Employment Pattern Diversification in Pakistan's Industrial Sector

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Abstract

This study provides a comparative evaluation of flexibility and adjustment cost by utilizing part-time and full-time employment data in the industrial sector, under the theoretical framework of the dynamic adjustment cost model of labor demand. Moreover, the categorical employment interrelationship elaborates on adjustment strategy among industrial divisions. The estimation is performed using the two-stage least squares (2SLS) and seemingly unrelated regression (SUR) methods, using data for the period, 1990–2012. The empirical estimates depict employment categories with higher employment flexibility and lesser adjustment cost for five out of seven divisions. It confirms the behavior of part-time employment as a cheap labor force, compared to full-time employment in production activities. This employment category increases flexibility and reduces costs to enhance production capacity for industrial growth in the economy.

Keywords

Employment pattern diversification, part-time employment, adjustment cost, dynamic labor demand, 2SLS, SUR.

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Afshan Muneer

Dedication

This work is dedicated in affection to

My Father Muhammad Munir and Mother Razia Munir

Who encouraged me to face any challenge.

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List of Acronyms and Abbreviations

2SLS	two-stage least squares
ADF	Augmented Dickey-Fuller (test)
AIC	Akaike information criterion
CPI	consumer price index
ESWT	Establishment Survey on Working-Time and Work-Life Balance
EU	European Union
FGLS	feasible generalized least squares
GEC	generalized event count
GLS	generalized least squares
GMM	generalized method of moments
HWF	household, work, and flexibility
ILO	International Labour Organisation
LFS	Labor Force Survey
LSDV	least-square dummy variable
LSDVc	least-square dummy variable (corrected)
OECD	Organisation for Economic Co-operation and Development
OLS	ordinary least squares
PES	Pakistan Economic Survey
PSY	Pakistan Statistical Yearbook
SC	Schwarz information criterion
SIC	Standard Industrial Classification
SUR	seemingly unrelated regression

CHAPTER 1

Introduction

Several structural changes can occur within the labor market along sustained economic stagnation that affects the industrial sectors of developing economies, tremendously. One of its most impressive features is the diversification of typical employment patterns in the workforce by acquiring varieties of career opportunities, as well as flexibility in the labor market. The modified forms of employment are divided into typical (such as full-time workers) and atypical (such as part-time workers) employment, which integrates to abolish negative economic crashes (Suzuki 2004). In this diversified employment pattern, the percentage share of full-time work is on the decline. Whereas the trend of part-time work has been on the rise since the middle of the last century in France, Germany, the European Union (EU), USA, Japan, UK, and other economies (Krahn 1995). This insertion of part-time employment helps to reconcile the recent tendency of industrial growth, and points towards the importance of flexible work in the labor market.

The coincidence of faster employment growth and adjustment in the industrial sector requires a restructuring of labor force patterns as full-time and part-time workers. Full-time workers are those who follow a full-time schedule, or work regular hours, whereas part-time workers are similar to voluntary part-time workers (Nardone 1986). Previous studies defined part-time workers as all of those persons who usually work less than 35 hours per week, connecting with the current labor market situation (Montgomery 1988; Ehrenberg, Rosenberg, and Li 1988; Larson and Ong 1994; Fallick 1999; Marchese and Ryan 2001; Euwals and Hogerbrugge 2004; Suzuki 2004; Hamaguchi and Ogino 2011).

In present scenario, part-time work consists of three major categories: short-time, secondary part-time, and retention part-time jobs. Short-time employment considers as a reduction of working hours instead of firing workers during the recession period of the business cycle. This type of employment is common in the manufacturing, mining, and construction industries. Secondary part-time jobs are characterized by low payments and fringe benefits, low productivity, and less skill requirements for work, whereas highly skilled and experienced labor exists in the retention part-time arrangements category (Tilly 1991).

At times, the industrial growth rate is measured as increasing the rate of hours worked in the respective industry while the concentration of part-time labor deals with the fraction of total hours in which part-time employees work in the industry. Many rapidly growing industries hire these workers because part-time work is well suited to alternative demand conditions. Therefore, industries with a higher ratio of part-time workers represent a higher overall growth rate of employment opportunities in several economies. The evidence suggests that employment growth is concentrated in those industries that commonly used part-time positions (Fallick 1999). Such type of employment actually promotes flexibility in the production processes. This leads to cost reductions - the main motive for hiring such workers, in the first place (Krahn 1995).

The growth of part-time arrangements in the industrial sector has increased faster than its full-time counterpart, but this trend does not indicate a technological shift towards the use of the part-time workforce, nor an anti full-time labor practice, rather more of an adjustment phase where the workforce begins as part-time workers and transitions into full-time workers (Farber 1999). A key advantage of these arrangements is identified as flexibility in the working schedule. The worker's flexibility has a prominent effect on employment level, production cost, and enhances the probability for job creation. The reasons for improving the ratio of part-time work include a positive response in development, allowing employees to maintain working schedules with respect to business cycle conditions, promoting adjustments of labor costs in production procedures, and providing a settlement place for unemployed persons in the labor market who are unable to work, properly (Buddeimeyer, Mourre, and Ward 2005).

On the other hand, the trend of part-time employment spreads more in relation to full-time employment because of lower hourly costs and inter-industry relationships among workers, which also depends upon their usage and cost-benefit analyses. The increasing level of variations in relative cost benefits is linked with the handling procedure of part-time work in different industrial divisions, while the response of reducing cost implies that part-time employees are willing to receive lower wages and fewer fringe benefits than full-time workers (Ehrenberg, Rosenberg and Li 1988).

Other historical studies focus on the supply-side factors of the labor market and variations in the industrial structure of employment to examine part-time employment relationships. However, the prolonged expansion of part-time employment may call for an examination of the dynamic relationship of labor demand determinants relative to supply-side factors (Tilly 1991). Therefore, part-time arrangement, which promoted over time, is a demand-side phenomenon rather than the supply-side of the labor market. In fact, the relative labor cost responds in relation to employment status, which is predictable in a demand-side analysis of the labor market (Ehrenberg, Rosenberg, and Li 1988). In this respect, the dynamic model of labor demand puts great stress on the adjusting costs of the labor force, which is adopted by industries in the labor market (Burgess 1988).

In the case of Pakistan, the contributing share of the industrial sector in economic growth has been stagnant for the last three decades, due to severe economic collapses. This depicts a reduction in the employment generating capacity of the industrial sector (Burki 2011). Considering full-time employment as a less efficient means of industrial growth, part-time work represents an alternative way for work-sharing arrangements that allocate the accessible absorption capacity of a growing labor force into work activities, by fostering employment and reducing production costs. This study explores the hypothesis that part-time workers, as an adapting category in employment patterns, performing a striking role in regulating the employment strategies of industries to reduce the effects of severe economic shocks.

1.1 Study Rationale

Part-time arrangements in employment patterns stand out as a remarkable feature of the labor market in most developing countries. Robinson (1979) studies its intensity and concentration in different sectors of Pakistan for the period, 1968–79. After this study, Shahnaz (2008) explains supply behavior of people in providing working hours and its effect on economic and social factors for part-time workers for the period 1990–2004. Research work on demand-side analysis of atypical employment in Pakistan’s labor market is missing from extant literature. To fill this gap, this study examines the role of part-time and full-time employment under the adjustment costs theory of labor demand in the industrial sector of Pakistan.

1.2 Study Objectives

This study expresses the association between two categories of employment patterns in labor markets and their effect on the adjustment costs of the labor force in the production processes of industries. Important objectives include the following:

i. To observe flexibility among the utilizing pattern of full-time and part-time workers in working hours and employment dimensions;
ii. To develop a standardized dynamic adjustment cost model of labor demand for two substitutive categories of workers to probe adjustment strategies in industries;
iii. To understand the dynamic interrelationship between the adjustments phase of part-time and full-time workers in the labor market.

1.3 Organization of the Study

This study is organized in the following pattern: Chapter 1 provides an introduction and study objectives. Chapter 2 comprises an extensive literature review in the relative context along with methodological casing. Chapter 3 explains the methodological framework in a theoretical and empirical mode to evaluate the adjustment cost for both categories of employment. It also elaborates on data description and sources. Chapter 4 serves as a brief description of estimation strategies used to support/refute the theoretical claims of the analysis. A discussion of empirical results is outlined in Chapter 5. It includes a robustness analysis. Chapter 6 describes conclusions and policy recommendations.

CHAPTER 2

Literature Review

2.1 Introductory Remarks

There is abundant literature on labor market fluctuations. Some research work deals with diversified employment patterns acquiring flexibility in working arrangements. Other research is related to reductions in the cost of production procedures under the demand-side analysis. However, a limited pursuit endeavors to examine the adjustment cost behavior of atypical employment under flexibility, in labor markets. Therefore, the review is confined to exploring divergent employment patterns specifically related to full-time and part-time workers in the context of demand-driven phenomenon. The discussion below divides into three sections. The first section relates to employment patterns in response to their adjustment costs. The second section explains flexibility settings by using typical and atypical employment patterns. The last section predicts employment patterns in the context of Pakistan.

2.1.1 Employment patterns and adjustment cost

Lucas (1970) describes two dominant theories of competitive industries considering cyclical variation in product demand, one placed on the neoclassical production function, and the other on fixed-factor proportions, but the inconsistent results for both theories are captured for cyclical variations in real wages or direct estimation from production functions by using US time-series data. An alternative theory based on two levels is articulated: first, the production function is promoted by precise capital stock for alteration in utilizing rates. Second, the cost structure of firms is rectified. An explicit model is developed by connecting workers' preferences with capital utilization to understand the cyclical variation. The result anticipates that the empirical production function and cyclical fluctuations are persistent with developed theoretical concepts. The summarizing views refer to the observed cyclical movement of production and real wages with the developed model. There is no model that allows the countercyclical pattern in real wage compensation, per man-hour.

Sergeant (1978) estimates a dynamic aggregate demand model for employment from US postwar data, and proposes a plausibly rich dynamic structure because firms are assumed to quickly adjust the costs of their workforce and consider it optimal to narrate forthcoming values of wage rates in driving existing employment. The model occupies the axiom of rational expectations and over-identifies restrictions on stochastic processes that consist of straight-time employment, over-time employment, and real-wage rate. The full-information maximum likelihood method is used to estimate variables in the model. In addition, the Granger causality test is practiced. The result shows the dynamic interaction between straight-time and over-time workers by utilizing the Markova processes of stochastic productivity shocks. These interactions presume the reliance of employment categories on each other. The overall conclusion predicts that employment and the real wage relationship exists along a demand-side schedule for employment. Without applying restrictions, it is uncertain whether the equilibrium level has contented, commonly.

