodological section. The index is an aggregation of a further five indexes and includes freedom of association and collective bargaining, the ILO's convention ratifications, gender discrimination related to employment, child labor, and forced labor. In the analysis, this index is constructed for Pakistan using principal component analysis (PCA)—it elaborates on the strength of labor standards enforcement in the economy. The effect of this index is empirically analyzed on both types of employment in the labor market. This type of study is the first attempt with reference to Pakistan in the literature. The empirical estimates elaborate on the opposing effect of core labor standards on both types of employment in the labor market. The results show that the relationship between core labor standards and informal employment is negative, which demonstrates the reduction in informal employment under the effective execution of labor standards. Formal employment presents a positive relationship with core labor standards, which explains the existence of labor standards in the formal sector. The concluding remark is that the effective execution of core labor standards supports the economy in transforming from informality to formality. The policies are recommended to help to increase the strength and implementation of labor standards in the economy.

The third essay explains the growth rate response of Pakistan's economy by enforcing core labor standards on informal sector employment. The study mainly evaluates the long-term effect of the better establishment of labor standards on the steady-state level of the economy. For this purpose, a theoretical model was established by adding core labor standards and informal labor to the human capital augmented Solow growth model followed by Mankiw et al. (1992).² This model creates a relationship between core labor standards, informal sector employment, and

² All of the studies in this section are available in the references section of essay 1.

economic growth. The specification of the empirical model evolves on the basis of a growth model and is estimated using an aggregate time-series dataset. To resolve the endogeneity problem, the non-linear, two-stage least square instrumental variable (NLSLS-IV) approach was applied to estimate the growth model. The empirical estimates illustrate the positive effect of enforcing core labor standards on economic growth in the presence of both formal and informal labor for the Pakistan case, and endorse the indication of the theoretical model. The conclusion of the analysis is that the execution of core labor standards increases economic productivity by protecting worker rights and eventually enhances economic growth. The growth policies should consider the phenomenon of labor standards enforcement in the economy. The implication and enforcement of labor standards proves to be a stimulus for economic growth under these circumstances.

1. Modeling the Motivating Factors of Informal Sector Formally: Individual and Household Analysis

1.1 Introduction

In the last few decades, there has been a vigorous and intense economic and academic debate on the role of the informal sector in countries, focused on the provocative issue of whether it is a necessity or choice (Loayza and Rigolini, 2011). The informal sector exhibits a considerable proportion of production activities in many countries (Mattos and Ogura, 2009). The informal sector glimpse as a building ground for workers waiting to enter the formal sector was endorsed by the International Labour Office (1973). The report presented the informal sector as a beginning point of employment in its own rules and at the level of economic planning. Most of the countries in the world, including the US and in Latin America, estimate approximately 10–50 percent informal sector in their economies, and it rises over time (Schneider and Enste, 2000). The informal sector size in Organisation for Economic Co-operation and Development (OECD) and transition countries has also expanded (Schneider, 2002). The substantial concern related to this issue is that what are the motivations behind the expansion of the informal sector? The economists linked to this area have not yielded precise judgments (Maloney, 2004).

The literature does not have a specific definition of the informal sector, but identifies numerous characteristics of informal economic activities (Eilat and Zinnes, 2000).³ The informal sector does not have an autonomous boundary, but has connections with the formal sector in different facets. A pioneering study by De Soto (1989) shows how workers in the informal sector develop their own laws and regulations to make up for the inadequacies of the formal sector. It is true that the size of the informal sector is influenced by many determinants. Workers have non-pecuniary preferences for the sectors in which they work, and these preferences play a role in evolving the level of formality and informality in an economy.

The previous supposition is that homogeneity exists in the informal sector. However, some studies evaluate the heterogeneous theory of the informal sector (Gunther and Launov, 2012). In

³ Informal sector activities are characterized by: (a) evading taxes; (b) escaping from regulatory requirements; (c) failing to crop up in statistical recording mechanisms; (d) neglecting currency requirements; and € being, per se, illegal and unauthorized.

this way, two conflicting theories prevail about informal sector employment. The segmentation hypothesis identifies informal employment as a scheme of the last resort to escape from unemployment, while the comparative advantage hypothesis states that informal employment is an intentional choice of workers depending on their utility maximization level (Gindling, 1991; Heckman and Hotz, 1986; Rosenzweig, 1988; Dickens and Lang, 1985; Magnac, 1991; Pratap and Quintin, 2006). However, the appearance of informal sector activities depends on the firms' and entrepreneurs' heterogeneity as a determinant feature in the recent literature (Amaral and Quintin, 2006; Gang and Gangopadhyay, 1990; Dessy and Pallage, 2003; Fortin et al., 1997; Rauch, 1991; Straub, 2005; Antunes and Cavalcanti, 2007).

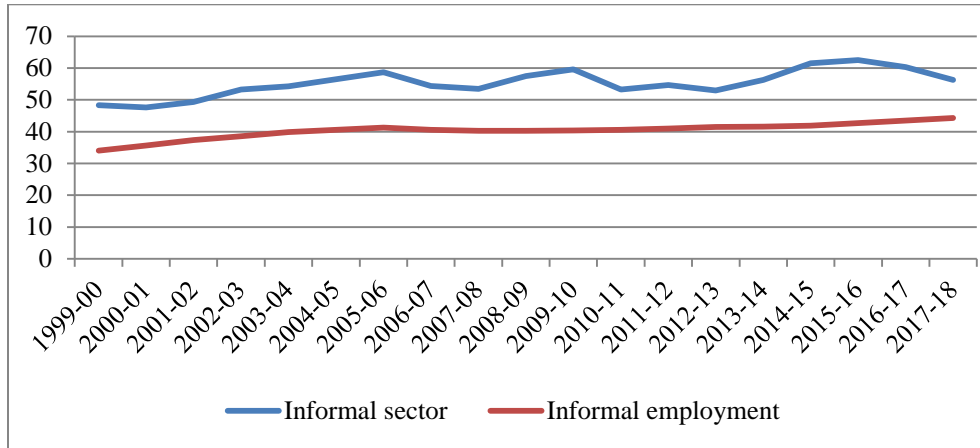
Small, informal firms are recognized as a key source of informal employment in third world countries (Mead and Liedholm, 1998). Many explanations have been presented to account for the increasing level of informal sector employment (Galli and Kucera, 2004). Most economies attempt to control these formal and informal activities through various structural measures (Porta and Shleifer, 2008). In addition, formal and informal sector employment discriminates between skilled and unskilled workers (Mattos and Ogura, 2009). Bates (1990) identifies financial capital as a factor that helps workers choose between the formal or informal sector. Gunther and Launov (2012) highlight the informal sector as an employment opportunity for people who do not find work in the formal sector. However, the informal sector is often a sensible choice grounded on the degree of attractiveness of the formal versus informal sector (Maloney, 2004; De Mel et al., 2011).

In other words, informal employment becomes a desirable choice for workers in most developing countries because the protections provided by the formal sector are inefficient and ineffective (Maloney, 1999; Funkhouser, 1996; Marcoullier et al., 1997; Saavedra and Chong, 1999). The earnings and occupational choices of workers at the household level replicate the different types of inherited characteristics and investment in human capital. The presence of workers in the informal sector represents their lower educational levels. In all likelihood, the human capital level of workers is responsible for their selection of the formal or informal sector (Carneiro and Henley, 2001).

In the Pakistani context, the existing literature contains various studies in which the size and features of the informal sector are described (Schneider and Klinglmair, 2004; Hussain and

Ahmad, 2006; Arby et al., 2010; Guisinger and Irfan, 1980). The size of Pakistan’s informal sector was 48 percent in 1999, which increased to 56 percent in 2017 (Khuong et al., 2020). In a later study, the percentage distribution of informal sector employment was estimated (Tahir and Tahir, 2012). According to the Labor Force Survey (LFS), the rate of informal employment in Pakistan’s economy was 33 percent in 1999, which increased to 44 percent in 2017 (Figure 1).

Figure 1: The informal sector and informal employment in Pakistan



This study investigates the labor force decision to choose the formal or informal sector of the labor market based on motivational factors, including managerial ability, managerial skill, and financial capital, at the individual level in Pakistan. In addition, the analysis is conducted at the household level by incorporating secondary workers in the labor market. The primary and secondary workers of households decide to participate in the formal or informal sector based on the motivational factors that comprise human capital and financial capital.⁴ This study evaluates the decision of secondary workers when the primary worker works in the formal sector. A theoretical model is followed—it develops a link between the formal and informal sectors at the individual and household levels. The behavior of informal sector employment is displayed on the basis of formal sector employment in the model. An empirical analysis is carried out at the individual and household levels.

The remainder of this essay is constructed as follows: section 2 is a literature review of existing studies. Section 3 illustrates the theoretical model. Section 4 elaborates on the empirical

⁴ Due to the unavailability of data on secondary workers, skill factors for the household level are excluded from the analysis.

methodology comprising data description and empirical model specification for both the individual and household analyses. In addition, the estimation technique is presented in this section. Empirical estimates are shown in section 5. Section 6 concludes the analysis, and policy implications are detailed in section 7. The references are shown at the end of the essay.

1.1.1 Objectives

This study examines the decisional behavior of workers based on their motivational factors to choose the formal or informal sector of the labor market at the individual and household level in Pakistan. The specific objectives are as follows:

1. To evaluate the individual decision based on motivational factors to choose firms that operate in the formal or informal sector of Pakistan.
2. To explore the participation decision of secondary members of the household in the formal or informal sector of the labor market of Pakistan based on motivational factors when the primary worker works in the formal sector.

1.1.2 Study significance

The informal sector encompasses all economic actions that are illegal and not recorded in national accounts in against to formal sector (Chen, 2012). This causes the segmented labor market because of unavailability of job in the formal sector. The workers are forced to work in the informal sector by accepting lower wages (Lewis, 1954). On one side, it comprises small, informal firms active in the sector while the informal worker, who is motivated to participate in different activities, is on the other side. These workers are associated with households that consist of primary and secondary workers who provide labor to the labor market (Galiani and Weinschelbaum, 2007; 2012). These workers are prompted to work in the informal sector based on their motivating factors. But the consensus opinion about the motivating factors of informal sector has not yielded from past three decades of research (Maloney, 2004).

In this scenario, the size of the informal sector is influenced by many factors contrasting to the formal sector (De Soto, 1989). Based on these factors, the individual has a preference for the sector in which they work. Descriptive reports related to informal sector firms and the basic characteristics of self-employed persons in the Pakistan context include age, household size, education level, skill acquisition, experience, and family background—these are available in

existing literature (Kemal and Mahmood, 1998a; 1998b). However, an empirical analysis to elaborate the effect of these factors on informal sector level is not presented. In addition, the causes of raising the level of informal activities are also determined in Pakistan's economy (Gulzar et al., 2010). But the primitive factors that motivate workers to participate are not declared in the study. In this respect, time-series analyses for describing factors are also missing from the literature.

However, information related to the motivational factors of workers joining the informal sector is not well identified. These factors are not arbitrated at the individual and household levels in developing countries. Thus, there is clearly a need to re-examine these motivational factors by emphasizing worker participation decisions at the individual level and by incorporating primary and secondary workers' decisions at the household level, which develop the formal and informal sector. For that purpose, this study will elaborate on the motivational factors of workers, which are the main cause of informal sector employment in the Pakistani economy.

1.2 Literature Review

The literature review depicts the motivational factors of workers in selecting sectors in which to work. The first part of the review describes the factors with which individuals deal to enter firms in the informal sector. Motivating factors of household members to work in the informal sector are demonstrated in the second part of the review.

1.2.1 The motivational factors of individual participating in Informal firms

The literature shows factors of individuals comprise of managerial ability, managerial skill and financial capital that force them to work in firms in the informal sector and raise the informality level in the economy. Kim and Song (2008) explore the determinants and size of informal economic activities in North Korea. In addition, they estimate the inner economic participation effect of labor supply in the formal economy and find that formal economic activities shrink by raising the rate of informal activities. Urdinola and Tanabe (2012) evaluate the key micro-determinants of informal employment in North Africa and the Middle East by focusing on the concept of human development. They quantify the labor informality arrangements of selected countries in the region according to gender, age, education level, profession, employment status,

marital status, geographic area, and employment sector. The main correlates of informality are the size of the public sector and agriculture sector in the region.

Managerial ability as a motivating factor of participation in informal sector exists in several studies. Rauch (1991) examines the theoretical characterization of size dualism between the formal and informal sectors by examining entrepreneur talent in the labor market. The theoretical model is established for formal and informal sector size dualism in which the choice of entrepreneurship is resolute endogenously between the formal and informal sectors. The individual with managerial talent at a certain level will take place within the average participation level of the formal and informal sectors. Arimah (2001) provides a quantitative analysis of the nature of the informal sector's linkage with the formal sector based on entrepreneurial characteristics, including entrepreneurial ability, in Nigeria. The setting of employees' quality in the informal sector plays an important role in forward and backward linkages with the formal sector. So, the entrepreneurial quality at an adequate level is the requirement of the informal sector for its linkages with the formal sector. Galiani and Weinschelbaum (2007) describe the stylized facts that characterize informality in Latin American countries. They develop a model of informality by considering the behavior of agents like formal and informal firms based on the decision factor of managerial ability. The dataset for the analysis consists of three rounds of surveys with pooled data from a 1974–76 survey, 1992 survey, and 1997–99 survey. The managerial ability determines size dualism at the firm level in the economic equilibrium. Individuals with low managerial ability work in the informal sector, and individuals with high managerial ability work in the formal sector. The low levels of managerial ability of individual cause increasing levels of informality in Latin America. Mel et al. (2011) describe entrepreneurial characteristics, including education and ability, in Sri Lanka. The data consists of three groups of workers—wage workers, own-account workers, and large firm owners (Sri Lankan Microenterprises Survey). They apply the relative risk aversion coefficient. They find that the majority of microenterprise owners have cognitive abilities as compared to large firm owners. The ability is an important and effective variable in differentiating between small manufacturing entrepreneurs and microenterprises owners. In this way, De Paula and Scheinkman (2011) examine the inferences of a simple equilibrium model of informality by considering entrepreneurs' managerial quality. In the model, the agents differ in their ability to manage the production process. The dataset comprises 48,000+ small firms in

Brazil, collected for one year such as in October 2003. The analysis explores the positive correlation between managerial ability and formality. The formal firms have highly talented entrepreneurs while informal firms are managed by less talented entrepreneurs. Jiménez et al. (2015) examine the significance of formal education on the rate of entrepreneurship. They elaborate on diverse education level impacts on the rate of formal and informal entrepreneurship. The tertiary and secondary education enhances formal entrepreneurship and reduces the rate of informal entrepreneurship. In addition, secondary education develops awareness about potential negative repercussions in the case of informal entrepreneurship. Moreover, the tertiary and secondary education encourages the creation level of formal firms in different countries. In this way, Rothenberg et al. (2016) scrutinize the competing theories related to sources of informality in developing countries and also demonstrate the scale and persistence of the informal sector in Indonesia. Their dataset consists of two nationally recognized surveys that conducted 48 interviews in every province for 2009, 2013, and 2014. Most of the informal firms in Indonesia are micro and small firms that are productive at a lower level and are operated by low education acquiring individuals. The consolidation of dual economies and rational exit theories illustrate the generating factor of informality in the economy.

Managerial skill is another motivating factor which help worker in selecting the sector to work. Dunn and Holtz-Eakin (2000) explore the effect of individuals' own wealth, parental wealth, experience, and human capital in transition from salaried employment to self-employment. The financial assets of young persons have a significant but modest impact on the transition as compared to parental wealth. In this analysis, skills and family-specific capital raise the probability of transition to self-employment. Then, Losby et al. (2002) indicate the significance of the informal economy in the US and speak of the socio-economic features of individuals, including gender, skill, immigrant status, level of income and education, industries and occupation, and regional differences, which are a few characteristics of labor force participation in informal economies. The study finds the informal economy to be an equal opportunity employer for unskilled workers. Lazear (2004) studies the pattern of human capital investment as a skill level for entrepreneurs and other workers. He finds that the entrepreneur has a more valid curriculum which enhances his skill level as compared to workers who work for others. The entrepreneur is proficient in a variety of skills that help them run businesses. Mattos and Ogura (2009) scrutinize the presence of skill differentiation between the Brazilian formal and informal

labor market. The theoretical model of skill differentiation is established for the analysis. Using self-employment data for 2003 and 2005, different types of estimation techniques, including propensity score, two-stage least square, treated method, and the Probit method are used. The outcomes show that formal firms have a larger proportion of employed workers with higher skills. The productivity level of formal firms is higher as compared to informal workers. The probability of formal operations increases by increasing the ratio of high-skill workers at the firm level.

Jackson (2012) illustrates the role of the informal economy in the provision of employment and skill development in sub-Saharan countries. The analysis suggests that the informal sector is appropriate for skill development and local communities. The informal sector, as a source of vocational training, accounts for a large number of skilled workers in sub-Saharan countries. Brookman and Thistle (2013) consider the explanatory power of managerial skill in formal firms. For this purpose, they used the manager-level data of 1,573 firms for the period 1993–2008. But this analysis ignores utility firms and financial firms. The managerial skill proves to be an essential determinant in managerial activities in accordance with labor market opportunities and firm size. An increase in managerial skill serves as transferable human capital in relation to firm-specific human capital in labor market actions. Nichter and Goldmark (2009) explore the firm and individual entrepreneur features related to the growth of small firms in developing countries. These features include managerial ability, work experience, and gender at the individual level, and age, formality, and access to finance at the firm level. The improvements in these features contribute to the development practices of small firms in developing countries.

In this discussion, financial capital takes as an essential motivating factor of participation in firms in informal sector. Honig (1998) explores the influence of financial capital on the performance of 215 micro-enterprises of the informal sector in Jamaica. The starting capital and loan amount provide benefits to both types of large and small enterprises in the analysis. So, the relationship between financial capital and entrepreneurship is necessary to comprehend dynamic organizational activities. Bosma et al. (2004) investigate the impact of financial capital in the form of capital investment on the performance of firms. They analyze that the performance of firms' founders is not only determined by talent but also by the level of financial capital. The business startup in the industry sector seems better for the firm's founder as compared to the

knowledge sector. In this way, specific financial investment improves the performance of entrepreneurs substantially. After that, Beck et al. (2008) examine the financing arrangements of small and large firms in 48 countries. The data was collected from a cross-sectional firm survey of 3,000 firms in developed and developing countries. The results suggest that small firms have less capacity to obtain external finance as compared to large firms. Most government sources and external finance provide benefits to large firms. The structural reforms are required to improve access to external finance for small firms. Small firms have fewer financial sources in developed and developing countries. Then, Farazi (2014) identifies the financing arrangements of informal firms and illustrates the distinction between formal and informal firms in terms of finance usage. This study also highlights the significant peculiarities of informal firms' link with higher financial assistance. The data was collected for more than 2,500 firms taken from 13 countries. Formal firms depend on internal funds less as compared to informal firms. Formal firms use bank financing and working capital as a source of finance. The firms' behavior related to operations and financing sources varied across countries.

Robb and Robinson (2014) examine the choices of capital structure that entrepreneurs take in the initial year of the operating process of Kauffman firms. The informal investors are imperative for firms that rely on external equity for their start-up capital. The proposed analysis elaborates that the success and formation of new firms is based on outside debt as a means of startup capital. The determination of capital structure is significant for startups and as a source of the continual growth of firms. Then, Lopez-Martin (2016) determines financial constraints for the size of the informal sector in four countries—the US, Mexico, Turkey, and Egypt. A theoretical framework is developed to elaborate firm dynamics with financial constraints and improve credit access for formal sector firms. The dataset comprises five thousands firms for each country and is taken for ten years. The probability of informality decreases with an increase in firm revenues. Whereas improvements in the credit access of formal firms increase productivity levels and decrease the size of the informal sector.

In this scenario, Kim et al. (2006) describe three types of resources for new business start-ups, including human, financial, and cultural capital, in the US. The cultural and financial capital are not necessary conditions for entry into entrepreneurship in the presence of human capital. The suggestion is that the entrepreneur's entry is not based on income and wealth, but that education

or human capital are the main sources for improving entrepreneurial effort. Then, Coleman (2007) explores the relationship between financial and human capital with the performance of small, men- and women-owned firms in the US retail and service sector. The findings describe that financial capital has a positive effect on both the profitability and growth of men-owned firms, whereas human capital has a positive impact on women-owned firms' profitability. There are both differences and similarities between the performance of small men- and women-owned firms in respect of financial capital and human capital.

1.2.2 The motivational factors of household for entrance in informal sector

Existing studies describe the participation decision of members of households to work in the informal sector based on various factors. Out of them, two of important motivating factors are discussed in this analysis. First one is the human capital which forces the household members to participate in any sector to work. Sanders and Nee (1996) examine the role of immigrant self-employment under the human capital resource and family composition. A theoretical model is constructed to show the relationship between household composition and human capital for self-employment. The dataset is taken for the period of thirty years. The study shows that the human capital resource is important for self-employment for operating new businesses because self-employed person uses human capital to attain business ownership.

Wamuthenya (2010) and Gerxhani and de Werfhorst (2011) scrutinizes the effect of human capital and other social, individual, and institutional factors on labor force participation in the informal economy. The negative relationship between informal labor participation and education levels is presented during the analysis. The education plays a role in determining broad civic attitudes more than the relation as a human capital factor. These findings offer an optimistic view of dealing with social inequality triggered by participating in the informal sector.

But, Galiani and Weinschelbaum (2012) examine the stylized facts of informality by elaborating on the role of the secondary worker in the labor market. A theoretical model is developed by integrating secondary workers based on the human capital level in the labor market. The study uses a sample size of 32,011 household observations. The findings of this analysis show that the secondary worker with a low level of human capital works in the informal sector. The increasing

participation level of secondary workers leads to raising informality in the economy. In this perspective, Dođrul (2012) considers the factors of formal employment and informal employment in the urban labor market of Turkey. The analysis is conducted using 2006 household budget survey data which comprises 7,085 observations. The persons with a higher level of education, such as tertiary education, work in the formal sector while people with a low level of education, such as primary education, work in the informal sector. The heterogeneous labor market exists, and the labor market is valued by the factors of labor supply.

However, Berniell (2017) explains the connection between investment in human capital and occupational choices in the informal sector. This relationship is elaborated upon by an economic model consisting of all these variables. The cross-country data is evaluated and discloses stylized facts about the relationship. The human capital investments increase the efficiency of managerial skill as well as labor. The cross-country evidence exhibits an increase in the informality level of the economy. The human capital investments in workers disincentive in the presence of higher informality levels in the economy, but some managers with high human capital grab incentives from the informal sector.

Another important motivating factor is financial capital for the household participation decision in any sector. In this regard, Funkhouser (1996) inspects employment patterns and earning structures in the formal and informal sectors of five countries in Central America, namely Guatemala, El Salvador, Honduras, Nicaragua, and Costa Rica. This study elaborates the competing views of employment in the informal sector using a cross-country comparison. Household survey data is used for different time spans and countries. The persons with the least education and low earnings exist in the informal sectors of the five countries. This low earning level is greater than the formal sector earning levels of most developed countries in the region. The level of informal sector earning is at least three-fifths in relation to the formal sector in these countries.

Diagne (1999) evaluates the demand of households for credit in the formal and informal market and explains a distinction between participation and access to credit in the markets of Malawi. The study carries out three rounds of 404 household surveys in five districts and 45 villages of Malawi during the period of ten years. The results show that fifty percent of the household sample can borrow from both markets, but formal and informal credits are not a perfect

substitute. The credit is used for both consumption and agricultural production and income-generating investment purposes. Then, Raijman (2001) explores the Mexican immigrant who faces various problems in starting a business, including financial resources and determining the potential of self-employment in society. The social ties play the main role in setting up a business. Financial and nonfinancial help put up businesses with modest resources. So, the resources of households in the form of financial investment affect the desire to do business because they provide capital for startups. Arosanyin et al. (2011) explore the important determinants of earning and employment generation in the informal transport sector of the Nigerian economy. The theoretical methodology of this analysis is based on an adequate Mincerian equation for household analysis. The dataset consists of 334 motorcycle operators in the transport sector. This analysis demonstrates that 21.7 percent of jobless people with a low level of education found employment in the informal transport sector. Yet, the employment level in the informal sector can improve by operating government regulations.

In this perspective of motivating factors, Bates (1995) describes the impact of financial capital constraints and education on self-employment entry in industrial groups. The data is taken from a survey of income and program participation, which is a longitudinal survey of households comprising a sample of 24,428 adults over a period of thirty two months. The findings shows that the entry of self-employed persons in skill services increases with the level of education, while the construction, manufacturing, and wholesale sectors clearly depend on financial capital. The self-employment constraint is binding for workers who have neither financial nor human capital. In another way, Kim (2002) describes the determinants of secondary employment in the informal Russian economy and the effect of participation in the informal economy based on job qualifications. The presence of secondary informal employment is positively related to a low level of human capital and higher wage compared to formal ones. The informal economy performs a negative role in two aspects: by increasing income inequality and by reducing the opportunity of human capital accumulation under informal jobs. Moreover, Pratap and Quintin (2006) observe the individual and job characteristics of employees in the formal and informal sectors of Argentina. The results suggest that formal workers have more human capital and higher wages. A model is discussed in which the managerial characteristics of formal and informal workers change systematically under perfectly competitive labor markets. The dataset is taken from the Argentinian Permanent Household Survey for two years. The formal workers are

inclined to be more educated and experienced, and earn more than informal workers. The informal sector emphasizes mostly on low-ability work because informal managers have access to fewer outside financing sources and identify low-ability labor as a suitable source for physical capital.

1.2.3 Conclusion

Early research elaborates upon the factors of informal sector participation in different perspectives at the individual and household levels. The studies reviewed show that managerial ability, managerial skill, and financial capital are essential factors of participation for individuals in the firms of the informal sector. Some studies consist of a theoretical model of the informal sector based on a single factor, and other studies based on empirical analysis. The datasets vary across the studies. However, the above-described factors, comprising human capital and financial capital, play an important role in the participation of relative households in the informal labor force. The review of these studies help in conducting the desired analysis at the individual and household level in the economy.

1.3 The Theoretical Framework

The theoretical framework is divided into two sections: the individual and the household. In the first section, an economic model is developed that describes the relationship of motivational factors for sector selection of workers at the individual level. In the second section, secondary workers are incorporated into the labor market to explore the motivational factors for sector selection at the household level by using an economic model.

Section 1: Individual

1.3.1 Model set-up

Following the work of Galiani and Weinschelbaum (2007) and De Paula and Scheinkman (2011), this section explains an economic model with two types of economic agents: a continuum of workers and a continuum of firms. These agents are parameterized by a scalar $\theta \geq 0$ that determines managerial ability as an agent's motivational factor. This study added two more motivational factors to the model—managerial skill and financial capital. Firms that symbolize as entrepreneurs are heterogeneous in these factors. They maximize profit by selecting whether to operate in the formal or informal sector and by acquiring labor. Workers are diverse

in their endowments of the above factors. They maximize utility by deciding whether to work in the formal or informal sector.⁵

1.3.2 Workers

Workers are available as L units of homogeneous labor in the labor market. There is a range of workers indexed by their labor endowment, and is elaborated with density function $g(L)$ with support in \mathbb{R}_+ . The substitutable labor units have acquired settled wages. Each worker decides whether to sell their labor to a formal or informal firm. The labor units of the worker cannot be split between different firms. In the formal firm, workers obtain ω_f per unit labor plus authorized social benefits, while in the informal firm, workers attain only ω_i per unit labor.

The utility level of the worker who decides to enter the formal sector for work can be described as follows:⁶

$$U_f(\omega_f L, PB) = \omega_f L + PB - \tau \quad (1)$$

Here, PB expresses non-pecuniary benefits. We assume that all family members of workers are covered by these benefits. Workers incur a fixed cost τ for executing work in the formal sector, e.g., tax deductions (De Soto, 1989). On the other side, workers in the informal sector cannot reap these benefits. The expected utility level of workers entering the informal sector can be expressed as follows:

$$U_i(\omega_i L, PB) = \omega_i L(1 - s) \quad (2)$$

Here, s displays the probability of capturing the worker who works informally and has the chance of losing their job. Workers with motivational factors having a low level of human capital, low level of skill, and low level of financial capital, cannot manage the fixed working cost of the formal sector ($\omega_f L - \tau \leq 0$ for some, $L > 0$). This constraint constitutes the lowest level of motivational factors which entail working in the formal sector such as:

⁵ Government, the third economic agent, is not included in the model. It collects payroll taxes, controls formal operations, and conducts arrangements to expose and penalize informal economic activities.

⁶ We assume that risk pooling behavior is used to abstract the linear utility function. This function is also allowed in the situation when more than one person per family works. Typically, this is a theoretical notion, and we cannot attempt to suggest that risk is not considered when households select the portfolio of a sector where its member work.

$$\hat{L} = \frac{\tau}{\omega_f}$$

The worker, having decision factor $L \geq \hat{L}$, can be employed in the formal sector.

When workers are employed in the formal sector, the utility function satisfies the condition that is attained by differentiating equations (1) and (2) with respect to L ,

$$\frac{dU_f(L)}{dL} > \frac{dU_i(L)}{dL} \quad \forall L \quad (3)$$

The equation shows that the change in the utility of formal workers is greater than the utility level of informal workers. The above condition holds only if

$$\frac{\omega_f}{\omega_i} > (1 - s) \quad (4)$$

Then, a unique cut-off point is obtained that describes the individual with a lower level of motivational factors working in the informal sector, while those with a higher level of motivational factors work in the formal sector. This cut-off point shows the level of L and maximum of \hat{L} that makes workers indifferent to working in the informal or formal sector. This level is denoted by \tilde{L} , which is defined by equating equations (1) and (2) as follows:

$$U_f(\omega_f \tilde{L}, PB) = U_i(\omega_i \tilde{L}, PB)$$

By putting the values,

$$\omega_f \tilde{L} + PB - \tau = \omega_i \tilde{L}(1 - s)$$

after solving the above expression, we get,

$$\tilde{L} = \left[\frac{\tau - PB}{\omega_f - \omega_i(1 - s)} \right]$$

The worker with level $L \geq \hat{L}$ is unconstrained in selecting the informal or formal sector. Only the worker with $L \geq \tilde{L}$ is promoted to work in the formal sector.⁷ The formal worker is willingly

⁷ Consider condition (4) and ($PB \geq \tau$). The formal sector would be preferable for all workers. In addition, if the worker assigns a positive utility to command pecuniary benefits only after gaining the minimum level of income, condition (4) can be assured to be a cut off-point regardless of the sign of ($PB \geq \tau$).

working in the formal sector, so the cut-off point that isolates the individual for formal or informal jobs based on their decision factors can be described as:

$$\bar{L} = \max\{\hat{L}, \tilde{L}\}$$

Workers with decision factor $L \leq \bar{L}$ engage in the informal sector, and workers with $\bar{L} < L$ engage in the formal sector. Thus, the formal labor supply can be written as:

$$L_s^f(\omega_f, \omega_i) = \int_{\bar{L}}^{\infty} L f(L) dL \quad (5)$$

While the informal labor supply can be described as:

$$L_s^i(\omega_f, \omega_i) = \int_0^{\bar{L}} L f(L) dL \quad (6)$$

Therefore, the total labor supply can be expressed as:

$$\mathcal{L}_s(\omega_f, \omega_i) = \int_0^{\bar{L}} L f(L) dL + \int_{\bar{L}}^{\infty} L f(L) dL = \mathcal{L}_s \quad (7)$$

Labor is supplied inelastically, but the total quantity is not supplied, so the wage level regulates the amount of labor that caters to the formal or informal sector.

1.3.3 Firms

Firms produce a homogeneous good that is executed in a perfectly competitive market by using motivational factor (θ) and homogenous units of labor (L). We assume that a continuum of firms are indexed by their ingrained decision factors and are distributed according to a probability density function $h(\theta)$ with support in \mathbb{R}_+ . If an entrepreneur of motivation quality θ employs L workers, then, under constant returns to scale, the Cobb-Douglas production function can be written as follows:

$$f(\theta, L) = \theta^b L^{1-b}$$

Each firm in the economy chooses to operate in the formal or informal sector and decides how many labor units will be engaged for its output production. When the firm performs its activities in the formal sector, its profit function can be described as:

$$\pi_f(\theta) = Pf(\theta, L) - \omega_f L(1 + t) - \gamma \quad (8)$$

In the above equation, P represents the price of the goods produced in the firm, $f(\theta, L)$ displays the production function, ω_f shows the prevalent wages per unit labor paid to the formal worker, t serves as the payroll tax imposed on firms, and γ is the fixed operating cost incurred by formal firms, e.g., license fees.⁸ On the other hand, when the firm performs its function in the informal sector, its expected profit function can be expressed as:

$$\pi_i(\theta) = (P(f(\theta, L) - \omega_i L)(1 - s) \quad (9)$$

Here, ω_i depicts the prevailing wage per labor unit paid to the informal worker and s shows the probability that the firm is caught conducting its functions informally with the potential to be shut down or make a loss.

For simplicity, we normalize $P = 1$, and the firm selects level L to maximize profits. Under these considerable assumptions, the labor demand derived for the firm with motivational factors (θ) can be described as:

$$L_f = \theta \left(\frac{(1-b)}{\omega_f (1+t)} \right)^{\frac{1}{b}}$$

If the firm performs its function in the formal sector, then,

$$L_i = \theta \left(\frac{(1-b)}{\omega_i} \right)^{\frac{1}{b}}$$

If the firm operates in the informal sector, both of these demand functions are linear in response to the motivational factors. Thus, firm size, which is measured by L , is linearly rising with θ . Small firms, having decision factor θ close to zero, perform their production activities in the informal sector on account of fixed cost γ that they have to incur to operate in the formal sector. Size dualism is present in this model as in Rauch (1991). According to this, large firms operate in the formal sector while small firms operate in the informal sector. There is an exclusive cut-off point for firm size. When firms perform in the formal sector, the profit function satisfies the following condition:

⁸ Many studies in the existing literature document different entry costs of the formal sector. Studies of comparative analysis recognize large costs associated with registering and operating formal firms in developing countries (Stone et al., 1996).

$$\frac{d\pi_f(\theta)}{d\theta} > \frac{d\pi_i(\theta)}{d\theta} \quad \forall \theta \quad (10)$$

By differentiating equations (8) and (9) with respect to θ , the above equation is equivalent to:

$$\left(\frac{1}{\omega_f(1+t)}\right)^{\frac{(1-b)}{b}} > (1-s) \left(\frac{1}{\omega_i}\right)^{\frac{(1-b)}{b}} \quad (11)$$

The above equation shows that the change in profit rate of formal firms due to decision factors is greater than that for informal firms. Both profit functions are displayed in linear form while the inequalities (10) and (11) are not related to the function of θ . The inequality (11) should be satisfied in order to operate firms formally. Hence, we establish a unique cut-off point ($\bar{\theta}$) in the presence of both formal and informal firms and satisfy:

$$\pi_f(\bar{\theta}) = \pi_i(\bar{\theta})$$

The above expression can be written as:

$$\bar{\theta} \left(\frac{(1-b)}{\omega_f(1+t)}\right)^{\frac{(1-b)}{b}} - \omega_f \bar{\theta} \left(\frac{(1-b)}{\omega_f(1+t)}\right)^{\frac{1}{b}} (1+t) - \gamma = \left[\bar{\theta} \left(\frac{(1-b)}{\omega_i}\right)^{\frac{(1-b)}{b}} - \omega_i \bar{\theta} \left(\frac{(1-b)}{\omega_i}\right)^{\frac{1}{b}} \right] (1-s)$$

The optimal choices are that $\theta \geq \bar{\theta}$ represents firms with a high level of managerial ability, managerial skill, and financial capital to operate in the formal sector. $\theta \leq \bar{\theta}$ represents firms with workers with a low level of managerial ability, managerial skill, and financial capital and, therefore, operate in the informal sector.