Symons and Layard (1984) corroborate labor demand functions in the absence of adjustment cost for five dominant countries, namely Canada, Germany, France, Japan, and USA, at the aggregate level. The scheme practices by quarterly data conducted for the OPEC period from 1955–80 and is estimated by the ordinary least square (OLS) method. The estimated outcome exhibits the dominancy level of employment on factor prices. The conclusion reveals a weak relationship between aggregate labor demand and real factor price, due to inadequacies in the analysis.

Trivedi (1985) assesses eminent distributional lag models that are driven from aggregation over heterogeneous microeconomic entities, by using the statistical approach of composite distributions, which use macro-distributed lags attained by the fusion of micro-heterogeneous distributed lags. The non-linear least square technique is used for parametric estimation, but the minimum chi-square method is more appropriate for estimating the statistical approach. The estimation uses 20 datasets from already published work and recommends the maximum likelihood as a superior method for better fitting the data, compared with the minimum chi-square test. The result observes that the aggregation approach is valuable in the presence of infinitely small micro-economic factors that respond to typical macro-economic stimuli. The concluding remarks propose that smoothening restrictions, along with dimensional restrictions, do not enforce in distribution lag determination, arbitrarily.

Epstein and Yatchew (1985) create three principal contributions in empirically-oriented work on dynamic factor demand systems, which depend upon a firm's adjustment cost model. First, demand and supply functions are derived from a simplified mechanism that abides by inter-temporal profit maximization and an expectation accumulating procedure of future prices. Second, a firm's technological and predicting pattern is determined by using a complete appraising process of the demand and supply framework. Third, the aggregated annual data of US manufacturing industries for the period 1947–77 is used to estimate the procedure and examine its compactness with theoretical foundations. Simultaneous equation systems and maximum likelihood functions are adopted to estimate the analysis and tackle the endogenic problem. In addition, different tests like the Bruesh-Godfrey test and Durbin Watson statistics are applied on the unrestricted form of model. The estimated results demonstrate insignificant coefficients for first-order adjustment costs under the restricted model, while the unrestricted model depicts significant coefficient values, considering second-order adjustment costs. This interpretation concludes that the response of fictional indicative firms cannot explain aggregate demand factors in the reference period. However, the desired extension in disaggregated data sets requires for managing quadratic specification.

Nickel (1986) discusses the theoretical justification of the dynamic model of labor demand, describing distinctive structures of hiring and firing costs and their inferences for periodic paths of employment. Empirical effort is based on the assumption that turnover cost is quadratic, which disaggregates the labor force into two types, due to enormous alterations in adjustment cost between distinct groups. Firm data is used, but aggregating level data covers intrinsic structures properly. The results convey the impression that quadratic adjustment costs are thin as compared to linear adjustment costs, because firms' employment policies cannot develop by an isolated function of expectations and pre-estimated variables. The conclusion predicts that parametric estimates are required to solve the optimum strategy for different variables, numerically. This process relaxes the assumption that firms proceed under exhaustive strategies in labor demand analysis.

Hamermesh (1989) analyzes the adjustment in labor demand by firms' cost behavior in response to exogenous shocks and evaluates an optimal track for employment, supporting varying adjustment costs. This study uses data from December 1977 to

May 1987 that relies on individual plants and a distant series of higher disaggregated companies. The maximum likelihood function and least square techniques are applied for estimation. The result is that the maintained adjustment of quadratic variable costs reported poor behavior, but alternative adjustment cost arrangements are uncertain in four-digit Standard Industrial Classification (SIC) industries at the aggregation level. The conclusion described a slow adjustment in labor demand due to an inclining trend in variable costs. The author deduced a link between maximum behaviors with macro analysis to choose appropriate mechanisms at the aggregation level, in contrast to using micro foundations.

Fry (1991) explores the adjustment pace of employment and working hours by using a framework of dynamic labor demand with adjustment cost in manufacturing industries for Britain and North America. The data spans the 1970s period for Britain and extends to the 1980s period in the American case. The estimation is done using the OLS procedure and maximum likelihood. The findings predict that American industries possessed employment adjustment with lower speed and working hour adjustments with faster speed than British industries. The conclusion reveals that the deviation of working hours is linked with employment deviation from its equilibrium level in the economy.

Friesen (1997) evaluates the demand of full-time and part-time labor by assigning a standardized dynamic adjustment cost model. Monthly data is used to estimate labor demand equations for part-time and full-time labor using a time span from January 1979 to December 1987. Seemingly unrelated regression (SUR) and the minimum distance procedure are applied, and in extension, own and cross-price elasticities are calculated for each type of worker. The statistical finding expresses independence in adjustment costs between two groups of labor, which exhibits disequilibrium in one category, and slows adjustment of the other. The concluding remarks are that part-time labor can use as a prominent source of dynamic flexibility in industries, and illustrates the growth of part-time employment in the labor market.

Nickell et al. (2002) considers unemployment patterns in Organisation for Economic Co-operation and Development (OECD) countries in the context of shifts in the beveridge curve. Unemployment and real wages demonstrate fluctuations by variation in institutions, and economic shocks have indicated this from 1960 to 1990. The estimated model includes aggregate demand, productivity, and wage shocks to illustrate the short-run dynamics of unemployment from the equilibrium level. The estimation is done using the co-integration test and dynamic simulation methods. The results indicate movement in the beveridge curve by changes in institutions of the labor market that struck with labor costs while these costs are consistent with the unemployment phenomenon. This observation concludes that fluctuation in unemployment rates across OECD countries is explicated by altering the structures of labor market institutions.

Polder and Verick (2004) illustrate a cross-country comparison of firms by adjusting capital and labor dynamically and admitting the feasibility of interrelation in the adjustment costs, which drove investment dynamics. A structural model is established for Germany and the Netherlands under the framework of convex and non-convex adjustment costs. The time length for two balanced datasets is taken from the period 1992–2000. Panel data models are estimated using the Bundle-bond system of the generalized method of moments (GMM) and try to remove the problem of hetroscadesticity and sample selection bias. The results show a clear difference between the labor adjustment of the two countries, indicated by changes in wage rates and investment that depend on a flexible labor market in the Netherlands, while Germany is faced with higher adjustment costs due to fixed costs. The overall conclusion of the study is that adjustment cost factors are credibly interrelated at the firm level and implies a restriction on employment to explain investment dynamics. There is no expression, through which labor market distinctions between the two countries disturb the dynamics of capital adjustment.

Barcelo (2007) explores the connection within labor demand and firms' market prices to concentrate on adjusting costs of firms for quasi-fixed agents, labor and capital, concurrently, by adopting the Q-model. The empirical practice is situated on a sample of 107 Spanish firms over the period 1987–97. The structural parameters of the cost function are estimated by the minimum distance procedure, and the two-step GMM is applied with an optimal weighting matrix, while Sargan test statistics are practiced for checking the instrument's validity and over-identifying constraints. The result shows that the marginal-adjustment cost of labor differs from capital demand, and an exquisite interchanging effect is observed between labor demand and investment on adjusting cost that induces firms' decision of adapting labor and capital agents. The overall conclusion mentions the pervasive use of temporary labor in industries, which split the production process, having a lower value of labor adjustment cost due to the particular characteristics of their technological and economic operations.

Lister et al. (2012) evaluate static and dynamic labor demand models for unskilled, medium, and high skilled labor at the firm level under an exogenous shock. The study follows acquisitive long-run and short-run adjustment strategies in the labor market. The dataset covers the period, 1996–2008. The GMM method is applied for the short-run analyses while the long-run relationship is conducted using the SUR and feasible generalized least squares (FGLS) estimation techniques. The result exposes little feedback from wage shocks in the short run, comparative to the long run, and deals with adjustment costs. Additionally, firms adjust unskilled labor demand faster than medium and high skilled labor. The study concludes that firms face adjustment costs to change their labor force, irrespective of input prices.

2.1.2 Employment patterns and flexibility

Cordova (1986) drives the expanse to which the legend model of employment association requires change in the recession period and seeks alternatives to full-time employment, through which the part-time approach has flourished, relating with other variants. It desires structural change in the manufacturing industries by utilizing advanced technologies and reshuffling activities, because traditional organizational designs look inadequate and demand increasing flexibility. The conclusion refers to the overhauling of the full-time employment model, by exploring inherent flexibility and adopting concerted action to assimilate part-time employment as a form of atypical employment.

Jakofsky and Peters (1987) scrutinize two categories of part-time employees with full-time employees on various management-related feedbacks and observed potential diversity in employment stages. The data is collected for full-time, part-time regular, and part-time irregular workers from sales personnel working at eleven stores of retail merchandise organization. Multivariate covariance analysis and the separate moderated regression technique are applied. A post-hoc comparison is imposed after arranging scores by setting covariates. The result intimates that part-time employees with irregular schedules seem to be more satisfied with their work and salaries as compared to other categories, including part-time regular and full-timers. The concluding remarks state that flexibility is created by using part-time arrangements in the structure of the labor market, while employment status is not linked with the performance conditions of workers. It abolishes the development of management policies for performance.

Bayer et al. (1987) examine the consequences of flexible strategies by associating time allocation within institutional limits of cumulative labor relations with social, physical, and political determinants. A model is constructed to predict employment strategies in different sectors. The estimation is carried out using a simulation method for ten sectors of data from the time span, 1970–81. The result interprets the variation in flexibility from one sector to another and inadequacy in its response to remove barriers, while the reduction in working times exhibits a positive response to decreasing the unemployment ratio. This directed to conclude that feedback redeems through flexibility in the labor market would not account for uncertainty in employment or deal with labor relations. During the recession, flexibility may have rectified the social system by revising policies.

Ehrenberg et al. (1988) examine the inter-industry variation of relative wage cost and fringe benefit differentials for part-time and full-time employees in the demand and supply framework. The inter-industry model of part-time variation is estimated for seven major occupational groups of the USA using aggregate time-series data for the period, 1955–84. The OLS technique is applied. The two-stage least squares (2SLS) technique is used to remove simultaneous equation bias. The result indicates that on the supply side, the coefficient of wages and fringe benefits—health insurance coverage, private pension coverage, etc—are more significant as compared to demand-side coefficients, which represent employees' behavior as an increased trend of part-time work. It is concluded that the supply-side response of part-time employees is exceeded, relative to demand-side responses in wage cost differentials across industries.

Hamermesh (1990) derives and estimates general dynamic labor demand models by introducing fixed adjustment costs and convex adjustment costs, alternatively. The study covers the period, 1969–76. The findings express complexities in employment structures and adjustments in labor demand paths, due to demand and cost disturbances. The concluding statement elaborates on the importance of fixed costs in employment adjustment by prohibiting wages.