For the formal firm, the demand for labor can be expressed as:

$$L_d^f(\omega_f, \omega_i) = \int_{\bar{\theta}}^{\infty} \theta \left(\frac{(1-b)}{\omega_f(1+t)}\right)^{\frac{1}{b}} g(\theta) d\theta \quad (12)$$

And for the informal firm, the labor demand can be described as follows:

$$L_d^i(\omega_f, \omega_i) = \int_0^{\bar{\theta}} \theta \left(\frac{(1-b)}{\omega_i}\right)^{\frac{1}{b}} g(\theta) d\theta \quad (13)$$

Therefore, total labor demand can be written as:

$$\mathcal{L}_d(\omega_f, \omega_i) = \int_{\bar{\theta}}^{\infty} \theta \left(\frac{(1-b)}{\omega_f(1+t)}\right)^{\frac{1}{b}} g(\theta) d\theta + \int_0^{\bar{\theta}} \theta \left(\frac{(1-b)}{\omega_i}\right)^{\frac{1}{b}} g(\theta) d\theta \quad (14)$$

Equation (14) elaborates the total labor demand of firms in the presence of the motivational factors of workers with formal and informal worker wage rates. It also expresses the direct and indirect effect of wage changes on labor demand.

1.3.4 Equilibrium

Firms and workers operate in the formal and informal sector, and workers take decisions voluntary, i.e. $\bar{L} = \tilde{L}$. The equilibrium is a $(\omega_f, \omega_i, L_s^f, L_s^i, L_d^f, L_d^i)$ vector in which the market is clear in both the informal and formal labor markets as:

$$L_s^f(\omega_f, \omega_i) = L_d^f(\omega_f, \omega_i) \quad (15)$$

$$L_s^i(\omega_f, \omega_i) = L_d^i(\omega_f, \omega_i) \quad (16)$$

Here, wages satisfy the inequalities of equations (4) and (11).

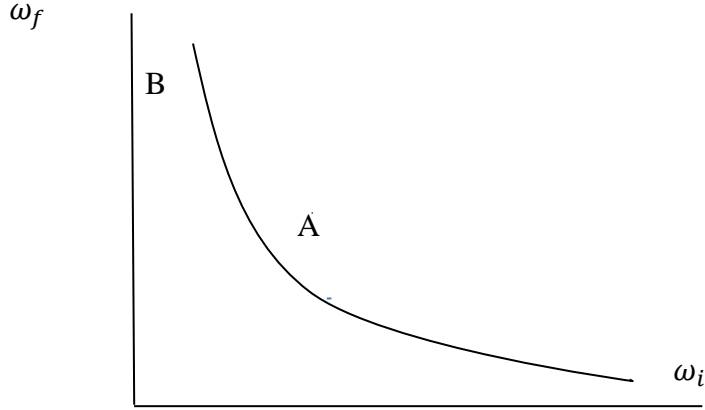
An interesting phenomenon about equilibrium is that it does not recommend the wage premium of the formal sector. ω_f can be lower, equal to, or higher than ω_i . Contrasting with existing literature, the occurrence of labor market dualism in the economy represents a positive wage premium in the formal sector, while the existence of a competitive environment is indicative of the absence of a wage premium in the labor market.

Graphically, the equilibrium of the economy is obtained by deriving the locus of wages, where total labor demand and total labor supply are equal. So, the wage pair (ω_f, ω_i) is expressed like $L_d(\omega_f, \omega_i) = \mathcal{L}$. From this, an implicit function found $R(\omega_f, \omega_i) = 0$ and it is represented by $\omega_f^R(\omega_i)$. This function shows the derivative of total labor demand in respect of both wages, which is negative, and produces a downward sloping curve (Figure 2). The economic equilibrium level must lie somewhere on this curve,⁹ while along this curve, total labor supply and demand are equal, but not in their composition. Each point of this curve plots to different vectors $(L_s^f, L_s^i, L_d^f, L_d^i)$. For example, point A represents a higher level of informal wages and low level of formal wages. In this case, the demand of firms for formal workers is high as compared to informal ones. However, the individual would prefer to be informal at that wage

⁹ This holds when direct effects dominate indirect effects. If the case changes as indirect effects prevail, the direct effect, $\omega_f^R(\omega_i)$, is not an imperative function. This case would cause multiple equilibria creating economic effects.

level. So, the equilibrium of this economy does not exist at point A. In the case of point B, a lower level of informal wages and higher level of formal wages are obtained. Then, at this prevailing wage, workers prefer to work formally. Again, equilibrium does not exist at point B.

Figure 2: Position of possible equilibria



The figure draws the wage pair $\omega_f(\omega_i)$ function in which the labor demand and supply align in every sector of the economy. By differentiating equation (15) with respect to both formal and informal wages, we get:

$$\frac{\frac{\partial L_s^f(\omega_f, \omega_i)}{\partial \omega_i} - \frac{\partial L_d^f(\omega_f, \omega_i)}{\partial \omega_i}}{\frac{\partial L_s^f(\omega_f, \omega_i)}{\partial \omega_f} - \frac{\partial L_d^f(\omega_f, \omega_i)}{\partial \omega_f}} = \frac{d\omega_f}{d\omega_i} \quad (17)$$

The above equation seems to be positive. Now, by differentiating equation (16) with respect to both types of wages, we obtain:

$$\frac{\frac{\partial L_s^i(\omega_f, \omega_i)}{\partial \omega_i} - \frac{\partial L_d^i(\omega_f, \omega_i)}{\partial \omega_i}}{\frac{\partial L_s^i(\omega_f, \omega_i)}{\partial \omega_f} - \frac{\partial L_d^i(\omega_f, \omega_i)}{\partial \omega_f}} = \frac{d\omega_f}{d\omega_i} \quad (18)$$

This expression is also positive. The total labor supply is inelastic, so,

$$\frac{\partial L_s^f(\omega_f, \omega_i)}{\partial \omega_i} = - \frac{\partial L_s^i(\omega_f, \omega_i)}{\partial \omega_i}$$

and,

$$\frac{\partial L_s^f(\omega_f, \omega_i)}{\partial \omega_f} = - \frac{\partial L_s^i(\omega_f, \omega_i)}{\partial \omega_f}$$

Since we assume that relative to both formal and informal wages, the total labor demand is sloped negatively, it holds that:

$$\frac{\partial L_d^f(\omega_f, \omega_i)}{\partial \omega_i} < - \frac{\partial L_d^i(\omega_f, \omega_i)}{\partial \omega_i}$$

and

$$- \frac{\partial L_d^f(\omega_f, \omega_i)}{\partial \omega_f} > \frac{\partial L_d^i(\omega_f, \omega_i)}{\partial \omega_f}$$

Hence, it follows that equation (18) > equation (17), which means the change in demand for formal labor is greater than the informal labor.

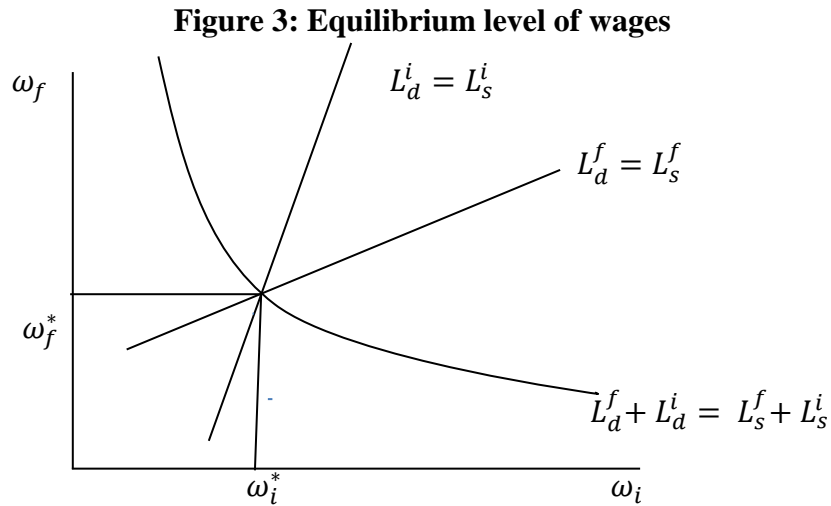


Figure 3 displays the three curves together and demonstrates the equilibrium level in this economy graphically.¹⁰

¹⁰ The figure is composed of three curves—formal labor force (L_f), informal labor force (L_i), and a combination of both. All of the equilibrium points of the area are defined in areas of inequalities (4) and (11). To keep the figure simple, these two relationships are displayed graphically.

For simplicity, we consider the same wage rate in the formal and informal sector, so the specification in equations (12) and (13) expresses that the labor demand of formal and informal workers is a function of decision factors (θ), which depends on worker preferences. Hence, from the specification of equations (12) and (13), we can adjust the functional relationship between the labor demand of firms and motivational factors of formal and informal workers as described in the following equations:

$$L_a^f = f(\theta) \quad ; \quad \theta \geq \bar{\theta} \quad (19)$$

$$L_a^i = f(\theta) \quad ; \quad \theta \leq \bar{\theta} \quad (20)$$

In the above equations, L_a^f represents the labor demand of firms for formal workers, while L_a^i represents the labor demand of firms for informal workers. This model explains the labor demand of firms for formal and informal individuals, which depends on the motivational factors of individuals to select sectors for work.

Section 2: Household

1.3.5 Incorporating secondary workers

Following the work of Galiani and Weinschelbaum (2012), we attempt to explore what happens to the economic equilibrium when a major shock occurs by permitting households to have secondary workers in the labor market. Primary and secondary workers are parameterized by a scalar $L \geq 0$ that determines workers' motivational factors, including human capital and financial capital. We assume both workers in the household possess equal levels of decision factors.

In this scenario, we first consider the household decision to choose a sector for work. When two persons of a household engage in the labor market, the decision can be made under three circumstances: 1) both persons are employed in the formal sector; 2) one person is employed in the formal sector and the other is employed in the informal sector; 3) both are employed in the informal sector. The expected utility of these possibilities is computed and, on its basis, we evaluate the corresponding choices of households.

In the first option, the utility level of the household having two workers in the formal sector can be expressed as:

$$U_{ff}(\omega_f L, PB) = 2\omega_f L + PB - 2\tau \quad (21)$$

A noticeable feature of the problem is that for a secondary worker, the net benefit of working in the formal sector, owning a level of motivational factors L , will be lower because the person is already enjoying some share of the non-pecuniary benefits generated by the first worker. For this reason, second workers are more likely to activate in the informal sector than primary workers.

In the second option in which one worker works in the formal sector and the other worker is employed in the informal sector, the utility level of the household can be described as follows:

$$U_{fi}(\omega_f L, PB) = sL\omega_f + (1-s)(\omega_f + \omega_i)L + PB - \tau \quad (22)$$

In the third option, when both workers engage in the informal sector, the utility of the household can be written as:¹¹

¹¹ To simplify the explanation, we assume that workers from the same household are independent in the probability of detection. However, we assume risk neutrality, but eliminating this assumption would not alter the results.

$$U_{ii}(\omega_i L, PB) = (1-s)^2 2L\omega_i + 2(1-s)s\omega_i L \quad (23)$$

By taking a derivative of these utility functions with respect to decision factors, we obtain:

$$\frac{dU_{ff}}{dL} > \frac{dU_{fi}}{dL} > \frac{dU_{ii}}{dL} \quad (24)$$

Whenever $\frac{\omega_f}{\omega_i} > (1-s)$

Equation (24) shows the same situation when we establish equilibrium by considering a cut-off point for separating workers between the formal and informal sectors.

In this situation, there are two cut-off points for workers. Workers with low levels of motivational factors engage in the informal sector up to the first cut-off point, while both members of the household with a higher level of motivational factors above the second cut-off point work in the formal sector. Workers in households with motivational levels between the two cut-off points elect to diversify between the formal and informal sectors.

The first cut-off point is described by equating equations (22) and (23) as:

$$U_{fi}(\omega_f \bar{L}, PB) = U_{ii}(\omega_f \bar{L}, PB)$$

After solving, we obtain the following expression:

$$\bar{L} = \left[\frac{\tau - PB}{\omega_f - (1-s)\omega_i} \right]$$

The cut-off point (\bar{L}), show that a household is indifferent between employing both workers in the informal sector or one worker in each sector. One worker is employed which is equal to (\bar{L}), the point at which the household with one worker is indifferent between employing in the formal or informal sector of the labor market. The reason is that decision to be working in formal or informal sector is not influence in the existence of an informal worker in household.

The second cut-off point is acquired by equalizing the two types of utility functions. One utility function is obtained when both workers are employed in the formal sector, and the other utility function is obtained by having one household worker in the formal sector and the other in the informal sector. By equating equations (21) and (22), we obtain:

$$U_{ff}(\omega_f \bar{\bar{L}}, PB) = U_{fi}(\omega_f L, PB)$$

Solving the above expression, we get:

$$\bar{\bar{L}} = \left[\frac{\tau}{\omega_f - (1-s)\omega_i} \right]$$

It is easy to clarify that $\bar{\bar{L}} = \bar{L} < \bar{L}$ described in Figure 2. This means the existence of a formal worker in the household reduces the likelihood that the other member will choose to activate in the formal sector. This result can only be produced in the model where workers select the sector in which they ideally wish to work.¹²

The theoretical framework in this section describes the role of motivational factors on sector selection for primary workers (heads of households) and secondary workers (spouses) at the household level. In this situation, we examine the role of spouses who wish to work in the informal sector if the head of the household works in the formal sector. Both workers behave differently in choosing sectors, so their functional relationship is represented in two separate equations:

$$L_s^H = f(L) \quad ; \quad \bar{\bar{L}} = \bar{L} > \bar{L} \quad (25)$$

$$L_s^S = f(L) \quad ; \quad \bar{\bar{L}} = \bar{L} < \bar{L} \quad (26)$$

Here, L_s^H and L_s^S represent the labor supply of the head of household and spouse, respectively. L is used as a symbol of motivational factors in the case of labor supply.

Figure 4: Dispersal of household cut-off point

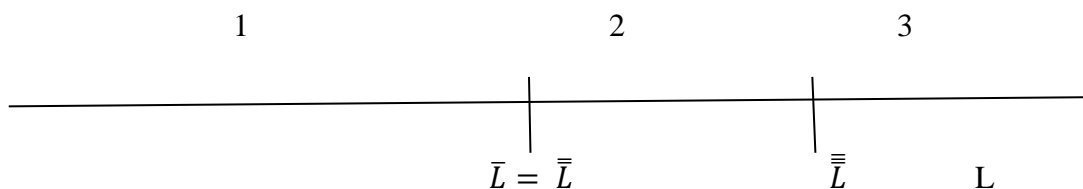


Figure 4 above shows the cut-off points, which create three regions in support of the distribution of motivational factors. In the first region, the household with one or two workers decides to engage in the informal sector. In the second region, the household with one worker decides to

¹² It is worth noting that the result in this section of the model can be obtained by considering only intra-household decisions in respect of workers' participation in the formal or informal sectors, by keeping wages constant. As such, this happens in the literature of family economics and intra-household decisions (Becker, 2005; Chiappori, 1992).

activate formally, while the household with two workers decides to diversify between sectors. Finally, in the third region, both households with one worker and two workers decide to operate in the formal sector.

The equilibrium of the economy is affected by the existence of secondary workers in the labor market, considering the above regions. In the first and third regions, the presence of secondary workers creates no change in equilibrium. In these regions, both types of workers select the same sectors. In the second region, workers with motivational factors are secondary workers who decide to work in the informal sector, whereas they can engage in the formal sector if they are the only household member. When secondary workers enter the second region, excess labor supply is shown in the informal sector, while excess labor demand is shown in the formal sector. Wages in the informal sector decrease. In this scenario, some informal workers move to the formal sector, while some formal firms want to operate informally. Therefore, the informal sector expands in the new equilibrium level. The presence of secondary workers in the labor market has the same effect as produced by the rearrangement of motivational factors towards informal sector workers.

Factors behavior in selecting formal and informal sector:

The equilibrium of the economy changes in response to the changes in the motivating factors of the workers includes: managerial ability/Human capital, managerial skill and financial capital as described in the previous section.

Managerial ability / Human capital:

The distribution of managerial ability/human capital among individuals provide base for selecting the sector (formal and informal) in which they work. The redistribution of managerial ability belonging to the same sector does not alter the total or sectoral supply of labor. On the other side, the redistribution of managerial ability/human capital from one to another sector changes both the total supply of labor and its composition between the formal and informal sector at the prevailing wage level.

Managerial skill:

The managerial skill level of individuals describes the professional skills of the workers which require performing the work in any sector. The redistribution phenomenon of managerial skill

relative to same sector does not create any change in the total labor supply at prevailing wage rate. The managerial skill factor behave as same as the managerial ability factor for individuals in response to choosing the formal and informal sector.

Financial capital:

The financial capital as a factor motivates the individuals to perform work activities in the desired sector. This factor affects the labor supply, if the redistribution occurs between two sectors (formal and informal). The individual with high human capital prefer to work in the formal sector and increase the labor supply of formal sector. But in some cases individual will prefer to informal sector to increase the rate of profit by avoiding government regulations.

1.4 Empirical Methodology

The empirical framework encompasses variable descriptions and sources, empirical model specification, and econometric techniques for both the individual and household analysis. The descriptive statistics of the variables are also included in this framework. The econometric techniques are unit root tests and the ARDL co-integration approach.

1.4.1 Variable descriptions and sources

The analysis is organized to determine the motivational (decisional) factors of sector participation at the individual and household level. Both the individual and household datasets are displayed in aggregated time-series terms for the period 1984–2015. Such type of short dataset is used for empirical analysis in various studies (Sharafat et al, 2014; Iqbal and Nakhoda, 2021; Ali et al, 1999; Shahbaz, 2010). The variables, their descriptions, and sources at the individual level are shown in Table 1.

Table 1: Variable descriptions and sources for the individual analysis

No.	Variable	Description	Source
1.	Formalization (TR)	No. of firms registered with authorities. ¹³	Census of Manufacturing Industries (CMI)
2.	Age (AG)	No. of persons aged 35 years or more. ¹⁴	LFS
3.	No. of employees (NE)	No. of employed persons aged over 35 years.	LFS
4.	Managerial ability (MA)	Represented by education level. ¹⁵ Managerial ability is divided into low, medium, and high.	LFS
(a)	Low managerial ability (LMA)	Persons who do not obtain a matriculation certificate.	LFS
(b)	Medium managerial ability (MMA)	Persons who obtain a matriculation certificate but not an intermediate certificate; and persons who obtain an intermediate certificate but not a degree.	LFS
(c)	High managerial ability (HMA)	Persons who obtain a degree or degrees.	LFS
5.	Managerial skill (MS)	Specified by persons' work experience. ¹⁶ Managerial skill is partitioned into three levels: low, medium, and high. ¹⁷	LFS
(a)	Low managerial skill (LMS)	Experienced, unemployed persons who do not obtain a matriculation certificate.	LFS
(b)	Medium managerial skill (MMS)	Experienced, unemployed persons who obtain a matriculation certificate but not an intermediate certificate; and persons who obtain an intermediate certificate but not a degree.	LFS
(c)	High managerial skill (HMS)	Experienced, unemployed persons who obtain a degree or degrees.	LFS
6.	Financial capital (FC)	Evaluated by persons' average monthly income. ¹⁸ The three levels of financial capital are low, medium, and high.	LFS
(a)	Low financial capital (LFC)	Employed persons with a monthly income range of up to PKR 1,500.	LFS

¹³ This definition of formalization is used by De Paula and Scheinkman (2011).

¹⁴ The threshold of 35 years of age is used for conducting the dataset of decision factors at the individual level.

¹⁵ Galiani and Weinschelbaum (2007) use this measure of managerial ability.

¹⁶ The work experience of a person is used as a proxy for managerial skills (Jones, 2001).

¹⁷ These categories are based on the same level used for the education variable (Galiani and Weinschelbaum, 2007).

¹⁸ Cetindamar et al. (2012) use this definition of financial capital.

No.	Variable	Description	Source
(b)	Medium financial capital (MFC)	Employed persons with a monthly income range of PKR 1,501–4,000.	LFS
(c)	High financial capital (HFC)	Employed persons with a monthly income range of PKR 4,001 and above. ¹⁹	LFS

The variables related to heads of households and spouses for the household analysis are presented in Tables 2(A) and 2(B). They show descriptions and sources of motivational factors and their levels for the heads of households and spouses.

Table 2(A): Variable descriptions and sources of heads of households for the household analysis

No.	Variable	Description	Source
1.	Head of household's sector decision (DF)	No. of heads of households with a formal salaried job. ²⁰	Household Income and Expenditure Survey (HIES)
2.	Age (AGHH)	No. of persons aged 45–54 years. ²¹	HIES
3.	Human capital (HCHH)	Evaluated by education level. The three levels of human capital are low, medium, and high.	HIES
(a)	Low human capital (LHCHH)	Heads of households who obtain middle education and a matriculation certificate.	HIES
(b)	Medium human capital (MHCHH)	Heads of households who obtain an intermediate certificate and a bachelor's degree.	HIES
(c)	High human capital (HHCHH)	Heads of households who obtain master's degrees and doctorates.	HIES
4.	Financial capital (FCHH)	Measured by the head of household's average monthly income. Financial capital is divided into low, medium, and high.	HIES
(a)	Low financial capital (LFCHH)	Heads of households with a monthly income under the range of the first quintile, which is PKR 1,000–2,500.	HIES

¹⁹ The threshold set for these three levels of financial capital is set on the basis of available categories in the labor force survey.

²⁰ The measure for the head of household's sector decision, spouse's sector decision, and human capital of the head of household and spouse are taken from Galiani and Weinschelbaum (2012).

²¹ Bates (1990) uses the age range 45–54 years for the first earner of the family and the age range 35–44 years for the second member of the family. This age threshold is used for conducting the dataset of the decision factors for both the head of household and spouse.

No.	Variable	Description	Source
(b)	Medium financial capital (MFCHH)	Heads of households with a monthly income under the range of the second and third quintiles, which is PKR 2,501–4,000.	HIES
(c)	High financial capital (HFCHH)	Heads of households with a monthly income under the range of the fourth and fifth quintiles, which is PKR 4,001 or more. ²²	HIES

Table 2(B): Variable descriptions and sources of spouses for the household analysis

No	Variable	Description	Source
1.	Spouse's sector decision (DS)	No. of employed second members or earners in the household.	HIES
2.	Age (AG)	No. of persons aged 35–44 years.	HIES
3.	Household size (HS)	Average no. of members per household.	HIES
4.	Log of wages (LW)	Wages and salaries in percentages.	HIES
5.	Human capital (HC)	Assessed by education level. The three levels are low, medium, and high.	HIES
(a)	Low human capital (LHC)	Spouses who obtain middle education and a matriculation certificate.	HIES
(b)	Medium human capital (MHC)	Spouses who obtain an intermediate certificate and a bachelor's degree.	HIES
(c)	High human capital (HHC)	Spouses who obtain a master's degree and a doctorate.	HIES
6.	Financial capital (FC)	Measured by the second earner's average monthly income. Financial capital is divided into low, medium, and high.	HIES
(a)	Low financial capital (LFC)	Spouses with a monthly income under the range of the first quintile, which is PKR 1,000–2,500.	HIES
(b)	Medium financial capital (MFC)	Spouses with a monthly income under the range of the second and third quintiles, which is PKR 2,501–4,000.	HIES
(c)	High financial capital (HFC)	Spouses with a monthly income under the range of the fourth and fifth quintiles, which is PKR 4,001 and above.	HIES

²² The threshold of financial capital for both the head of household and spouse is set on the basis of quintiles available in the HIES.

Data source limitations

In the case of the individual analysis, the data was acquired from the Census of Manufacturing Industries (CMI) for the years 1980–81, 1985–86, 1987–88, 1990–91, 1995–96, 2000–01, 2005–06, and 2015–16.²³ The LFS data used was for the years 1984–85, 1985–86, 1986–87, 1987–88, 1990–91, 1991–92, 1992–93, 1993–94, 1996–97, 1997–98, 1999–2000, 2001–02, 2003–04, 2005–06, 2006–07, 2007–08, 2008–09, 2009–10, 2010–11, 2012–13, 2013–14, 2014–15, and 2017–18.

For the household analysis, the dataset was acquired from the Household Integrated Economic Survey—later renamed the ‘Household Income and Expenditure Survey’ (HIES)—for the years 1984–85, 1985–86, 1986–87, 1987–88, 1990–91, 1992–93, 1996–97, 1998–99, 2001–02, 2005–06, 2007–08, 2010–11, 2011–12, 2013–14, and 2015–16.²⁴

Descriptive statistics

The descriptive statistics of variables used in the analysis show interesting facts about the motivational factors of workers in selecting sectors. At the individual level, the number of workers with low managerial ability (5.17 percent) is larger compared to the number of workers with high managerial ability (1.10 percent) (Table 3).

Other motivational factors, such as low managerial skill (30.24 percent), are acquired by a larger number of workers compared to the number of workers with high managerial skill (6.85 percent). The number of workers with medium financial capital (44.91 percent) is larger compared to those with low (39.29 percent) and high (21.35 percent) financial capital (Table 3).

²³ The data for the year 2015–16 for formalization is taken from a CMS brochure (2015–16) published by The Urban Unit.

²⁴ Data for missing years was obtained using the interpolation method.

Table 3: Descriptive statistics of variables for the individual analysis

Variables	Observations	Mean	Std. dev.	Min.	Max.
Formalization	32	5657.502	1405.063	4230.820	8548.410
Age	32	36.07	0.78	34.95	37.48
No. of employees	32	30.38	11.84	18.68	44.54
Low managerial ability	32	5.17	0.73	4.05	6.33
Medium managerial ability	32	2.87	0.89	1.75	4.59
High managerial ability	32	1.10	0.46	0.48	1.98
Low managerial skill	32	30.24	6.75	16.06	40.13
Medium managerial skill	32	25.69	4.23	18.05	34.34
High managerial skill	32	6.85	1.71	4.11	11.24
Low financial capital	32	39.29	37.02	3.95	141.38
Medium financial capital	32	44.91	14.09	20.17	60.91
High financial capital	32	21.35	20.02	0.89	75.88

At the household level, the number of heads of households with medium human capital (almost one percent) is larger relative to the number of heads of households with high human capital (0.29 percent). The number of heads of households with high financial capital (48.69 percent) is larger than the number of heads of households with medium financial capital (39.76 percent) (Table 4(A)).

On the other side, the number of spouses with low human capital (3.94 percent) is larger compared to the number of spouses with high human capital (0.48 percent). The number of spouses with medium financial capital (57.55 percent) is larger relative to the number of spouses with low (34.57 percent) and high (57.38 percent) financial capital (Table 4(B)).

**Table 4(A): Descriptive statistics of variables of heads of households
for the household analysis**

Variables	Observations	Mean	Std. dev.	Min.	Max.
Head of household's sector decision	32	20.44	3.46	13.59	26.19
Age	32	14.67	0.68	13.12	15.83
Medium human capital	32	0.99	0.46	0.44	2.13
High human capital	32	0.29	0.13	0.13	0.59
Medium financial capital	32	39.76	33.41	5.75	85.37
High financial capital	32	48.69	39.61	3.02	96.32

Table 4(B): Descriptive statistics of variables of spouses for the household analysis

Variables	Observations	Mean	Std. dev.	Min.	Max.
Spouse's sector decision	32	53.09	5.25	43.50	59.45
Age	32	19.87	0.83	18.17	21.96
Household size	32	6.53	0.19	6.21	6.96
Log of wages	32	11012.84	10071.18	1774.11	35662.00
Low human capital	32	3.94	0.70	2.51	6.12
Medium human capital	32	1.85	0.72	1.07	3.89
High human capital	32	0.48	0.24	0.19	1.09
Low financial capital	32	34.57	24.15	4.51	6.84
Medium financial capital	32	57.55	53.43	7.12	127.62
High financial capital	32	57.38	42.84	4.97	109.20

This analysis shows that the number of spouses with medium and high human capital is larger compared to the number of heads of households with medium and high human capital. Similarly, the number of spouses with medium and high financial capital is larger relative to the number of heads of households. Spouses' decisions based on these motivational factors lead to increases in the number of workers in the formal or informal sectors of the economy.

1.4.2 Empirical model specification

This section covers the empirical specifications of motivational factors on the variation of labor force participation between the formal and informal sectors of the labor market. The empirical arrangement of the study is composed of individual and household analyses.

1.4.2.1 Individual analysis

Labor force participation in formal and informal firms is based on the motivational factors mentioned in the theoretical model. De Paula and Scheinkman (2011) use the following estimating equation with managerial ability (MA) as a motivational factor in their analysis.

$$TR = \alpha + \beta_1 MA + \beta_2 NE + \beta_3 AG + \varepsilon \quad (1)$$

In the above model, the current study incorporates two more motivational factors—managerial skill and financial capital. Now, the equation can be expressed as:

$$TR = \alpha + \beta_1 MA + \beta_2 MS + \beta_3 FC + \beta_4 NE + \beta_5 AG + \varepsilon \quad (2)$$

Here, TR serves as formalization, MA is managerial ability, MS is managerial skill, FC is financial capital, NE is the number of employees, AG is age, and ε is the error term. For the desired estimation, the three levels of motivational factors—low, medium, and high—are used. In this way, the estimating equation can be written as:

$$TR = \alpha + \beta_1 LMA + \beta_2 MMA + \beta_3 HMA + \beta_4 LMS + \beta_5 MMS + \beta_6 HMS + \beta_7 LFC + \beta_8 MFC + \beta_9 HFC + \beta_{10} NE + \beta_{11} AG + \varepsilon \quad (3)$$

In equation (3), LMA , MMA , and HMA act as workers' low, medium, and high managerial ability, respectively. LMS , MMS , and HMS act as workers' low, medium, and high managerial skill, respectively. LFC , MFC , and HFC act as workers' low, medium, and high financial capital, respectively. The rest of the variables are the same as before.

1.4.2.2 Household analysis

At the household level, the heads of households and spouses (second members) elect to participate in the formal or informal sector for work based on motivational factors as described in the preceding section. Galiani and Weinschelbaum (2012) are followed for the empirical analysis. The head of the household decides to work in the formal sector based on his

motivational factor, e.g., human capital. In this circumstance, the spouse decides to work in the informal sector.²⁵ Thus, the empirical model comprises two equations which can be expressed as:

$$DF = \sigma + \pi_1 HCHH + \pi_2 AGHH + \gamma LW + \varepsilon_1 \quad (4)$$

$$DS = \alpha + \beta_1 HC + \beta_2 AG + \gamma LW + \varepsilon_2 \quad (5)$$

The current model introduces financial capital as a motivational factor that affects the participation behavior of heads of households and spouses in the labor market. Then, the analysis has the following expression:

$$DF = \sigma + \pi_1 HCHH + \pi_2 FCHH + \pi_3 AGHH + \gamma LW + \varepsilon_1 \quad (6)$$

$$DS = \alpha + \beta_1 HC + \beta_2 FC + \beta_3 AG + \gamma LW + \varepsilon_2 \quad (7)$$

Equation (6) is the head of household equation. DF symbolizes the head of the household's sector decision. $HCHH$ is the head of the household's human capital, $FCHH$ is the head of the household's financial capital, $AGHH$ is the head of the household's age, LW is the log of wages, and ε_1 is the error term.

Equation (7) is the spouse equation. DS exhibits the spouse's sector decision. HC is the spouse's human capital, FC is the spouse's financial capital, AG is the spouse's age, LW is the log of wages, and ε_2 is the error term.

For estimation purposes, the analysis consists of two models. In model 1, the log of wages (LW) is used as a control variable. The low, medium, and high categories of motivational factors are incorporated into equations (6) and (7). The expressions are then written as:

$$DF = \sigma + \pi_1 MHCHH + \pi_2 HHCHH + \pi_3 MFCHH + \pi_4 HFCHH + \pi_5 AGHH + \gamma_1 LW + \varepsilon_1 \quad (8)$$

$$DS = \alpha + \beta_1 DF^*LHC + \beta_2 DF^*MHC + \beta_3 DF^*HHC + \beta_4 HHC + \beta_5 DF^*LFC + \beta_6 DF^*MFC + \beta_7 DF^*HFC + \beta_8 HFC + \beta_9 AG + \gamma_1 LW + \varepsilon_2 \quad (9)$$

In equation (8), $MHCHH$ and $HHCHH$ are the medium and high human capital levels of the head of the household, respectively. $MFCHH$ and $HFCHH$ are the medium and high financial capital

²⁵ This condition displays the second option of the theoretical model by incorporating secondary workers.

levels of the head of the household, respectively. $AGHH$ is the age of the head of the household, σ, π_s, γ_1 are the parameters, and ε_1 is the error term.

In equation (9), $DF^*LHC, DF^*MHC,$ and DF^*HHC show the interaction of DF with spouses' low, medium, and high levels of human capital, respectively. HHC exhibits the spouse's high human capital level. $DF^*LFC, DF^*MFC,$ and DF^*HFC show the interaction of DF with spouses' low, medium, and high levels of financial capital, respectively. HFC shows the spouse's high financial capital level. AG is the age of the spouse, $\alpha, \beta_s, \gamma_1$ are the parameters, and ε_2 is the error term.