Hausman and Osawa (1995) examine the trend of part-time and temporary employment in Japan and the characteristics of a non-regular workforce by examining their role in the industrial relation system, developing agents, and public strategies. The annual data on part-time employment is used at the aggregate and sectoral level in quite cyclical perceptive that decline with respect to trend over the recessionary period of the early 1980s and 1990s. The result displays correlation between part-time employment or temporary employment, and firm size differs significantly across industries, but their rates increase in the wholesale and retail trade sector, but decline in the manufacturing sector. The conclusion indicates that part-time and temporary positions of employment are attractive for firms to decrease labor costs and increase employment flexibility, because workers are not protected by industrial relations processes, life-time jobs and promotion facilities.

Carnoy et al. (1997) explore the diverse patterns of flexible employment in Silicon Valley by conducting extensive interviews with companies and temporary employment agencies. The time span for this study is 1984–95. The empirical estimates by comparing the share of the flexible workforce of Silicon Valley with the rest of the USA, express the growth in flexible employment, which is much higher than the overall employment. Considering the case of the upper bound, flexible employment grows five times more, while, by yielding the lower bound, its ratio is 2.5 times higher as compared to total employment. It is concluded that longer turnover periods and the inter-firm movements of the workforce among high technological industries are essential features of labor market flexibility, in addition to the Valley’s traditional trends of competition between product markets.

Grip et al. (1997) illustrate the significance of two major types of atypical employment comprising part-time and temporary workers intimates with supply-side and demand-side occupational categories in eleven member states of the EU. The empirical estimates appear for the period, 1983–91 under the binomial logit technique. The results express that a higher probability of gender as a personal characteristic and lower probability of intermediate skills relative to occupational groups, are responsible for regulating part-time work and shows preference over temporary work. This supports the conclusion that both kinds of atypical employment depicts contradicting behavior, but the generation of part-time jobs by promoting temporary employment relations seems to access flexibility in a sluggish labor market.

Fallick (1999) checks the stock to establish plausible affiliations between employment growth and the dominance of part-time workers in industry, and probes the role of rapidly growing industries in providing opportunities of part-time employment in seven countries, namely Australia, Canada, Israel, the Netherlands, Sweden, Taiwan, and the UK. The time span under study is 1979–94. The estimation uses a weighted and un-weighted Pearson correlation coefficient and Spearman rank correlations. The result executes that the Spearman coefficient are positively significant over the post-war period and exhibits strong relations between part-time intensity and industrial growth at the two-digit aggregation level. The important corollary is that faster growing industries extends the use of part-time labor intensity that pursue to expand quickly, because the part-time workforce competes with the changing demand conditions of advance industries.

Houseman (2001) describes the motive for the usage of flexible staffing arrangements and employee opinions about its importance in organizational structures. This study recognizes the factors influencing employers to appoint flexible workers like part-time, on-call, direct hiring, temporary and contract workers, etc. A multivariate analysis including the Probit and Tobit models, is implemented. The statistical findings denote positive and significant coefficient values of good benefits for temporary help agencies, on-call workers, and part-time workers, which illustrate the usage of flexible arrangements due to the exception of their costs. The summarized comment states that workers' desire to work fewer hours fulfilled in the presence of part-time jobs, while employers reduces wages and save their costs by using such staff arrangements.

Wallace (2003) investigates flexibility in the working processes of people in the form of time, place, and states in eight European countries, and expresses its conditions. In this study, the household, work, and flexibility (HWF) project to seek flexibility use three research methods. First, the working pattern of respective countries is described by observing their contextual knowledge and statistics. Second, a standardized survey is conducted to obtain information of the working population in the age group of 18–65 in targeted countries. Finally, a comparison between family scheme and flexibility is recorded in different national circumstances. The chi-square test and correlation coefficient methods are used to estimate data from 1980 to 2000. The results suggest that the overall combination among distinct forms of flexibility depicts a positive correlation at lower levels. The flexibility related to contract and time consort with each other, while place flexibility responds in a dynamic way. The conclusion describes variation in flexibility from one country to another, which depends on the texture of the labor market, rules of regulation, and division of the workforce.

Buddelmeyer et al. (2004) display part-time employment at the firm level and distinguishes the structural and business cycle determinants for its expansion in 15 countries of the EU, to discuss flexible working arrangements. The pooled data, including a variation of cross-section and time-series for the period, 1983–2001 is estimated using the generalized least squares (GLS) technique. In addition, to remove hetroscadesticity and endogenic problems, the more appropriate estimating technique is the two-stage FGLS method. The results predict that business cycle fluctuations exerts a negative impact on the development of part-time jobs and records a higher rate in the recessionary phase, while structural or other institutional factors has positive effects on part-time employment rates. The concluding remarks favor the utilization of part-time employment as a source of adjusting the workforce within firms, concedes with economic activity and augments the flexibility in rigid labor markets.

Sato (2004) conducts a case study to analyze the policy direction for diversification of employment structures and depicts the rise in non-standard employees, such as part-time and dispatched workers relative to standard company employees in Japan's service industry. The time-series data is arranged and the analysis is done under supply and demand matching. The inquiry indicates an increase in non-standard work on one hand, and a decrease in standard work, after investigating the differing behaviors of seven companies in the case studies.

Hirsch (2005) elaborates the effects of working conditions, occupational skill requirements, and worker's skills on wage differentials of full-time and part-time work, for observing job possibilities. The panel of workers is established to permit overlook for wage differentials between both categories of workers from September 1996 to December 2002, in consecutive years. In addition, the author uses sets of occupational skill variables to compare the same abilities of part-time and full-time worker in parallel jobs. Longitudinal analysis is used to measure movement changes between part-time and full-time work. The estimated results shows that part-time wage penalties surge over time, but are small on average, due to accumulating less human capital relative to other workers. The concluding remarks indicate that the appearance of part-time workers does not create any systematic failures for full-time job opportunities.

Gaston and Kishi (2006) analyze the main determinants of part-time employment under the both demand and supply side factors of Japanese labor market at individual and firm level. For this purpose, the data is obtained from Japan's Survey on Diversified Types of Employment and estimation is done by using probit model and full-information maximum likelihood method. The estimating results predict the worker's behavior towards flexible hours for work and represent the growth of part-time work as a voluntary labor market development. The obtaining conclusion is that the firms for fulltime jobs screen the part-time workers. In addition, part-time workers can arrange full-time worker's responsibilities voluntarily.

Jacobi and Schaffner (2008) apprehend the substitution pattern located between regular and marginal part-time employment in Germany under the heterogeneous labor demand approach by five distinct worker categories, namely regular part-time, marginal part-time, highly skilled full-time, skilled full-time, and unskilled full-time employment. The quarterly time periods on marginal part-time employment for the years 2002, 2003, and 2005 are analyzed before and after the reform for East and West German industries. The Morishima Substitution Elasticity and the generalized event count (GEC) model render the calculation. In accession, heteroscadesticity and autocorrelation exist in standard errors, robustly. The anticipating results describe that entire employment categories are a perfect substitute for marginal part-time employment due to depreciation in its cost benefits, but extracting greater substitution elasticity predicts for highly skilled workers. The summarizing statement is that the cost advantages of marginal employment perform an essential role for its enhancement, and any change in wage schedules with reference to marginal employment has massive effects on employment levels.

Klinger and Wolf (2008) examine the variation in par-time and full-time labor employment levels in accordance with change in the sectoral structure of the German economy. Yearly data is used to estimate least square dummy variables (LSDVc) for the phase, 1991–2005. The results suggest that the predicting variables demonstrate variation in sectoral employment patterns in association with labor demand channels. The conclusion reported that the increasing trend of part-time labor and declining trend of full-time labor exhibits flexibility and adjustment cost as inherent elements for conversion toward the service sectors.

Pinker et al. (2010) elaborate on the distinction between the short-run and long-run benefits of working force flexibility, which is constituted on starting times, part-time, cross-training level, job switching ability, and buffer size handling with a two-stage optimization framework under uncertain demand patterns. In the first stage, employer exerts a measure for demand and selects policy for working force flexibility. In the second stage, minor alterations in the model made to redistribute workers to react with demand shocks. The results express the workforce-planning rule that accept the starting position of time flexibility in the labor force and settle staff size in the planning stages with small buffers. However, under uncertain conditions, starting time flexibility replaces with part-time work and then further into cross training. The corollary depicts cross training as the weakest type of flexibility, relative to others that link with time, which identified the benefits under temporal uncertain demand.

Haataja and Kauhanen (2010) examine the employer demand determinants for part-time labor in three countries, namely Sweden, Finland, and Denmark. It relates with employee wishes and establishment requirements for part-time work. The logit model is employed for the data set taken from the Establishment Survey on Working-Time and Work-Life Balance (ESWT), 2004–05. The results express the behavioral differences of employees and employers toward the part-time labor force. In case of workers' desire, the transition assessment from part-time to full-time labor is better, while on the other side, employers' response is more negative in Finland management than Sweden and Denmark management, in the promotion perspective. The overall conclusion presents the equal motivational perspectives for both part-time and full-time employees in all economies.

Nelen et al. (2011) scrutinize firm productivity in the presence of part-time employment under the production function. The GMM method is used to estimate productivity for heterogeneous employment in the service sector using a panel dataset. The estimated results reveal that firms having a large share of part-time employment predict high productivity levels, comparative to full-time employment, based on their allocation efficiencies. It is concluded that the high ratio of part-time employment serve as higher firm productivity.

Anxo et al. (2012) examine the demand-side analysis of part-time work with its expansion on firm characteristics and countries institutional settlement in term of usage and intensity for European companies. The data is based on a sample of more than 21,000 establishments operating in 21 EU member countries. The proportion of part-time work is evaluated using multivariate multilevel modeling in a Bayesian environment. The estimated results show that European organizations with unfair age distribution, short-term contracts, high rates of female workers, and low-skilled workers, are supine to a large proportion of part-time work. The conclusion supports the fact that observed fluctuations in part-time intensity are more induced by societal preferences and institutional agents, as compared to distinction in industrial structure or arrangements among countries.

2.1.3 Employment patterns in Pakistan

Robinson and Abbasi (1979) quantifies the extent of underemployment in Pakistan and its concentration and tendency in assorted sectors over time, by applying direct and indirect methods. The time period taken for this analysis is 1968–79. The results of the direct approach find the rate of underemployment significantly higher in rural areas because of its social and economic patterns, which is based on family enterprises. In the indirect approach, labor productivity is taken as a function of increase in output, rather than altering employment scheme in modern sectors. This study concludes that output increases by appointing more workers and keeping technology and capital, constant that depicts the growing underemployment rate in trade, agriculture, and construction in the reference period.