In model 2, we add the household size variable (HS) as a control variable. Its parameter is represented by γ_2 . In this condition, equations (8) and (9) can be expressed as follows:

$$DF = \sigma + \pi_1MHCHH + \pi_2HHCHH + \pi_3MFCHH + \pi_4HFCHH + \pi_5AGHH + \gamma_2HS + \varepsilon_1 \quad (10)$$

$$DS = \alpha + \beta_1DF^*LHC + \beta_2DF^*MHC + \beta_3DF^*HHC + \beta_4HHC + \beta_5DF^*LFC + \beta_6DF^*MFC + \beta_7DF^*HFC + \beta_8HFC + \beta_9AG + \gamma_2HS + \varepsilon_2 \quad (11)$$

Both models 1 and 2 express the role of the motivational factors of household members in the labor market. These models are estimated by applying the ARDL co-integration technique. This econometric technique is appropriate for the time-series dataset and explores the long-run association between the variables.

1.4.3 Econometric techniques

1.4.3.1 Unit root tests

Possessing time-series data, regression analysis requires stationary testing as a standard. This attempt is made to check the stationary or non-stationary level of the series. The reason is that if the selected variable is non-stationary, the OLS regression for the variable permits a spurious regression (Enders, 2010; Ononugbo, 2012). In addition, it is presumably in the event that variables with non-stationary properties acquire linear combinations with stationary properties and predict the long-run relationship between the variables (Engel and Granger, 1987). For this analysis, the stationary level of the series is analyzed using two tests—the Augmented Dickey-Fuller (ADF) test (Said and Dickey, 1984) and the Kwiatkowski-Philips-Schmidt-Shin (KPSS)

test (Kwiatkowski et al., 1992).²⁶ The ADF unit root test is intended on the basis of the null hypothesis, but it has low power in rejecting it, whereas the KPSS unit root test removes this problem (Jafari et al., 2012; Katircioglu et al., 2014; Kebede, 2017; Behera and Dash, 2017). For this reason, the analysis relies on the KPSS unit root test for more robust results. These tests help detect the order of integration for the desired series in the analysis.

1.4.3.1.1 ADF test

The most common unit root test to hold autoregressive moving average (ARMA) (p, q) models with unidentified orders is the ADF test introduced by Said and Dickey (1984). It explores the null hypothesis such that the time-series Y_t is I(1) while the alternative hypothesis denotes that the series is I(0) under the assumption that the data dynamics have ARMA structure. The test regression for estimating the ADF test can be expressed as:

$$Y_t = \hat{\beta}P_t + \mu Y_{\Delta t-1} + \sum_{j=1}^d \varphi_j \Delta Y_{t-j} + \epsilon_t \quad (1)$$

Here, P_t expresses the deterministic terms vector and contains a constant and trend, etc. The d serves as a lagged difference term, ΔY_{t-j} is utilized to approximate the errors of the ARMA structure, and d is set so that the ϵ_t error is serially uncorrelated. The error term is considered to be homoscedastic. The deterministic term specification depends on the behavior assumed by Y_t covered by the alternative hypothesis related to trend stationarity. By considering the null hypothesis, Y_t is I(1), which indicates that $\mu = 1$. The least square estimates of equation (1) elaborate the ADF t-statistics, which can be described as:

$$ADF_t = t_{\mu=1} = \frac{\mu - 1}{SE(\mu)}$$

In another way, the ADF formulation for test regression can be expressed as:

$$\Delta Y_t = \hat{\beta}P_t + \sigma Y_{t-1} + \sum_{j=1}^d \varphi_j Y_{t-j} + \epsilon_t \quad (2)$$

Here, $\sigma = \mu - 1$. The null hypothesis is ΔY_t is I(0), which signifies that $\sigma = 0$. Then, the usual t-statistics can be used as ADF t-statistics for testing $\sigma = 0$. This t-statistic notifies the testing significance of coefficient Y_{t-1} .

²⁶ Both the ADF and KPSS unit root tests are conducted for the individual analysis. Only the ADF unit root test is used for the household analysis.

1.4.3.1.2 KPSS test

Proposed by Kwiatkowski et al. (1992), the KPSS test is the most widely used stationarity test. It is derived using the following model:

$$Y_t = \hat{\beta}P_t + \mu_t + U_t$$

$$\mu_t = \mu_{t-1} + \epsilon_t, \quad \epsilon_t \sim WN(0, \delta^2)$$

Here, P_t displays the deterministic part containing a constant plus time trend or constant, etc. U_t is I(0) and can be heteroscedastic. μ_t serves as a pure random walk with innovation variance δ^2 . The null hypothesis that is Y_t is I(0) and systematically specifies as $H_0: \delta^2 = 0$, which means that μ_t is a constant value. The alternate hypothesis is $H_A: \delta^2 > 0$. The statistics for the KPSS test are score statistics or the Lagrange multiplier that can be expressed as:

$$KPSS = \frac{(L^{-2} \sum_{t=1}^L \hat{G}_t^2)}{\hat{\theta}^2}$$

Here, $\hat{G}_t = \sum_{j=1}^t \hat{U}_t$ where \hat{U}_t is a residual regression of Y_t on P_t . $\hat{\theta}^2$ is the consistent estimate of the long-term variance of U_t and \hat{U}_t . This stationarity test displays as a one-sided, right-tailed test.

1.4.3.2 *The ARDL co-integration approach*

The ARDL co-integration approach was initially developed by Pesaran et al. (2001) to entrench the co-integrating vector among selected variables. This approach probes the long-run relationship irrespective of the integrating order of the variables, which may be I(0), I(1), or a combination of both. Each of these variables sets a single equation for a long-run relationship. Under these circumstances, the ARDL co-integration approach provides efficient and realistic estimates.

The model specification for the ARDL co-integration approach can be described as follows:

$$\varphi(L, R)Y_t = \sum_{i=1}^T \gamma_i(L, S_i)x_{it} + \sigma w_t + \epsilon_t \quad (1)$$

$$\text{Where } \varphi(L, R) = 1 - \varphi_1 L - \varphi_2 L^2 - \dots - \varphi_R L^R$$

$$\gamma(L, S) = 1 - \gamma_1 L - \gamma_2 L^2 - \dots - \gamma_S L^S \quad i = 1, 2, \dots, T, \quad \epsilon_t \sim iid(0, \lambda)$$

\mathcal{L} represents the lag operator such as $\mathcal{L}^0 Y_t = x_t$, $\mathcal{L}^1 Y_t = Y_{t-1}$. w_t is $(c \times 1)$ vector of deterministic variables like coefficients of intercept, trend and exogenous variables, or seasonal dummies with fixed lags. $R = 0, 1, 2, \dots, h$, $S = 0, 1, 2, \dots, h$, and $i = 1, 2, \dots, T$ serve as a total of $(h + 1)^{T+1}$ distant ARDL models. The order of maximum lag h is chosen with respect to the model. The sample period is $t = h + 1, h + 2, \dots, n$.

In another way, the ARDL (R, S) model specification can be described as:

$$\varphi(\mathcal{L})Y_t = \delta + \omega(\mathcal{L})x_t + \varepsilon_t \quad (2)$$

With

$$\varphi(\mathcal{L}, R) = 1 - \varphi_1 \mathcal{L} - \varphi_2 \mathcal{L}^2 - \dots - \varphi_R \mathcal{L}^R$$

$$\omega(\mathcal{L}, S) = 1 - \gamma_1 \mathcal{L} - \gamma_2 \mathcal{L}^2 - \dots - \gamma_S \mathcal{L}^S$$

Thus, the common ARDL $(R, S_1, S_2, \dots, S_T)$ model is:

$$\varphi(\mathcal{L})Y_t = \delta + \omega_1(\mathcal{L})x_{1t} + \omega_2(\mathcal{L})x_{2t} + \omega_T(\mathcal{L})x_{Tt} + \varepsilon_t \quad (3)$$

The lag operator \mathcal{L} is used for each constituent of the vector. $\mathcal{L}^T Y = Y_{t-T}$ is appropriate for illustrating the lag polynomial $\varphi(\mathcal{L}, R)$ and vector polynomial $\gamma(\mathcal{L}, S)$. The error term ε_t is the white-noise process.

1.4.3.2.1 Stages of the ARDL approach

The ARDL approach consists of three stages (Nkoro and Uko, 2016). In the first stage, the long-run relationship between the variables is scrutinized by applying the bound F-statistic. The ARDL model tests the relationship between the forcing variables through the hypothesis testing of the long-run relationship between the underlying variables. This approach uses ARDL (R, S) regression with I(d) regressors.

$$Y_t = \varphi_1 Y_{t-1} + \dots + \varphi_R Y_{t-R} + \omega_0 x_t + \omega_1 x_{t-1} + \dots + S_1 x_{t-R} + \varepsilon_{1t} \quad (4)$$

$$t = 1, 2, \dots, k \quad \varepsilon_t \sim iid(0, \sigma^2).$$

In the above equations, the deterministic regressors like constant and linear time are not included. $\varphi, \omega_0, \omega_1$ are unknown parameters. Y_t is an I(d) process created by:

$$Y_t = Y_{t-1} + \mu_t$$

For all logs, ε_t and μ_t are uncorrelated because Y_t is strictly exogeneous in relation to ε_t while μ_t is a linear stationary process.

The co-integration condition is that if $\varphi < 1$, then the model is dynamically stable. This condition indicates the long-run relationship of $Y_t(x_t)$. In practical form, the ARDL (R, S_1, S_2, \dots, S_T) model approach for co-integration testing can be written as:

$$\Delta Y_t = \sigma_{0i} + \sum_{i=1}^T \beta_1 \Delta Y_{t-1} + \sum_{i=1}^T \beta_2 \Delta x_{t-1} + \sigma_1 Y_{t-1} + \sigma_2 x_{t-1} + v_{it} \quad (5)$$

In the above equation, β_1 and β_2 describe the short-run dynamics while σ_1 and σ_2 coincide with the long-run relationship of the model.

The hypothesis is that the coefficient of lag variables, which represents the existence of a long-run relation, is zero and is tested as follows:

$$H_0: \sigma_1 = \sigma_2 = 0$$

$$H_1: \sigma_1 \neq \sigma_2 \neq 0$$

This hypothesis is tested by applying the F-statistic which permits two sets of critical values to serve as a lower bound critical value and an upper bound critical value. When the estimated F-statistic is higher than the upper bound critical value, the null hypothesis is rejected and represents co-integration between the variables. However, if the estimated F-statistic value is lower than the low bound critical value, the null hypothesis cannot be rejected, and shows no co-integration between the variables.

In the second stage, the appropriate lag length is selected for the model by using order selection criteria, including the Akaike information criterion (AIC), Schwarz Bayesian criterion (SBC), or Hannan-Quinn criterion (HQC). The model with the smallest value of AIC or SBC estimates and high R-squared value perform relatively better. The coefficient of the long run for Y_t with respect to change in x_t is estimated as:

$$\widehat{\omega}_i = \frac{\widehat{\gamma}_i(1, \widehat{S}_i)}{\widehat{\varphi}_i(1, \widehat{R}_i)} = \frac{\widehat{\gamma}_{i0} + \widehat{\gamma}_{i1} + \dots + \widehat{\gamma}_{iS}}{1 - \widehat{\varphi}_1 - \widehat{\varphi}_2 - \dots - \widehat{\varphi}_R} \quad i = 1, 2, \dots$$

Similarly, the coefficient of the long run for deterministic variables with fixed lags is computed as:

$$\widehat{\pi} = \frac{\widehat{\sigma}(\widehat{R}, \widehat{S}_1, \widehat{S}_2, \dots, \widehat{S}_T)}{1 - \widehat{\varphi}_1 - \widehat{\varphi}_2 - \dots - \widehat{\varphi}_R}$$

Here, $\hat{\sigma}(\hat{R}, \hat{S}_1, \hat{S}_2, \dots, \hat{S}_T)$ describes the OLS estimates of σ in equation (1) of the selected ARDL model. In practical form, the long-run ARDL model equation can be described as follows:

$$Y_t = \sigma_0 + \sum_{i=1}^T \beta_1 x_{1t} + \sum_{i=1}^T \beta_2 x_{2t} + \sum_{i=1}^T \beta_3 x_{3t} + \sum_{i=1}^T \beta_n x_{nt} + v_{1t} \quad (6)$$

Here, $x_{1t}, x_{2t}, x_{3t}, \dots, x_{nt}$, are long-run forcing or explanatory variables. T shows the optimum lag order number.

In the last (third) stage, the unrestricted error correction model (ECM) related to the ARDL (R, S_1, S_2, \dots, S_T) model can be acquired by rewriting equation (1) in the form of lagged levels and first difference of $Y_t, x_{1t}, x_{2t}, x_{3t}, \dots, x_{Tt}$, and w_t .

$$\Delta Y_t = -\varphi(1, \hat{R}) EC_{t-1} + \sum_{i=1}^T \gamma_{i0} \Delta x_{it} + \sigma \Delta w_t - \sum_{j=1}^{R-1} j \Delta_{t-j} - \sum_{i=1}^T \sum_{j=1}^{\hat{S}_i-1} \gamma_{Ij} \Delta x_{i,1-j} + \mu_t \quad (7)$$

EC_t symbolizes the error correction term, which is defined as:

$$EC_t = \mu_t = Y_t - \sum_{i=1}^T \hat{\omega}_i x_{it} - \pi w_t$$

The EC_t term serves as the speed-of-adjustment parameter derived as the error term from the co-integration model. This term describes how much correction is possible to settle the disequilibrium. A positive coefficient value describes the divergence, while the convergence is expressed by the negative value of the error correction term. If the value of $EC_t = 1$, the adjustment level will grasp at 100% within the period, and elaborate the full adjustment. If $EC_t = 0$, there is no adjustment and, therefore, no existence of a long-run relationship in the given period. The ARDL co-integration model and its ECM can be estimated using the OLS method.

Diagnostic tests are applied to assess the quality of the dynamic model. They include Breusch and Godfrey's (1981) Lagrange multiplier test to test the serial correlation of the residual term of the ECM, Engle's (1982) autoregressive conditional heteroscedasticity (ARCH) Lagrange multiplier test to scrutinize the heteroscedasticity, and the Jarque-Bera normality test to check the model's goodness-of-fit.

1.5 Estimation Results

This section elaborates on the estimates of the individual- and household-level analysis. Tables for both are presented.

1.5.1 Results of the individual analysis

1.5.1.1 Preliminary time-series characteristics

The preliminary aspect for the co-integration procedure is to scrutinize the integration order of each series. All of the variables at the individual level are converted into a natural log form. This conversion is required to curtail the outlier's impact and smooth the variable series (Maddala and Lahiri, 1992). The presence of a unit root in the series is tested by applying the ADF (1984) test. The results of the ADF test are shown in Tables 5(A) and 5(B).

Table 5(A): ADF unit root test of the individual analysis at level of series

Variable	Lag	Regressors		Test statistic	Order of integration
		Drift	Trend		
LTR	1	Yes	No	-3.185**	I(2)
LLMA	0	Yes	No	-4.241***	I(1)
LMMA	0	Yes	No	-5.388***	I(1)
LHMA	0	Yes	No	-4.318***	I(1)
LLMS	0	Yes	No	-4.817***	I(1)
LMMS	0	Yes	No	-3.818***	I(1)
LHMS	0	Yes	No	-7.453***	I(1)
LLFC	0	Yes	No	-6.094***	I(1)
LMFC	0	Yes	No	-5.206***	I(1)
LHFC	0	Yes	No	-5.140***	I(1)
LNE	0	Yes	No	-3.420***	I(1)
LAG	0	Yes	No	-5.233***	I(1)

*** denotes a significance level at 1%; ** denotes a significance level at 5%; * denotes a significance level at 10%.

Table 5(B): ADF unit root test of the individual analysis at the first difference of series

ADF Regression Model Variable	Lag	Regressors		Test statistic	Order of integration
		Drift	Trend		
$\Delta(\Delta LTR)$	1	Yes	No	-3.185**	I(0)
$\Delta LLMA$	0	Yes	No	-4.241***	I(0)
$\Delta LMMA$	0	Yes	No	-5.388***	I(0)
$\Delta LHMA$	0	Yes	No	-4.318***	I(0)
$\Delta LLMS$	0	Yes	No	-4.817***	I(0)
$\Delta LMMS$	0	Yes	No	-3.818***	I(0)
$\Delta LHMS$	0	Yes	No	-7.453***	I(0)
$\Delta LLFC$	0	Yes	No	-6.094***	I(0)
$\Delta LMFC$	0	Yes	No	-5.206***	I(0)
$\Delta LHFC$	0	Yes	No	-5.140***	I(0)
ΔLNE	0	Yes	No	-3.420***	I(0)
ΔLAG	0	Yes	No	-5.233***	I(0)

*** denotes a significance level at 1%; ** denotes a significance level at 5%; * denotes a significance level at 10%.

The estimates show that the dependent variable, such as the log of formalization (*LTR*), is integrated of order $I(2)$ at level and stationary at second difference. The other variables, including the log of low, medium, and high managerial ability (*LLMA*, *LMMA*, *LHMA*), log of low, medium, and high managerial skill (*LLMS*, *LMMS*, *LHMS*), log of low, medium, and high financial capital (*LLFC*, *LMFC*, *LHFC*), number of employees (*LNE*), and age (*LAG*) are integrated of order $I(1)$ at level. All of these variables are stationary at first difference. According to prevailing literature, the computed value of the F-statistic in the bound approach is not credible in the presence of variables having order of integration $I(2)$ because the bound test statistics are estimated under the assumption of order of integration $I(0)$ or $I(1)$ (Pesaran et al., 2001; Ouattara, 2004). To resolve this problem, the stationary levels of the variables series are inspected using the KPSS unit root test. The estimates of the KPSS test are shown in Tables 6(A) and 6(B).

Table 6(A): KPSS unit root test of individual analysis series at level

ADF Regression Model Variable	Lag	Regressors		Test statistic	Order of integration
		Drift	Trend		
LTR	1	Yes	Yes	0.280***	I(1)
LLMA	0	Yes	No	2.550***	I(0)
LMMA	0	Yes	No	3.139***	I(0)
LHMA	0	Yes	No	3.113***	I(0)
LLMS	0	Yes	No	2.283***	I(0)
LMMS	0	Yes	Yes	0.282***	I(0)
LHMS	0	Yes	No	2.580***	I(0)
LLFC	0	Yes	No	2.435***	I(0)
LMFC	0	Yes	No	0.867***	I(0)
LHFC	0	Yes	No	2.659***	I(0)
LNE	0	Yes	Yes	0.299***	I(0)
LAG	0	Yes	No	0.152***	I(1)

*** denotes a significance level at 1%; ** denotes a significance level at 5%; * denotes a significance level at 10%.

Table 6(B): KPSS unit root test of the individual analysis series at the first difference

ADF Regression Model Variable	Lag	Regressors		Test statistic	Order of integration
		Drift	Trend		
Δ LTR	0	Yes	No	2.472***	I(0)
LAG	0	Yes	No	2.566***	I(0)

*** denotes a significance level at 1%; ** denotes a significance level at 5%; * denotes a significance level at 10%.

This test estimates that the log of formalization and log of age variables have the integrated order of $I(1)$ at level and stationary at the first difference, which is presented as $I(0)$. The rest of the variables display stationary behavior at the level that is $I(0)$. The KPSS test shows that the dependent variable is integrated of order $I(1)$ while the independent variables show the integrated order of $I(0)$ and $I(1)$. Hence, in these circumstances, the ARDL co-integration

approach is a suitable estimation methodology for computing the long-term and short-term relations among the variables for the individual analysis.

1.5.1.2. The co-integration bound test

The presence of a long-term relationship among the selected variables is the first step of the ARDL co-integration analysis. The optimal lag order for the first difference variable is according to the AIC. The insignificant lag related to the first difference is dropped from the analysis by applying the general-to-specific method proposed by Hendry (1995). The estimated equation is then tested using the Breusch and Godfrey (1981) Lagrange multiplier test to check the serial correlation, Jarque-Bera statistics to expose residual normality, and Engle's (1982) ARCH Lagrange multiplier test to ensure the estimated model residual with constant variance. Then the final equation is obtained. The co-integration estimates are shown in Table 7.

Table 7: The estimates of the co-integration test for individual analysis

Dependent variable	F-statistic	DF	I(0)	I(1)	Outcome
LTR	46.990***	11	11.79	9.81	Co-integration

*** denotes a significance level at 1%; ** denotes a significance level at 5%; * denotes a significance level at 10%.

The formalization that represents tax-registered firms is the dependent variable of the model. The F-statistic assesses the joint null hypothesis that the lagged level variable parameters are zero. The selected model succeeds in rejecting the null hypothesis. This shows that a long-term relationship is present among the selected variables.

1.5.1.2 The long-term estimated coefficient of the individual analysis

The long-run estimates of the analysis by using the ARDL co-integration approach are attained by normalizing the co-integrated vector of the log of the dependent variable—formalization. The estimates of the long-term individual analysis are shown in Table 8.

Table 8: Long-run estimates of the ARDL model for the individual analysis

Independent variable	Model
C	-26.573*** [-7.709]
LLMA	-2.284*** [-4.449]
LMMA	1.193*** [5.930]
LHMA	0.303** [1.955]
LLMS	-0.188*** [-6.556]
LMMS	-0.121*** [-5.655]
LHMS	0.130** [2.007]
LLFC	-0.630*** [-9.000]
LMFC	-0.390*** [-7.306]
LHFC	0.335*** [8.348]
LLNE	0.299*** [5.526]
LLAG	7.815*** [7.991]
Observations	32

*** denotes a significance level at 1%; ** denotes a significance level at 5%; * denotes a significance level at 10%; [] t-statistic values are in parenthesis.

The attaining signs for each of the independent variables are as predicted. The estimates suggest that the entrepreneur or individual with low competence of motivational factors participates in the informal sector, whereas the individual acquiring high competence of motivational factors engages in the formal sector.

The worker possessing low managerial ability has a negative and significant relationship with formalization. This shows that the worker with low managerial ability selects the informal sector

for work. The reason is that the informal sector has space for less educated workers (Maloney and Arias, 2007). On the other side, the worker with high managerial ability has a positive relationship with formalization. This means that formal firms hire highly educated persons (Mincer, 1991). However, this relationship is insignificant because highly educated persons cannot always find work in the formal sector due to the unavailability of vacancies. Persons with medium managerial ability have a positive and significant association with formalization. This means that formal firms also hire medium-level educated persons based on work requirements (De Paula and Scheinkman, 2011).

Workers with low managerial skill have a negative but significant relationship with formalization. This shows that unskilled workers are not engaged in the formal sector—they have to enter the informal sector to obtain skills (Cano-Urbina, 2015). High-managerial skill workers have a positive but insignificant relationship with formalization because formal firms require highly skilled professionals (Lazear, 2004). However, some skilled professionals cannot engage in formal firms due to mismatches between skills and job requirements (Di Pietro and Urwin, 2006; Restrepo, 2015). This makes the estimate insignificant. Medium-skilled workers have a negative and significant relationship with formalization. This means that less skilled and medium-skilled workers find work opportunities in the informal sector because they acquire skills from this sector and then transfer to the formal sector as skilled workers (Mattos and Ogura, 2009).

The low- and medium-level financial capital of workers has a negative and significant association with formalization. This association shows that these workers enter informal sector firms because they do not fulfill the requirements of formal sector firms. Informal sector firms pay lower wages and do not provide pecuniary benefits. These workers work in the informal sector because of their lower financial capital. On the other side, low and medium financial capital forces them to start firms in the informal sector to avoid various legal requirements (Avdeitchikova, 2008). The high financial capital worker has a positive and significant relationship with formalization (Amaral and Quintin, 2006). Wage rates are high for workers in the informal sector, and they acquire high financial capital. In addition, formal workers with high human capital have the capacity to start businesses in the formal sector by tolerating the fixed costs implemented by authorities.

The number of employees has a positive and significant relationship with formalization—these workers work in formal firms. Age has a positive and significant relationship with formalization. This variable is used to express the ability of workers in the analysis (De Paula and Scheinkman, 2011).

The results show that individuals with low managerial ability, managerial skill, and financial capital work in the informal sector while individuals with high managerial ability, managerial skill, and financial capital select formal firms.

1.5.1.3 The short-term dynamic estimates of the individual analysis

Under the ARDL approach, the ECM is commonly used to obtain short-term dynamic estimates in time-series analysis. This model is used to extend the convergence hypothesis. The convergence hypothesis is the tendency of formalization transfer towards the steady-state equilibrium point of formalization (Cellini, 1994). The imperative determinant of the ECM is the long-term co-integrated function residual. These residuals are identified as error correction terms or disequilibrium estimates. This term measures deviation from the long-term equilibrium point of formalization in period $(t - 1)$, and speed-of-adjustment information related to the steady-state point of formalization is attained. The coefficient sign of the lagged level of the error correction term should be negative, and the coefficient value should be between -1 and zero. Then, both the necessary and sufficient conditions of the ECM will be satisfied. The estimated results for the short-term dynamics of the individual analysis are shown in Table 9.

The table reveals that workers with low managerial ability have a negative and significant relationship with formalization. But workers possessing medium and high managerial ability have a positive and statistically significant relationship with formalization (Galiani and Weinschelbaum, 2007).

On the other side, workers with low managerial skill show a positive association with formalization. In addition, workers with medium and high managerial skill also have a positive relationship with formalization in the short term. This means that individuals acquiring any level of managerial skill enter the formal sector because formal firms hire skilled persons of different levels (Amaral and Quintin, 2003).

In the case of financial capital, workers with low and medium financial capital have a negative association with formalization, while workers with high financial capital also have a negative relationship with formalization in the short-term analysis. This shows that workers possessing high financial capital participate in the informal sector in the short term because workers with financial capital prefer setting-up their own businesses (Ramirez and Hondagneu-Sotelo, 2009).

Table 9: The short-run dynamics of the ARDL model for the individual analysis

Independent variable	Model
$\Delta LLMA$	-0.827*** [-83.209]
$\Delta LMMA$	0.886*** [117.451]
$\Delta LHMA$	0.338*** [77.622]
$\Delta LLMS$	0.237*** [110.353]
$\Delta LMMS$	0.446*** [149.365]
$\Delta LHMS$	0.056*** [33.092]
$\Delta LLFC$	-0.072*** [-58.752]
$\Delta LMFC$	-0.473*** [-133.718]
$\Delta LHFC$	-0.249*** [-107.246]
ΔLNE	0.237*** [133.791]
ΔLAG	4.801*** [128.950]
EC	-0.062*** [-132.211]
R ²	0.987
Adjusted R ²	0.969

Independent variable	Model
F-statistic	54.825 [0.000]
Observations	32
Diagnostic test	
Serial correlation Lagrange multiplier test	7.232 [0.088]
ARCH test	0.195 [0.671]
Jarque-Bera normality test	0.239 [0.887]

*** denotes a significance level at 1%; ** denotes a significance level at 5%; * denotes a significance level at 10%; [] t-statistic values are in parenthesis.

The number of employees and age have a positive relationship with formalization (De Paula and Scheinkman, 2011). The influence of all of these short-term estimated results is consistent with the influence of long-term estimates, except for the estimates of low-managerial skilled workers and high-financial capital workers.

The coefficient value of the lagged error correction term has a negative sign in the short-term analysis. It certifies the convergence behavior of formalization toward the steady-state point of formalization after bearing a shock. The error correction term's magnitude is -0.06 , which is very small. It shows that the motivational factors of workers' participation reduce the speed of convergence towards the equilibrium level of formalization. This ECM clears all of the diagnostic tests—the serial correlation check by Breusch and Godfrey (1981), the homoscedasticity check by applying the ARCH residual test, and the Jarque-Bera normality test.

1.5.2 Results of the household analysis

1.5.2.1 Primitive time-series characteristics

In the household case, the analysis describes the behavior of spouses and heads of households using two separate equations. All of the selected variables of both equations are converted into natural logarithmic forms to evade the negative number in the series. The integrated order of the series is required to conduct the co-integration analysis. For this purpose, the statistics of the ADF (1984) test are used to check the unit root in the series.

Table 10(A): ADF unit root test of heads of households at level of series

ADF Regression Model	Regressors			Test statistic	Order of integration
Variable	Lag	Drift	Trend		
LDF	0	No	No	-4.353***	I(1)
LMHCHH	0	No	No	-4.501***	I(1)
LHHCHH	0	No	No	-5.925***	I(1)
LMFCHH	0	No	No	-4.434***	I(1)
LHFCHH	0	No	No	-4.490***	I(1)
LAGHH	0	No	No	-4.617***	I(1)

*** denotes a significance level at 1%; ** denotes a significance level at 5%; * denotes a significance level at 10%.

Table 10(B): ADF unit root test of series of heads of households at the first difference

ADF Regression Model	Regressors			Test statistic	Order of integration
Variable	Lag	Drift	Trend		
Δ LDF	0	No	No	-4.353***	I(0)
Δ LMHCHH	0	No	No	-4.501***	I(0)
Δ LHHCHH	0	No	No	-5.925***	I(0)
Δ LMFCHH	0	No	No	-4.434***	I(0)
Δ LHFCHH	0	No	No	-4.490***	I(0)
Δ LAGHH	0	No	No	-4.617***	I(0)

*** denotes a significance level at 1%; ** denotes a significance level at 5%; * denotes a significance level at 10%.

The ADF estimates of heads of households are expressed in Tables 10(A) and 10(B). The dependent variable, such as the head of household's sector decision (*LDF*), is stationary at the first difference and integrated with order one as $I(1)$. The rest of the selected variables comprise the medium human capital and high human capital of heads of households (*LMHCHH*, *LHHCHH*) and the medium financial capital and high financial capital of heads of households (*LMFCHH*, *LHFCHH*), which are also integrated related to order one $I(1)$ at level and stationary at the first difference as $I(0)$. The ADF statistical estimates of spouses are shown in Tables 11(A) and 11(B).

Table 11(A): ADF unit root test of spouses at level of series

ADF Regression Model Variable	Lag	Regressors		Test statistic	Order of integration
		Drift	Trend		
LDS	1	Yes	No	-3.620***	I(1)
LDF*LHC	0	No	No	-4.966***	I(1)
LDF*MHC	0	No	No	-4.461***	I(1)
LDF*HHC	0	No	No	-4.902***	I(1)
LHHC	0	No	No	-1.922**	I(0)
LDF*LFC	0	No	No	-4.445***	I(1)
LDF*MFC	0	No	No	-4.194***	I(1)
LDF*HFC	0	No	No	-4.454***	I(1)
LHFC	0	No	No	-4.606***	I(1)
LLW	0	Yes	Yes	-4.083***	I(1)
LHS	0	No	No	-4.563***	I(1)
LAG	1	Yes	Yes	-3.185*	I(0)

*** denotes a significance level at 1%; ** denotes a significance level at 5%; * denotes a significance level at 10%.

Table 11(B): ADF unit root test of spouses at the first difference of series

ADF Regression Model Variable	Lag	Regressors		Test statistic	Order of integration
		Drift	Trend		
Δ LDS	0	No	No	-3.883***	I(0)
Δ LDF*LHC	0	No	No	-4.966***	I(0)
Δ LDF*MHC	0	No	No	-4.461***	I(0)
Δ LDF*HHC	0	No	No	-4.902***	I(0)
Δ LDF*LFC	0	No	No	-4.517***	I(0)
Δ LDF*MFC	0	No	No	-4.194***	I(0)
Δ LDF*HFC	0	No	No	-4.553***	I(0)
Δ LHFC	0	No	No	-4.606***	I(0)
Δ LLW	0	No	No	-4.126***	I(0)
Δ LHS	0	No	No	-4.563***	I(0)

*** denotes a significance level at 1%; ** denotes a significance level at 5%; * denotes a significance level at 10%.

The estimates show that the dependent variable, such as spouses' sector decision (*LDS*), is integrated with order of $I(1)$ at level and stationary at the first difference. All of the variables except high human capital (*LHHC*) and age (*LAG*) are stationary at the first difference and express integrating order of $I(1)$, whereas variables like high human capital and age are integrated of order zero and stationary at level, that is $I(0)$.

The ADF statistics of both the head of household and spouse variables explain the dependent variable with integrated order of one as $I(1)$. The independent variables are integrated with order of $I(0)$ and $I(1)$. In this situation, the ARDL co-integration econometric technique is applied to obtain the short-term and long-term estimates of the household analysis.

1.5.2.2 The co-integration bound test

The existence of co-integration among the selected variables is checked in the first step of the ARDL co-integration approach. The household analysis comprises two models. Model 1 uses the log of wages as a control variable, and model 2 uses the log of household size as a control variable.²⁷

In the head-of-household case, the maximum lag order for model 1 using the AIC is two. In model 2, the maximum lag order value is one under the same criterion. The estimates of the co-integration test are shown in Table 12.

Table 12: The estimates of the co-integration test for the household analysis

Dependent variable	F-statistic	DF	$I(0)$	$I(1)$	Outcome
<i>LDF (M-1)</i>	4.549***	6	3.15	4.43	Co-integration
<i>LDF (M-2)</i>	6.125***	6	3.15	4.43	Co-integration
<i>LDS (M-1)</i>	12.832***	10	2.54	3.86	Co-integration
<i>LDS (M-2)</i>	3.504**	10	2.06	3.24	Co-integration

*** denotes a significance level at 1%; ** denotes a significance level at 5%; * denotes a significance level at 10%.

²⁷ The diagnostic tests used were the Breusch-Godfrey (1978) test for serial correlation, Engle's (1982) ARCH test to expose the constant variance of models, and the Jarque-Bera test of normality.

The head of the household's sector decision is the dependent variable in the head-of-household equation. Both models 1 and 2 show that the F-test statistic rejects the null hypothesis of no long-run relationship among the variables because the coefficient value lies above the upper critical bound value of the F-statistic.

In the spouse case, the maximum lag order is two for model 1 and one for model 2 using the AIC. The estimates are shown in Table 12. The dependent variable is the spouse's sector decision. The F-statistic test value for both models 1 and 2 rejects the null hypothesis because the computing estimates lie above the upper critical bound value of the F-statistic. This represents the existence of a long-run relationship between the variables of both models.

1.5.2.3 The long-term estimated coefficient of the household analysis

The long-term estimates of the ARDL co-integration approach can be achieved in the presence of co-integration among the variables of the household analysis.

1.5.2.3.1 Head of household

The long-term estimates for the head of household are displayed in Table 13.

In model 1, heads of households with a medium level of human capital have a negative and statistically significant relationship with head-of-household sector decisions. This result shows that heads of households with medium human capital do not enter the formal sector—the formal sector accommodates persons with a high human capital level. In this way, heads of households with high human capital have a positive association with head-of-household sector decisions (Galani and Weinschelbaum, 2007 & 2012). This result shows that heads of households with high human capital participate in the formal sector because they can properly utilize their high education in that sector. However, it is insignificant because the formal sector does not possess the capacity to provide employment to all heads of households.

Table 13: The long-run estimates of the ARDL model of the head of household

Independent variable	Model 1	Model 2
C	-2.917** [-1.983]	-3.055 [-0.437]
LMHCHH	-0.168** [-2.178]	-0.333* [-1.875]
LHHCHH	0.068 [0.782]	0.287* [1.617]
LMFCHH	-0.100* [-1.715]	-0.020 [-0.145]
LHFCHH	0.214*** [3.693]	0.163 [1.238]
LAGHH	1.859*** [3.340]	2.244* [1.712]
LW	0.075* [1.333]	-
LHS	-	-0.047 [-0.019]
Observations	32	32

*** denotes a significance level at 1%; ** denotes a significance level at 5%; * denotes a significance level at 10%; [] t-statistic values are in parenthesis.

In the case of financial capital, heads of households with medium financial capital have a negative and statistically significant relationship with head-of-household sector decisions. This shows that heads of households with medium financial capital do not participate in the formal sector. On the other side, heads of households with high financial capital have a positive and statistically significant connection with head-of-household sector decisions. This result shows that heads of households with high financial capital will enter the formal sector (Manning and Pramoto, 2013) because they can pay taxes deducted from their salaries and other monetary requirements set by authorities.

The wage rate for heads of households with formal sector jobs is high, making them financially strong and stable. The log of wages, which is used as a control variable, has a positive and statistically significant relationship with the head of household's sector decision (Galani and Weinschelbaum, 2007 & 2012).

In model 2, the signs impact of the estimated coefficient of medium and high levels of human capital and financial capital are consistent with the estimated coefficient signs of model 1. The relationship of the head of household's sector decision with high and medium human capital is statistically significant (Merrick, 1976). However, heads of households with medium and high financial capital display insignificant associations with their sector decisions. The reason is that most heads of households prefer starting business activities with their financial capital (Dunn and Holtz-Eakin, 2000). The relationship of household size as a control variable with heads of households' sector decisions is negative and insignificant (Galiani and Weinschelbaum, 2007 & 2012).

1.5.2.3.2 Spouse

In the spouse case, the long-term estimated coefficients are presented in Table 14. In model 1, the interaction variables with the head of household's sector decision, such as ($LDF * LHC$) and ($LDF * MHC$), have a negative and statistically significant relationship with the spouse's sector decision. These results show that spouses with low and medium levels of human capital participate in the informal sector when heads of households are employed in the formal sector. The reason is that the spouse is already enjoying the benefits of the head of household's formal sector job (Galiani and Weinschelbaum, 2007 & 2012).

However, in some circumstances, the spouse is attracted to formal sector opportunities based on their high human capital. From this perspective, the relationship of ($LDF * HHC$) and the spouse's sector decision is positive and insignificant. This result shows that spouses with high human capital participate in the formal sector when the head of the household is already engaged in the formal sector (Amaral and Quintin, 2006).

Spouses with high human capital have a negative and insignificant relationship with their sector decisions. This shows that spouses with high human capital enter the informal sector (Galiani and Weinschelbaum, 2007 & 2012), but the insignificance level predicts that they possess the possibility of working in the formal sector.

Table 14: The long-run estimates of the ARDL model of the spouse

Independent variable	Model 1	Model 2
C	1.898* [1.652]	-1.807 [-0.967]
LDF*LHC	-0.696*** [-6.068]	-1.052*** [-4.197]
LDF*MHC	-0.122** [-2.080]	-0.296*** [-2.693]
LDF*HHC	10.984 [1.235]	25.585** [1.937]
LHHC	-10.685 [-1.203]	-25.172** [-1.914]
LDF*LFC	-0.194*** [-15.186]	-0.216*** [-7.342]
LDF*MFC	0.235*** [10.441]	0.294*** [5.694]
DF*HFC	-10.392 [-1.180]	-24.513** [-1.887]
LHFC	10.341 [1.175]	24.414** [1.882]
LAG	1.389*** [3.226]	2.712*** [3.058]
LW	-0.030*** [-3.141]	-
LHS	-	0.122 [0.535]
Observations	32	32

*** denotes a significance level at 1%; ** denotes a significance level at 5%; * denotes a significance level at 10%; [] t-statistic values are in parenthesis.

In the case of financial capital as a motivating factor, ($LDF * LFC$) has a negative and significant relationship with the spouse's sector decision. This result means that spouses with low financial capital participate in the informal sector when heads of households work in the formal sector (Portes et al., 1986). The reason is that informal sector activities provide low wage rates to their informal workers. On the other hand, ($LDF * MFC$) has a positive and significant relationship with the spouse's sector decision. This shows that spouses acquiring a medium level of financial

capital will enter the formal sector even when heads of households already work in the formal sector (Dunn and Holtz-Eakin, 2000). The spouse of this category will perform jobs in the formal sector, but sometimes prefers to start their own business in the informal sector using their high financial capital—even if the head of the household serves in a formal sector job. In this way, $(LDF * HFC)$ has a negative but insignificant association with the spouse's sector decision. This result highlights that spouses with high financial capital will enter the informal sector when heads of households work in the formal sector. The insignificance of the estimate expresses that spouses with high financial capital may engage in the formal sector even when heads of households are employed in the same sector (Portes et al., 1986).

The spouse with high financial capital has a positive but insignificant association with their own sector decision. This shows that spouses with high financial capital engage in the formal sector. The insignificance predicts the change in the spouse's participation decision (Manning and Pramoto, 2013). The age variable has a positive and significant relationship with the spouse's sector decision. The relationship between the log of wages and the spouse's sector decision is negative and statistically significant—the log of wages is the control variable of the analysis.

In model 2, the impact of all of the estimates related to low, medium, and high levels of human capital and low, medium, and high levels of financial capital and their interaction variable with the head of the household's sector decision is identical to the impact of the computed coefficient values of model 1. All of model 2's computed estimates are statistically significant except the control variable. The control variable (household size) has a positive relationship with the spouse's sector decision (Galiani and Weinschelbaum, 2007 & 2012).

The results suggest that when the head of the household is employed in the formal sector, the spouse with a low level of motivational factors—human and financial capital—will participate in the informal sector in the long-term analysis (Galiani and Weinschelbaum, 2007 & 2012).

1.5.2.4 The short-term dynamic estimates of the household analysis

Under the ARDL co-integration approach, the short-term dynamics of the model are attained by using ECM and convergence theory for the household analysis. Short-term dynamic estimates have been obtained for both equations.

1.5.2.4.1 Head of household

In the head-of-household case, the results are displayed in Table 15. In model 1, the impact of all of the variables comprises medium human capital, high human capital, medium financial capital, high financial capital, and the age of the head of the household. The short-term dynamics are consistent with the impact of the long-term analysis of model 1, except the log of wages. The log of wages shows a negative relationship with the head of the household's sector decision in the short-term analysis (Suryahadi et al., 2003).

These results show that the head of the household with a high level of human and financial capital will contribute to the formal sector because these factors help them perform formal work activities (Galiani and Weinschelbaum, 2007 & 2012; Manning and Pramoto, 2013). All of the computed variable outcomes of model 2 in the short term are identical to the estimated outcomes of model 2 of the long-term estimates.

In both the short-term model dynamics of the head of the household, the error correction term in lagged form is negative and highly significant. The error correction terms for model 1 and model 2 are -0.89 and -0.50 , respectively. These coefficient values display the speed of adjustment towards the steady-state point of equilibrium of the analysis. The error correction term value for model 2 is relatively small as compared to that of model 1. This indicates the slow convergence speed of the participation of the head of the household into the formal sector with high human capital and high financial capital.

All of the diagnostic tests comprise a serial correlation check by applying the Breusch and Godfrey (1981) test, a homoscedasticity examination using the ARCH residual test, and a normality test using Jarque-Bera statistics. These are satisfied for both the ECMs of the head of the household.

Table 15: The short-run dynamics of the ARDL model of the head of the household

Independent variable	Model 1	Model 2
Δ LMHCHH	-0.151** [-1.904]	-0.170** [-1.972]
Δ LHHCHH	0.061 [0.796]	0.146** [1.851]
Δ LMFCHH	-0.670*** [-3.929]	-0.010 [-0.139]
Δ LHFCHH	0.775*** [4.340]	0.083 [0.919]
Δ LAGHH	1.665** [2.397]	1.143* [1.464]
Δ LW	-0.852** [-2.254]	-
Δ LHS	-	-0.023 [-0.019]
EC	-0.895*** [-4.923]	-0.509*** [-2.526]
R ²	0.686	0.780
Adjusted R ²	0.495	0.713
F-statistic	3.588 [0.008]	11.696 [0.000]
Diagnostic test		
Serial correlation Lagrange multiplier test	0.833 [0.495]	23.257 [0.198]
ARCH test	0.081 [0.784]	0.973 [0.340]
Jarque-Bera normality test	1.567 [0.456]	0.572 [0.750]
Observations	32	32

*** denotes a significance level at 1%; ** denotes a significance level at 5%; * denotes a significance level at 10%; [] t-statistic values are in parenthesis.

1.5.2.4.2 Spouse

In the spouse case, the short-run dynamics estimates are available in Table 16. The influence of the interaction term of (*LDF*) with low, medium, and high human capital, high human capital,

and the interaction term of (*LDF*) with low, medium, and high financial capital, high financial capital, age, and log of wages of the spouse of model 1 in the short term is consistent with the influence of the estimated variables of model 1 of the long-term analysis.

These results show that the spouse with the motivating factors of low and medium human capital will engage in informal sector activities when the head of the household is attached to the formal sector (Galiani and Weinschelbaum, 2007 & 2012). In addition, the spouse with high human capital enters the informal sector regardless of the head of household's sector decision. The spouse with low and medium levels of financial capital can contribute to the informal sector (Portes et al., 1986). This will cause an increase in the informality level of the economy. In other circumstances, the decision of the spouse with high human capital, medium financial capital, and high financial capital can differ depending on opportunities available in the formal sector (Dunn and Holtz-Eakin, 2000; Amaral and Quintin, 2006). Similarly, for model 2, the estimated results of the short-term analysis for these variables are the same as the estimated results of the long-term analysis.

The computed error correction term of the spouse for both models is small and highly significant. The error correction terms for model 1 and model 2 are -0.80 and -0.42 , respectively. In this circumstance, the value of the error correction term in model 2 is much smaller relative to model 1, which is reliable. This small value specifies the slow convergence speed of the spouse with a low level of human and financial capital toward the equilibrium point that will engage in the informal sector. These ECMs of the spouse also clear the diagnostic tests, including serial correlation using the Breusch and Godfrey (1981) test, the homoscedasticity check by applying the ARCH residual test, and the normality test using Jarque-Bera statistics.

Table 16: The short-run dynamics of the ARDL model of the spouse

Independent variable	Model 1	Model 2
$\Delta LDF * LHC$	-0.465^{***} [-8.267]	-0.447^{***} [-6.510]
$\Delta LDF * MHC$	-0.153^* [-1.509]	-0.207^{***} [-5.273]
$\Delta LDF * HHC$	4.680 [0.912]	4.797* [1.437]

Independent variable	Model 1	Model 2
ΔLHHC	-4.432 [-0.868]	-4.543* [-1.368]
$\Delta\text{LDF*LFC}$	-0.191*** [-10.700]	-0.195*** [-12.614]
$\Delta\text{LDF*MFC}$	0.211*** [6.639]	0.217*** [8.231]
$\Delta\text{LDF*HFC}$	-4.196 [-0.841]	-4.243 [-1.295]
ΔLHFC	4.194 [0.842]	4.241 [1.296]
ΔLAG	1.047** [2.028]	1.153*** [4.102]
ΔLW	-0.024** [-2.349]	-
ΔLHS	-	0.052 [0.515]
EC	-0.805*** [-3.367]	-0.425*** [-4.337]
R^2	0.994	0.945
Adjusted R^2	0.982	0.864
F-statistic	86.516 [0.000]	11.660 [0.000]
Diagnostic test		
Serial correlation Lagrange multiplier test	1.208 [0.560]	0.193 [0.797]
ARCH test	1.055 [0.321]	0.495 [0.498]
Jarque-Bera normality test	1.022 [0.599]	2.151 [0.341]
Observations	32	32

*** denotes a significance level at 1%; ** denotes a significance level at 5%; * denotes a significance level at 10%; [] t-statistic values are in parenthesis.

1.6 Conclusion

The current analysis scrutinizes the motivating factors of workers' participation in the formal and informal sectors of the labor market. A theoretical model is presented in which formal and informal sector size is determined endogenously. Worker participation is explored at the individual and household level based on motivational factors. The analysis uses data for the period 1984–2015. The estimation analysis is conducted using the ARDL co-integration technique for both the individual and household analyses.

The worker participation decision in the formal or informal sector depends on various factors, including managerial ability, managerial skill, and financial capital. Low, medium, and high levels of motivational factors predict workers' selection behavior. The estimates suggest that the worker with low managerial ability, low managerial skill, and low financial capital will join the informal sector. The informal sector provides work to less educated and less skilled workers who receive low wages. Workers with high managerial ability, high managerial skill, and high financial capital will be hired by formal firms. Formal firms accommodate highly educated and skilled workers and pay high wages. The behavior of workers with a medium level of decision factors is ambiguous in the analysis.

On the other side, the household level of workers plays an important part in labor market sector selection. The behavior of the head of household and spouse is governed by their motivational factors—human capital and financial capital. The medium and high categories of motivational factors are applied to elaborate on the behavior of the head of household. The results express that heads of households possessing high human capital and high financial capital enter the formal sector. The role of medium decision factors is ambiguous in the case of the head of household. The spouse results shows that spouses with low levels of human capital and financial capital enter the informal sector when heads of households engage in the formal sector. The spouse with a medium level of human capital enters the informal sector, while the spouse with a medium level of financial capital works in the formal sector. Even the spouse with a high level of human capital and financial capital will engage in the informal sector when the head of household is employed in the formal sector.

The participation behavior of individuals is based on their motivational factors to join firms in the informal sector. Less education and skill force workers to join the informal sector and earn

less income. This behavior increases the participation rate of labor in the informal sector. On the other side, the spouse's behavior in contributing to the informal sector is based on these motivational factors, causing an increase in the rate of informal labor. In addition, highly educated people who do not find work in the formal sector, enter the informal sector. This entire situation leads to an increase in the informality level of the economy.

1.7 Policy Implications

This analysis elaborates on the important factors of increasing the level of the informal sector in the economy. These factors play an important role in resolving the informality problem on the policy front. This practice reveals that policymakers should consider labor supply to tackle the informality rate in the economy—policies to increase the formality rate in the economy are required to curtail the informal labor rate. This point is necessary to keep in mind while establishing economic policies.

This study proposes policies to tackle the problem of informality at the firm and individual level:

1. The informality rate of the economy can be controlled by giving regulatory powers to monitoring authorities to tackle informal firms. These authorities can implement small and affordable registration fees for small enterprises and informal firms. This process will allow firms to enter the formal sector.
2. Taxation rate policies for informal firms can be designed by applying low taxes to small, informal firms based on their size and number of workers. These policies should be implemented in the economy. This will enhance the tax revenues and income of the economy.
3. The government should provide basic structural arrangements and an appropriate environment that allows small enterprises to flourish. In this respect, the government can announce easy ways to register informal firms and provide better infrastructure for their activities.
4. Policies should be developed to provide financial support to small, informal firms. Under these policies, small loan offers can be implemented to increase the capacity of their production units. Then, these units, which require skilled and unskilled workers, will help increase employment opportunities in the economy.

These policies will help decrease the number of informal firms and increase the number of formal firms. This process will enhance employment levels for individuals and lead to increases in the formal sector.

In addition, the participation behavior of workers in sector selection at the household level requires attention in terms of welfare policies. Based on this study, the following policies are recommended at the household level:

1. The computed estimates show that unskilled and uneducated workers will enter the informal sector. Policies should be developed to provide better levels of education and skill opportunities for workers. Educational, professional, and technical institutions should be established at the city level. This will provide opportunities to people to obtain education and skills, and raise the rate of educated and skilled workers in the labor force.
2. The low-earning member of the household will enter the informal sector. Policies should be designed to provide financial assistance at individual levels. Financial institutions can provide small loans and grants to persons to start new businesses in the formal sector.
3. Economic labor policies should be developed to provide social and pecuniary benefits to both second and first earners of households in formal sector jobs. Benefits are provided mostly to the first earner, which forces second earners with high education and skills to engage in the informal sector, thereby increasing the informality rate in the economy.

However, to overcome high informality levels, policies should not be established at only the sector level—the circle should extend to the individual level. Policies of better opportunities for education, skill, and finance for workers will enhance formal labor in the labor market. This will increase the formality rate and decrease the informality rate in the economy.

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2. The Relation of Core Labor Standards with Informal and Formal Employment

2.1 Introduction

Most national laws and regulations as well as labor standards addressed by the International Labour Organization (ILO) cover different facets of the employment relationship (Ladbury and Gibbons, 2000). Thus, the notion of core labor standards is significant due to its association with other human rights. These standards stem from the 1998 ILO Declaration on the Fundamental Principles and Rights at Work and are the result of changes in the international labor rights regime over several decades (Alston, 2004). The adoption of this declaration endorses respect for labor standards in an era of globalization.

This new hierarchy established four core labor standards contrasting with previous heterogeneous labor rights. The core labor standards comprise freedom of association and collective bargaining, freedom from child labor and forced labor, and non-discrimination in employment (Chau and Kanbur, 2001). ILO conventions apply only to countries that ratify them. The organization cannot enforce compliance, but it does depend on advice, international pressure, and compliance monitoring (Krueger, 1996).

The measurement of labor standards is based on laws and regulations. Most of the pure measures are limited to laws that manage the labor market, while the extensive measures encompass social and political rights (Block, 2005). The pure measure of labor standards is used to compute employment security in the Caribbean, Latin America, and OECD countries (Heckman and Pages-Serra, 2000), whereas unionization rates, freedom house civil liberties, and political indexes are used as broader measures of labor standards in some studies (Kucera, 2001; Maskus, 2003; Galli and Kucera, 2004; Kucera and Sarna, 2004).

There are other measures related to the merging of labor market outcomes and legislative measures. In this way, ILO convention-ratified data and child labor data are used to compute the aspects of labor standards (Busse, 2001; Cuyvers and Van Den Bulcke, 2004). In this context, the index of core labor standards is constructed to evaluate the existence of core labor standards in different countries (Bazillier, 2005). The predominant objectives of labor standards are to

certify the adequate workers protection in term of employment security and minimum living standard (Akorsu, 2013). These core labor standards affect the trend of formal and informal employment in developed and developing countries under the circumstances of poor working conditions (Galli and Kucera, 2004). The peculiarities of formal and informal work upsurge to peculiar labor standard. The insistence of formal-informal dualism reflects the concern by which a large portion of the population works in semi-capitalized and illegal enterprises, and where formal jobs are not available for people in developing countries (Telles, 1992). The features of informal jobs are typically not subject to labor market rules and regulations. This infers the workers to stay outside most social security arrangements and often confronted with low compensations (Jutting et al, 2008). Regarding opposite effect of labor standards, the expansion of labor standards in formal sector will lead to high portion of informal employment (Singh and Zammit, 2000).

Portes and others use the development approach to explain the increasing level of informal employment (Portes and Schauffler, 1993; Portes, 1989 & 1994). These policies were adopted to cluster the industry in one or two cities of countries. An abundant number of jobs were produced in cities but were inadequate in offering formal jobs. This labor surplus resulted in rises in open unemployment and increased informal employment (Portes, 1989). The other factors that increase informal employment are the increasing supply of female labor and service sector growth in which informal workers work (de Oliveira and Roberts, 1994; Carr and Chen, 2001; Saavedra and Chong, 1999).

Another description argues that labor standards affect both types of sector employment. Singh and Zammit (2000) contend that the powerful rights of freedom of association and collective bargaining lead to the process of informalization and may hinder or prevent economic development, especially in developing countries. Many factories in developing countries continue to utilize child labor in hazardous working environments (Locke et al., 2007a)—forced labor causes involuntary entry into the labor market and the coercion that prevails within (Lerche, 2007).

An ILO report states that a minimum of 12.3 million persons work as forced labor, which was the first legal estimate of worldwide forced labor (ILO, 2006). A more recent figure is 25 million, including men, women, and children (ILO, 2018). Pager et al. (2009) find that

employment discrimination is an agent of rising unemployment levels and reductions in labor force participation. The ratification compliance of ILO conventions is perceived as a benchmark that indicates a country's willingness to implement protections policies for worker rights (Helfen and Sydow, 2013). In addressing this, it is useful to discuss core labor standards that may well affect formal and informal employment (Galli and Kucera, 2004).

In the Pakistani economy, the ratio of informal employment is increasing while formal employment is almost stagnant. Informal employment covers around 74 percent of the existing labor force (Tahir and Tahir, 2018). Thus, the current analysis is divided into two steps. In the first step, an index is constructed to measure the core labor standards of Pakistan using a time-series analysis. This index consists of four indexes, including freedom of association and collective bargaining, child labor, forced labor, and discrimination in employment. This process also includes the index of ILO conventions ratified by the country. All of these indexes will be aggregated using PCAs to display the enforcement of CLSI in the economy. The effect of this index on informal employment levels of the economy is evaluated. In the second step, the analysis examines empirical evidence on the influence of the CLSI on formal employment in the Pakistani economy.

The rest of the study is arranged as follows: section 2 reviews existing literature. Section 3 describes the methodology, including the construction of a CLSI and a description of an empirical model and its variables. The estimation technique is described in section 4. The estimation results are presented in section 5. Section 6 concludes the study, and section 7 provides policy implications. The references and appendices are shown at the end of the essay.

2.1.1 Objectives

The study elaborates on the effect of the core labor standards stated by the ILO declaration on the level of informal and formal employment in the Pakistani economy. The specific objectives are:

1. To analyze the impact of the CLSI on informal employment in the Pakistani economy.
2. To evaluate the influence of the CLSI on formal employment in the Pakistani economy.

2.1.2 Study significance

Traditional labor rights comprise a heterogeneous and extensive range of labor rights set in past decades. To resolve rights complications, a new normative ladder has been established in the form of core labor standards (Alston, 2004). The demand for these labor standards to protect worker rights has been growing with the globalization process. These standards measure the conditions of working labor in a country.

On the other side, the execution of these standards influences employment opportunities because they flourish in formal sectors but are often ignored in informal sectors (Galli and Kucera, 2004). That is why their presence causes alterations in the levels of formal and informal employment in the labor market of developing countries. Two possibilities are predicted. First, the weak implementation of labor standards (Bazillier, 2008) and second, the poor protection of worker rights (Brown, 2000). In this scenario, it is necessary to evaluate the impact of labor standards on the formal and informal employment levels that dictate labor practices in the labor markets of developing countries.

Prevailing work describes the cross-country analysis of labor standards indexes (Chau and Kanbur, 2001; Bazillier, 2008, 2004; Galli and Kucera, 2004) for developed and developing countries. Some studies highlight the impact of other factors, e.g., international trade and monitoring and global chains, etc. on international labor standards (Brown, 2000; Locke et al., 2007b; Fichter and Sydow, 2002), but the effects of these standards on formal and informal employment are missing from existing literature. Thus, this study is an attempt to explore the impact of core labor standards on informal and formal employment levels in Pakistan.

2.2 Literature Review

The existing literature highlights the relationship of core labor standards with informal and formal employment in a different context. This review is split into two sections. The first discusses core labor standards, while the second links them with informal and formal employment.

2.2.1 The evolution of core labor standards

Brown (2000) offers a critical review of the present debate on several aspects of international labor standards. He considers the competition between labor contracts and legal protections that occur in the presence of labor protections. The core labor standards are enforced and established with larger tasks. Labor standards affect trade, which in turn causes reductions in wages and ultimately leads to the unemployment of unskilled workers. Alston (2005) contends that the ILO plays an important role in defining core labor standards and their implications for private voluntary initiatives. The study sketches the steps that the ILO takes to ensure the protection of the basic rights of workers in the present century.

Chau and Kanbur (2001) and Busse (2004) examine the determinants of labor standards indirectly and the factors of ratification directly. The study recommends two key factors—regulating national standards for countries and the costs of deviating from international standards. The countries that judge the ratification and try to balance their benefits and costs after ratification have higher standards than before. Heintz (2002) scrutinizes the critical issues related to the establishment of a global labor standards system. The labor standards promote the working lives of a large number of people. The enforcement of basic standards through regulatory schemes provides a model for conducting multinational economic activities. This effective scheme for implementing global labor standards provides a sufficient policy goal for international consumption and production.

Turnell (2002) suggests ways to incorporate core labor standards into the agenda of the World Trade Organization (WTO). The study accepts the appraisal of the OECD, World Bank, and ILO that core labor standards have economic merit. The arguments predict that the absence and weakness of the enforcement power of core labor standards leads to a dangerous democratic deficit at the soul of the international system. In this regard, establishing a multinational institution to ensure the adherence of core labor standards provides legitimacy for the global economic system.

Palley (2004) probes the theoretical case for international core labor standards in developed and developing countries. He elaborates on the static and dynamic efficiencies related to free association and workers' collective bargaining rights. The efficiency gains obtained from labor standards are not realistic in competitive markets. The actual gains attained by official

intervention are those that highlight core labor standards as applicable rules of the game. Bazillier (2005) establishes a new methodology for constructing the CLSI to measure effective levels of labor standards in 155 countries using a cross-sectional dataset and five indicators—number of conventions ratified, child labor, freedom of association and collective bargaining, discrimination, and forced labor. This index can be obtained to evaluate the enforcement of labor standards in these countries and the government employers and worker organizations can help promote labor standards. Block (2005) examines the process of measuring discrepancies in labor standards to scrutinize the effect of differential labor standards across countries. The Block-Robert methodology is used. The sub-national political jurisdictions endorse labor standards within countries, which is the measure for estimating the differences in labor standards across countries.

Haworth et al. (2005) and Cotton et al. (2005) analyze the response of international labor standards regimes to the settlement of labor standards. The study highlights the role of the ILO in determining alternative ways by which the regulation of labor standards can be established through global consensus. The core labor standards regime contributes as a promising platform to bring about progress in labor protection by integrating social policy with economic governance.

In this context, Berik and Rodgers (2008) explore the compliance and enforcement of labor standards in two Asian countries—Bangladesh and Cambodia—with the lowest labor costs in the world. They assess mechanisms for promoting working conditions in the manufacturing sectors of both countries. These mechanisms comprise ILO-ratified conventions, the global enforcement of labor standards, and the implementation of labor laws and their promulgation by national governments. However, Habib-Mintz (2009) revisits the debate on the role of stakeholders in promoting labor standards in the multinational corporations (MNCs) of developing countries. The MNCs expand labor standards in developing countries as a conducive bottom-line, but do not capture all the aspects. The governments of host countries can enforce labor standards because MNCs have limited authority to implement labor standards because they have no aggregate dominance over developing countries.

2.2.2 The core labor standards link with informal and formal employment

Studies in the literature elaborate on the relationship of core labor standards with formal and informal employment. In this context, Anderson (1987) offers a labor market segmentation model for the Caribbean which divides the labor market into three sectors—primary, secondary, and informal. There are variations in income and employment factors between these sectors. The equitable trade-offs can be settled by appraising the costs and benefits of disparate employment strategies. Bazillier (2008) describes the effective enforcement of international core labor standards in developing countries. Then, Gimpelson et al. (2009) explore the implementation of employment protection legislation on Russia's regional and sub-regional labor markets. The interregional differences in the enforcement of employment protection legislation have a statistically significant influence on the labor market and regional economies. Conversely, strict legislation suppresses the employment level and expands unemployment. The general level of employment protection legislation compliance in the labor market can be increased by making legislation easier, cheaper, and more transparent.

In response to labor standard in formal sector, Dougherty (2008) discusses the effect of employment protection legislation on employment dynamics in the organized sector of the Indian economy. The study adopts quantitative measures to gauge state labor laws and national regulations using a dataset for the period 1998–2004 and by constructing a labor reforms index. Some reforms weakly support some of the labor laws and that more comprehensive reforms are required for implementing core labor laws. These reforms are imperatively incremental and provide a way to acquire benefits through the better crafting of regulations. Meanwhile, Davies et al. (2011) assess the implementation and monitoring of fundamental labor rights (which are enumerated in international framework agreements) in subcontracting chains of construction MNCs in three countries—Brazil, Malaysia, and Ukraine. The industrial relations and labor rights-controlling institutions are imperative for developing the scope of workplace management and monitoring at the local and societal level. In this regard, the social organization of the labor market in the three countries is an important issue because management challenges are a prerequisite for labor-controlling regulations.

On the other side of labor market, Márquez and Pages (1998) and Valodia (2001) provide evidence linking job security and informal employment in different countries. There is a highly

significant relationship between the employment protection index and self-employment. The workers will tend towards self-employment in the presence of highly protected labor markets. In this scenario, labor policies through the control of the regulatory environment shape the form and growth of informal work.

Trebilcock (2004) illustrates the provision of the scope of ILO conventions and recommendations that address the problems of informal workers. International labor standards seem to act counterproductive relative to the informal economy. These standards will offer a platform of support towards achieving decent work facilities for all types of workers in all sectors of the economy. In addition, various international labor standards are inappropriate for informal economies. In severe circumstances, labor standards need to be implemented even though some people still pursue work in the informal economy. Conversely, Singh and Zammit (2004) emphasize the obstacles to establishing labor standards in the extensive informal sector of developing countries. They use a dataset for the period of thirty five years. The labor standards are arduous to achieve in both rural and urban informal sectors and in the agricultural sector because the organizational methods and represented needs are quite different in these sectors. In this regard, Kapelyushnikov et al. (2012) seek to scrutinize the combination of the inefficient imposition of labor regulations and the emergence of a broad informal sector of the labor market and how they lead to employment stabilization. The labor market model is materialized in Russia and explores the effect of the economic crisis on the labor market. The analysis is conducted for the ten years period. The findings suggest that the institutional core of labor relations has a great variation of informal arrangements that mitigate the formal rules of employment. This flexibility limits the exposure of formal rules and relies on the arrangements of informal employment instead. The ubiquity of informal arrangements dims the line between the formal and informal sector to the extent that firms ignore labor rules. Likewise, Akorsu (2013) examines the scope of labor standards application in framing employment conditions and relations within the informal economy of Ghana. The study considers thirty informal sector manufacturing firms and uses interview data from forty three entrepreneurs and workers. The results find that labor standards are not applicable among informal economy operators because of ineffective enforcement, the peculiarities of organizational work, ignorance, dynamic apprenticeship systems, and the lack of labor regulations. The opportunities should be created to apply labor standards in the informal

sector by extending legislative instruments and formulating targeted policies to cover informal work.

However, Cooke (2011) explores the competence of labor protection regulations for informal workers in China by inspecting distinct institutional factors. The study is based on a first-hand and secondary empirical dataset. The first-hand empirical dataset was collected through interviews and the secondary data was obtained from media sources and academic publications. The findings suggest that the majority of the growing labor force in China's informal sector will remain unprotected in the absence of effective execution of employment associated regulation. The efficient productivity is obtained by removing loopholes in the establishment of labor regulations. In this respect, Ojha and Vrat (2015) discuss the sprout hiring of informal labor in India's manufacturing sector. The study develops a system dynamics model to simulate a flexible formal-informal labor mix ratio to describe long-run policy implications in the manufacturing sector. The various dimensions of these implications are examined in a historical context. The employer perceptions can change significantly by hiring contractual labor that seems better in the short term. The manufacturing plants should perform their functions with a balanced ratio of formal and informal labor by adopting national labor regulations.

A study by Galli and Kucera (2004) explore the relationship between labor standards and formal and informal labor markets using the dataset of a panel of specific groups of formal and informal employment in fourteen Latin American countries. The countries with high levels of labor standards have higher levels of formal sector employment and lower levels of informal sector employment. So, the stronger labor standards increase formal employment in the long run. Similarly, Fagernäs (2007) determines the impact of industrial dispute legislation and the settlement process of disputes on formal versus informal employment levels in India. The main focus of this study is on the performance of the dispute settlement system and alterations to the Industrial Dispute Act in the Indian state. The findings explain that the selected indicators matter to an extent, but the significance level of factors vary in different datasets. The changes in industrial disputes cannot modify the expansion plans of firms and do not affect the division of formal and informal workers.

2.2.3 Conclusion

The prevailing literature describes the effect of rules and regulations in the form of international labor standards on the employment structures of labor markets. They use an index to elaborate on this effect, which is an aggregate of four types of labor standards. Most of the studies use cross-country analysis for this purpose. Different techniques are used for econometric estimation. The existing studies explain the negative relationship between labor standards and informal employment. This means that higher levels of labor standards will decrease informal employment levels in economies. In addition, they find that there is a positive relationship between formal employment and core labor standards. This predicts the increasing ratio of formal employment in the presence of a higher level of labor standards in economies.

2.3 Construction of the CLSI

This section comprises the introduction of the core labor standards and its index. The inner structure of these standards and aggregate CLSI are also described. In the end, PCA is used to construct a CLSI for Pakistan.

2.3.1 Core labor standards

International pressure prevails to improve labor standards arising from the fundamental failure of internal authorities to implement their own labor laws and regulations. These labor standards vary from one country to another based on their income levels and political, cultural, and social conditions and preferences (Brown et al., 1998). Most labor laws are quite extensive in developing countries and cover all of the core labor standards. The ILO seeks to encourage core labor standards in member countries via the adoption of a series of conventions that help ensure the enactment of national legislation and implementation (Kuruvilla and Verma, 2006).

The measurement of core labor standards is handled by using the ratification procedure of ILO conventions (Chau and Kanbur, 2001). The ILO has a total of 189 conventions. It has established a set of four core labor standards that consist of eight fundamental conventions. These core standards are elaborated upon in the Declaration on the Fundamental Principles and Rights at Work in the form of four headings (ILO, 2001) (Table 1).