Shahnaz and Khalid (2008) evaluate the hour’s supply behavior model of young people in Pakistan in order to assess and learn about the social and economic considerations of the underutilization of labor supply within a statutory definitional framework. The time period considered in this study span is 1990–2004. The estimation is done using three approaches including OLS, logit, and multivariate logit techniques. The result outlines that the share of underemployment is 12–15%, in accordance with the International Labor Organisation (ILO) definition, and 0.3–3.1%

at the national level. Its rate is higher in the Labor Force Survey (LFS) description under gender-wise and regional analysis. It is concluded that alternative activities should be sought to make the growing young population more productive and a more contributing entity in the process of economic development.

2.2 Concluding Remarks

Early research presents the dynamic labor demand model in different perspectives to capture the distinctive phenomenon. The studies review introduces heterogenic employment into the model to observe flexibility and adjustment costs in the labor market. These studies depict the adjustment of part-time and full-time labor at the firm, sectoral, national, and international level. With the passage of time, the data specification should change from the micro to macro level in order to achieve the desiring results. The literature on employment patterns in Pakistan is reviewed at the end of the chapter. The dynamic labor demand model, including adjustment cost, is in the proceeding chapter.

CHAPTER 3

Methodological Framework and Data Description

3.1 Introductory Remarks

This chapter gives a theoretical and empirical sketch for the dynamic labor demand model by introducing adjustment cost. The theoretical narration builds upon a dynamic analysis of labor demand approaches and is directed toward its empirical foundation. This empirical effort provides the desired labor demand system and variable measures for an estimation strategy.

3.2 The Theoretical Model

3.2.1 Framework of the model

There are various theories describing the behavior of competitive industry during cyclical variations in the demand side of the labor market. These theories depend upon the neoclassical production function, which requires labor and capital stock as its prominent factors of production. When capital stock is taken as a constant, then industry handles fluctuations by adjusting the cost and demand of the labor force. Some studies including Lucas (1967), Gould (1968), and Treadway (1969) work on the labor force for maintaining its demand under costly adjustments during production processes. By blending these studies, Lucas predicts his static model of capacity and overtime work in (1970). Based on Lucas's work, Sargent (1978a) creates a dynamic structure of straight-time and over-time employment by adding adjustment cost in labor demand schedules. This study modifies the existing model of Sargent (1978a) by replacing over-time with part-time employment, and analyzes the diversification of employment patterns among industries. It is claimed that the adjustment of part-time labor is cheap and quicker than that of full-time labor. This is because part-time labor responds more actively to market signals than full-time labor. The industry bears the cost of quickly adjusting labor, and determines its current employment from its future expected wage rates.

Consider a representative firm to derive a simple model that can handle various types of diversity among firms in different economic sectors[1]. In this model, the diversified dimension links with employment patterns based on part-time and full-time workers.

Let us assume that the firm observes the following instantaneous production function:

$$Y_{(t+\eta)} = g[\, n_{(t+\eta)}, k_{(t+\eta)} \,]$$

$t = 0, 1, 2, 3, ...$ and $\eta \varepsilon [0,1)$

Here, $g_n, g_k, g_{nk} > 0;\ g_{nn}, g_{kk} < 0$.

In the above production function equation, $Y_{(t+\eta)}$ represent the output rate at instant $t + \eta$, while $n_{(t+\eta)}$ and $k_{(t+\eta)}$ show numbers of employees and capital stock at instant $t + \eta$, respectively. t indicates day while η indicates moments in that day.

The firm hires part-time workers of fixed length $h_a < h$ at wage $\omega_{\boldsymbol{a}}$ and full-time workers of length $h_b > h$ with wage rate ω_b, during the day. Confronted with market regulations, it is optimum for firms to set $n_{(t+\eta)} = n_{at}$ for $\eta \varepsilon [0, h]$ and $n_{(t+\eta)} = n_{bt}$ for $\eta \varepsilon [h,1]$ which represent a single level of part-time and full-time employment, respectively. The capital stock is constant over the day. So, $k_{(t+\eta)} = k_{(t)} \equiv k_t$ for $\eta \varepsilon [0, 1]$.

Then, the firm's productivity over the entire day is:

$$Y_t = \int_0^1 Y_{(t+\eta)}\, dt$$

$$Y_t = \int_0^h Y_{(t+\eta)}\, dt + \int_h^1 Y_{(t+\eta)}\, dt$$

$$= h_a g\,(n_{at}, k_t) + h_b g\,(n_{bt}, k_t)$$

This setup further solve by using two steps. First, k_t can be neglected because it is constant during a day. Second, operating the production function in quadratic form

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[1] Assuming a representative firm is just for simplicity, even though the model permits the theory of aggregation.

and its instantaneous productivity for part-time and full-time employees, is written as:

$$\mathrm{g}(n_{at}, k) = \mathrm{g}(\mathrm{g}_0 + q_{at})n_{at} - (\mathrm{g}_1/2)n_{at}^2$$

$$\mathrm{g}(n_{bt}, k) = \mathrm{g}(\mathrm{g}_0 + q_{bt})n_{bt} - (\mathrm{g}_1/2)n_{bt}^2$$

Here, $\mathrm{g}_0, \mathrm{g}_1 > 0$

In the quadratic form, q_{at}andq_{bt} indicate exogenous stochastic processes, which affect the productivity of part-time and full-time employment. Let us assume that

$\mathrm{E}q_{at} = \mathrm{E}q_{bt} = 0$.

3.2.2 Adjustment cost specification

The firm faces daily adjustment costs for the part-time labor force as $(d/2)(n_{at} - n_{at-1})^2$ and for full-time labor force as $(c/2)(n_{bt} - n_{bt-1})^2$. As we know, it is more costly to adjust the full-time labor force as compared to the part-time labor force. So, $c \gg d$. The firm's part-time and full-time real wage rates are $\omega_a h_a n_{at}$ and $\omega_b h_b n_{bt}$, respectively.

The firm maximizes its present value by adopting the following contingency plans for n_{at} and n_{bt}:

$$L_t = E_t \sum_{i=0}^{\infty} r^j [(\mathrm{g}_0 + q_{at+i} - \omega_{t+i})h_a n_{at+i} - (\mathrm{g}_1/2)h_a n_{at+i}^2 - d/2(n_{at+i} - n_{at+i-1})^2 + (\mathrm{g}_0 + q_{bt+i} - \omega_{t+i})h_b n_{bt+i} - (\mathrm{g}_1/2)h_b n_{bt+i}^2 - c/2(n_{bt+i} - n_{bt+i-1})^2] \quad (1)$$

Here, $\mathrm{g}_0, \mathrm{g}_1, c, d > 0,\ 0 < r < 1$.

where r is the real discount factor and the mathematical expression operator. E_t is determined by $E_t y \equiv Ey|\Omega_t$. While y is considered as a random variable and Ω_t represents a set which contains all available information for the firm during time t.

The firm maximizes its present value by selecting stochastic processes for n_{at} and n_{bt} from the information set. Consider the stochastic measures q_{at+i}, q_{bt+i}, and w_{t+i} are less than $1/r$. It indicates that for any $\text{K} > 0$ and any y such that $1 \leq y < 1/r$,

$$|E_t q_{at+i}| < K(y)^{i+t}, |E_t q_{bt+i}| < K(y)^{i+t}, |E_t \text{w}_{t+i}| < K(y)^{i+t}$$

for all i and all $t \geq 0$.

In order to find an appropriate solution, consider the above optimizing problem in a finite horizon to maximize:

$$L_t^T = E_t \sum_{i=0}^{T} r^j [(\text{g}_0 + q_{at+i} - \text{w}_{t+i}) h_a n_{at+i} - (\text{g}_1/2) h_a n_{at+i}^2 - d/2(n_{at+i} - n_{at+i-1})^2 + (\text{g}_0 + q_{bt+i} - \text{w}_{t+i}) h_b n_{bt+i} - (\text{g}_1/2) h_b n_{bt+i}^2 - c/2(n_{bt+i} - n_{bt+i-1})^2] \quad (2)$$

After solving equation (2) for $n_{at+i}, n_{bt+i}, n_{at+T}$, and n_{bt+T}, we get the following first-order conditions:

$$\frac{\partial L_t^T}{\partial n_{at+i}} = h_a \text{g}_0 + h_a q_{at+i} - h_a \text{w}_{at+i} - h_a \text{g}_1 n_{at+i} - d(n_{at+i} - n_{at+i-1}) + dr(n_{at+i+1} - n_{at+i}) \quad (3)$$

$$\frac{\partial L_t^T}{\partial n_{bt+i}} = \text{h}_\text{b} \text{g}_0 + h_b q_{bt+i} - h_b \text{w}_{bt+i} - h_b \text{g}_1 n_{bt+i} - c(n_{bt+i} - n_{bt+i-1}) + cr(n_{bt+i+1} - n_{bt+i}) \quad (4)$$

$$\frac{\partial L_t^T}{\partial n_{at+T}} = r^T [h_a \text{g}_0 + h_a q_{at+T} - h_a \text{w}_{at+T} - h_a \text{g}_1 n_{at+T} - d(n_{at+T} - n_{at+T-1}) \quad (5)$$

$$\frac{\partial L_t^T}{\partial n_{bt+T}} = r^T [h_b \text{g}_0 + h_b q_{bt+T} - h_b \text{w}_{bt+T} - h_b \text{g}_1 n_{bt+T} - c(n_{bt+T} - n_{bt+T-1})] \quad (6)$$

These equations further solve to obtain Euler equations and transversality conditions.