Table 1: Core labor standards and their fundamental conventions

1.	The Freedom of Association and the Right to Collectively Bargain <ul style="list-style-type: none">▪ C087 - Freedom of Association and the Protection of the Right to Organize Convention, 1948▪ C098 - Right to Organize and Collective Bargaining Convention, 1949
2.	The Elimination of Forced and Compulsory Labor <ul style="list-style-type: none">▪ C029 - Forced Labor Convention, 1930▪ C105 - Abolition of Forced Labor Convention, 1957
3.	The Elimination of Employment Discrimination <ul style="list-style-type: none">▪ C100 - Equal Remuneration Convention, 1951▪ C111 - Discrimination (Employment and Occupation) Convention, 1958
4.	The Abolition of Child Labor <ul style="list-style-type: none">▪ C138 - Minimum Age Convention, 1973▪ C182 - Worst Forms of Child Labor Convention, 1999

Source: ILO (2001)

The ILO asserts that these descriptive core labor standards denote fundamental worker rights—they can be functional all over the world and in all phases of development. The OECD substantiates this selection by two arguments: they are fundamental factors of human rights, and their consideration brings more efficiency. An international consensus states that these fundamental rights of workers should be identified and preserved globally.

The ILO has established a process that leads to the betterment of labor standards globally. Each national authority has the right to implement these conventions. A lack of success in conventions implementation can result in an accusation to the ILO. This accusation proceeds to a commission of inquiry and action can be taken on the basis of the ILO's constitution—remedial activities against violators (Kuruvilla and Verma, 2006). Of 187 ILO member nations, 155 have ratified the freedom of association convention, 175 have ratified the discrimination convention, 178 have ratified the convention on forced labor, and 186 have ratified the convention on child labor (ILO website).

2.3.2 The existence of core labor standards in Pakistan

The above-mentioned global rules and principles concerning professional and work conditions are used to state labor standards (OECD, 1996). These standards are multidimensional in their perspective. Most labor standards are based on specified national circumstances. They depend on

institutions; social, political, and cultural conditions; and phases of development that vary across countries (Stern, 2000).

Pakistan has ratified 36 ILO conventions, including the eight fundamental labor standards conventions—including two governance conventions and 26 technical conventions. Pakistan was the second country among all ILO members to ratify all eight fundamental conventions.

These conventions were ratified in distant decades. Convention no. 87 was ratified in February 1951; convention no. 98 was ratified in May 1952; convention no. 29 was ratified in December 1957; convention no. 105 was ratified in February 1960; convention no. 111 was ratified in January 1961; convention no. 100 and no. 182 were ratified in October 2001; and convention no. 138 was ratified in July 2006 (ILO website). Pakistan completed the ratification procedure of these fundamental conventions within 56 years.

At the present time, global compliance is measured by building an index that consists of these four core labor standards. For this purpose, various indexes will be constructed to measure freedom of association, discrimination, child labor, and forced labor. Another approach requires measuring the labor standards in the number of ILO convention ratifications. The construction of this index is described in the next section.

2.3.3 Demonstration and structure of the CLSI

The labor standards index can be established by five indexes: freedom of association, the ILO's convention ratification, discrimination, child labor, and forced labor (a dummy variable). These indexes contain aggregate information from different sources. They can be classified into five groups. This step is needed to avoid giving a high weight to variables with additional modalities. The different indexes can be compared even if they are measured with distant variables. Additionally, this classification is required because by using the same reason, the aggregated index is constructed by covering all aspects of core labor standards. For this, we have the following set of ordinal indexes defined by Bazillier (2004, 2005, & 2008).

2.3.3.1 Index of freedom of association and collective bargaining (I_{FC})

This is a compound index. It is designed to measure for a large number of countries both in the qualitative and quantitative context. Its criteria include unionization rates, the number of ILO

conventions ratified on the freedom of association by the country, and Freedom House civil rights.

- a. Unionization rate (UR):** This is not a confined instrument to express the freedom of association. Its value can be higher for countries with weak levels of freedom of association and lower for countries with good levels of freedom of association. However, this indicator is feasible for only a few countries. The unionization rate provides information related to countries' freedom of association level. The usefulness of this indicator depends on its availability. The unionization rate is the ratio of union force in the labor force of a country. Data is accessible for 92 countries. For other countries, this indicator is calculated by taking the average of two other indicators, i.e. the number of ILO-ratified conventions and the civil rights indicator of Freedom House.²⁸
- b. The number of ILO-ratified conventions (NRC) on freedom of association:** The freedom of association has six ILO conventions. Only two of them are accepted as core conventions: the Freedom of Association and Protection Right to Systemize Organization, 1948 (no. 87) and Rights to Collective Bargaining and Organize Convention, 1949 (no. 98). There are another four conventions that are more precise and technical. These includes the Workers' Representative Convention, 1971 (no. 135), the Labor Relations Convention, 1978 (no. 151), the Collective Bargaining Convention, 1981 (no. 154), and the Rural Workers' Organization Convention, 1975 (no. 141). The country concern on the matter of freedom of association is expounded on the basis of the number of ratifications for the above-mentioned conventions.
- c. Civil rights indicator (CRI):** This indicator is broader than the concept of freedom of association. It includes not only the freedom of association, but also the rule of human rights and law, freedom of expression, economic rights, freedom of belief, and personal autonomy. All of these variables are correlated and defend this indicator in order to judge freedom of association. This indicator is a combination of the civil liberty index (LI) and political index (PI).

$$\text{CRI} = \text{LI} + \text{PI}$$

²⁸ The countries for which unionization rate data is not available.

The freedom of association aggregated index (I_{FC}^A): This is the average value between unionization rates, the number of ILO-ratified conventions, and the civil rights indicator. Data for the last two indicators is available for most countries, but a few countries also have data related on unionization.²⁹

$$I_{FC}^A = UR + NRC + CRI/3$$

2.3.3.2 *Index of gender discrimination related to employment (I_{GD})*

Gender discrimination is a perplexing phenomenon. The proposition is that discrimination in education is taken as an important and integral feature of employment discrimination. Discrimination in current labor markets may affect discrimination in pre-labor markets. Women will be less likely to invest skills in professions they find difficult to enter (Coate and Loury, 1993). This correlation of discrimination between the current and pre-labor market leads to a strong relationship between discrimination in employment and education (Jolliffe and Campos, 2005). Different measures are used to build the index of discrimination in employment and education. The five essential variables are alphabetization rate differences, schooling rate differences, income differences, activity rates, and the United Nations Development Programme's (UNDP) measurement of gender empowerment (GEM).

- a. Alphabetization rate differences (ARD):** This is the ratio between the female literacy rate (FLR) and male literacy rate (MLR).
- b. School enrollment rate differences (SERD):** This is produced by the ratio between the female school enrollment rate (FSER) and male school enrollment rate (MSER), which can be measured by combining primary, secondary, and tertiary schooling rates.
- c. Income differences (IN):** This is the percentage of income difference (earned in PPP) between male income (MI) and female income (FI).

²⁹ Due to the unavailability of unionization rate data for Pakistan, the average method is used in the construction of the index.

- d. **Female activity rate (FAR):** This is measured by women’s participation rate in the labor force.³⁰
- e. **Gender empowerment measures (GEMI):** This is a UNDP index that calculates gender inequality based on three scopes of empowerment. These are political contribution and decision-making, economic sharing and decision-making, and power accomplished by economic resources. The data for this index is available for 66 countries.

The aggregated index for discrimination (I_{GD}^A): This aggregated index is obtained by combining all of the above five variables—alphabetization rate differences, schooling rate differences, income differences, female activity rates, and UNDP’s measurement of gender empowerment. Data is unavailable for all of the indicators. However, to measure the discrimination index, at least two of the above indicators can be used under certain conditions.³¹ This index is a mean value of all accessible indicators.

$$I_{GD}^A = ARD + SERD + IN + AR + GEMI$$

2.3.3.3 *Index of child labor (I_{CL})*

The construction of the child labor index comprises two indexes: raw and adjusted. The raw index (RI) is described by the percentage of working children aged 10–14 years. We recognize this rate as an acceptable proxy for child exploitation. Yet, this raw index is not fully acceptable because most developing countries have a problem with collecting such data. There is definitely a credible number of children that neither do work, nor go to school. However, we pretend that such countries in which half of the children do not go to school anticipate the crucial child labor problem. But the precise child labor rate is non-existent for various countries. This elusive paradox can be described by the inadequacy of data and political considerations. The adjusted index is used to remove this statistical bias. So, the raw index determines the adjusted index. The number of children joining work with school is nearly equal to those children who do not attend school with no work (Bescond et al., 2003). The adjusted index (AI) is adapted by taking the

³⁰ The female activity rate is used due to the discriminative behavior of the female share of the labor force (Maskus, 2003).

³¹ In Pakistan’s case, an aggregated value of three variables is used to construct the index. These are alphabetization rate differences (ARD), schooling rate differences (SERD), and female activity rate (FAR).

percentage of children who does not attend school.³² The adjusted CL is calculated using the following formula:

$$CL_{adjusted} = \max\left(CL'_{raw}; \frac{CL_{raw} + \text{ratio of children who does not attend primary school}}{2}\right)$$

The obtained value cannot be taken as the percentage of working children. However, it represents the index to measure child labor in the form of an ordinal value.

2.3.3.4 Index of forced labor (I_{FL})

This index is denoted by a dummy variable whose value is one if the country has forced labor and zero if the country does not have forced labor. For this index, the definition used for forced labor is as follows:

“Forced labor is described as work or service exacted under the menace of penalty for which a person has not volunteered. Work or services do not apply where obligations are imposed to undergo education and training. The menace of penalty includes the loss of rights or privileges as well as penal sanctions.” (ILO, 1998)

Busse and Braun (2003) propose two indexes to measure forced labor. One index encompasses core forms of forced labor (scale of 0–5). The other contains all forms of forced labor (scale of 0–9). It is imperative to focus on the core forms of forced labor. For this, the following formula is recommended:

$$FL_{raw} = \text{Forced1}^2 + \text{Forced2}$$

Here, Forced1 and Forced2 represent the index of the core form of forced labor and all forms of forced labor, respectively. This indicator gives values of 0–7.5. An alternative method to calculate the missing values of the index is to operate a discrepancy between all forms and core forms to attain a comparable value.

Several sources are adopted to build this indicator. They include Antislavery International and Confederation of Free Trade Unions (ICFTU) (2001), Busse and Braun (2003), and ILO (2001).³³

³² This analysis uses gross values rather than net values of the enrollment rate for the adjusted index.

2.3.3.5 Index of the ILO's convention ratification (I_{CR})

The number of ratified conventions is reserved as a proxy of political will related to the upgrading of labor standards. For the number of ratified conventions index, we report both the number of core conventions and the global number of ratified conventions. The core conventions are given a higher weight in the applied formula and set to a range of 0–1. The formula used to determine the ILO's convention ratification is as follows:

$$N Rraw = \frac{N_1 * (N_2)^2}{11776}$$

Here, N_1 represents the number of ratified conventions and N_2 represents the number of ratified core conventions. The number 11776 represents the number of inspections for ratified conventions.

$N Rraw$ will be equal to 1 if the country ratified all 190 conventions, including the eight core conventions. The index can be calculated for every country that ratified the ILO's conventions.

2.3.4 Aggregated index for the core labor standards

The study focuses on the aggregated impact of all four core labor standards for several reasons. First, an aggregated index evaluates the general index of labor standards which can compute the social consequences of the economy. Second, complementary effects exist for each standard. For example, the index of freedom of association ensures the efficient enforcement of other standards. Trade unions related to the rights of workers have positive leverage compared to other labor standards. This impact can be computed using the global index of labor standards. Third, international organizations, including the ILO, justify this approach which promotes all four core labor standards. If this approach works economically, studying the common impact of the CLSI is more appealing.

The worldwide index of core labor standards can simply be constructed by adding different indexes created for each category of labor standards. The hypothesis is that the worldwide

³³ The types and measurement of forced labor are shown the Appendix.

instrument of fundamental worker rights can be demonstrated by giving the same relative weight to every standard.

Let us consider that every category of standards may have diverse discriminating power. In another way, the aggregated index cannot be obtained by adding the degree of consent to deal with every labor standard. The equation for the aggregated index for core labor standards (I_{CLS}^A) is as follows:

$$I_{CLS}^A = I_{FC}^A + I_{GD}^A + I_{CL} + I_{FC} + I_{CR}$$

A set of indexes is required to measure the distinct aspects of labor standards. A good index should have the capability of measuring the degree of yield of workers' fundamental rights and not depend on the degree of the effect of every category of labor standards.

The accurate measure to enforce all core labor standards is to sum the distant values of the individual index. However, this method creates biasness in measuring the index for two reasons. First, by summing each index of different standards, we acquire a scalar index that represents the same explicative power for each norm to describe the level of worker rights. The analysis considers that each standard has distinct discriminative power. Second, the availability of good data without statistical bias cannot be considered for each standard due to the problem of imperfect information. A common tendency can be taken for these core labor standards by isolating the effect of each standard and deleting all other effects. For this purpose, data analysis is used to isolate common factors between distinct variables. This objective is pursued by applying PCA. The definitions, nature, timespan, and sources of variables for the CLSI are available in Tables 2(A) and 2(B).

Table 2(A): Definition of variables used in the construction of the CLSI

No.	Variables	Definitions
1. Index of freedom of association and collective bargaining (I_{FC})		
(a)	Unionization rate (UR)	The ratio of union force in the labor force of the country.
(b)	No. of ILO-ratified conventions (NRC) on freedom of association	Based on the ratification of six ILO conventions. Two of them are accepted as core conventions.
(c)	Civil rights indicator (CRI)	Includes the combination of the civil liberty index (LI) and political index (PI).
2. Index of gender discrimination related to employment (I_{GD})		
(a)	Alphabetization rate differences (ARD)	The ratio of the female literacy rate (FLR) and male literacy rate (MLR).
(b)	School enrollment rate differences (SERD)	The ratio of the female school enrollment rate (FSER) and male school enrollment rate (MSER) (primary, secondary, and tertiary).
(c)	Income differences (IN)	The difference in the percentage of male average monthly income (MI) and female average monthly income.
(d)	Female activity rate (FAR)	The female labor force participation rate.
(e)	Gender empowerment measures (GEMI)	A UNDP index that calculates gender inequality using three scopes of empowerment (gender inequality index).
3. Index of child labor (I_{CL})		
(a)	Raw index (RI)	Percentage of working children aged 10–14 years.
(b)	Adjusted index (AI)	Ratio of children aged 10–14 years who do not attend primary school.
4. Index of forced labor (I_{FL})		
(a)	Core form of forced labor (<i>Forced1</i>)	The core form of forced labor using a scale range of 0–5 (Busse and Braun, 2003).
(b)	All form of forced labor (<i>Forced2</i>)	Links with all forms of forced labor using a scale range of 0–9 (Busse and Braun, 2003).
5. Index of ILO’s convention ratification (I_{CR})		
(a)	Total no. of ratified conventions (N_2)	The ILO has 190 conventions.
(b)	Total no. of core ratified conventions (N_1)	The ILO has eight core conventions.

Table 2(B): Nature, timespans, and sources of CLSI variables

No.	Variables	Nature	Timespan	Sources
1. Index of freedom of association and collective bargaining (I_{FC})				
(a)	Unionization rate (UR)	-	-	-
(b)	No. of ILO-ratified conventions (NRC) on freedom of association	Continuous	1982–2017	ILO website
(c)	Civil rights indicator (CRI)	Continuous	1982–2017	Freedom House (2003)
2. Index of gender discrimination related to employment (I_{GD})				
(a)	Alphabetization rate differences (ARD)	Continuous	1982–2017	World Bank website
(b)	School enrollment rate differences (SERD)	Continuous	1982–2017	World Development Indicators (WDI)
(c)	Income differences (IN)	Continuous	1982–2017	LFS
(d)	Female activity rate (FAR)	Continuous	1982–2017	WDI
(e)	Gender empowerment measures (GEMI)	Continuous	1995–2017	WDI
3. Index of child labor (I_{CL})				
(a)	Raw index (RI)	Continuous	1982–2017	LFS
(b)	Adjusted index (AI)	Continuous	1982–2017	LFS
4. Index of forced labor (I_{FL})				
(a)	Core form of forced labor (<i>Forced1</i>)	Ordinal	1982–2017	Anti-Slavery International and ICFTU (2001); Busse and Braun (2003); and US Department of State (2003)
(b)	All form of forced labor (<i>Forced2</i>)	Ordinal	1982–2017	Anti-Slavery International and ICFTU (2001); Busse and Braun (2003); and US Department of State (2003)
5. Index of ILO's convention ratification (I_{CR})				
(a)	No. of ratified conventions (N_2)	Ordinal	1982–2017	ILO website
(b)	No. of core ratified conventions (N_1)	Ordinal	1982–2017	ILO website

2.3.4 CLSI for Pakistan

Introduced by Child (1970), the PCA serves as a dimension-reduction tool. It is used to reduce large sets of correlated variables into a short set of uncorrelated variables, termed principal components (Stock and Watson, 2003). PCA standardized the variables. The ordinary and continuous variables are used in this process due to standardization of variables. This procedure allows indicating different dimensions of core labor standards in the form of a single index which contains the maximum amount of information from the original dataset. The weight of each factor of core labor standards is computed using PCA. The arrangement of core labor standards can be described as follows:

$$ICLS_t = w_1IFC_t + w_2IGD_t + w_3ICL_t + w_4ICR_t + w_5IFL_t$$

Here, w_i shows the weight of each component, which is provided by selected principal components using their relative eigenvectors. The eigenvectors and eigenvalues of the correlation matrix of core labor standards are shown in Table 3. It shows that the variation in the dataset is almost 66.75 percent captured by the first principal component such as $[\sum \lambda_k = 2.67 + 1.09 + 0.21 + 0.03 = 4, \lambda_1 = (2.67/4) * 100 = 66.75$. The first component captures the highest correlation value in contrast to the second and third eigenvectors.

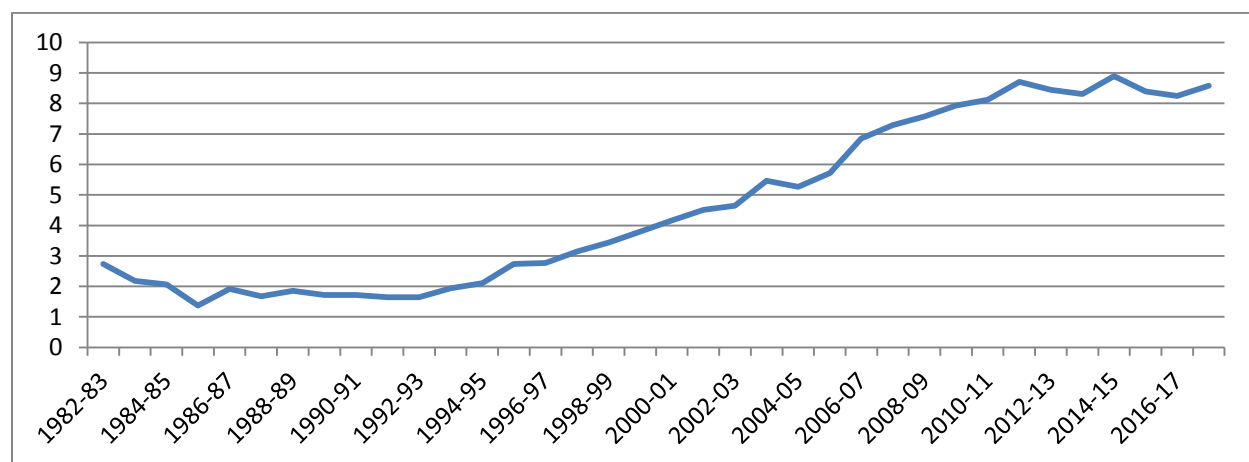
Table 3: Eigenvalues and eigenvectors of the correlation matrix of core labor standards variables

Variables	Eigenvectors			
	U1	U2	U3	U4
IFCt	-0.04	0.95	0.32	0.02
IGDt	0.59	-0.13	0.43	0.67
ICLt	0.54	0.29	-0.79	0.08
ICRt	0.59	-0.06	0.31	-0.74
Eigenvalues	2.67	1.09	0.21	0.03
Variability	66.75	27.25	5.25	0.75

We substitute the eigenvalues as a weight for each core labor standard from the first principal component in the equation. The CLSI is calculated as follows:³⁴

$$ICLS_t = -0.04 IFC_t + 0.59 IGD_t + 0.54 ICL_t + 0.59 ICR_t$$

Figure 1: Graph of CLSI of Pakistan



The graph of the CLSI of Pakistan is shown in Figure 1. It shows an almost gradual trend in the 1980s, which depicts weak labor standards and the presence of poor worker rights in Pakistan’s economy. The implementation of labor standards appears to be weak in this era in many developing countries (Singh and Zammit, 2004). Gender discrimination at the employment level and child labor are another reason for the low levels of the labor standard. Policies of privatization and deregulation were applied in this period. Industries began to liberalize, but no attention was given to labor standards. After 1993, the trend starts rising because liberalization policies were implemented in the 1990s (Sajid and Chaudhary, 1996). These policies support worker rights and increase the strength of labor standards by addressing gender discrimination and child labor in the economy (Locke et al., 2007a).

After a period of 11 years in the 2000s, the trend declines in 2003, but begins rising again after two years. Sound economic recovery policies were adopted in this period (Mahmood et al., 2008). The trend starts decreasing again in 2011, but then rising after two years—it reaches its peak in 2014. This is the period characterized by the suitable implementation of privatization and

³⁴ The index of forced labor is removed from the calculation due to its constant values throughout the period. The reverse method is used for the index of freedom of association and collective bargaining, the index of gender discrimination related to employment, and the index of child labor.

liberalization policies. These policies support labor by lowering gender discrimination at the education and employment level. Workers were given more rights of freedom of association and bargaining. In addition, the level of child labor declines gradually in this period due to management disputes (Ul-Haq et al., 2020). These policies lead to the existence and strength of labor standards in Pakistan's economy.

The graphs of individual indexes are available. The trend of the index of gender discrimination related to employment is similar to the trend of the CLSI. The index of child labor depicts a marginally different trend from the CLSI, while the index of forced labor shows a constant trend. The trend of the index of freedom of association and collective bargaining and index of ILO's convention ratification are similar to each other and the trend of the CLSI.

Figure 2: Graph of index of freedom of association and collective bargaining of Pakistan

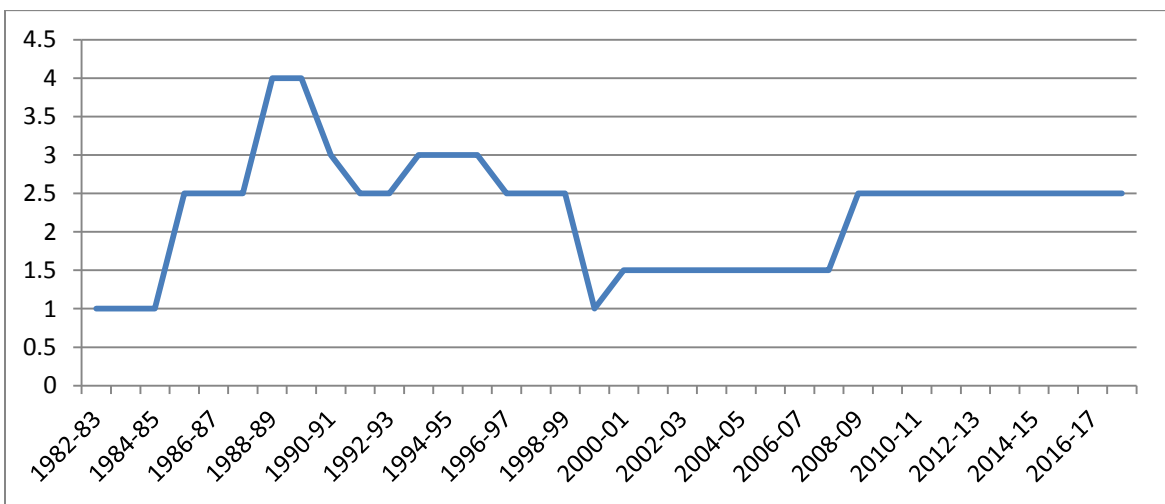


Figure 3: Graph of index of gender discrimination related to employment of Pakistan

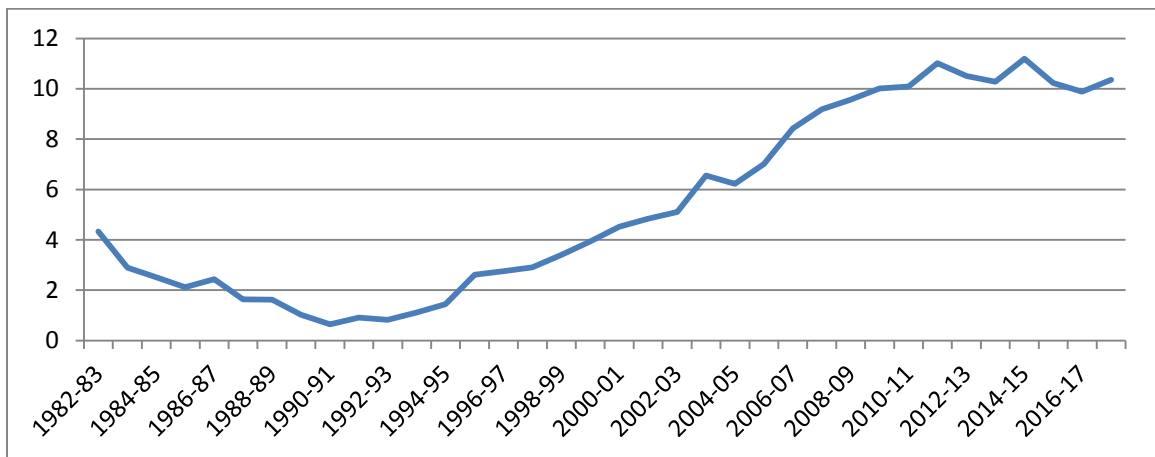


Figure 4: Graph of index of child labor of Pakistan

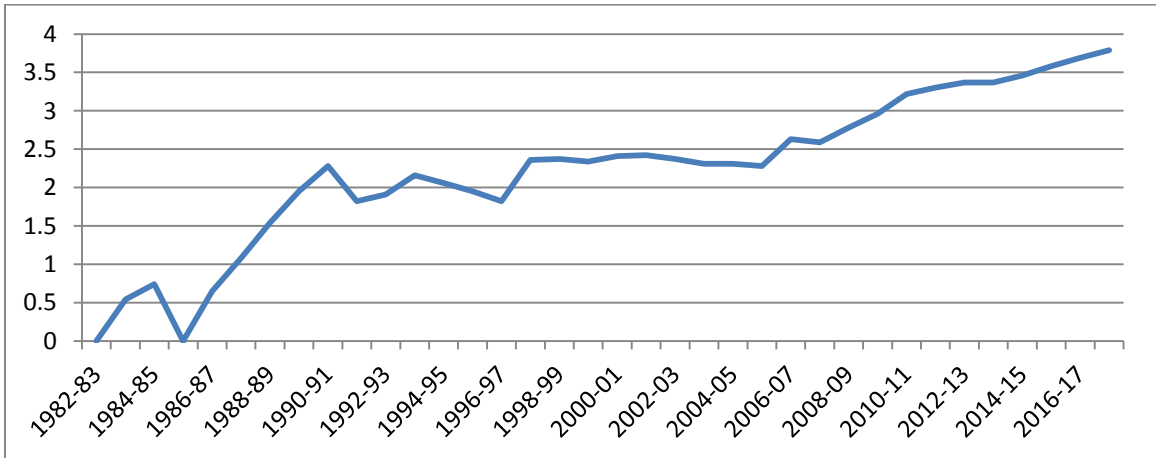


Figure 5: Graph of index of forced labor of Pakistan

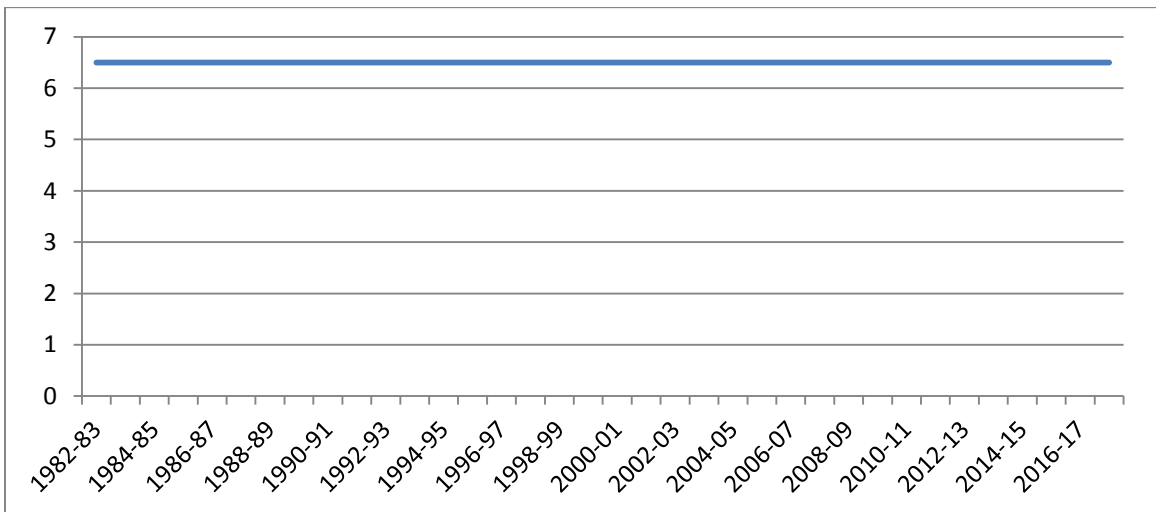
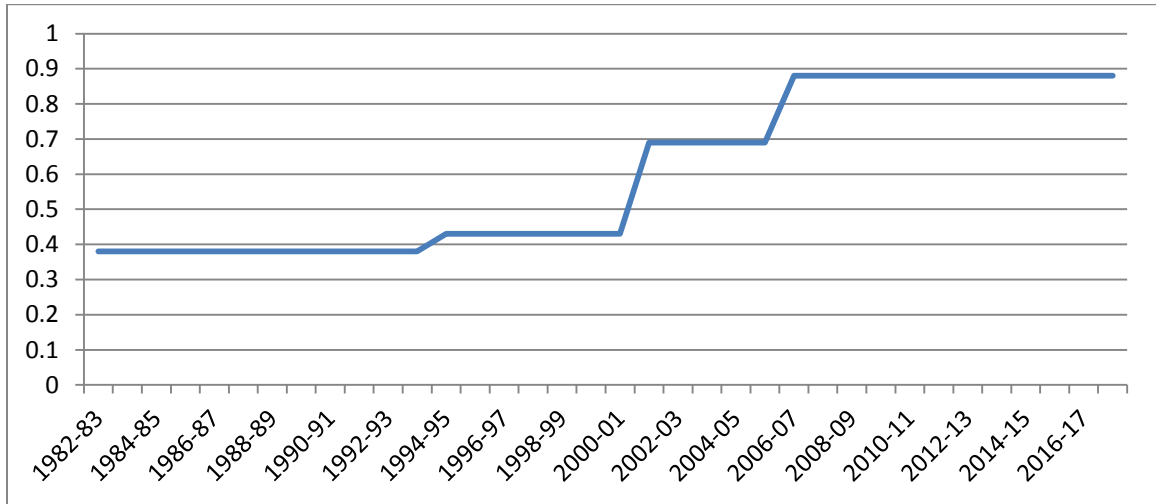


Figure 6: Graph of index of ILO convention ratification of Pakistan



2.4 Empirical Methodology

The empirical section comprises a data description, empirical model satisfaction, and econometric technique. The ARDL co-integration technique is used for the empirical analysis and is described in this section.

2.4.1 Data description

For this analysis, a dataset from 1982 to 2017 on the annual frequencies for the variables is used.³⁵ Multiple contending definitions of formal and informal employment are used in the existing literature. The International Conference of Labor Standards (ICLS) definition cannot be used due to data unavailability. However, informal employment is proxied as the share of self-employment in the labor force, i.e. own-account workers excluding professional, administrative, technical, and unpaid family workers (Loayza and Rigolini, 2011; Galli and Kucera, 2004). Formal employment is elaborated by public and private sector employment comprising federal, provincial, and local government employers and employees. The employment of other government-authorized establishments is also included (Doğrul, 2012).

The CLSI, which consists of five indexes, is used in the analysis (constructed in the last section). The other variables are urban population, urban unemployment rate, value-added for agriculture as a percentage of GDP, value-added for manufacturing as a percentage of GDP, value-added for

³⁵ Such type of short data set is used in numerous studies (Afzal et al, 2012; Hussain and Malik, 2011; Khalid 2006).

industry as a percentage of GDP, and value-added for services as a percentage of GDP (Galli and Kucera, 2004). Table 4 shows the variable descriptions and sources.

Table 4: Description of variables and sources

No.	Variable	Description	Source
1	Informal employment	The share of self-employment in the labor force, i.e. own-account workers, excluding professional, administrative, technical, and unpaid family workers.	LFS
2	Formal employment	Public and private sector employment comprising employers and employees of the federal, provincial, and local government.	LFS
3	Urban population	The no. of people in urban areas.	Pakistan Economic Survey (PES)
4	Urban unemployment rate	The rate of unemployed persons in the urban areas of the country.	PES
5	Value-added of agriculture	The value added from forestry, hunting, fishing, the cultivation of crops, and livestock production as a percentage of GDP. ³⁶	WDI
6	Value-added of manufacturing	The value added from the manufacturing sector as a percentage of GDP.	WDI
7	Value-added of industry	The value added from mining, electricity, construction, water, and gas as a percent of GDP.	WDI
8	Value-added of services	The value added from the retail trade, wholesalers, transport, and government, professional, financial, and personal services, including health and education and real estate services as a percent of GDP.	WDI

Data for formal and informal employment is provided by the LFS published by the Pakistan Bureau of Statistics. The urban population and urban unemployment rate data is produced by the Pakistan Economic Survey (PES) published by Pakistan's Ministry of Finance. The World Development Indicators (WDI) are published by the World Bank and are used to collect data for

³⁶ Value-added is the value of the net output of a sector after the addition of all outputs and the deduction of intermediate inputs.

the remaining variables, i.e. value-added of agriculture, manufacturing, industry, and services. The descriptive statistics of the variables are available in Table 5.