3.2.3 Euler equations

For part-time employment, equation (3) can be expressed as:

$$\frac{\partial L_t^T}{\partial n_{at+i}} = h_a g_0 + h_a q_{at+i} - h_a \text{ω}_{at+i} - h_a g_1 n_{at+i} - dn_{at+i} + dn_{at+i-1} + drn_{at+i+1} + drn_{at+i}$$

$$drn_{at+i+1} - h_a g_1 n_{at+i} - dn_{at+i}(1+r) + dn_{at+i-1} = h_a \text{ω}_{at+i} - h_a q_{at+i} - h_a g_0$$

$$bn_{at+i+1} - \left[\frac{h_a g_1}{d} + (1+r)\right] n_{at+i} + n_{at+i-1} = (h_a/d)(\text{ω}_{at+i} - q_{at+i} - g_0)$$

$$bn_{at+i+1} + \varphi_1 n_{at+j} + n_{at+i-1} = (h_a/d)(w_{t+i} - q_{at+i} - g_0) \tag{7}$$

where $\varphi_1 = -\left[\frac{h_a g_1}{d} + (1+r)\right]$

For full-time employment, equation (4) can be written as:

$$\frac{\partial L_t^T}{\partial n_{bt+i}} = h_b g_0 + h_b q_{bt+i} - h_b \text{ω}_{bt+i} - h_b g_1 n_{bt+i} - cn_{bt+i} + cn_{bt+i-1} + crn_{bt+i+1} + crn_{bt+i}$$

$$crn_{bt+i+1} - h_b g_1 n_{bt+i} - cn_{bt+i}(1+r) + cn_{bt+i-1} = h_b \text{ω}_{bt+i} - h_b q_{bt+i} - h_b g_0$$

$$cn_{bt+i+1} - \left[\frac{h_b g_1}{c} + (1+r)\right] n_{bt+i} + n_{bt+i-1} = (h_b/c)(\text{ω}_{t+i} - q_{bt+i} - g_0)$$

$$bn_{bt+i+1} + \varphi_2 n_{bt+i} + n_{bt+i-1} = (h_b/c)(\text{ω}_{t+i} - q_{bt+i} - g_0) \tag{8}$$

where $\varphi_2 = -\left[\frac{h_b g_1}{c} + (1+r)\right]$

3.2.4 Transversality conditions

In the case of part-time employment, equation (5) has the following expression:

$$r^T[h_a g_0 + h_a q_{at+T} - h_a \text{ω}_{at+T} - h_a g_1 n_{at+T} - d(n_{at+T} - n_{at+T-1})] n_{at+T} = 0$$

$$\lim_{T\to\infty} r^T E_t m_1 n_{at+T} = 0$$

$$\lim_{T\to\infty} r^T n_{at+T} = 0 \tag{9}$$

Whereas in the case of full-time employment, equation (6) can be presented as

$$r^T[h_b g_0 + h_b q_{bt+T} - h_b \mathrm{w}_{bt+T} - h_b g_1 n_{bt+T} - c(n_{bt+T} - n_{bt+T-1})]n_{bt+T} = 0$$

$$\lim_{T\to\infty} r^T E_t m_2 n_{bt+T} = 0$$

$$\lim_{T\to\infty} r^T n_{bt+T} = 0 \tag{10}$$

Equations (9) and (10) are transversality conditions for part-time and full-time employment, respectively.

The Euler equations further solve for obtaining optimal contingency plans. Equations (7) and (8) can be written as:

$$r\left(1 + \frac{\varphi_1}{r} S + \frac{1}{r} S^2\right) n_{at+i+1} = \left(\frac{h_a}{d}\right)(\mathrm{w}_{at+i} - q_{at+i} - g_0) \tag{11}$$

Where, $\left(1 + \frac{\varphi_1}{r} S + \frac{1}{r} S^2\right) = (1 - \alpha_1 S)(1 - \alpha_2 S)$ (11a)

$$r\left(1 + \frac{\varphi_2}{r} S + \frac{1}{r} S^2\right) n_{bt+i+1} = \left(\frac{h_b}{c}\right)(\mathrm{w}_{bt+i} - q_{bt+i} - g_0) \tag{12}$$

Where, $\left(1 + \frac{\varphi_2}{r} S + \frac{1}{r} S^2\right) = (1 - \beta_1 S)(1 - \beta_2 S)$ (12a)

Equations (11a) and (12a) are factorization solving equations (Annex A). Assumptions about parameters comprise r, φ_1 and φ_2; it requires that factorizations hold with $0 < \alpha_1 < 1 < \frac{1}{r} < \alpha_2$ and $0 < \beta_1 < 1 < \frac{1}{r} < \beta_2$. By using the value of (a) in equation (11) and the value of (b) in equation (12), we get

$$r(1 - \alpha_1 S)(1 - \alpha_2 S) n_{at+i+1} = \left(\frac{h_a}{d}\right)(\mathrm{w}_{at+i} - q_{at+i} - g_0) \tag{13}$$

$$r(1 - \beta_1 S)(1 - \beta_2 S) n_{bt+i+1} = \left(\frac{h_b}{c}\right)(\mathrm{w}_{bt+i} - q_{bt+i} - g_0) \tag{14}$$

By operating the forward inverse of $(1 - \alpha_2 S)$ on both sides of equation (13), we obtain the following solution for part-time employment:

$$r(1-\alpha_1 S)n_{at+i+1} = \frac{h_a d^{-1}}{(1-\alpha_2 S)}(\omega_{at+i} - q_{at+i} - g_0)$$

$$r(1-\alpha_1 S)n_{at+i+1} = -\frac{(\alpha_2 S)^{-1}}{1-(\alpha_2 S)^{-1}} h_a d^{-1}(\omega_{at+i} - q_{at+i} - g_0)$$ Footnote2

$$(1-\alpha_1 S)n_{at+i+1} = -h_a(dr\alpha_2 S)^{-1}(1+\frac{1}{\alpha_2}S^{-1} + \left(\frac{1}{\alpha_2}\right)^2 S^{-2} + \ldots\ldots)(\omega_{at+i} - q_{at+i} - g_0)$$

$$(1-\alpha_1 S)n_{at+i+1} = -\frac{h_a}{d}(r\alpha_2 S)^{-1}\sum_{i=1}^{\infty}(\frac{1}{\alpha_2})^{i}(\omega_{at+j} - q_{at+j} - g_0)$$

The above process derives the following expression:

$$(1-\alpha_1 S)n_{at+i+1} = -\frac{h_a}{d}\alpha_1\sum_{i=1}^{\infty}(\frac{1}{\alpha_2})^{i}E_t(\omega_{at+j} - q_{at+j} - g_0)$$

$$n_{at+i+1} - \alpha_1 S n_{at+i-1} = -\frac{h_a}{d}\alpha_1\sum_{i=1}^{\infty}(\frac{1}{\alpha_2})^{i}E_t(\omega_{at+j} - q_{at+j} - g_0)$$

$$n_{at+i+1} = \alpha_1 n_{at+i} - \frac{h_a}{d}\alpha_1\sum_{i=1}^{\infty}(\frac{1}{\alpha_2})^{i}E_t\left(\omega_{at+j} - q_{at+j} - g_0\right) \quad (15)$$

Similarly, by operating the forward inverse of $(1 - \beta_2 S)$ on both sides of equation (14), we obtain the following expression for full-time employment:

$$n_{bt+i+1} = \beta_1 n_{bt+i} - \frac{h_b}{c}\beta_1\sum_{i=1}^{\infty}(\frac{1}{\beta_2})^{i}E_t\left(\omega_{bt+j} - q_{bt+j} - g_0\right) \quad (16)$$

If $i = -1$ holds, then, equations (15) and (16) obtain the initial conditions that satisfy both Euler equations and transversality conditions for part-time and full-time employment. These conditions are given below:

[2] I use the following forward inverse process:

$$\frac{1}{(1-\alpha_2 S)} = -\frac{(\alpha_2 S)^{-1}}{1-(\alpha_2 S)^{-1}} = -\frac{1}{\alpha_2 S}(1+\frac{1}{\alpha_2}S^{-1} + \left(\frac{1}{\alpha_2}\right)^2 S^{-2} + \ldots\ldots)$$ Where, $\alpha_1 = (r\alpha_2 S)^{-1}$.

$$n_{at} = \alpha_1 n_{at-1} - \frac{h_a}{d}\alpha_1 \sum_{i=1}^{\infty}(\frac{1}{\alpha_2})^{\mathrm{i}} E_t\big(\mathrm{w}_{at+j} - q_{at+j} - \mathrm{g}_0\big) \tag{17}$$

$$n_{bt} = \beta_1 n_{bt-1} - \frac{h_b}{c}\beta_1 \sum_{i=1}^{\infty}(\frac{1}{\beta_2})^{\mathrm{i}} E_t\big(\mathrm{w}_{bt+j} - q_{bt+j} - \mathrm{g}_0\big) \tag{18}$$

Equations (17) and (18) show the demand schedule for part-time and full-time employment, respectively. Each equation consists of current employment levels, once-lagged employment, wage rates, and productivity shocks. α_1,α_2, β_1, and β_2 are the parameters. From equations (11a) and (12a), we find that α_1 and $(1/\alpha_2)$ are declining functions of $(h_a \mathrm{g}_1/d)$, while β_1 and $(1/\beta_2)$ are declining functions of $(h_b \mathrm{g}_1/c)$. It describes that an increase in α_1 and $(1/\alpha_2)$ or β_1 and $(1/\beta_2)$ values, causes the adjustment-cost parameter to increase. Equations (17) and (18) follow that increasing the value of the adjustment cost parameter responds to a decreasing speed of productivity and wage signals received by the firm.

These equations show decision rules for arranging n_{at} and n_{bt} as a linear system of the information set comprising n_{at-1}, n_{bt-1}, and conditional expectations, including $E_t \mathrm{w}_{at+j}$, $E_t \mathrm{w}_{bt+j}$, $E_t q_{at+j}$ and $E_t q_{bt+j}$, which are convenient for empirical work.

3.1 **The Empirical Model**

The decision rules for part-time and full-time employment are linear functions of information set Ω_t. But the perfect linear decision rule requires one to replace conditional expectations in equations (17) and (18) with linear least-square projections by using its operator Ê.

In order to achieve a precise rule for n_{at} and n_{bt}, constraint the stochastic measures q_{at+j}, q_{bt+j} and w_{t+j}. Assume that, $q_{at}$and q_{bt} are proceeded under the first-order Markov mechanism. We get

$$\hat{\mathrm{E}}_t q_{at+j} = R_1^j q_{at} \qquad j \geq 0$$

$$\hat{\mathrm{E}}_t q_{bt+j} = R_2^j q_{bt} \qquad j \geq 0 \tag{19}$$

Where, $|R_1| < 1/r$ and $|R_2| < 1/r$

Therefore, we assume the following stochastic measure for q_{at} and q_{bt},

$$q_{at} = R_1 q_{at-1} + \in_{1t}$$

$$q_{bt} = R_2 q_{bt-1} + \in_{2t} \qquad (20)$$

Where, $\in_{1t}$ and $\in_{2t}$ are least-squares resides which are correlated contemporaneously and allow correlation only with nonzero lags.

Thus, $\hat{E} \in_{1t} |\Omega_{t-1} = \hat{E} \in_{2t} |\Omega_{t-1} = 0$.

Now, assume that Ш_t is an nth-order Markov mechanism. Then,

$$\text{Ш}_t = \varphi_0 + \varphi_1 \text{Ш}_{t-1} + \varphi_2 \text{Ш}_{t-2} + \cdots + \varphi_n \text{Ш}_{t-n} + \in_{3t} \qquad (21)$$

Where, $\in_{3t}$ is the least-square shock that confirms $\hat{E}_{t-1} \in_{3t} \equiv \hat{E} \in_{3t} |\Omega_{t-1} = 0$. But the condition $\hat{E} \in_{3t} |\Omega_{t-1} = 0$ states that $\in_{3t}$ is serially uncorrelated.

It is suitable to represent the nth-order Markov mechanism in vector form. Suppose that,

$$Z_t = DZ_{t-1} + \xi_t$$

In matrix form,

$$Z_t = \begin{bmatrix} \text{Ш}_t \\ \text{Ш}_{t-1} \\ \text{Ш}_{t-2} \\ \vdots \\ \text{Ш}_{t-n} \\ 1 \end{bmatrix}, \quad D = \begin{bmatrix} \varphi_1 & \varphi_2 & \cdots & \varphi_n & \varphi_0 \\ 1 & 0 & \cdots & 0 & 0 \\ 0 & 1 & \cdots & 0 & 0 \\ \vdots & \vdots & \ddots & \vdots & \vdots \\ 0 & 0 & \cdots & 0 & 0 \\ 0 & 0 & \cdots & 0 & 1 \end{bmatrix} Z_{t-1}, \qquad \xi_t = \begin{bmatrix} \in_{3t} \\ 0 \\ 0 \\ \vdots \\ 0 \\ 0 \end{bmatrix}$$

We rewrite it as

$$Z_{t+1} = DZ_t + \xi_{t+1}$$

$$Z_{t+2} = D^2 Z_t + \xi_{t+2} + D\xi_{t+1}$$

$$\vdots$$

$$Z_{t+i} = D^{i} Z_t + \xi_{t+i} + D\xi_{t+i-1} + \cdots + D^{i-1}\xi_{t+1}$$

Since, $\hat{E}_t \xi_{t+i} = 0$, it means that $\hat{E}_t Z_{t+i} = D^{i} Z_t$.

Suppose that eigenvalues of D are definite so that D can be described as $D = R\Lambda R^{-1}$. Column R shows eigenvalues of D, and Λ represents a diagonal matrix that contains eigenvalues as its elements. Then, we obtain,

$$\hat{E}_t Z_{t+i} = R\Lambda^{i} R^{-1} Z_t$$

As we know that

$$W_t = G Z_t$$

$$\hat{E}_t W_{t+i} = G \hat{E}_t Z_{t+i}$$

Here, G is a row vector. By putting the value of $\hat{E}_t Z_{t+i}$ in the above equation,

$$\hat{E}_t W_{t+i} = G R \Lambda^{i} R^{-1} Z_t \qquad (22)$$

These provisions operate further in the model for both cases of employment to achieve estimable decision rules.

3.3.1 Part-time employment

Substituting values from equations (19) and (22) into equation (17), we get

$$n_{at} = \alpha_1 n_{at-1} - \frac{h_a}{d}\alpha_1 \sum_{i=1}^{\infty}(\frac{1}{\alpha_2})^{i} E_t w_{at+j} + \frac{h_a}{d}\alpha_1 \sum_{i=1}^{\infty}(\frac{1}{\alpha_2})^{i} g_0 +$$
$$\frac{h_a}{d}\alpha_1 \sum_{i=1}^{\infty}(\frac{1}{\alpha_2})^{i} E_t q_{at+j}$$

$$n_{at} = \alpha_1 n_{at-1} - \frac{h_a}{d}\alpha_1 G R \sum_{i=1}^{\infty}(\frac{1}{\alpha_2}\Lambda)^{i} R^{-1} Z_t + \frac{h_a}{d}\alpha_1 \sum_{i=1}^{\infty}(\frac{1}{\alpha_2})^{i} g_0 +$$
$$\frac{h_a}{d}\alpha_1 \sum_{i=1}^{\infty}(\frac{1}{\alpha_2})^{i} R_1^{j} q_{at}$$

$$n_{at} = \alpha_1 n_{at-1} - \frac{h_a}{d}\alpha_1 G R \sum_{i=1}^{\infty}(\frac{1}{\alpha_2}\Lambda)^{i} R^{-1} Z_t + \frac{h_a}{d}\alpha_1 \left[g_0 / \left(1 - \frac{1}{\alpha_2}\right)\right] +$$
$$\frac{h_a}{d}\alpha_1 \left[1 / \left(1 - \frac{R_1}{\alpha_2}\right)\right] q_{at}$$

Let δ_i be the iith element of Λ. Then, [3]

$$n_{at} = \alpha_1 n_{at-1} - \frac{h_a}{d}\alpha_1 GR \sum_{i=1}^{\infty}(\frac{1}{\alpha_2})^{i}\delta_i R^{-1} Z_t + \frac{h_a}{d}\alpha_1\left[g_0/\left(1-\frac{1}{\alpha_2}\right)\right] +$$

$$\frac{h_a}{d}\alpha_1\left[1/\left(1-\frac{R_1}{\alpha_2}\right)\right] q_{at}$$

$$n_{at} = \alpha_1 n_{at-1} - \frac{h_a}{d}\alpha_1 GR\left[1/\left(1-\frac{\delta_1}{\alpha_2}\right)\right] R^{-1} Z_t + \frac{h_a}{d}\alpha_1\left[g_0/\left(1-\frac{1}{\alpha_2}\right)\right] +$$

$$\frac{h_a}{d}\alpha_1\left[1/\left(1-\frac{R_1}{\alpha_2}\right)\right] q_{at}$$

Since, $\alpha_2 = (1/\alpha_1 r)$. But we know that $|\delta_i/\alpha_2| = |\delta_i \alpha_1 r| < 1$. Thus, $|\delta_i . r| < 1$. In addition, infinite sum converges. So,

$$n_{at} = \alpha_1 n_{at-1} - \frac{h_a}{d}\alpha_1 GR[1/(1-\delta_i\alpha_1 r)]R^{-1}Z_t + \frac{h_a}{d}\alpha_1[g_0/(1-\alpha_1 r)]$$

$$+ \frac{h_a}{d}\alpha_1[1/(1-R_i\alpha_1 r)]q_{at}$$

Substituting the value of vector Z_t into the above equation, we get

$$n_{at} = \alpha_1 n_{at-1} - \frac{h_a}{d}\alpha_1 GR[1/(1-\delta_i\alpha_1 r)_{ii}]R^{-1}[W_t + W_{t-1} + W_{t-2} + \ldots +$$

$$W_{t-n}] + \frac{h_a}{d}\alpha_1[g_0/(1-\alpha_1 r)] + \frac{h_a}{d}\alpha_1[1/(1-R_i\alpha_1 r)]q_{at}$$

$$n_{at} = \alpha_1 n_{at-1} - \frac{h_a}{d}\alpha_1 GR[1/(1-\delta_i\alpha_1 r)_{ii}]R^{-1}W_t -$$

$$\frac{h_a}{d}\alpha_1 GR[1/(1-\delta_i\alpha_1 r)_{ii}]R^{-1}W_{t-1} - \frac{h_a}{d}\alpha_1 GR[1/(1-\delta_i\alpha_1 r)_{ii}]R^{-1}W_{t-2} -$$

$$\ldots - \frac{h_a}{d}\alpha_1 GR[1/(1-\delta_i\alpha_1 r)_{ii}]R^{-1}W_{t-n} - \frac{h_a}{d}\alpha_1 GR[1/(1-\delta_i\alpha_1 r)_{ii}]R^{-1} +$$

$$\frac{h_a}{d}\alpha_1[g_0/(1-\alpha_1 r)] + \frac{h_a}{d}\alpha_1[1/(1-R_i\alpha_1 r)]q_{at}$$

[3] I use the expression $\sum_{i=1}^{\infty}(\frac{1}{\alpha_2})^{i} R_1^{j} q_{at} = \left[1/\left(1-\frac{R_j}{\alpha_2}\right)\right] q_{at}$

[4] By reminding assumption that w_t is less than $1/r$.

The above equation can be written as

$$n_{at} = \alpha_1 n_{at-1} + x_1 W_t + x_2 W_{t-1} + \cdots + x_n W_{t-n} + x_0 + \frac{h_a}{d}\alpha_1[g_0/(1 - \alpha_1 r)] + q'_{at} \quad (23)$$

Where, $[x_0, x_1, x_2, \ldots, x_n] = -\frac{h_a}{d}\alpha_1 GR[1/(1 - \delta_i\alpha_1 r)_{ii}]R^{-1}$ (23a)

$$q'_{at} = \frac{h_a}{d}\alpha_1[1/(1 - R_i\alpha_1 r)]q_{at}$$

3.3.2 Full-time employment

Similarly, substituting values from equations (19) and (22) into equation (18), we get the following equation:

$$n_{bt} = \beta_1 n_{bt-1} - \frac{h_b}{c}\beta_1 GR\left[1/\left(1 - \frac{\delta_1}{\beta_2}\right)\right]R^{-1}Z_t + \frac{h_b}{c}\beta_1\left[g_0/\left(1 - \frac{1}{\beta_2}\right)\right] + \frac{h_b}{c}\beta_1\left[1/\left(1 - \frac{R_1}{\beta_2}\right)\right]q_{bt}$$

Since $\beta_2 = (1/\beta_1 r)$. But, we know that $|\delta_i/\beta_2| = |\delta_i\beta_1 r| < 1$. Thus, $|\delta_i.r| < 1$.

$$n_{bt} = \beta_1 n_{bt-1} - \frac{h_b}{c}\beta_1 GR[1/(1 - \delta_i\beta_1 r)]R^{-1}Z_t + \frac{h_b}{c}\beta_1[g_0/(1 - \beta_1 r)] + \frac{h_b}{c}\beta_1[1/(1 - R_i\beta_1 r)]q_{bt}$$

Substituting the value of vector Z_t into the above equation, we get

$$n_{bt} = \beta_1 n_{bt-1} - \frac{h_b}{c}\beta_1 GR[1/(1 - \delta_i\beta_1 r)_{ii}]R^{-1}[W_t + W_{t-1} + W_{t-2} + \ldots + W_{t-n}] + \frac{h_b}{c}\beta_1[g_0/(1 - \beta_1 r)] + \frac{h_b}{c}\beta_1[1/(1 - R_i\beta_1 r)]q_{bt}$$

$$n_{bt} = \beta_1 n_{bt-1} - \frac{h_b}{c}\beta_1 GR[1/(1 - \delta_i\beta_1 r)_{ii}]R^{-1}W_t - \frac{h_b}{c}\beta_1 GR[1/(1 - \delta_i\beta_1 r)_{ii}]R^{-1}W_{t-1} - \frac{h_b}{c}\beta_1 GR[1/(1 - \delta_i\beta_1 r)_{ii}]R^{-1}W_{t-2} - \ldots - \frac{h_b}{c}\beta_1 GR[1/(1 - \delta_i\beta_1 r)_{ii}]R^{-1}W_{t-n} - \frac{h_b}{c}\beta_1 GR[1/(1 - \delta_i\beta_1 r)_{ii}]R^{-1} + \frac{h_b}{c}\beta_1[g_0/(1 - \beta_1 r)] + \frac{h_b}{c}\beta_1[1/(1 - R_i\beta_1 r)]q_{bt}$$

The above equation can be written as:

$$n_{bt} = \beta_1 n_{bt-1} + y_1 W_t + y_2 W_{t-1} + \cdots + y_n W_{t-n} + y_0 + \frac{h_b}{c}\beta_1[g_0/(1 - \beta_1 r)] + q'_{bt} \quad (24)$$

Where, $[y_0, y_1, y_2, \ldots, y_n] = -\frac{h_b}{c}\beta_1 GR[1/(1 - \delta_i \beta_1 r)_{ii}]R^{-1}$ (24a)

$$q'_{bt} = \frac{h_b}{c}\beta_1[1/(1 - R_i \beta_1 r)]q_{bt}$$

Equations (23) and (24) indicate decision rules for part-time and full-time employment, but these rules are not consistent with variations in the stochastic measures for wage rate. Equations (23a) and (24a) represent structural parameters of adjustment like α, β, d and c, including with wage parameters x and y. This pattern of model estimates these parameters explicitly while equations (23) and (24) rectify for further empirics.