Table 5: Descriptive statistics of variables

Variables	Observations	Mean	Std. dev.	Min.	Max.
Informal employment (<i>IE</i>)	36	39.32	4.21	33.29	47.91
Formal employment (<i>FE</i>)	36	36.16	4.20	27.32	43.78
Core labor standards index (<i>CLSI</i>)	36	4.65	2.73	1.38	8.89
Urban population (<i>UP</i>)	36	47.12	16.77	24.83	77.93
Urban unemployment rate (<i>UUR</i>)	36	5.49	2.01	2.43	8.84
Value-added of agriculture (<i>AGRI</i>)	36	23.54	1.65	20.22	28.45
Value-added of manufacturing (<i>MANU</i>)	36	14.26	1.08	11.98	17.49
Value-added of industry (<i>INDU</i>)	36	21.36	1.92	17.94	27.74
Value-added of services (<i>SERV</i>)	36	47.64	3.80	41.62	53.11

2.4.2 Empirical model specification

The CLSI impacts formal and informal employment in opposing ways. According to the theory, it affects formal employment positively and informal employment negatively. By following common practices, we establish two empirical models. The first model displays the impact of CLSI on informal employment while the second exhibits the effect of CLSI on formal employment. For this purpose, we use an empirical model consistent with Galli and Kucera (2004). The general empirical model is as follows:

$$Y = \alpha + \beta X + \gamma Z + \epsilon$$

Here, Y describes the dependent variables—informal and formal employment. X represents the independent variable, Z shows the control variables, α , β , and γ represent constants, and ϵ is the error term.

For the estimation of this analysis, the following two empirical models are used:

$$IE = \alpha + \beta_1 CLSI + \gamma_2 UP + \gamma_3 UUR + \gamma_4 AGRI + \gamma_5 MANU + \gamma_6 INDU + \gamma_7 SERV + \epsilon$$

and

$$FE = \alpha + \beta_1 CLSI + \gamma_2 UP + \gamma_3 UUR + \gamma_4 AGRI + \gamma_5 MANU + \gamma_6 INDU + \gamma_7 SERV + \epsilon$$

IE symbolizes informal employment and *FE* represents formal employment. *CLSI* stands for the CLSI. *UP* shows the urban population, while *UUR* is the urban unemployment rate. *AGRI*, *MANU*, *INDU*, and *SERV* are value-added for agriculture, manufacturing, industry, and services, respectively.

To explore the impact of the CLSI on informal and formal employment, we find it suitable to estimate the empirical model using the ARDL co-integration approach. This approach is used to scrutinize the long-run relationship between the selected variables.

2.4.3 The ARDL co-integration approach

The ARDL co-integration procedure is adopted to determine long-term and short-term relations and dynamic interaction between the variables of interest. This approach was introduced by Pesaran et al. (2001) to explore co-integration among variables.

It three advantages. First, it circumvents the issue of order of integration related to other co-integration techniques. Second, it is appropriate for small sample sizes. Third, it provides unbiased estimates for long-term models and effective t-statistics in the presence of endogenous regressors. The ARDL co-integration approach has the following expression to test the existence of co-integration between variables:

$$\Delta Y_t = c_{0i} + \sum_{i=1}^T \gamma_1 \Delta Y_{t-1} + \sum_{i=1}^T \gamma_2 \Delta x_{t-1} + \delta_1 Y_{t-1} + \delta_2 x_{t-1} + U_t \quad (1)$$

δ_i represents the long-term multipliers, c is the intercept term, and U_t is the white-noise error term. In the first step, the long-term relationship between the variables is estimated by applying OLS to equation (1). The hypothesis is that the lag variable coefficients, which symbolize the existence of a long-run relation, are zero such that:

$$H_0: \delta_1 = \delta_2 = 0$$

$$H_A: \delta_1 \neq \delta_2 \neq 0$$

Under this process, the joint significance of a lagged-level variable coefficient is obtained by conducting the F-statistic. The test contains two asymptotic critical bound values for co-integration in the presence of an independent variable as $I(d)$ where $0 \leq d \leq 1$. The lower-bound value predicts the $I(0)$ regressors and the upper-bound value predicts the regressors as $I(1)$. If the computed F-value is above the upper critical bound, the null hypothesis is rejected irrespective of integration order. Conversely, if the computed value is below the lower critical bound value, the null hypothesis cannot be rejected. If the computed f-value is between these two bounds, the result is inadequate.

After applying co-integration, the conditional ARDL model can be described as:

$$Y_t = c_0 + \sum_{i=1}^S \gamma_1 Y_{1t-i} + \sum_{i=1}^T \gamma_2 x_{2t-i} + \sum_{i=1}^T \gamma_3 x_{3t-i} + \sum_{i=1}^T \gamma_n x_{nt-i} + U_t \quad (2)$$

The second step is to select the order for the ARDL (S, T) model by using the AIC. In the third step, the short-term dynamics parameters are obtained by computing an ECM related to long-term estimates. The expression is as follows:

$$\Delta Y_t = \theta + \sum_{i=1}^S \gamma_1 \Delta Y_{1t-i} + \sum_{i=1}^T \gamma_2 \Delta x_{2t-i} + \sum_{i=1}^T \gamma_3 \Delta x_{3t-i} + \sum_{i=1}^T \gamma_n \Delta x_{nt-i} + \tau ec m_{t-1} + U_t \quad (3)$$

In the above equation, $\gamma_1, \gamma_2, \gamma_3, \dots, \gamma_n$ denote the short-term dynamics coefficient and τ serves as the speed of adjustment.

2.5 Estimation Results

2.5.1 Preamble time-series characteristics

The permeable feature of the co-integration analysis is used to investigate the integration order of each series used in the analysis. The ADF test is applied to check the presence of a unit root in the series. The results of this test are presented in Tables 6(A) and 6(B).

The results show that the series of formal employment, urban population, urban unemployment rate, and value-added for the service sector are non-stationary at level, but stationary at the first difference, which is presented as $I(1)$. The remaining variables, including informal employment,

CLSI, and value-added for agriculture, manufacturing, and industry, are stationary at level and indicated by $I(0)$.

Table 6(A): ADF unit root test at level of series

ADF Regression Model Variable	Lag	Regressors		Test statistic	Order of integration
		Drift	Trend		
IE	0	Yes	Yes	-3.19*	I(0)
FE	0	Yes	No	-4.59***	I(1)
CLSI	0	Yes	Yes	-3.16*	I(0)
UP	0	No	No	-4.29***	I(1)
URR	0	No	No	-6.24***	I(1)
AGRI	0	Yes	No	-3.39***	I(0)
MANU	0	Yes	Yes	-3.66***	I(0)
INDU	0	Yes	No	-4.23***	I(0)
SERV	0	Yes	No	-5.07***	I(1)

*** denotes a significance level at 1%; ** denotes a significance level at 5%; * denotes a significance level at 10%.

Table 6(B): ADF unit root test at the first difference of series

ADF Regression Model Variable	Lag	Regressors		Test statistic	Order of integration
		Drift	Trend		
Δ FE	0	No	No	-4.28***	I(0)
Δ UP	0	No	No	-4.29***	I(0)
Δ UUR	0	No	No	-6.24***	I(0)
Δ SERV	0	No	No	-4.81***	I(0)

*** denotes a significance level at 1%; ** denotes a significance level at 5%; * denotes a significance level at 10%.

The test shows that one dependent variable is $I(0)$ while the other is $I(1)$, and the independent variables are $I(0)$ or $I(1)$. Hence, the ARDL co-integration approach is a suitable estimation methodology for computing the long-run and short-run dynamics of the desired analysis.

2.5.2 Bound test result for co-integration

The existence of a long-run relationship between the selected variables of the model is examined using the bound test. The maximum lag order for first-difference variables is one, which is selected based on the AIC. During the estimation process, the insignificant first-difference lags are dropped from the model by applying the general-to-specific method. The diagnostic tests applied to choose the final model include the Breusch-Godfrey (1981) Lagrange multiplier test for checking no serial correlation, Engle's (1982) ARCH Lagrange multiplier test to ensure the constant variance of the residual of the model, and Jarque-Bera statistics for checking residual normality. The bound test results for co-integration are shown in Table 7.

Table 7: The co-integration test result

Independent variable	F-statistic	Df	I(0)	I(1)	Outcome
IE	4.85	7	2.96	4.26***	Co-integration
FE	3.19	7	2.03	3.13*	Co-integration

*** denotes a significance level at 1%; ** denotes a significance level at 5%; * denotes a significance level at 10%.

There are two models. The first model takes informal employment as a dependent variable. As can be seen, the F-statistic rejects the null hypothesis of no long-run relationship between informal employment and CLSI, because the F-statistic value is higher than the upper limit of the critical value. In the second model, formal employment serves as the dependent variable. The F-statistic value rejects the null hypothesis in this model because the computed F-statistic value is higher than the upper limit critical value. This expresses the co-integration relationship between formal employment and CLSI.

2.5.3 Results of the long-run coefficient of the ARDL co-integration approach

The long-run coefficients of the ARDL approach are attained by normalizing the co-integrated vector on informal and formal employment (Table 8). Model 1, having informal employment as a dependent variable, depicts a negative and significant relationship with CLSI. It explains that the improvement and implementation of core labor standards decreases the ratio of informal employment in the economy. These core labor standards protect worker rights, leading to low employment in the informal sector—this sector operates illegally and avoids providing worker

rights (Freije, 2001). The implementation of core labor standards provides rights to informal sector workers and decreases the growth of informal employment. A positive, statistically significant relationship exists between formal employment and CLSI, as shown in model 2. The formal sector admits labor standards and supports worker rights. Formal employment increases in the economy due to the occurrence of core labor standards. The standards affect both formal and informal employment, but in opposite directions. These results are consistent with the findings of Galli and Kucera (2004).

Table 8: Long-run estimates of the ARDL co-integration approach

Independent variable	Model 1	Model 2
C	-89.283** [-1.88]	167.076*** [3.63]
CLSI	-3.048*** [-3.49]	2.471*** [3.65]
UP	0.069 [0.90]	-
UUR	-0.339 [-0.79]	-
AGRI	1.674*** [3.46]	-1.111*** [-2.73]
MANU	3.166*** [2.68]	-3.346*** [-3.11]
INDU	-1.138*** [-2.55]	0.718** [1.95]
SERV	1.705*** [2.67]	-2.208*** [-3.61]
Observations	36	36

*** denotes a significance level at 1%; ** denotes a significance level at 5%; * denotes a significance level at 10%; [] t-statistic values are in parenthesis.

The urban population has a positive relationship with informal employment, while the urban unemployment rate has a negative relation with employment in the informal sector. Both, however, are insignificant.³⁷ The positive relationship depicts employment in the informal sector

³⁷ Both of these control variables are dropped in the case of formal employment to increase the significance level of the estimates.

as an opportunity for urban populations to work, but the absence of legal rights makes this relationship insignificant (Heinonen, 2008; Günther and Launov, 2012). The urban unemployment rate increases due to restrictions and barriers to entry to the informal sector. This elaborates the negative relationship between the urban unemployment rate and informal employment—the unemployment rate becomes higher because the barriers reduce the ratio of informal employment (Kingdon and Knight, 2001 & 2003).

The value-added for agriculture has a positive and statistically significant relationship with informal employment. It describes the presence of most of the informal employment in the agricultural sector because this sector absorbs most of the labor force that is uneducated and unskilled (Cuevas et al., 2009). The relationship of formal employment with this sector is negative but significant because formal employment does not occur in this sector. Workers are not equipped with the higher education or skills required to utilize modern agricultural techniques (Maligalig et al., 2009).

The value-added for the manufacturing sector has a positive relationship with informal employment and a negative relationship with formal employment (Srija and Shirke, 2014). Both are statistically significant. The positive relationship shows that informal employment increases in the informal manufacturing sector due to ease of entry and also as an available employment opportunity. However, the negative relationship of formal employment describes restrictions and requirements, including higher education, high skill, and high financial resources for workers to enter the formal manufacturing sector.

The service sector depicts a positive and statistically significant relationship with informal employment. It is now becoming the largest sector of the economy. In this regard, the share of informal employment is greater in the service sector because informal labor is mostly uneducated and unskilled (Yamada, 1996). The opposing or negative relationship of formal employment with the formal sector shows that the service sector is less abundant with formal employment because the benefits and facilities provided to formal workers are not sufficiently available in this sector (Maligalig et al., 2009). Thus, workers prefer other sectors to the service sector for formal employment.

The overall industrial sector has a negative and statistically significant relationship with informal employment. This shows the existence and implementation of labor standards in the economy,

which force a reduction in informal employment. The relationship of the industrial sector behaves positively with formal employment and is statistically significant. These results also depict the implementation of labor standards and increasing formal employment in the economy, because the enforcement of labor standards leads the economy towards formality and provides workers with basic rights (Fagernäs, 2007).

2.5.4 Results of the short-run coefficients of the ARDL approach

In the time-series analysis, an ECM is adopted to compute the convergence theory for the concerned economy. Convergence theory in this analysis can be interpreted as the propensity of formal and informal employment to shift towards a steady-state equilibrium level of economic employment (Cellini, 1994). The results of the ECM describe the satisfaction of statistical fitness and competence of the estimated model (Sakyi, 2011). The important determinant of the ECM is the residual of the long-run co-integration function. These residuals are termed error correction terms or disequilibrium estimates. The sufficient condition for the error correction term is that the coefficient value lies between -1 and 0 .

The estimated coefficient values for the short-run analysis, which is acquired from the ECM equation, are given in Table 9.

These estimates reveal that the impact of CLSI and value-added for agriculture, manufacturing, and services is negative with informal employment in model 1. Conversely, a positive relationship is presented between urban population, urban unemployment rate, and value-added for industry with informal employment. All of the estimates are statistically significant, except urban population, urban unemployment rate, and value-added for agriculture and services.

The estimates of model 2 reveal that the CLSI and value-added for industry have a positive relationship with formal employment and a negative relationship with value-added for agriculture, value-added for manufacturing, and value-added for services with formal employment. All of these estimated coefficients are statistically significant. Hence, the short-run coefficients are consistent with the long-run coefficients in this analysis. These results describe the decrease in the informal employment rate and increase in the formal employment rate in the presence of CLSI in the economy (Galli and Kucera, 2004).

Table 9: Short-run estimates of the ARDL co-integration approach

Independent variable	Model 1	Model 2
Δ CLSI	-1.915*** [-2.84]	2.435*** [3.27]
Δ UP	0.043 [0.86]	-
Δ UUR	-0.213 [-0.78]	-
Δ AGRI	0.219 [0.79]	-0.623 ** [-2.28]
Δ MANU	0.794* [1.47]	-1.632 *** [-3.36]
Δ INDU	-0.409** [-2.08]	0.402*** [2.64]
Δ SERV	0.286 [0.86]	-0.858*** [-2.86]
EC	-0.628*** [-4.42]	-0.398*** [-4.68]
R ²	0.965	0.484
Adjusted R ²	0.947	0.365
F-statistic	51.944 [0.000]	4.066 [0.005]
Diagnostic test		
Serial correlation Lagrange multiplier test	1.505 [0.22]	0.544 [0.59]
ARCH test	1.572 [0.21]	1.713 [0.20]
Jarque-Bera normality test	1.834 [0.39]	1.363 [0.51]
Observations	36	36

*** denotes a significance level at 1%; ** denotes a significance level at 5%; * denotes a significance level at 10%; [] t-statistic values are in parenthesis.

The coefficient value of the error correction term is negative and highly significant for both models in the short-run analysis. The coefficient value of the error correction term for model 1 is -0.62, while the coefficient value for model 2 is -0.39. It verifies the convergence of informal and formal employment towards the steady-state level of employment in the economy. In

addition, the coefficient value for the dynamic ECM of informal employment is relatively large compared to formal employment. It shows that the reduction in informal employment will increase the speed of adjustment towards the equilibrium path of employment.

To test the validity of the estimated results, various diagnostic tests are applied on the short-run coefficients of the ARDL co-integration approach. These include the Breusch-Godfrey (1981) test for serial correlation, ARCH test for homoscedasticity, and Jarque-Bera statistics to check the normality of residuals. These tests are clear for the dynamic ECM of both the informal and formal employment models (Table 9 above).

2.6 Conclusion

This study evaluates the influence of core labor standards on the informal employment level of Pakistan's economy. The effect of core labor standards on formal employment is also elaborated upon. The Pakistan CLSI is constructed using PCA. The index consists of four indicators, namely freedom of association and collective bargaining, gender discrimination related to employment, child labor, and forced labor. In addition, ILO convention ratification is included in the structure of the index. The dataset is taken for the period 1982–2017. The ARDL co-integration approach is used to compute the long-run and short-run estimates for the informal employment and formal employment levels of the economy.

The graph of CLSI for Pakistan moves gradually in the beginning and starts rising after 11 years. The problems of gender discrimination and child labor affect the index in the reference period. It is also affected by privatization and liberalization policies implemented in the economy. These policies emphasize the strength of labor standards and worker rights, which leads to better living standards. After 2003, the effective execution of these policies highlights the existence of labor standards in the economy. The implementation and effectiveness of these core labor standards affect the informal and formal employment levels in the economy.

The findings suggest that the impact of core labor standards on informal employment is negative and statistically significant in the long run. This describes the reduction in the ratio of informal employment due to the implementation of labor standards. These standards protect worker rights, which are ignored in the atmosphere of an informal sector. The control variables, including value-added for agriculture, manufacturing, and services, have a positive relationship with

informal employment—value-added for industry does not. The influence of core labor standards on formal employment is positive in the long run. This expresses the occurrence of labor standards in the employment conditions of the formal sector. The control variables behave in opposing directions for formal employment. The results of formal and informal employment in the short run are consistent with the estimated results in the long run.

The concluding remark is that the reduction in the ratio of informal employment will increase the speed of adjustment towards the equilibrium path of formal employment. It explains that the economy with high labor standards has a low ratio of informal employment and a high ratio of formal employment (Galli and Kucera, 2004). However, labor standards to protect worker rights are increasing in the economy. The effective implementation of these labor standards helps enhance the ratio of formal employment as compared to informal employment. This phenomenon contributes to decreasing the informality level in the economy.

2.7 Policy Implications

The phenomenon of core labor standards plays an important role in workers' movement between labor market sectors. The measurement of CLSI elaborates the strength and effectiveness of labor standards in the economy. Based on the analysis, some important policies are suggested:

1. Policymakers can use this index as a tool to check the efficiency of international labor standards in different sectors of the economy. Strict policies should be made for the implementation of core labor standards at the national level to achieve required targets. Operative policies of labor standards decrease the ratio of informal workers in the labor force. On the other side, the effectiveness of labor standards increases the ratio of formal employment in the economy.
2. Policymakers should create policies for providing benefits in accordance with employment status to facilitate the entry of workers into the formal sector. Such policies also attract informal workers to work in the formal sector. Most workers receive social and economic benefits under international labor standards. National policies should be made to keep a check on the formal sector's maintenance of these core labor standards.

The effective implementation of core labor standards through national policies will increase the transition of workers from the informal sector to the formal sector. In this way, the production share of the formal sector will increase. This will decrease the informality level and improve the overall economy.

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Appendix

Types and measurement of forced labor

Forced labor exists in illegitimate economies and is often not captured by valid statistics—its presence is difficult to calculate accurately. The most common type of forced labor is bonded labor, which occurs in Pakistan, Bangladesh, India, and Nepal. Slaves are forced to execute simple and non-technical work, exclusively in the agriculture and manufacturing sector (Bales, 1999).

The first report published by ILO (2001) on forced labor recognizes eight types. The first is slavery and abductions for forced labor, and exists in areas of Africa. The second is compulsory participation in public works. This type is used to promote local or national development. The third is coercive recruitment practices that appear in remote rural and agricultural areas. The fourth is work in private households or domestic work, which can involve coercion. In the fifth type, forced labor is established on civilian populations by military and related authorities. Bonded labor or debt bondage is the sixth type of forced labor. The seventh type is trafficking in persons. The last type is prison labor which involves elements of forced labor.³⁸ Forced labor is generally hidden in the economy, so a quantitative indicator cannot be computed due to insufficient data. Hence, qualitative measures are used instead. The indicator of forced labor is developed by using the number of different types of forced labor that exist in a particular country to approximate the extent of forced labor. A dummy variable is introduced for each of eight types that takes a value of 1 if that type occurs and 0 if that type does not occur. The dummy variable for the trafficking of persons is taken differently—it takes values of 0, 0.5, or 1 to make the differentiation evaluation possible. These respective dummy variables for the concerned country are summed to attain the indicator.

Two diverse indicators have been calculated. The first indicator is FORCED1 that concentrates on the types of forced labor, namely coercive recruitment systems, slavery and abduction, prison labor, and bonded forced labor. Accordingly, its value is taken as five if forced labor exists in all types and zero if no type of forced labor exists. The second indicator, FORCED2, includes all types of forced labor. Its range is nine if all types of forced labor exist and zero if no type of

³⁸ Child exploitation cases are not included because they are linked with another labor standard.

forced labor exists. In both indicators, the dummy variable of bonded labor is multiplied by two before summing. Yet, the higher value of both indicators represents the higher extent of forced labor (Busse and Braun, 2003).

3. The Impact of Core Labor Standards and Informal Sector Employment on Economic Growth

3.1 Introduction

Over recent decades, the issue of enforcing labor standards to protect worker rights and the existence of the informal sector as a source of employment are prominent in the phenomenon of economic growth. The conditions of working people have undergone a major transformation in developing countries (Heintz and Pollin, 2003). These countries have experienced a high percentage of unemployed people. The informal sector is considered a residual category (Gerry, 1987). Under the neoclassical approach, the insertion of the informal sector allows a full-employment assumption in case workers without formal sector jobs work informally (Hemmer and Mannel, 1989). Although in the current regime, macroeconomic theories shifted their concern from short- or medium-term adjustments towards an improved interest in long-term growth. An international assessment of advanced countries predicts that some job regulations and labor rights have adverse consequences on short-track efficiency but have a significant impression on economic growth (Boyer, 1993).

The extensive rise in the proportion of informal sector employment creates a broad trend towards the condition of informalization in the labor market of countries. This proportion seems to be rising even when the rate of economic growth is mounting (Castells and Portes, 1989; Benería, 2001; ILO, 2002; Charmes, 2000). According to the 15th International Conference of Labor Statisticians (ICLS), employment in the informal sector comprises all household enterprises owned and operated by own-account workers (informal own-account enterprises) (ILO, 2016).³⁹

Informal arrangements of employment comprise waged domestic work, agricultural day workers, urban street sellers, home producers of manufacturing goods, etc. Most informal workers are self-employed. Women are disproportionately active in the informal sector in many countries.

³⁹ The 15th ICLS also includes enterprises owned and operated by employers with less than ten persons engaged. It includes the owner(s) of the enterprise, contributing family workers, and employees, whether employed on an occasional or continuous basis, or as apprentices. All enterprises engaged in agricultural activities or wholly engaged in non-market production are excluded (ILO, 2016).

Informal employment is not restricted to any single discrete sector of the economy in the logic of a specific industry cluster or economic activity (ILO, 2002).

Employment in informal sector activities is able to flourish when few alternative opportunities are available to workers. The process of informalization has abundant parallels, with general concern over deteriorating employment conditions and the growing occurrence of labor exploitation. In many cases, the existence of informal sector employment is directly linked with human rights violations (Heintz and Pollin, 2003). These standards comprise four core labor standards: 1) the provision of the freedom of association and collective bargaining; (2) the exclusion of discrimination in employment; (3) the abolition of child labor; and (4) the prohibition of forced labor (Bazillier, 2005).

The promotion of labor standards may have significant consequences on the determinants of economic growth. Some opponents of societal clauses in the WTO contend that the condition of weak labor standards is suitable for the development of the poorest countries because of a comparative advantage in the unskilled labor force (Bazillier, 2008). The production procedure entails abuses of workers in the presence of weak labor standards (Mosley and Uno, 2007). These standards reduce efficiency, lower output, and raise costs, although strong labor rights in a country are linked with better working conditions and increased productivity (Aidt and Tzannaos, 2002; Huber and Stephens, 2001). Thus, there is a demand for labor standards rises for improving per-capita income because it increases the competence of the labor force, allowing competition with the labor forces of other countries. Core labor standards increase the economic growth of developing countries in both the short and long term (Martin and Maskus, 2001).

The two basic strategies for maintaining informal sector employment in developing countries are improving labor market management by adopting labor standards and boosting the economic growth rate (Heintz and Pollin, 2003). The universal assumption of a negative relationship between informal sector employment and economic growth has been disputed on many fronts. The relative proportion of informal activities has definitely contracted and expanded over time, but these activities did not simply represent the transitional path towards a higher economic growth level (Stansell, 1983; John, 1986).

According to a 2018 labor market profile, 73 percent of workers in Pakistan were involved in the informal economy in 2014. Pakistan's ranking in the global rights index of workers is 5, among

the worst in the world. Both informal sector employment and labor standards play an important role in economic growth. The combined effect of core labor standards and informal sector employment on economic growth rate is necessary to evaluate in Pakistan economy which is not addressed in the existing literature. In this scenario, the goal of this paper is to explore the impact of core labor standards and informal sector employment on Pakistan's economic growth. The theoretical model is constructed by adding labor standards and informal sector employment to the Solow growth model proposed by Mankiw et al. (1992). In this study, the focus is to evaluate the long-term effects of the better establishment of core labor standards that provide the long-term steady-state of a developing country—in other words, an examination of the effect of informal sector employment on economic growth. Both the presence of informal employment trends and increasing attention on labor standards improvements can accelerate economic growth.

The rest of the study is structured as follows: section 2 is a review of existing literature. Section 3 describes the construction of the theoretical model. Section 4 elaborates on the empirical model by including data descriptions and describing econometric techniques. Section 5 discusses the estimation results of the study. The conclusion and policy implications are covered in sections 6 and 7, respectively. The references and appendix are available at the end of the essay.

3.1.1 Objectives

This study examines the role of core labor standards and informal sector employment on the economic growth of Pakistan. The main objectives are as follows:

1. To construct a theoretical model by adding core labor standards and informal sector employment to an economic growth model.
2. To explore the empirical influence of core labor standards and informal sector employment on the economic growth of Pakistan.

3.1.2 Study significance

Some studies elaborate on the role of labor standards on economic growth (Bazillier, 2004 & 2008; Berik and Rodgers, 2008). The better enforcement of labor standards has a positive impact on long-term economic growth, but weak labor standards are the condition of economic growth

in poor countries. It is, therefore, all the more interesting to study the impact of labor standards on economic growth (Bazillier, 2004).

On the other side, a few studies describe the influence of informal sector employment on economic growth (Cheng and Gereffi, 1994; Loayza, 1996; Meng, 2001). This impact is also ambiguous in the prevailing literature (Portes and Schaufli, 1993; Loayza, 1996; Dell'Anno, 2008; Loayza and Rigolini, 2011). Some economies with high economic growth rates exist in the presence of expanded informal sector employment (Cheng and Gereffi, 1994). The opposing view elaborates on the negative effects of rising informal sector employment and how they lead to decreasing the growth rate of an economy (Loayza, 1996).

However, the combined effect of core labor standards and informal sector employment on economic growth is missing from the existing literature. This study fills this gap by examining the impact of core labor standards and informal sector employment on the economic growth of Pakistan. In other words, this study is an attempt to elaborate on the relationship of core labor standards and informal sector employment with Pakistan's economic growth.

3.2 Literature Review

The literature review is divided into three parts. The first demonstrates the impact of the informal sector on economic growth; the second discusses the relationship between labor standards and economic growth; and the third elaborates on the relationship among the three variables used in the analysis.

3.2.1 The informal sector and economic growth

Several studies explain the relationship between the informal sector and economic growth in different contexts. For this phenomenon, two types of views exist. Some studies include Portes and Schaufli (1993) describe measurement approaches to learn about the informal sector and scrutinize ways in which the informal sector affects development policies. Monetary methods and physical input methods are used. The typology of informal activities indicates that informal sector microenterprises are certainly the engine for sustained economic growth. Petersen (1982) examines the impact of the informal sector on real economic growth using the impression of public expenditure and tax building. The negative correlations among public expenditures and the real gross national product growth rate cannot be taken as proof of retarded growth arising

from growing state activities. The state activities have induced the transfer of resources from the formal to the informal economy, which causes economic growth.

In this regard, Cheng and Gereffi (1994) analyze the informal economies of four industrialized countries of East Asia. The dataset covers the period 1963–88. The efficient suppliers constitute a more diversified local connection of small enterprises in Taiwan as compared to Hong Kong. The informal economies can be productive and can be effectively connected to the global economy, which leads to economic development. Meng (2001) suggests that the informal sector plays a significant role in economic development. It distinguishes between self-employed and wage-earner collections within the informal and formal sectors, finding that, with regard to income and other benefits, both wage earners and self-employed groups in the informal sector are better-off than those working in the formal sector.

Mohapatra et al. (2007) assess the self-employment role in promoting entrepreneurship and development in China's rural economy using a dataset for the period of twenty years. The self-employment in rural areas shares many components of the productive and formal business sector and becomes a symbol of development in rural China. In the same way, Debrah (2007) examines the government of Ghana's efforts to formalize the informal sector to develop gainful and productive employment and convert the sector into a source of economic growth. The study concedes the structuralistic and marginalistic view of the informal sector as contributing to survival jobs. The evidence shows that the informal sector provides employment to the majority of jobless persons who are below the subsistent level of employment. For adequate economic growth, the informal sector can be treated as a source of gainful employment in the countries of sub-Saharan Africa. Dell'Anno (2008) considers the relationship between the unofficial economy and official GDP. Empirical evidence on the pro-cyclicality of the unofficial economy supports the conclusion that these types of economies are complements rather than substitutes for Latin American countries. The unofficial economy is characterized as a beneficial source for sustaining economic growth.

A study by Gurtoo (2009) examines the vulnerabilities of informal sector entrepreneurs to settle a policy framework for economic growth in India. The study develops an integrative approach to consolidate the entrepreneurs of the informal sector into the formal economy. The market-driven policy structure and its capabilities provide growth opportunities by encouraging entrepreneurial

behavior in the informal economy. Yet, the governance structure and existing institutions should establish a market-based policy structure to control informal sector entrepreneurs for economic growth. Then, Loayza and Rigolini (2011) describe the cycles and trends of the informal sector to illustrate its implications for the economy as a growth engine or safety net. Their theoretical model for the informal economy is built for both the short and long run using a dataset covering the period of twenty four years for fifty four countries. The informal sector increases when there is a reduction in the level of government service, labor productivity, and business flexibility in the long run, while in the short run, it acts counter-cyclically. The informal sector plays a safety net role in most of the study's countries.

Chidoko et al. (2011) sought to explore the economic influence of the informal sector in the Zimbabwean economy. The findings suggest that the informal sector positively impacts the economy by enhancing employment opportunities, increasing investment, and contributing to GDP. Small entrepreneurs find problems in operating businesses due to their lack of collateral and capital. The informal sector has the potential for supplying a large share of employment in the economy and has the capacity to graduate into the formal sector by implementing relaxed government policies and enhancing economic growth. Similarly, Etim and Daramola (2020) explore the analytical perspective of informal sector contributions to the economic growth of Nigeria and South Africa. This study also analyses the differences and similarities between the two countries. The factors of informal sector activities show significant similarities in both countries. However, the informal sector can contribute to economic growth through the provision of better infrastructure, technology, and social support, thereby enhancing the productivity levels of small enterprises and leading to economic growth.

In the light of second view, Loayza (1996) presents the informal economy's effects on economic growth when unnecessary taxes and regulations are executed by governments. The determinants of the informal sector are considered in an endogenous growth model by using data from the early 1990s for Latin American countries. The multiple causes and multiple indicators techniques are used. The results suggest that an increase in informal sector size negatively affects growth. The conclusion is that the surge in the relative size of the informal sector diminishes the rate of economic growth. Likewise, Eilat and Zinnes (2000) describe the impact of the shadow economy on economic growth. The physical input approach and latent variable modeling

approach are used for estimation using data for the period 1990–97. The results illustrate that GDP growth is attended by a contraction of the shadow economy. The conclusion is that the shadow economy is an essential feature of the dynamic transition to a mature market economy. Ihrig and Moe (2004) highlight the evolution of the informal sector by incorporating government enforcement policies. A simple dynamic model is built in which agents choose to adopt time between the informal and formal sectors in accordance with taxation policies. The analysis predicts a negative and convex relationship between informal employment and the living standards of countries. The resources provided by international organizations have a minimal effect on reducing the ratio of informal employment in developing countries.

A study by Gibson (2005) describes the impact of the informal sector on economic growth and income distribution in the presence of human capital. A dynamic structure computable general equilibrium (CGE) model is constructed with numerical simulations. The simulation findings describe two trajectories. First, the speedy rate of human capital expands per-capita income and reduces economic informality. Second, the expanding levels of informality and inadequate human capital result in lower economic growth. So, the decreasing in human capital ratio leads to unemployment, poverty, and stagnation. For this purpose, Ishengoma and Kappel (2006) and Aftab and Rahim (2007) assess the approaches and factors related to the informality-formality trade-off and the subject of formalization as a solution for the growth of firms. They also review the flaws of these approaches. The barrier lies in the social and economic background of the informal firm's owner-manager which limits their capability to attract and involve the skills and resources—through the market—needed to adopt necessary technical and managerial enhancements. Then, Porta and Shleifer (2008) highlight the issue of the unofficial economy and economic development in light of economic theories. The ratio of informal economic activity is 30–40 percent in developing countries. The evidence suggests that in the context of economic growth, countries should not depend on the unofficial economy as it will dissolve over time. The highly productive formal firms are the main source of economic growth.

Moreover, Maarek (2012) evaluates the causal impact of development on the labor share and informal sector of developing countries. The theoretical model is constructed to explain the relationship between labor share, the informal sector, and the development process on the basis of a decrease in entry and production costs. The labor share decreases in lower-income

economies and increases in high-income economies during the growth process. So, the shrinking of the informal sector is due to decreasing entry costs and low productivity in developing countries.

3.2.2 Labor standards and economic growth

This section reviews literature that highlights the relationship between labor standards and economic growth. Freeman (1992) and Boyer (1993) propose a distinct perspective of labor market policies on economic growth. The study analyzes contradictory policy implications for labor markets on economic reform. The evidence predicts that policy interventions promote wellbeing and advise the government to encourage labor rights and regulations, adhere to labor standards, and regulate market outcomes. On the other side, labor market policy interventions impair wellbeing and economic growth. These labor regulations cannot be restricted to short-run mechanisms—they must also contemplate long-run implications. In the end, labor regulations matter for long-run economic growth. Then, Nickell and Layard (1999) analyze the role of labor market institutions, including employment protection and labor market regulation, on economic growth rates. The study examines institutional influences on the cross-country difference range of growth rates using a dataset for the period of fourteen years. The strict labor regulations and employment protection have a positive impact on economic performance which increases the growth rate of an economy.