3.3.1 Extension to data fit model

This model fits into the data, which is a deviation from means and trends. For this purpose, the constant will drop from the equations (21), (23), and (24). Substitute equation (21) and subtract $R_1 q'_{at-1}$ from both sides of equation (23). Then we obtain

$$n_{at} = \alpha_1 n_{at-1} + x_1(\varphi_1 W_{t-1} + \varphi_2 W_{t-2} + \ldots + \varphi_n W_{t-n} + \epsilon_{3t}) + x_2 W_{t-1} + \ldots + x_n W_{t-n} + q'_{at} - R_1 q'_{at-1}$$

$$n_{at} = \alpha_1 n_{at-1} + (x_2 + x_1\varphi_1)W_{t-1} + (x_3 + x_1\varphi_2)W_{t-2} + \cdots + (x_n + x_1\varphi_{n-1})W_{t-n+1} + (x_1\varphi_n)W_{t-n} + [x_1 \epsilon_{3t} + (q'_{at} - R_1 q'_{at-1})]$$

By taking expectations, we get

$$\hat{E}_{t-1} n_{at} = \alpha_1 n_{at-1} + \rho_1 W_{t-1} + \rho_2 W_{t-2} + \cdots + \rho_n W_{t-n}$$

Where, $[x_1 \epsilon_{3t} + (q'_{at} - R_1 q'_{at-1})] = 0$. So, the final labor demand equation for part-time employment can be written as:

$$n_{at} = \alpha_1 n_{at-1} + \rho_1 W_{t-1} + \rho_2 W_{t-2} + \cdots + \rho_n W_{t-n} + U_{1t} \quad (25)$$

In a similar way, substitute equation (21) and subtract $R_1 q'_{bt-1}$ from both sides of equation (24). Then, the final labor demand equation for full-time employment can be written as:

$$n_{bt} = \beta_1 n_{bt-1} + \theta_1 \mathrm{W}_{t-1} + \theta_2 \mathrm{W}_{t-2} + \cdots + \theta_n \mathrm{W}_{t-n} + U_{2t} \tag{26}$$

However, from equations (25) and (26), we obtain the following reduced-form of the labor demand equations:

$$\dot{n}_{at} = \gamma_{11} n_{at-1} + \gamma_{12} n_{bt-1} + \rho_1 \mathrm{W}_{at-1} + \rho_2 \mathrm{W}_{at-2} + \rho_1 \mathrm{W}_{bt-1} + \rho_2 \mathrm{W}_{bt-2} \tag{27}$$

$$\dot{n}_{bt} = \gamma_{21} n_{at-1} + \gamma_{22} n_{bt-1} + \theta_1 \mathrm{W}_{at-1} + \theta_2 \mathrm{W}_{at-2} + \theta_1 \mathrm{W}_{bt-1} + \theta_2 \mathrm{W}_{bt-2} \tag{28}$$

Where, $\dot{n}_{at}$ and $\dot{n}_{bt}$ represent the growth level of part-time and full-time employment. $\gamma, \rho,$ and θ are the reduced-form parameters. In addition, each equation shows employment levels with a once-lag period and the wage rate with the two-lagged period for both part-time and full-time workers. These equations esteemed to empirical strategy for estimating demand analysis.

3.4 Data Description and Data Sources

The dataset collected for this study consists of employment and real wage rates for both part-time and full-time workers. It is based on annual observations and the time span considered is 1990–2012. This study adopts seven industrial divisions, out of nine major industrial divisions of economic activity of Pakistan (Annex B). Their selection is based on worker participation rates across time. The divisions with a constant participation rate are ignored during the analysis. The data is collected using solid definitions acquires from reviewing literature. The definitions of full-time and part-time work forces being used in this analysis are specific to Pakistan, since evaluation benchmarks may vary in other countries. So, the variables are constructed on the basis of the following definitional measures:

3.4.1 Part-time employment (n_{at})

Part-time employment is defined as the number of employees who work less than 35 hours per week. It is a standard measure for collecting data on part-time workers in the LFS. Part-time work related with this measure in previous studies (Robinson and

Abbasi 1979; Frisen 1997; Shahnaz and Khalid 2008). According to the ILO, a part-time worker is defined as an employee whose working duration is less than his comparative full-time worker.

3.4.2 Full-time employment (n_{bt})

Full-time employment refers to the number of employees who work more than 35 hours per week. According to the ILO, 35–40 hours is considered a common duration of work. Such measures are used to avoid difficulties during the analysis of different working categories. But the ILO does not report official definitions of full-time work since it differs by country (Shahnaz and Khalid 2008). Under labor law, an employee should work eight hours per day or 48 hours per week. That's why, full-time workers lie within the range of 35–48 hours per week in this analysis.

3.4.3 Growth rate ($\dot{n}$)

The employment levels of industry extend with ratios different from aggregate employment. It creates a spurious trend in employment levels. To remove this problem, the following formula is used to acquire the growth level of part-time employment:

$$\dot{n}_{atKT} = \left(\frac{n_{atKT}}{tot_T}\right) E_T$$

Where n_{atKT} indicates the number of part-time employees in industry K in time period T. tot represents the total number of employees, and E_T represents the total number of paid employees in the selected sample in time period T. Similarly, the growth level of full-time employment is obtained using the following expression:

$$\dot{n}_{btKT} = \left(\frac{n_{btKT}}{tot_T}\right) E_T$$

Here, n_{btKT} represents the number of full-time employees in industry K in time period T. tot and E_T show the total number of employees and paid employees in time period T in the selected sample. The graphical presentation of the growth trend for both types of employment in all industrial divisions is given in Annex D.

3.4.4 Real wage rate ($\mathbb{W}$)

Wage rate data on the average monthly wages of workers is used in each period. The nominal hourly wage of part-time workers (ω_{at}) is computed as reported weekly wages divided by weekly hours of part-time workers.[4] The nominal wage rate converts into the real wage rate of part-time workers by deflating it with the consumer price index (CPI).

In a similar way, the nominal hourly wages of full-time workers (ω_{bt}) is computed as weekly wages divided by weekly hours of full-time workers.[5] This calculated wage rate is deflated with the CPI to obtain the real wage rate of full-time workers. The descriptive statistics of variables data for seven industrial divisions are presented in Annex C, Table 1.

3.4.5 Data sources

The dataset is collected from three authentic and reliable sources. The first source is the Pakistan Statistical Yearbook (PSY) published by the Pakistan Bureau of Statistics, government of Pakistan. It provided data for both part-time and full-time employed persons. The second source is the LFS, also published by the Pakistan Bureau of Statistics. As required, the monthly wage rate data for workers is taken from its various issues. The third source is the Pakistan Economic Survey (PES) published by the Ministry of Finance, government of Pakistan. It contains CPI data for the required period.

3.5 Concluding Remarks

The theoretical model represents dynamic labor demand, including the concept of adjustment cost in labor markets. The proposed model claims part-time labor adjustment at a faster speed relative to full-time labor in the production function. The empirical concept gratifies the theoretical model and provides a slot for the implication of econometric techniques specify in Chapter 4. Additionally, data descriptions and sources used during the empirical work, are mentioned.

[4]The working hours for part-time labour (h_a) is 34 hours per week.

[5]The working hours for full-time labour (h_b) is 48 hours per week.

CHAPTER 4

Estimation Strategy

4.1 Introductory Remarks

The model is estimated in various phases by using relevant estimation approaches. Many mechanisms like maximum likelihood, structural vector auto regression, and autoregressive moving average are useful. However, the most suitable approaches are the 2SLS and the SUR methods. In addition, elasticities are calculated and evaluate the certain outcomes.

4.2 Unit Root Test

The stationary level of the variable series inspects by identifying the unit root in the data. The most appealing unit root test is the Augmented Dickey-Fuller test (ADF). This test has the following regression specifications:

$$\Delta\mathcal{X}_t = \gamma + \theta T + \mu\mathcal{X}_{t-1} + \omega_j \Sigma\Delta\mathcal{X}_{t-1} + \mathcal{E}_t$$

This test executes on two phases i.e. level and first difference to check the time-series properties of the data. The null hypothesis for this test is H_0: $\mu = 0$ whereas the alternate hypothesis is H_1: $\mu < 0$. If the value of the ADF is smaller than the critical t-ratio, then the null hypothesis is rejected and it predicts the stationary series. If the reverse of values exists, then the null hypothesis is accepted.

4.3 2SLS Model

One of the familiar approaches to estimate structural parameters and to deal with the endogeneity problem of the dynamic labor demand model is the 2SLS method. It is practiced when explanatory variables correlate with error terms within equations. This problem is solved by introducing instruments in the model. This approach comprises two stages for the following model.

$$\Upsilon_t = \gamma_0 + \gamma_1\mathcal{X}_t + \gamma_2\mathcal{W}_t + u$$

where $\mathcal{X}_t$ is an endogenous variable. In the first stage, the endogenous variables are regressed on the instruments that are uncorrelated with residual terms and highly correlated with explanatory variables. Then, the OLS estimates are computed as:

$$\mathcal{X}_t = \gamma_0 + \gamma_1 \mathcal{Z}_{t-1} + \varepsilon$$

$$\widehat{\gamma_1} = (\mathcal{Z}'\mathcal{Z})^{-1}\mathcal{Z}'\mathcal{X}$$

$$\widehat{\mathcal{X}} = \mathcal{Z}\widehat{\gamma_1} = \mathcal{Z}(\mathcal{Z}'\mathcal{Z})^{-1}\mathcal{Z}'\mathcal{X} = \mathrm{R}_{\mathcal{Z}}\mathrm{Y}$$

In the second stage, the computed value is introduced into a regression function. These values are uncorrelated with error terms and estimated by OLS. This stage provides a 2SLS estimator of the model.

$$\mathrm{Y}_t = \gamma_0 + \gamma_1 \widehat{\mathcal{X}}_t + \gamma_2 \mathcal{W}_t + u^*$$

$$\gamma_{2SLS} = (\mathcal{X}' R_{\mathcal{Z}} \mathcal{X})^{-1} \mathcal{X}' R_{\mathcal{Z}} \mathrm{Y}$$

The method is used to correct relations between explanatory variables and residual terms, but is less reliable due to biasness in the parameter’s standard error. These problems are handled using the SUR method. The goodness-of-fit process is carried out by applying restrictions in the Wald test and examining chi-square estimates.