The studies like Bazillier (2004) and (2008) investigate the effect of core international labor standards on economic growth. The analysis comprises two models—modeling for per-capita income at the steady-state and transition modeling for per-capita income at the steady-state. The panel dataset consists of 108 developing countries for the period 1960–96. The first model suggests that higher labor standard countries have high steady-state levels and have a positive impact on per-capita income. The second model finds that the effect is stronger for medium- and good-labor standard countries. Yet, the establishment of labor standards has a positive effect on income and growth in the long run. Djankov et al. (2006) examine the effect of labor regulations on the economic growth of 135 countries. The study develops an aggregate index of regulation for each country using a ranking system and a dataset for the period of nine years. The labor regulations and reform can accelerate economic growth. These reforms and regulations should be considered while designing growth policies. In this regard, Calderón et al. (2007) examine the

impact of enforceable and non-enforceable labor regulations on long-term economic growth. The study focuses on the enforcement of regulations on the labor market and its link with economic performance using a dataset for the thirty years' time period —arranged in five-year observations for one hundred twenty one countries. The growth rate is not affected by non-enforceable labor regulations, but that enforceable regulations affect economic growth. The binding and enforceable labor regulations have the capacity to affect the economic growth of both industrial and developing countries.

In contrast to above mention views, Besley and Burgess (2004) discuss the importance of labor market regulations on the economic growth rate of India. The impact of these regulations on the performance of the manufacturing sector is also analyzed. The study finds that the labor market regulations promote labor interests, but that they constrain economic growth. However, these regulations have a prominent impact on manufacturing development. Then, Berik and Rodgers (2008) scrutinize the enforcement and consent of labor standards in two Asian economies—Cambodia and Bangladesh—with the lowest labor costs in the world. The dataset uses survey analysis, inspection, and focus groups to project trajectories in agreement with basic labor standards. Bangladesh has extremely poor conditions and low wages, while Cambodia improves trade agreements with labor standards enforcement. The less developed countries focus on labor standards to enhance working conditions without delaying job growth.

However, Bonnal (2010) scrutinizes the relationship between international labor standards and the economic growth of developed and developing countries. The study elaborates on the empirical model of endogenous growth augmented with international labor standards. It uses a dataset for 101 countries for the period thirty years. The greater labor standards are linked with higher rates of economic growth in countries. The higher levels of labor standards support development processes—they play an important role in promoting living standards and accelerating economic growth in both developed and developing countries.

3.2.3 Labor standards, the informal sector, and economic growth

The role of labor standards and the informal sector on economic growth describe in few studies of existing literature. Heintz and Pollin (2003) explore the relationship between informalization, labor standards, and the neoliberal policies of developing Latin American countries and their effect on economic growth using data covering the period of seven years. The study evaluates

measures for increasing the decent job percentage via improving core labor standards and reversing the informalization process. These countries should promote labor market regulations and raise the economic growth rate by reducing the level of informalization. On the other side, Loayza et al. (2005) examine the effects of regulation on the informal sector and economic growth in a large sample of developing and industrial countries. The dataset covers the thirteen years period for seventy five countries. The study finds that a high level of regulation is linked with sluggish growth. By considering this analysis, a regulatory burden on labor and product markets decreases growth and encourages informality.

3.2.4 Conclusion

In the existing literature, some studies depict the relationship between labor standards and economic growth, while others describe the connection between economic growth and the informal sector. Few studies illustrate the association among all three variables. These studies discuss a positive relationship between labor standards and economic growth, or a positive relationship between informal sector employment and economic growth. This means that economies with a high level of labor standards and a high level of informal sector employment have a higher level of economic growth. But in some cases, the opposite occurs. This level of ambiguity among variables presents a gap in the literature and provides way to find the relationship among them for the Pakistan's economy.

3.3 Theoretical Framework: The Relationship between Core Labor Standards, Informal Sector Employment, and Economic Growth

3.3.1 Growth model

Core labor standards and informal sector employment influence economic growth, as described in the previous section. This section elaborates on the role of both core labor standards and informal sector employment on economic growth using the human capital augmented Solow growth model proposed by Mankiw et al. (1992), whose study is an extension of Solow (1956). Murdoch and Sandler (2002) and others explore the impact of diverse variables on long-term per-capita income. This study computes the effect of core labor standards on economic growth in the presence of informal sector employment via the process of spillover effects on different production components.

The production function in Cobb-Douglas form can be written as:

$$Y_t = K_t^\sigma H_t^\rho (A_t L_t)^{1-\sigma-\rho} \quad (1)$$

$$\sigma, \rho \in [0,1) \quad \text{and} \quad \sigma + \rho \in [0,1)$$

Here, K symbolizes physical capital stock, H represents human capital stock, A is the labor productivity level, L shows the level of the labor force, σ and ρ serve as output elasticities relative to physical and human capital, and $(1 - \sigma - \rho)$ represents the output elasticity for effective labor ($A_t L_t$). In this model, the symbol L is used to depict the labor force, which includes both formal and informal labor. Following Cimoli et al. (2006), the labor force can be expressed as follows:

$$L_f + L_i = L$$

In the above equation, L_f shows formal labor and L_i shows informal labor. The labor force L is a combination of both. In the general case, A shows the level of total factor productivity. However, in this model, it depicts the labor productivity level based on labor standards because economists consider A to be a residual that encompasses quality changes in output (Chen, 2007). On one side, A shows labor productivity while the labor standard affects this productivity level on the other side (Autor et al., 2007; Martin and Scarpetta, 2012).

However, L and A are assumed to grow exogenously, which can be expressed as:

$$L_t = L_0 e^{nt+vt}$$

$$A_t = A_0 e^{gt+\mu CI}$$

Here, n represents the growth rate of formal labor, v expresses the growth rate of informal labor, g depicts the growth rate of labor productivity, and μ is the parameter that determines the effect of labor standards, which is symbolized as CI .⁴⁰ In this way, the number of effective units of labor ($A_t L_t$) grows at the rate of $(n + v + g)$.

In terms of effective labor units, equation (1) can be written as:⁴¹

$$\tilde{y}_t = \tilde{k}_t^\sigma \tilde{h}_t^\rho \quad (2)$$

Because, $\frac{Y_t}{A_t L_t} = \tilde{y}_t$, $\frac{K_t}{A_t L_t} = \tilde{k}_t$, and $\frac{H_t}{A_t L_t} = \tilde{h}_t$ which quantify effective labor units.

For the transition equation of physical capital, the dynamics of physical capital are expressed as:

$$\dot{K}_t = s_K Y_t - \delta K_t \quad (3)$$

In this equation, s_K is the income fraction invested in physical capital and δ serves as the depreciation rate of capital.⁴² Dividing both sides of the equation by \dot{K}_t we obtain:

$$\frac{\dot{K}_t}{K_t} = \frac{s_K Y_t}{K_t} - \delta$$

⁴⁰ Here, we note that the extended model (by using the equation of A_t) should not be interpreted as the labor standard affecting economic growth through technological processes, as in the general model case. But the extension is based on the notion that A_t depicts physical input such as labor productivity independently, and labor standards effect labor productivity in the analysis (Bazillier, 2008).

⁴¹ The solution of the production function equation in terms of effective labor units is as follows:

$$\frac{Y_t}{A_t L_t} = \frac{K_t^\sigma H_t^\rho (A_t L_t)^{1-\sigma-\rho}}{(A_t L_t)}$$

$$\frac{Y_t}{A_t L_t} = \left[\frac{K_t}{A_t L_t} \right]^\sigma \left[\frac{H_t}{A_t L_t} \right]^\rho$$

⁴² The depreciation rate is the same for both types of physical and human capital. A uniform rate is assumed to explain the model. This will not alter the overall results of the model because the production functions used for physical and human capital are the same. One unit of consumption can be converted into one unit of physical or human capital without any cost by following Mankiw et al. (1992).

Subtracting $\frac{\dot{A}_t}{A_t}$ and $\frac{\dot{L}_t}{L_t}$ from the above equation, we obtain:

$$\frac{\dot{K}_t}{K_t} - \frac{\dot{A}_t}{A_t} - \frac{\dot{L}_t}{L_t} = \frac{s_K Y_t}{K_t} - \delta - \frac{\dot{A}_t}{A_t} - \frac{\dot{L}_t}{L_t}$$

Then,

$$\frac{d \log K_t}{dt} - \frac{d \log A_t}{dt} - \frac{d \log L_t}{dt} = \frac{s_K Y_t}{K_t} - \delta - g - (n + v)$$

Where, $\frac{\dot{L}_t}{L_t} = (n + v)$ and $\frac{\dot{A}_t}{A_t} = g$

$$\frac{d}{dt} \left[\log \frac{K_t}{A_t L_t} \right] = \frac{s_K Y_t}{K_t} - (n + v + g + \delta)$$

Dividing and multiplying the equation by $A_t L_t$, we obtain:

$$\frac{1}{K_t} \cdot \frac{dK_t}{dt} = \frac{s_K Y_t}{K_t} \cdot \frac{A_t L_t}{A_t L_t} - (n + v + g + \delta)$$

Where $\frac{K_t}{A_t L_t} = k_t$ and $\frac{Y_t}{A_t L_t} = y_t$. Then the equation becomes:

$$\frac{\dot{k}_t}{k_t} = \frac{s_K y_t}{k_t} - (n + v + g + \delta)$$

Now, multiplying the equation by k_t , we obtain:

$$\dot{\tilde{k}}_t = s_K \tilde{y}_t - (n + v + g + \delta) \tilde{k}_t \quad (4)$$

Similarly, the transition equation for human capital can be written as:⁴³

$$\dot{\tilde{h}}_t = s_H \tilde{y}_t - (n + v + g + \delta) \tilde{h}_t \quad (5)$$

Following Mankiw et al. (1992), we assume the same production function practice for physical capital, human capital, labor standards, informal sector employment, and consumption.

If $\sigma + \rho < 1$, this expresses a decreasing return to all types of capital. Then, the equation implies that the economy converges to the steady-state level.

⁴³ The solution for the transition equation of human capital is shown in Appendix A1.

3.3.2 The steady-state level of income

In the steady state, we assume that $\dot{\tilde{h}}_t = 0$. Then equation (5) can be written as:

$$\dot{\tilde{h}}_t = s_H \tilde{y}_t - (n + v + g + \delta) \tilde{h}_t$$

$$0 = s_H \tilde{y}_t - (n + v + g + \delta) \tilde{h}_t$$

$$s_H \tilde{y}_t = (n + v + g + \delta) \tilde{h}_t$$

By substituting the value of \tilde{y}_t from equation (2) into the above equation, we obtain:

$$s_H \tilde{k}_t^\sigma \tilde{h}_t^\rho = (n + v + g + \delta) \tilde{h}_t$$

$$\tilde{h}_t^{\rho-1} = \left[\frac{(n + v + g + \delta)}{s_H} \right] \tilde{k}_t^{-\sigma}$$

$$\tilde{h}_t = \left[\frac{s_H}{(n + v + g + \delta)} \right]^{\frac{1}{1-\rho}} \tilde{k}_t^{\frac{\sigma}{1-\rho}} \quad (6)$$

By substituting this value into the other steady-state condition of $\dot{\tilde{k}}_t = 0$, we obtain:

$$\dot{\tilde{k}}_t = s_K \tilde{y}_t - (n + v + g + \delta) \tilde{k}_t$$

$$0 = s_K \tilde{y}_t - (n + v + g + \delta) \tilde{k}_t$$

$$s_K \tilde{y}_t = (n + v + g + \delta) \tilde{k}_t$$

By substituting the value of \tilde{y}_t , we obtain:

$$s_K \tilde{k}_t^\sigma \tilde{h}_t^\rho = (n + v + g + \delta) \tilde{k}_t$$

By putting in the value of \tilde{h}_t from equation (6) into the above expression, we obtain:

$$s_K \tilde{k}_t^\sigma \left[\left[\frac{s_H}{(n + v + g + \delta)} \right]^{\frac{1}{1-\rho}} \tilde{k}_t^{\frac{\sigma}{1-\rho}} \right]^\rho = (n + v + g + \delta) \tilde{k}_t$$

$$\tilde{k}_t^{\sigma-1} \left[\frac{s_H}{(n + v + g + \delta)} \right]^{\frac{\rho}{1-\rho}} \tilde{k}_t^{\frac{\sigma\rho}{1-\rho}} = \left[\frac{(n + v + g + \delta)}{s_K} \right]$$

$$\begin{aligned}
\tilde{k}_t^{\frac{(\sigma-1)(1-\rho)+\sigma\rho}{1-\rho}} &= \left[\frac{S_K}{(n+v+g+\delta)} \right]^{-1} \left[\frac{S_H}{(n+v+g+\delta)} \right]^{\frac{-\rho}{1-\rho}} \\
\tilde{k}_t^{\frac{\sigma+\rho-1}{1-\rho}} &= \left[\frac{S_K}{(n+v+g+\delta)} \right]^{-1} \left[\frac{S_H}{(n+v+g+\delta)} \right]^{\frac{-\rho}{1-\rho}} \\
\tilde{k}_t^* &= \left[\frac{S_K}{(n+v+g+\delta)} \right]^{-\left[\frac{1-\rho}{\sigma+\rho-1}\right]} \left[\frac{S_H}{(n+v+g+\delta)} \right]^{\left[\frac{-\rho}{1-\rho}\right]\left[\frac{1-\rho}{\sigma+\rho-1}\right]} \\
\tilde{k}_t^* &= \left[\frac{S_K}{(n+v+g+\delta)} \right]^{\left[\frac{1-\rho}{1-\sigma-\rho}\right]} \left[\frac{S_H}{(n+v+g+\delta)} \right]^{\left[\frac{\rho}{1-\sigma-\rho}\right]} \\
\tilde{k}_t^* &= \left[\frac{S_K^{1-\rho} S_H^\rho}{(n+v+g+\delta)} \right]^{\left[\frac{1}{1-\sigma-\rho}\right]} \tag{7}
\end{aligned}$$

Equation (7) above describes the steady-state level of physical capital. For the steady-state level of human capital, we put this value into equation (6):

$$\begin{aligned}
\tilde{h}_t^* &= \left[\frac{S_H}{(n+v+g+\delta)} \right]^{\frac{1}{1-\rho}} \left[\left[\frac{S_K}{(n+v+g+\delta)} \right]^{\left[\frac{1-\rho}{1-\sigma-\rho}\right]} \left[\frac{S_H}{(n+v+g+\delta)} \right]^{\left[\frac{\rho}{1-\sigma-\rho}\right]} \right]^{\frac{\sigma}{1-\rho}} \\
\tilde{h}_t^* &= \left[\frac{S_H}{(n+v+g+\delta)} \right]^{\frac{1}{1-\rho}} \left[\frac{S_K}{(n+v+g+\delta)} \right]^{\left[\frac{\sigma(1-\rho)}{(1-\sigma-\rho)(1-\rho)}\right]} \left[\frac{S_H}{(n+v+g+\delta)} \right]^{\left[\frac{\sigma\rho}{(1-\sigma-\rho)(1-\rho)}\right]} \\
\tilde{h}_t^* &= \left[\frac{S_H}{(n+v+g+\delta)} \right]^{\frac{1-\sigma-\rho-\sigma\rho}{(1-\sigma-\rho)(1-\rho)}} \left[\frac{S_K}{(n+v+g+\delta)} \right]^{\frac{\sigma}{1-\sigma-\rho}} \\
\tilde{h}_t^* &= \left[\frac{S_H}{(n+v+g+\delta)} \right]^{\frac{(1-\rho)(1-\sigma)}{(1-\sigma-\rho)(1-\rho)}} \left[\frac{S_K}{(n+v+g+\delta)} \right]^{\frac{\sigma}{1-\sigma-\rho}} \\
\tilde{h}_t^* &= \left[\frac{S_H}{(n+v+g+\delta)} \right]^{\frac{1-\sigma}{(1-\sigma-\rho)}} \left[\frac{S_K}{(n+v+g+\delta)} \right]^{\frac{\sigma}{(1-\sigma-\rho)}} \\
\tilde{h}_t^* &= \left[\frac{S_H^{1-\sigma} S_K^\sigma}{(n+v+g+\delta)} \right]^{\frac{1}{(1-\sigma-\rho)}} \tag{8}
\end{aligned}$$

Equation (8) depicts the steady-state level of human capital.

We then put the value of equations (7) and (8) into equation (2), which is described below:

$$\tilde{y}_t^* = \tilde{k}_t^{*\sigma} \tilde{h}_t^{*\rho}$$

$$\begin{aligned} \tilde{y}_t^* &= \left[\left[\frac{S_K}{(n+v+g+\delta)} \right]^{\left[\frac{1-\rho}{1-\sigma-\rho} \right]} \left[\frac{S_H}{(n+v+g+\delta)} \right]^{\left[\frac{\rho}{1-\sigma-\rho} \right]} \right]^\sigma \\ &\quad * \left[\left[\frac{S_H}{(n+v+g+\delta)} \right]^{\left[\frac{1-\sigma}{(1-\sigma-\rho)} \right]} \left[\frac{S_K}{(n+v+g+\delta)} \right]^{\left[\frac{\sigma}{(1-\sigma-\rho)} \right]} \right]^\rho \\ \tilde{y}_t^* &= \left[\frac{S_K}{(n+v+g+\delta)} \right]^{\left[\frac{\sigma(1-\rho)}{1-\sigma-\rho} \right]} \left[\frac{S_H}{(n+v+g+\delta)} \right]^{\left[\frac{\sigma\rho}{1-\sigma-\rho} \right]} \left[\frac{S_H}{(n+v+g+\delta)} \right]^{\left[\frac{\rho(1-\sigma)}{(1-\sigma-\rho)} \right]} \\ &\quad \left[\frac{S_K}{(n+v+g+\delta)} \right]^{\left[\frac{\sigma\rho}{(1-\sigma-\rho)} \right]} \\ \tilde{y}_t^* &= \left[\frac{S_K}{(n+v+g+\delta)} \right]^{\frac{\sigma-\sigma\rho+\sigma\rho}{(1-\sigma-\rho)}} \left[\frac{S_H}{(n+v+g+\delta)} \right]^{\frac{\rho-\sigma\rho+\sigma\rho}{(1-\sigma-\rho)}} \\ \tilde{y}_t^* &= \left[\frac{S_K}{(n+v+g+\delta)} \right]^{\frac{\sigma}{(1-\sigma-\rho)}} \left[\frac{S_H}{(n+v+g+\delta)} \right]^{\frac{\rho}{(1-\sigma-\rho)}} \end{aligned}$$

By multiplying both sides of the above equation by A_t , we obtain:

$$y_t^* = A_t \left[\frac{S_K}{(n+v+g+\delta)} \right]^{\frac{\sigma}{(1-\sigma-\rho)}} \left[\frac{S_H}{(n+v+g+\delta)} \right]^{\frac{\rho}{(1-\sigma-\rho)}}$$

After simplifying the above expression, we obtain:

$$y_t^* = A_t \left[\frac{s_K^\sigma s_H^\rho}{(n+v+g+\delta)^{\sigma+\rho}} \right]^{\frac{1}{(1-\sigma-\rho)}} \quad (9)$$

We know that $A_t = A_0 e^{gt+\mu CI}$

By putting in the value of A_t and taking the log of equation (9), we obtain:

$$\ln(y_t^*) = \ln \left[\frac{y_t^*}{L_t} \right]^* = \ln(A_0) + g_t + \mu CI + \frac{\sigma}{1-\sigma-\rho} \ln(S_K) + \frac{\rho}{1-\sigma-\rho} \ln(S_H) - \frac{\sigma+\rho}{1-\sigma-\rho} \ln(n+v+g+\delta) \quad (10)$$

Equation (10) elaborates the income per worker of the economy. This equation shows the impact of physical capital, the growth rate of formal and informal labor, human capital, and labor standards on income per worker.

3.3.3 Speed of convergence activity

The convergence activity describes the movement of income per worker (y_t) towards the steady-state level of income per worker (y_t^*). The economy moves on a balanced growth path with a specific speed of convergence activity. This speed varies by country.

The conditional convergence can be derived by using equation (4) which can be described as:

$$\dot{\tilde{k}}_t = s_K \tilde{y}_t - (n + v + g + \delta) \tilde{k}_t$$

Dividing the above equation by \tilde{k}_t , we obtain:

$$\frac{\dot{\tilde{k}}_t}{\tilde{k}_t} = \frac{s_K \tilde{y}_t}{\tilde{k}_t} - (n + v + g + \delta)$$

$$\frac{\dot{\tilde{k}}_t}{\tilde{k}_t} = s_K e^{\ln \tilde{y}_t - \ln \tilde{k}_t} - (n + v + g + \delta)$$

$$\dot{\tilde{k}}_t = r(\ln \tilde{y}_t, \ln \tilde{k}_t)$$

In this case, the first-order Taylor approximation relative to the steady-state level yields:

$$\frac{\dot{\tilde{k}}_t}{\tilde{k}_t} \approx r(\ln \tilde{y}_t^*, \ln \tilde{k}_t^*) + \frac{\partial (\ln \tilde{y}_t, \ln \tilde{k}_t)}{\partial \ln \tilde{y}_t} \Big|_{\ln \tilde{y}_t = \ln \tilde{y}_t^*} (\ln \tilde{y}_t - \ln \tilde{y}_t^*) + \frac{\partial (\ln \tilde{y}_t, \ln \tilde{k}_t)}{\partial \ln \tilde{k}_t} \Big|_{\ln \tilde{k}_t = \ln \tilde{k}_t^*} (\ln \tilde{k}_t - \ln \tilde{k}_t^*) \quad (11)$$

Now, the steady-state level can be presented as:

$$r(\ln \tilde{y}_t^*, \ln \tilde{k}_t^*) = \frac{\dot{\tilde{k}}_t}{\tilde{k}_t} = 0$$

By taking the derivative of equation (11), we obtain:

$$\begin{aligned} \frac{\partial (\ln \tilde{y}_t, \ln \tilde{k}_t)}{\partial \ln \tilde{y}_t} \Big|_{\ln \tilde{y}_t = \ln \tilde{y}_t^*} &= \frac{\partial (s_K e^{\ln \tilde{y}_t - \ln \tilde{k}_t} - (n + v + g + \delta))}{\partial \ln \tilde{y}_t} \Big|_{\ln \tilde{y}_t = \ln \tilde{y}_t^*} \\ &= s_K e^{\ln \tilde{y}_t - \ln \tilde{k}_t} \\ &= r(\ln \tilde{y}_t^* - \ln \tilde{k}_t^*) + (n + v + g + \delta) = (n + v + g + \delta) \end{aligned} \quad (12)$$

And

$$\begin{aligned}
\left. \frac{\partial (\ln \tilde{y}_t, \ln \tilde{k}_t)}{\partial \ln \tilde{k}_t} \right|_{\ln \tilde{k}_t = \ln \tilde{k}_t^*} &= \left. \frac{\partial (s_K e^{\ln \tilde{y}_t - \ln \tilde{k}_t} - (n + v + g + \delta))}{\partial \ln \tilde{k}_t} \right|_{\ln \tilde{k}_t = \ln \tilde{k}_t^*} \\
&= -s_K e^{\ln \tilde{y}_t - \ln \tilde{k}_t} \\
&= r(\ln \tilde{y}_t^* - \ln \tilde{k}_t^*) - (n + v + g + \delta) = -(n + v + g + \delta) \quad (13)
\end{aligned}$$

By putting the value of equations (12) and (13) into equation (11), we obtain:

$$\frac{\dot{\tilde{k}}_t}{\tilde{k}_t} \approx r(\ln \tilde{y}_t^*, \ln \tilde{k}_t^*) + (n + v + g + \delta)(\ln \tilde{y}_t - \ln \tilde{y}_t^*) - (n + v + g + \delta)(\ln \tilde{k}_t - \ln \tilde{k}_t^*)$$

The above equation can be written as follows:

$$\frac{\dot{\tilde{k}}_t}{\tilde{k}_t} \approx (n + v + g + \delta) [(\ln \tilde{y}_t - \ln \tilde{y}_t^*) - (\ln \tilde{k}_t - \ln \tilde{k}_t^*)] \quad (14)$$

This equation elaborates the steady-state level of \tilde{k}_t . Similarly, by applying the convergence procedure, the steady-state level of \tilde{h}_t can be expressed as:

$$\frac{\dot{\tilde{h}}_t}{\tilde{h}_t} \approx (n + v + g + \delta) [(\ln \tilde{y}_t - \ln \tilde{y}_t^*) - (\ln \tilde{h}_t - \ln \tilde{h}_t^*)] \quad (15)$$

Now, taking the time derivative of equation (2), we obtain:

$$\frac{\dot{\tilde{y}}_t}{\tilde{y}_t} = \sigma \frac{\dot{\tilde{k}}_t}{\tilde{k}_t} + \rho \frac{\dot{\tilde{h}}_t}{\tilde{h}_t} \quad (16)$$

By putting the value of equations (14) and (15) into equation (16), we obtain the following expression:

$$\begin{aligned}
\frac{\dot{\tilde{y}}_t}{\tilde{y}_t} &= (n + v + g + \delta) (\sigma + \rho)(\ln \tilde{y}_t - \ln \tilde{y}_t^*) - (n + v + g + \delta) [\sigma(\ln \tilde{k}_t - \ln \tilde{k}_t^*) + \\
&\rho(\ln \tilde{h}_t - \ln \tilde{h}_t^*)] \quad (17)
\end{aligned}$$

After solving the above expression, we obtain:⁴⁴

⁴⁴ The solution of equation (17) is available in Appendix A2.

$$\frac{\dot{\tilde{y}}_t}{\tilde{y}_t} = (n + v + g + \delta) (\sigma + \rho) (\ln \tilde{y}_t - \ln \tilde{y}_t^*) - (n + v + g + \delta) (\ln \tilde{y}_t - \ln \tilde{y}_t^*)$$

$$\frac{\dot{\tilde{y}}_t}{\tilde{y}_t} = (n + v + g + \delta) (\sigma + \rho - 1) (\ln \tilde{y}_t - \ln \tilde{y}_t^*)$$

$$\frac{\dot{\tilde{y}}_t}{\tilde{y}_t} = - (n + v + g + \delta) (1 - \sigma - \rho) (\ln \tilde{y}_t - \ln \tilde{y}_t^*)$$

$$\frac{\dot{\tilde{y}}_t}{\tilde{y}_t} = \lambda (\ln \tilde{y}_t^* - \ln \tilde{y}_t)$$

Where $\lambda = (n + v + g + \delta) (1 - \sigma - \rho)$

The above equation can also be written as:

$$\frac{d \ln \tilde{y}_t}{dt} = \lambda (\ln \tilde{y}_t^* - \ln \tilde{y}_t) \quad (18)$$

In the above equation, λ expresses the speed of convergence activity. Equation (18) indicates the movement of (y_t) towards (y_t^*) at a speed approximately proportionate to the distance from (y_t) . The growth rate value of $(\ln \tilde{y}_t^* - \ln \tilde{y}_t)$ is constant and equal to the value of λ .

Let us suppose that $x = \ln \tilde{y}_t - \ln \tilde{y}_t^*$ and then re-arrange equation (18) as follows:

$$\frac{dx}{x} = -\lambda dt$$

$$\int_{x_0}^{x_t} \frac{1}{x} dx = - \int_0^t \lambda dt$$

$$\ln x_t - \ln x_0 = -\lambda t$$

$$\frac{x_t}{x_0} = e^{-\lambda t}$$

Where $x = \ln \tilde{y}_t - \ln \tilde{y}_t^*$

$$\frac{\ln \tilde{y}_t - \ln \tilde{y}_t^*}{\ln \tilde{y}_0 - \ln \tilde{y}_t^*} = e^{-\lambda t}$$

$$\ln \tilde{y}_t - \ln \tilde{y}_t^* = e^{-\lambda t} (\ln \tilde{y}_0 - \ln \tilde{y}_t^*)$$

$$\ln \tilde{y}_t = (1 - e^{-\lambda t}) \ln \tilde{y}_t^* + e^{-\lambda t} \ln \tilde{y}_0 \quad (19)$$

Where $\ln \tilde{y}_0$ represents the initial value of income per worker. By subtracting $\ln \tilde{y}_0$ from both sides of equation (19), we obtain:

$$\ln \tilde{y}_t - \ln \tilde{y}_0 = (1 - e^{-\lambda t}) \ln \tilde{y}_t^* + e^{-\lambda t} \ln \tilde{y}_0 - \ln \tilde{y}_0$$

$$\ln \tilde{y}_t - \ln \tilde{y}_0 = (1 - e^{-\lambda t}) \ln \tilde{y}_t^* + (1 - e^{-\lambda t}) \ln \tilde{y}_0 \quad (20)$$

By substituting the value of \tilde{y}_t^* from equation (9) into equation (20), we obtain the following expression:

$$\ln \tilde{y}_t - \ln \tilde{y}_0 = (1 - e^{-\lambda t}) \ln \left[\frac{s_K^\sigma s_H^\rho}{(n+v+g+\delta)^{\sigma+\rho}} \right]^{\frac{1}{(1-\sigma-\rho)}} + (1 - e^{-\lambda t}) \ln \tilde{y}_0 \quad (21)$$

By supplanting $\tilde{y}_t = \frac{Y}{AL}$ in equation (21) with $y = \frac{Y}{L}$, we obtain:

$$\begin{aligned} \ln y_t - \ln y_0 = & (1 - e^{-\lambda t}) \left[\ln(A_0) + g_t + \mu CI \right. \\ & \left. + \frac{\sigma}{1-\sigma-\rho} \ln(s_K) + \frac{\rho}{1-\sigma-\rho} \ln(s_H) - \frac{\sigma+\rho}{1-\sigma-\rho} \ln(n+v+g+\delta) \right] \\ & - (1 - e^{-\lambda t}) \ln \tilde{y}_0 \end{aligned}$$

By putting $\omega = 1 - e^{-\lambda t} = 1 - e^{-(n+v+g+\delta)(1-\sigma-\rho)t}$, we obtain the following equation:

$$\begin{aligned} \ln \frac{y_t}{y_0} = & \omega \left[\ln(A_0) + g_t + \mu CI + \frac{\sigma}{1-\sigma-\rho} \ln(s_K) + \frac{\rho}{1-\sigma-\rho} \ln(s_H) - \frac{\sigma+\rho}{1-\sigma-\rho} \ln(n+v+g+\delta) \right. \\ & \left. \right] - \omega \ln \tilde{y}_0 \quad (22) \end{aligned}$$

Equation (22) describes the convergence activity equation of the augmented Solow growth model. It infers that the growth rate of income per worker is explained by the determinant of the

steady-state level and initial level of income under the specified assumptions. Income per worker is positively related to physical capital, human capital, and core labor standards, while the negative relationship is illustrated by the growth rate of formal and informal sector employment.

3.4 Empirical Methodology

The empirical section of this study comprises variable descriptions, empirical model specifications, and econometric techniques. The empirical results of the analysis are also incorporated into this section. The analysis is carried out with an aggregate time-series dataset for the period 1999–2017. The main reason to use such a short time period is unavailability of segmented labor force data into formal and informal labor before this period. The labor force survey revises his questionnaire in 1999 and collects quantitative information about the formal and informal labor in the economy. On the other side, the empirical estimation for this short period is possible by selecting appropriate estimation method as presented in existing studies (Chigbu and Njoku, 2013; Briscoe and Wilson, 2003).

3.4.1 Variable descriptions and sources

The theoretical model highlights the variables used during the analysis.

Income per worker: This represents economic growth in the analysis. It is described as the rate of GDP in the local currency unit divided by the combination of formal and informal labor.

Formal and informal labor: The growth rate of formal labor is determined by applying a growth formula to the formal labor rate. Similarly, the growth rate of informal labor is obtained by using the informal labor rate after applying the growth formula.⁴⁵

Human capital: This is described by the gross secondary enrollment ratio, which explains the number of enrolled students in secondary school.

Physical capital: The physical capital series is generated by using the first-order difference equation of capital stock (Burney, 1986), which can be written as:⁴⁶ $K_t = (1 - \delta)K_{t-1} + I_t$

⁴⁵ The formula for growth rate is expressed as subtracting the past value from the current value, and then dividing that value by the past value and multiplying by 100.

⁴⁶ This method is used by Burney (1986) to generate a series of physical capital stock for Pakistan.

In the above equation, K_t represents physical capital in year t , K_{t-1} describes physical capital in the year $t - 1$, I_t serves as gross investment in year t , and δ represents the depreciation rate.

The physical capital series is constructed by applying the perpetual inventory method. The following equation is used:

$$K_t = (1 - \delta)^{t-1}K_0 + \sum_{j=0}^{t-1} (1 - \delta)^j I_{t-(j+1)}$$

For this purpose, the data of gross fixed capital formation is used. The depreciation rate is fixed at five percent due to the unavailability of data for every year.

The data for income per worker and human capital is available from the WDI published by the World Bank. The Labor Force Survey (LFS), which is published by the Pakistan Bureau of Statistics (PBS), is used for the data of formal and informal labor.⁴⁷ The data for physical capital is present in the Pakistan Economic Survey (PES) published by Pakistan's Ministry of Finance. Table 1 shows the descriptive statistics of these variables.

Table 1: Descriptive statistics of variables

Variables	Observations	Mean	Std. dev.	Min.	Max.
Income per worker (y_t)	19	1.53E+11	3.13E+10	1.07E+11	2.02E+11
Formal labor growth rate (n)	19	1.55	1.71	-1.72	5.01
Informal labor growth rate (v)	19	0.20	5.07	-9.09	9.58
Core labor standards index (CI)	19	6.88	1.75	3.80	8.89
Physical capital (S_K)	19	4.03E+12	1.35E+12	1.81E+12	7.23E+12
Human capital (S_H)	19	33.41	8.05	22.81	46.11

⁴⁷ Data for the division of the labor force into formal and informal labor began being published in 1999 by the LFS. That is why the dataset is taken for the short period of 19 years for the desired analysis.

3.4.2 Empirical model specification

The model described in the previous section specifies the effect of core labor standards on economic growth in the presence of informal sector employment. Physical and human capital are the traditional determinants of the growth model. The ultimate equation of the theoretical model can be expressed as:

$$\ln(y_t^*) = \ln \left[\frac{y_t}{L_t} \right]^* = \ln(A_0) + g_t + \mu CI + \frac{\sigma}{1-\sigma-\rho} \ln(s_K) + \frac{\rho}{1-\sigma-\rho} \ln(s_H) - \frac{\sigma+\rho}{1-\sigma-\rho} \ln(n + v + g + \delta) \quad (10)$$

By considering equation (10), the empirical model is established to assess the effect of core labor standards and informal sector employment on economic growth. Assuming the growth rate of labor productivity g_t follows a deterministic trend in equation (10) as proposed by Mankiw et al. (1992), we know that:

$$\ln(A_0) = a_0 + \varepsilon_t \quad (23)$$

Here, a_0 represents the constant and ε_t depicts the error term. So, by putting these values, equation (10) can be written as:

$$\ln(y_t^*) = a_0 + \mu CI + \frac{\sigma}{1-\sigma-\rho} \ln(s_K) + \frac{\rho}{1-\sigma-\rho} \ln(s_H) - \frac{\sigma+\rho}{1-\sigma-\rho} \ln(n + v + g + \delta) + \varepsilon_t \quad (24)$$

However, the empirical model can be expressed as follows:⁴⁸

$$\ln y_t = a_0 + \mu CI + \gamma_1 \ln(s_K) + \gamma_2 \ln(s_H) + \gamma_3 \ln(n + v + g + \delta) + \varepsilon_t \quad (25)$$

Where,

$$\gamma_1 = \frac{\sigma}{1-\sigma-\rho}, \quad \gamma_2 = \frac{\rho}{1-\sigma-\rho}, \quad \gamma_3 = \frac{\sigma+\rho}{1-\sigma-\rho}$$

In equation (25), y_t is the income per worker, CI is the core labor standards, s_K is physical capital, s_H is human capital, n and v serve as the growth rates of formal and informal labor,

⁴⁸ The empirical model in log-linear form is appropriate for authentic estimation (Jalil and Idrees, 2013).

respectively, and the value of $(g + \delta) = 0.05$.⁴⁹ $a, \mu, \gamma_1, \gamma_2$, and γ_3 represent the parameters, while ε_t is the error term, where $\mu, \gamma_1, \gamma_2 > 0$ and $\gamma_3 < 0$.

This study estimates the impact of core labor standards and informal sector employment on economic growth. The global index measure, which depicts the evaluation of social consciousness in the economy, is used for the labor standards. In addition, the effect of informal sector employment in the economy is discussed.

3.4.3 Econometric approach

The analysis is conducted using two econometric approaches—the ARDL co-integration approach and the NLTOLS-IV approach.

3.4.3.1 The ARDL co-integration approach

This study elaborates on the long-run relationship of core labor standards and informal sector employment with economic growth. The ARDL co-integration approach proposed by Pesaran et al. (2001) is used to create co-integrating vectors among the defined variables of the growth model. The vector ECM of the ARDL co-integration can be described as:

$$\Delta S_t = a_0 + \gamma t + \sum_{i=1}^{l-1} \rho_i \Delta S_{t-i} + \pi S_{t-1} + \xi_t t$$

Here, a_0 and γ represent the $(m \times 1)$ vector coefficient of the drift and trend term, ρ_i describes the coefficient of short-run dynamics, and π expresses the $(m \times m)$ matrix comprising long-term information. S_t is the $(m \times 1)$ vector including both the dependent $y_t \sim I(0)$, and $x_t = [x_{2t}, x_{3t}, \dots, x_{mt}]$ is the vector of explanatory variables of $I(0)$ or $I(1)$. ξ_t is a random error term. Σ is $(m \times m)$ representing the error term variance-covariance matrix.

This approach consists of three stages. In the first stage, the co-integration among the selected vectors is explored using the bound test approach. In the second stage, the coefficient of the long-run relationship of the growth equation is estimated. In the third stage, the short-run model

⁴⁹ This value of $(g + \delta)$ is assumed by Mankiw et al. (1992).

is acquired by error-correction model estimation, which associates with long-term estimates. This approach elaborates the long-run relationship between the variables.

3.4.3.2 The NLTSLs-IV approach

The NLTSLs-IV instrumental variable approach is useful when the explanatory variables of the linear and non-linear function are correlated with the disturbance term of the equation in the regression analysis. The instrumental variable is uncorrelated with the disturbance term but is correlated with the explanatory variable (Johnston, 1984).

Consider the following equation:

$$Z = \alpha_Z + \gamma_1 Z + \gamma_2 g(Z) + \xi \quad (26)$$

Here, Z is the $(v \times 1)$ vector of the latent variables; α_Z is the $(v \times 1)$ vector of the intercept term; γ_1 is the $(v \times v)$ matrix enclosed constant coefficient for effect of Z on Z 's other variables; $g(Z)$ is an $(s \times 1)$ vector of non-linear function in Z ; γ_2 is a $(v \times s)$ vector comprising a constant coefficient for the impact of $g(Z)$ on Z ; and ξ is the $(v \times 1)$ vector of the disturbance term. The above equation endorses the non-linear effect in the latent variables.

For identification, we scale the latent variable using an indicator such as:

$$q_i = Z + \varepsilon_i$$

and

$$Z = q_i - \varepsilon_i \quad (27)$$

By substituting equation (27) into equation (26), we obtain:

$$\begin{aligned} q_i - \varepsilon_i &= \alpha_Z + \gamma_1(q_i - \varepsilon_i) + \gamma_2 g(q_i - \varepsilon_i) + \xi \\ q_i &= \alpha_Z + \gamma_1 q_i + \gamma_2 g(q_i - \varepsilon_i) + \varepsilon_i - \gamma_1 \varepsilon_i + \xi \end{aligned} \quad (28)$$

In the form of a single equation, the above expression can be expressed as:

$$q_i = \alpha_{Zi} + \gamma_{1i} q_i + \gamma_{2i} g(q_i - \varepsilon_i) - \gamma_{1i} \varepsilon_i + \varepsilon_i + \xi_i \quad (29)$$

The non-linear function can be described as:

$$g(q_i - \varepsilon_i) = h_1(q_1) + h_2(q_1, \varepsilon_1)$$

Where $h_1(\cdot)$ and $h_2(\cdot)$ are the functions of related variables in the parentheses. So, equation (29) can be written as:

$$q_i = \alpha_{zi} + \gamma_{1i}q_1 + \gamma_{2i}h_1(q_1) + \mu_i \quad (30)$$

Here, μ_i represents the composite disturbance term. The μ_i correlates with the dependent variable of equation (30) and expresses the least square as an inconsistent estimator of the parameters α_{zi}, γ_{1i} , and γ_{2i} . In this case, the two-stage least square estimator is the consistent estimator for these parameters. The two-stage least square estimator permits the equations that comprise linear parameters and non-linear variables.

Let us suppose that $M_i = [1, q_i, h_1(q_1)]$ and $B_i = [\alpha'_{zi}, \gamma'_1, \gamma'_2]$. Then, equation (30) can be rewritten as:

$$q_i = M_i B_i + \mu_i \quad (31)$$

The two-stage least square estimator requires an instrumental variable matrix which is represented by V_i . In the general case, the μ_i of equation (31) will correlate with the variables of M_i . This possibility rules out the OLS method for estimating B_i .

In the first stage, the two-stage least square estimator executes an OLS regression of M_i on V_i with coefficients:

$$(V_i' V_i)^{-1} V_i' M_i$$

By post-multiplying the above coefficient with V_i , we obtain the \widehat{M}_i matrix as:

$$\widehat{M}_i = (V_i (V_i' V_i)^{-1} V_i' M_i)$$

In the second stage, the two-stage least square estimation of \widehat{B}_i expresses the OLS regression of q_i on \widehat{M}_i , which provides the following coefficients:

$$\widehat{B}_i = (\widehat{M}_i' \widehat{M}_i)^{-1} \widehat{M}_i' q_i \quad (32)$$

This is the known estimator of the two-stage least square, which is the consistent estimator of B_i (Johnston, 1984).

Suppose that,

$$\frac{1}{\sqrt{N}} \widehat{M}_i' \mu_i \sim AN(0, \sigma_{\mu_i}^2 \Sigma_{\widehat{M}_i \widehat{M}_i})$$

Here, AN describes the asymptotically normal distribution. The assumptions of the instrumental variable imply that:⁵⁰

$$plim \left(\frac{1}{N} \widehat{M}_i' \widehat{M}_i \right)^{-1} = \Sigma_{\widehat{M}_i \widehat{M}_i}^{-1}$$

Then, the asymptotic distribution of \widehat{B}_i can be described as:

$$\sqrt{N} (\widehat{B}_i - B_i) \rightarrow N(0, \sigma_{\mu_i}^2 \Sigma_{\widehat{M}_i \widehat{M}_i}^{-1})$$

Then, the asymptotic covariance matrix estimator of \widehat{B}_i can be expressed as:

$$acov(\widehat{B}_i) = \widehat{\sigma}_{\mu_i}^2 (\widehat{M}_i' \widehat{M}_i)^{-1}$$

Where $\widehat{\sigma}_{\mu_i}^2 = (q_i - M_i \widehat{B}_i)'(q_i - M_i \widehat{B}_i)/N$. The preceding procedure conveys the consistent coefficient estimator for the linear and non-linear terms of equation (30) and also the statistical variability measures.

⁵⁰ The instrumental variable satisfies the following assumptions, following Bollen (1995):

$$plim \left(\frac{1}{N} V_i' M_i \right) = \Sigma_{V_i M_i}$$

$$plim \left(\frac{1}{N} V_i' V_i \right) = \Sigma_{V_i V_i}$$

$$plim \left(\frac{1}{N} V_i' \mu_i \right) = 0$$

3.5 Estimation Results

3.5.1 Basic time-series properties

The variable series is converted into a natural log—except the growth rate of formal and informal labor variable due to the presence of negative values in the series. The conversion of the series into logarithmic form decreases the impact of outliers in the series and smoothens the data series for the desired analysis (Maddala and Lahiri, 1992).

The estimation procedure is conducted on the basis of a log linear function, which is a suitable form for time-series analysis. However, the presence of unit root problems in the series causes spurious regression. The order of integration of the series is determined to check the possibility of co-integration analysis. For this purpose, the ADF test is applied to the dataset. The results are presented in Tables 2(A) and 2(B).

Table 2(A): ADF unit root test at level of series

ADF Regression Model Variable	Lag	Regressors		Test statistic	Order of integration
		Drift	Trend		
$\ln y_t$	2	Yes	Yes	-4.13**	I(0)
$\ln(S_K)$	0	Yes	No	-3.62***	I(1)
$\ln(S_H)$	2	Yes	Yes	-3.39**	I(0)
$(n + v + g + \delta)$	1	Yes	No	-2.52*	I(0)
$\ln CI$	0	Yes	No	-2.52*	I(0)

*** denotes a significance level at 1%; ** denotes a significance level at 5%; * denotes a significance level at 10%.

Table 2(B): ADF unit root test at the first difference of series

ADF Regression Model Variable	Lag	Regressors		Test statistic	Order of integration
		Drift	Trend		
$\Delta \ln(S_K)$	0	Yes	No	-3.62***	I(0)

*** denotes a significance level at 1%; ** denotes a significance level at 5%; * denotes a significance level at 10%.

The ADF result shows that all of the variables, including income per worker, human capital, CLSI, and growth rate of formal and informal labor, are integrated of order zero or $I(0)$. This means they are stationary at level except the physical capital variable, which is non-stationary at level. This variable is stationary at the first difference or $I(1)$. The ADF test shows that the dependent variable is integrated of the order of zero $I(0)$ while the independent variables are integrated of the order of $I(0)$ or $I(1)$.

3.5.2 Estimates of the co-integration test

First, equation (25) is estimated by using the ARDL co-integration approach. In this way, the maximum value of the lag order is two, which is selected using the AIC. By applying Hendry's (1995) general-to-specific approach, the first-difference variables with insignificant lags are neglected from the model. The results of the co-integration test are shown in Table 3.

Table 3: The estimated results of the co-integration test

Independent variable	F-statistic	Df	I(0)	I(1)	Outcome
$\ln y_t$	4.88***	5	2.96	4.26	<i>Co-integration</i>

*** denotes a significance level at 1%; ** denotes a significance level at 5%; * denotes a significance level at 10%.

Income per worker is the dependent variable of the model. The results show that the F-statistic value rejects the joint null hypothesis of no long-run relationship among the variables because the value lies above the higher bound of the critical value. So, the long-run relationship exists across the income per worker variable and independent variables of the model. The estimation process of equation (25) comprises two mechanisms.

3.5.3 Estimates of the ARDL co-integration approach

Model 1 expresses the estimation outcome by applying the ARDL co-integration approach. The long-run estimated results of the model are described in Table 4(A). The ARDL estimates for the long-term relationship are acquired by normalizing the co-integrated vector on the log form of income per worker. During the long-run analysis, the effect of the CLSI on income per worker is positive and statistically significant. This means that the effective implementation of core labor standards increases (Bazillier, 2004). The growth rate of formal and informal labor has a

negative and insignificant relationship with income per worker. Similarly, the relationship between the share of physical capital and income per worker is also negative but statistically insignificant. The estimates of the share of human capital in relation to income per worker are positive and statistically significant.

Table 4(A): Long-run estimates of the ARDL co-integration approach

Independent variable	Model 1
<i>C</i>	27.665*** [25.271]
<i>lnCI</i>	0.537*** [5.207]
<i>ln(S_K)</i>	-0.152*** [-4.049]
<i>ln(S_H)</i>	0.421*** [5.891]
$(n + v + g + \delta)$	-0.001 [-0.356]
Adjusted R ²	0.913
F-statistic	13.940 [0.025]
Observations	19

*** denotes a significance level at 1%; ** denotes a significance level at 5%; * denotes a significance level at 10%; [] t-statistic values are in parenthesis.

The results of the short-run dynamics are consistent with the long-run dynamics, except for the estimates of the growth rate of formal and informal labor which show a positive relationship with economic growth. In addition, the estimates of the share of human capital are also insignificant. The estimates of the short-run analysis and diagnostic tests are presented in Table 4(B). The theory predicts the endogeneity problem between CLSI and economic growth.⁵¹ This problem creates biasness in the estimates of the ARDL co-integration approach.

⁵¹ The endogeneity problem between core labor standards and economic growth is expressed by Bazillier (2008).

Table 4(B): Short-run estimates of the ARDL co-integration approach

Independent variable	Model 1
$\Delta \ln CI$	0.575*** [3.065]
$\Delta \ln(S_K)$	-0.149*** [-2.927]
$\Delta \ln(S_H)$	0.019 [0.139]
$\Delta(n + v + g + \delta)$	0.001 [0.394]
EC	1.495** [-2.423]
Adjusted R ²	0.913
F-statistic	13.940 [0.025]
Diagnostic test	
Serial correlation Lagrange multiplier test	6.703 [0.009]
ARCH test	0.003 [0.956]
Jarque-Bera normality test	4.396 [0.111]
Observations	19

*** denotes a significance level at 1%; ** denotes a significance level at 5%; * denotes a significance level at 10%; [] t-statistic values are in parenthesis.

3.5.4 Estimates of the NLTSLs-IV approach

To overcome the problem of endogeneity, the NLTSLs-IV approach is used, described by model 2. For this purpose, lagged values of the first differences and levels are practiced as instruments. Moreover, the practice of deleting the insignificant lagged variable is pursued to obtain a parsimonious regression in the estimation of the short-term dynamics. Equation (25) is estimated

by applying the NLTOLS-IV approach. The long-run and short-run estimated results of this approach are provided in Tables 5 and 6.⁵²

Table 5: Long-run estimates of the NLTOLS-IV approach

Independent variable	Model 2	Model 3
C	26.694 [1.517]	15.083*** [6.639]
$\ln CI$	0.646** [2.251]	0.465* [1.750]
$\ln(S_K)$	-0.225*** [-3.208]	-0.156*** [-2.689]
$\ln(S_H)$	0.302 [0.859]	0.026 [0.228]
$(n + v + g + \delta)$	-0.004 [-1.108]	0.003** [2.068]
Adjusted R ²	0.786	0.675
F-statistic	5.615 [0.090]	4.119 [0.065]
J-statistic	2.316 [0.127]	0.171 [0.679]
Observations	19	19

*** denotes a significance level at 1%; ** denotes a significance level at 5%; * denotes a significance level at 10%; [] t-statistic values are in parenthesis.

In the long-run analysis, the estimated coefficient of CLSI in relation to income per worker is positive and statistically significant.⁵³ The relationship between the share of physical capital and income per worker is negative but statistically significant.⁵⁴ The share of human capital in relation to income per worker is also positive but insignificant, while the coefficient estimates of

⁵² The variable of human capital is deleted from the equation under the general-to-specific strategy to obtain better estimates in the short-run analysis. The estimated results of model 2 before deleting human capital also appear in Tables 7(A) and 7(B) in Appendix B.

⁵³ The positive relationship between core labor standards and economic growth proves the veracity of this theoretical approach (Bazillier, 2008).

⁵⁴ The relationship of the share of physical capital and economic growth is also negative and significant in the case of model 1.

the growth rate of formal and informal labor in relation to income per worker are negative and insignificant. In the short-run analysis, the coefficient signs of the variables are approximately consistent with the long-run analysis.

Table 6: Short-run estimates of the NLTOLS-IV approach

Independent variable	Model 2	Model 3
$\Delta \ln CI$	0.480*** [7.506]	0.239*** [5.461]
$\Delta \ln(S_K)$	-0.135*** [-6.530]	-0.076*** [-3.881]
$\Delta(n + v + g + \delta)$	-0.004*** [6.173]	-
Dum09	-	0.027** [1.973]
EC	-0.871*** [-7.255]1	-0.447*** [-6.626]
Adjusted R ²	0.909	0.819
F-statistic	19.653 [0.000]	12.358 [0.000]
J-statistic	5.406 [0.368]	0.308 [0.997]
Diagnostic test		
Serial correlation Lagrange multiplier test	0.457 [0.499]	0.730 [0.392]
ARCH test	0.169 [0.681]	1.086 [0.297]
Jarque-Bera normality test	0.295 [0.863]	0.399 [0.819]
Observations	19	19

*** denotes a significance level at 1%; ** denotes a significance level at 5%; * denotes a significance level at 10%; [] t-statistic values are in parenthesis.

The resulting coefficient of the estimated equation seems impressive, although the coefficient value of some variables appears insignificant. The residual of the estimated equation highlights one outlier in 2009. This outlier effect may be present due to the global recession that affected

the economy to some extent (Khawaja et al., 2010). Therefore, this effect is captured by introducing a dummy into the estimated equation which is represented by (Dum09). The dummy is equal to 1 during 2009 and zero in other years. Equation (25) is estimated again by incorporating the dummy and represented by model 3. However, the dummy is insignificant in the long term but significant in the short-term analysis.

The estimated results of the long-run dynamics of the final model 3 are expressed in Table 5. Under the long-term analysis, the estimated coefficient of the relationship between CLSI and income per worker is positive and statistically significant. This result shows that the existence of core labor standards increase income per worker. The implementation of these labor standards will increase the protection of workers, which positively affects labor productivity. This process will prove to be a step to leading the economy on a growth path (Bazillier, 2004). The implementation and effectiveness of core labor standards will participate in economic growth by increasing the protection and living standards of workers.

The estimated coefficient for the share of physical capital in relation to income per worker is negative but statistically significant. This relationship shows that a lower ratio of physical capital in the economy will increase income per worker.⁵⁵ The negative relationship highlights two reasons. First, by decreasing the ratio of physical capital, the working hours of workers increase, which increases labor productivity. This leads to an increase in economic growth (Bartolini and Bonatti, 2008). Second, income per worker is computed by dividing GDP by a combination of formal and informal labor instead of the population, and the physical capital is computed by using the formula method as described in the variable construction. The change in these variables' construction may create a negative coefficient for the relationship between the share of physical capital and income per worker (Arcand and D'hombres, 2007).⁵⁶

⁵⁵ This result contradicts the existing literature of growth models because most studies describe a positive relationship between the share of physical capital and economic growth (Mankiw et al., 1992; Solow, 1956; Brumm, 1996; Gundlach, 1995; Li et al., 1998; Nonneman and Vanhoudt, 1996).

⁵⁶ Arcand and D'hombres (2007) evaluate the negative coefficient value of human capital in the growth model. The variable construction creates problems in choosing the empirical instrument and affects the sign of the respective coefficient. But in the current analysis, the focus is on the coefficient of CLSI and growth rate of formal and informal labor.

The estimated coefficient for the share of human capital in relation to income per worker is positive but statistically insignificant. It shows that the human capital of a country increases the income per worker. The insignificance of the estimated result expresses uneducated people and children who do not attend school. Uneducated people cannot actively participate in economic activities while people with human capital can raise economic growth and prosperity (Mincer, 1984).

The results show that formal and informal sector employment has a positive relationship with income per worker.⁵⁷ This relationship is statistically significant. The people linked with informal sector employment are mostly uneducated and unskilled. These people participate in informal economic activities in accordance with their abilities and also contribute to economic growth (Porta and Shleifer, 2008). On the other side, people attached with formal sector employment have a high level of education and skills—they actively participate in economic growth activities (Hanushek and Kim, 1995). In this respect, both formal and informal employment participates in the production activities of the economy. These production activities include the production of goods and services in different sectors and enhance the overall production level of the economy, thereby increasing economic growth (Paudel and Perera, 2009).

In the short-run dynamics, the estimated coefficient for the CLSI and share of physical capital are consistent with the estimated coefficients of the long-run dynamics. The estimated results of the short-run dynamics of model 3 are presented in Table 6.⁵⁸ The dummy variable shows a positive and statistically significant relationship with economic growth.

The ECM is applied to estimate the speed of adjustment of the economy in the time-series analysis. The error correction term for this analysis is -0.44 . This term shows the speed of adjustment (λ) which describes the convergence of income per worker towards the steady-state level of income per worker. The estimated coefficient shows that the economy will converge at

⁵⁷ A positive relationship is obtained in this analysis because formal and informal labor are used instead of population in the empirical analysis, which contradicts the results of the growth model.

⁵⁸ Human capital and the growth rate of formal and informal labor are dropped in the short-run analysis to obtain better significance levels for the estimates.

the speed of 44 percent towards the steady-state equilibrium level of income per worker, which represents economic growth.⁵⁹

The value of the J-statistic describes the validity of the instrument used in the analysis. The estimated results express the strength of the instrument because the probability value of the J-statistic is near 1 for model 3. The diagnostic tests, which comprise the Breusch-Godfrey (1981) test to analyze serial correlation, Jarque-Bera statistics for residual normality, and Engle's (1982) ARCH Lagrange multiplier test to check homoscedasticity, are applied to the dynamic ECM. The estimates of model 3 satisfy all of these diagnostic tests and are shown in Table 6.

3.6 Conclusion

The study evaluates the effect of core labor standards and informal sector employment on economic growth. For this purpose, the human capital augmented Solow growth model is used as proposed by Mankiw et al. (1992). The growth model is extended by incorporating core labor standards and informal sector employment to evaluate their effect on economic growth. The problem of endogeneity arises between the relationship of core labor standards and economic growth. To solve this problem, the NLSLS-IV approach is applied. The dataset used is for the period 1999–2017.

The computed estimates describe that the core labor standards have a positive relationship with economic growth. The effective implementation of core labor standards will enhance the growth rate of the economy. The impact of the growth rate of formal and informal labor on economic growth is positive. The increase in the number of persons in the labor force, both formal and informal, raises the productivity level and contributes to the growth rate of the economy. The share of physical capital has a negative relationship due to changes in the variable construction of economic growth, while a positive relationship exists between the share of human capital and economic growth.

The concluding remark is that the presence of good labor standards enhances the growth rate of the economy. They reduce exploitative behavioral activities and protect the rights of the labor force. These activities increase workers' confidence and productivity levels. Under these

⁵⁹ The negative sign is a necessary condition for convergence towards the equilibrium level of steady state. The sufficient condition is that it lie between -1 and zero.

circumstances, a large proportion of the labor force, both formal and informal, will actively participate in economic growth activities. The effective implementation of labor standards converge the economy towards its steady-state level more rapidly.

3.7 Policy Implications

Theoretical and empirical work elaborates the relationship of core labor standards and informal sector employment with economic growth. In these circumstances, the effective implementation of core labor standards will increase the working environment of the manufacturing and production sectors. The presence of worker rights enhances the productivity level and living standard of workers. Workers linked with informal employment also contribute to economic activities. The following policies are recommended to increase the economic growth rate:

1. Economic policies should enforce core labor standards as an important determinant of economic growth. This will increase the competing power of workers with workers of other nations on the basis of their productivity and human capital level. Effective policies related to labor standards increase production levels and decrease the exploitation of workers at the national level.
2. Core labor standards should be incorporated into the national labor policy, and their implementation should be established by competent authorities in the labor market.
3. Policies should be developed to reduce the unemployment rate by exploring the informal sector because it acts as a source of employment openings for jobless workers. It proves to be a temporary survival strategy and entry point for unskilled, unemployed persons.
4. Policymakers should make soft policies for providing facilities for the activities of the informal sector. At the same time, economic growth policies should provide opportunities (employment and other social benefits) to informal workers to help them enter the formal sector.

Therefore, policymakers should consider the enforcement of core labor standards and the flourishing of informal sector employment in Pakistan's growth policies. This will not only increase production levels but will enhance people's living standards. Both contribute to increasing the economic growth rate of Pakistan's economy.

3.8 References

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Appendix A

A1. Transition equation for human capital

The dynamics of human capital can be expressed as:

$$\dot{H}_t = s_H Y_t - \delta H_t$$

In the above expression, s_H represents the income fraction invested in human capital.

Dividing the above equation by H_t , we obtain:

$$\frac{\dot{H}_t}{H_t} = \frac{s_H Y_t}{H_t} - \delta$$

By subtracting $\frac{\dot{A}_t}{A_t}$ and $\frac{\dot{L}_t}{L_t}$ from both sides of the above equation, we obtain:

$$\frac{\dot{H}_t}{H_t} - \frac{\dot{A}_t}{A_t} - \frac{\dot{L}_t}{L_t} = \frac{s_H Y_t}{H_t} - \delta - \frac{\dot{A}_t}{A_t} - \frac{\dot{L}_t}{L_t}$$

$$\frac{d \log H_t}{dt} - \frac{d \log A_t}{dt} - \frac{d \log L_t}{dt} = \frac{s_H Y_t}{H_t} - \delta - g - (n + v)$$

Knowing that $\frac{\dot{L}_t}{L_t} = n + v$ and $\frac{\dot{A}_t}{A_t} = g$, the equation becomes:

$$\frac{d}{dt} \left[\log \frac{H_t}{A_t L_t} \right] = \frac{s_H Y_t}{H_t} - (n + v + g + \delta)$$

Dividing and multiplying by $A_t L_t$, we obtain:

$$\frac{1}{H_t} \cdot \frac{dH_t}{dt} = \frac{s_H Y_t}{H_t} \cdot \frac{A_t L_t}{A_t L_t} - (n + v + g + \delta)$$

Where $\frac{H_t}{A_t L_t} = h_t$ and $\frac{Y_t}{A_t L_t} = y_t$

$$\frac{\dot{h}_t}{h_t} = \frac{s_H y_t}{h_t} - (n + v + g + \delta)$$

Multiplying the above equation by h_t , we obtain:

$$\dot{\tilde{h}}_t = s_H \tilde{y}_t - (n + v + g + \delta) \tilde{h}_t$$

This is the transition equation for human capital accumulation.

A2. Solution for the simplification of equation (17)

We know that the production function is as follows:

$$\tilde{y}_t = \tilde{k}_t^\sigma \tilde{h}_t^\rho$$

$$\ln \tilde{y}_t = \sigma \ln \tilde{k}_t - \rho \ln \tilde{h}_t$$

And for $\ln \tilde{y}_t^*$, the expression can be written as:

$$\ln \tilde{y}_t^* = \sigma \ln \tilde{k}_t^* - \rho \ln \tilde{h}_t^*$$

By equalizing the above equations, we obtain:

$$\sigma \ln \tilde{k}_t - \sigma \ln \tilde{k}_t^* + \rho \ln \tilde{h}_t - \rho \ln \tilde{h}_t^* = 0$$

$$\sigma (\ln \tilde{k}_t - \ln \tilde{k}_t^*) + \rho (\ln \tilde{h}_t - \ln \tilde{h}_t^*) = 0$$

So,

$$\ln \tilde{y}_t - \ln \tilde{y}_t^* = \sigma (\ln \tilde{k}_t - \ln \tilde{k}_t^*) + \rho (\ln \tilde{h}_t - \ln \tilde{h}_t^*)$$

Appendix B

Table 7(A): Long-run estimates of the NLTOLS-IV approach (before deleting human capital)

Independent variable	Model 2
C	56.097 [1.983]
$\ln CI$	1.116 [2.476]
$\ln(S_K)$	-0.279* [-3.089]
$\ln(S_H)$	0.924 [1.476]
$(n + v + g + \delta)$	-0.002 [-0.645]
Observations	19

*** denotes a significance level at 1%; ** denotes a significance level at 5%; * denotes a significance level at 10%; [] t-statistic values are in parenthesis.

Table 7(B): Short-run dynamics of the NLTOLS-IV approach (before deleting human capital)

Independent variable	Model 2
$\Delta \ln CI$	0.835 [2.612]
$\Delta \ln(S_K)$	-0.168 [-2.795]
$\Delta \ln(S_H)$	0.178 [0.726]
$\Delta(n + v + g + \delta)$	-0.002 [-0.564]
EC	-2.073 [-1.784]
Adjusted R ²	0.780
F-statistic	4.805 [0.344]
J-statistic	1.000 [3.173]
Observations	19

*** denotes a significance level at 1%; ** denotes a significance level at 5%; * denotes a significance level at 10%; [] t-statistic values are in parenthesis.

4. Conclusion

The dissertation is basically highlighting the phenomenon of formal and informal employment in the Pakistan's economy. All the three essays evaluate the segmented employment pattern in different perspective to extant its importance in the economy.

The first chapter describes the motivating factors of informal sector employment in the economy of Pakistan. The behavior of these factors depends upon the performance of formal sector employment. For this purpose, theoretical model is presented to show the conduct of individual and household in selection of the formal or informal sector to work. The individual decision to participate in any sector is based on three motivating factors which include: managerial ability, managerial skill and financial capital etc. The division of motivating factors in low, medium and high categories shows the individual selection behavior of sector to enter. The estimates suggest that individuals having low level of managerial ability, managerial skill and financial capital will enter in the informal sector. On the other side, individuals acquiring high managerial ability, managerial skill and financial capital will participate in formal sector. It means that individual with low level of education and low level of skill will enter in the informal sector and earn the lower wages as compare to formal sector. On the other side, individual with high level of education and higher skill will absorb in the formal sector as a skilled labor force. The individual get higher wages in the formal sector.

In the household case, the head of household and spouse will decide the sector in which they want to work based on their motivating factors includes: human capital and financial capital. The factor of managerial skill is ignoring because of unavailability of data at the household level. In the analysis, medium and high categories of motivational factors are used for head of household while spouse used all three like low, medium and high categories of motivating factors. The estimates present that the head of household possessing high level of human capital and financial capital will work in the formal sector. The spouse behavior shows that spouse with low level of human capital and financial capital will join informal sector when head of household engage in the formal sector. The spouse with medium level of human capital will participate in the informal sector while spouse with medium level of financial capital engage in formal sector. In addition, the spouse with high level of human and financial capital will work in the informal sector when

the head of the household job in the formal sector. The medium level of categories of motivation factors shows ambiguous results in the case of individual and head of household analysis. This behavior increases the participation rate of labor force in the informal sector and enhances the informality rate in the economy.

The second essay evaluates the level of informal employment in the presence of core labor standards in the Pakistan Economy. The effect of these core labor standards on the formal employment is also elaborated. The core labor standard index of Pakistan economy is calculated by using principle component analysis (PCA) which is consisting of four indicators. These indicators are freedom of association and collective bargaining, gender discrimination related to employment, child labor and forced labor. In addition, ILO convention ratification is used as an indicator of CLSI. The graph of CLSI of Pakistan move gradually in the beginning and then start rising. The fluctuations in the index graph causes due to liberalization and privatization policies in the economy. This graph shows the implementation and effectiveness of labor standards in the economy.

The empirical estimates show the negative impact of core labor standard on the informal employment level of the economy. This describes the reduction of informal employment level in the effective presence of core labor standards. The control variables comprise of value added for agriculture, manufacturing and services shows positive relation with core labor standards except the value added for industry. The relation of core labor standard with formal employment is positive in the long run and highlights the effectiveness of core labor standards on the employment condition of formal sector. The controlling variables behave opposing to the informal employment. The behavior of these variables in the short run is identical to long run behavior. This analysis explains that the ratio of informal employment decreases in the presence of effective core labor standard and opposing behavior is obtained in the case of formal employment. These core labor standards proves to be a stimulus for lowering the informality rate and higher the formality rate in the economy.

The third essay discusses the impact of core labor standards and informal sector employment on the economic growth of Pakistan's economy. The human capital augmented Solow growth model is extended by incorporating core labor standards and informal sector employment to describe their effect on the rate of economic growth. The findings of the analysis suggest the

positive relation of core labor standard with economic growth. The implementation of labor standards enhances the growth rate of the economy. The growth rate of formal and informal labor has positive impact with economic growth. This elaborates the increase in the productivity of labor force in the sector and contributes in the economic growth rate of the country. The share of physical capital shows negative relation due to change in the variable construction. The relation of human capital with economic growth is positive and consistent with the results of economic growth model. The enforcement of strong labor standards reduce the exploitation behavior with workers ,increase their confidence and productivity level, which ultimately cause the increasing growth rate of the economy in the presence of both formal and informal labor.

This dissertation seems to be a journey from describing the motivating factors of formal and informal employment, assessing the role of core labor standards on the both type of employment and leads toward the increasing economic growth rate in the presence of both core labor standards and formal and informal employment. The overall analysis describes the reason of increasing the informal employment level and phenomenon to control this increasing rate of informality by applying core labor standards which will protect the rights, reduce the exploitation behavior and increase the productivity level of workers. This will reduce the informality rate and increase the formality rate and indicate the economy on the path of economic growth.

Limitations of the Dissertation

There are various limitations in the essays of this dissertation. First, due to unavailability of data, the analysis is conducting using time series data at aggregate level for shorter time period in all three essays. Second, the analysis of first essay is based on the motivating factors of participation of workers in the formal sector to evaluate the entry of workers in the informal sector during the estimation process. Last, the core labor standard index in second essay is only used to conduct the strength and effectiveness of labor standards at the national level. But this index can also be used to further explore the role of labor standards at sector level in the economy.