4.4 SUR Model

The SUR model serves in the linear equations framework, which was devised by Zellner in 1962. It deals with the error term that is contemporaneously correlated among equations. The proposed model consists of $l = 1, \dots, n$ and linear equations for $k = 1, \dots, M$ industries. The linear regression equations for kth industries can be written as:

$$\mathrm{Y}_{kl} = \mathcal{X}'_{kl}\gamma_l + \mathcal{E}_{kl}$$

By stacking all observations, the equation is expressed as:

$$\mathrm{Y}_l = \mathcal{X}'_l \gamma_l + \mathcal{E}_l$$

The proposed model converted into the SUR model using the following expression:

$$\begin{bmatrix} \mathrm{Y}_1 \\ \mathrm{Y}_2 \\ \vdots \\ \mathrm{Y}_n \end{bmatrix} = \begin{bmatrix} \mathcal{X}_1 & 0 & 0 & 0 \\ 0 & \mathcal{X}_2 & 0 & 0 \\ 0 & 0 & \ddots & 0 \\ 0 & 0 & 0 & \mathcal{X}_n \end{bmatrix} \begin{bmatrix} \gamma_1 \\ \gamma_2 \\ \vdots \\ \gamma_n \end{bmatrix} + \begin{bmatrix} \mathcal{E}_1 \\ \mathcal{E}_2 \\ \vdots \\ \mathcal{E}_n \end{bmatrix}$$

The above model shows that the error term has a zero mean and homoskadestic relation across industries. But across equations, it correlates as follows:

$$E(\mathcal{E}_{kl}\mathcal{E}_{kl}|\mathcal{X}) = \sigma_{ll'} \ and \ \ \sigma_{ll'} \neq 0 \, where \ \ l \neq l'$$

In this scenario, the error term $\mathcal{E}_l$ assumes the following conditions:

i. Mean of $\mathcal{E}_l$: $E(\mathcal{E}_l|\mathcal{X}) = 0$
ii. Variance of $\mathcal{E}_l$: $E(\mathcal{E}_l\mathcal{E}_l'|\mathcal{X}) = \sigma_{ll}I_M$
iii. Co-variance of $\mathcal{E}_l$ across equations $l \ and \ l'$: $E(\mathcal{E}_l\mathcal{E}_{l'}'|\mathcal{X}) = \sigma_{ll'}I_M \ \ where \ l \neq l'$
iv. Overall variance-covariance matrix: $\Omega = E(\mathcal{E}\mathcal{E}) = \Sigma \otimes I_M$

However, the estimation of the SUR model consists of two stages:

In the first stage, each equation of the system is estimated by regressing using OLS. This obtains the estimator $\hat{\gamma}_l$ with a separate residual term. These terms are used to compute Σ which operates in next stage:

$$\widehat{\mathcal{E}_l} = \mathrm{Y}_l - \mathcal{X}_l\widehat{\gamma_l}$$

$$\hat{\gamma}_l = (\mathcal{X}'\mathcal{X})^{-1}\mathcal{X}'\mathrm{Y} \quad \text{and} \quad \hat{\sigma}_{ll'} = \hat{\mathcal{E}}_l^{'}\hat{\mathcal{E}}_{l'}/M$$

In the second stage, the computed value of $\hat{\Sigma}$ is substituted into Σ of the GLS estimator $\hat{\gamma}$, which considers an optimal estimator from that estimator, yield by OLS consistent estimators of each equation. The GLS estimator and its variance can be expressed as:

$$\hat{\gamma} = \{\mathcal{X}'(\Sigma^{-1} \otimes I_M)\mathcal{X}\}^{-1}\{\mathcal{X}'(\Sigma^{-1} \otimes I_M)\mathrm{Y})\}$$

$$V(\hat{\gamma}) = \{\mathcal{X}'(\Sigma^{-1} \otimes I_M)\mathcal{X}\}^{-1}$$

By putting values, we get

$$\hat{\gamma} = \{\mathcal{X}'(\hat{\Sigma}^{-1} \otimes I_M)\mathcal{X}\}^{-1}\{\mathcal{X}'(\hat{\Sigma}^{-1} \otimes I_M)\mathrm{Y})\}$$

From the above GLS estimator, we acquire a SUR estimator for the model, which is given below:

$$\hat{\gamma}_{SUR} = \{\mathcal{X}'(\hat{\Sigma} \otimes I_M)^{-1}\mathcal{X}\}^{-1}\{\mathcal{X}'(\hat{\Sigma} \otimes I_M)^{-1}\mathrm{Y}\}$$

The SUR model proceeds when linear equations are correlated only through their error terms. Its parametric estimate differs from one equation to another, but the fluctuation in regressors depends on the nature of the model.

4.5 Price Elasticity of Demand

The demand elasticity depicts the change in the quantity demanded of a variable in response to changes in its price, and is known as own-price elasticity of demand. It is expressed as

$$E_d = \frac{p}{q_l} \times \frac{dq_l}{dp}$$

These price elasticities should be negative in order to respond to the demand theory. On the other side, the cross price elasticity of demand describes the variation in demand response of predicted variables by changes in the price of its counter variable. The elasticity estimate illustrates the percentage change in one variable occurring in reaction to percentage changes in the price of the other variable. The positive or negative values of cross-price demand elasticity produce interesting results in the demand analysis.

4.6 Concluding Remarks

The desire to obtain definite and unbiased parametric estimates leads to better empirical approaches. The estimate of 2SLS will prove biased due to its lacking capability of handling standard errors across equations. In this situation, the SUR method will prove to be a more reliable technique to estimate the dynamic demand model in the presence of contemporaneously correlated error terms. The elasticity estimates will represent the variation in variable demand arrangements with respect to their price fluctuation. The empirical estimates of these techniques are available in the chapter of empirical results to show the behavior of relative variables in the specified time period.

CHAPTER 5

Discussion of Estimation Results

5.1 Introductory Remarks

This chapter provides estimated results of the required variables by using the econometric approaches discussed in Chapter 4. First of all, the data series scrutinizes consciously and then derives the appropriate lag length for the model. The elasticity estimates are compared among industrial divisions of economic activity. To check the robustness, the SUR method with de-trended data is estimated. Based on these valuations, we generate a conclusion about the adjustment of diverse employment in different sectors.

5.2 Interpretation of Estimation Results

Before describing the empirical results, the stationary level of variables are tested and presented in Annex C, Table 2. Most of the variables are stationary at the first difference and the remaining, such as part-time employment in agriculture and full-time employment in construction, are stationary at level for the model. The adopted lag length for variables is two, which is selected under the Akaike information criterion (AIC) and Schwarz information criterion (SC).

The estimated values of structural parameters of part-time and full-time employment by using the 2SLS approach can be found in Annex C, Table 3. γ_{11} and γ_{22} represent own-adjustment parameters while γ_{21} and γ_{12} indicate cross adjustment parameters[6]. The values of own-adjustment parameters are precise for both types of employment. However, in the agriculture division, the estimated value of part-time employment is negative. In the case of cross adjustment parameters, the estimates are positive for electricity, wholesale, transport, and finance while the rest of the industries, including agriculture, manufacturing, and construction have negative coefficients. In addition, the values of adjustment cost parameters d and c are positive and convincing for all

[6] Replace α and β parameters with γ for linking with estimates of the reduced-form model in Annex C, Table 1.

industries, except electricity and finance. These estimates are insignificant in most divisions. The coefficients for wage rates are plausible in relation to part-time and full-time employment. The chi-square value is present at the bottom of the table for each division. It is used to predict goodness-of-fit to structural estimates in the model. These estimates rejected the null hypothesis for electricity and the finance division at the 5% significance level. These computing estimates ruin the possibility of disentagling the adjustment cost parameters from the marginal productivity criterion.

These poor estimates of Table 3 pointed towards the computation of reduced-form parameters for getting comparatively better outcomes. The own-adjustment parameter γ_{ii} exhibits the rate, which reports the employment adjustment towards its optimum stage for a longer duration. The greater value of this parameter leads to a slower employment adjustment rate. This point indicates that quick adjustment requires a smaller coefficient value of the own-adjustment parameter of part-time employment in respective industrial divisions. In the same way, the cross-adjustment parameter γ_{ij} influences the employment arrangement in industries. Its ratio shows that fluctuations in one category of employment sluggish the adjustment speed of second category. It imitates a dynamic interrelationship among employment levels in the demand model of different industrial divisions. The overall adjustment rate captures both the above parameters (Friesen 1997).

The outcomes of the reduced-form model are considered in Annex C, Table 4. The estimate indicates that own-adjustment coefficient values are positive and smaller for part-time employment as compared to full-time employment in all industrial divisions. On the other side, the estimated values of the cross-adjustment parameter of part-time employment are lower for electricity, construction, wholesale, transport, and finance, but higher for the agriculture and manufacturing divisions. This parameter clearly exposed a distinct ratio of part-time and full-time adjustment under change in economic activity. It means that the overall adjustment ratio of part-time employment is faster in the electricity, construction, wholesale, transport, and finance divisions, relative to full-time employment. By considering results, these divisions exhibit space for a cheap and flexible labor force by cutting social benefits like pensions etc (Hauseman and Osawa 1995). However, this type of employment is incompatible in agriculture because it already absorbs a large proportion of the labor force and does not have space for more adjustment (Robinson and Abbasi 1979), while the manufacturing division desires a skilled labor force under a specific time period for work. In this way, part-time employment is unsuited and expresses slow adjustment for this industrial division (Lister et al. 2012). The estimated coefficients for wage rate of both categories of employment are definite and plausible. Some values are negative, but most of the estimates are statistically significant for both employment categories.

The model introduces a dummy variable during the estimation process to capture the economic shock in the data.[7] The SUR model estimated coefficients describes in Annex C, Table 5 and are insignificant for all the industrial divisions. Therefore, the dummy variable drops from the model and relies on the previous estimates of Table 4.

5.3 Elasticity Estimates

The association of diverse employment patterns among industries is shown by computing own and cross-price elasticities in Table 6. In all cases, the own price elasticity is negative and statistically significant, except four values which contradict the theory of labor demand. The demand of part-time labor is more own-price elastic in manufacturing, electricity, and transport than the full-time labor, whereas agriculture, construction, wholesale, and finance have own-price inelastic demand. The cross-price elastic estimates of part-time labor depict negative values for electricity, construction, and transport. These estimates predict that part-time employment decreases in response to increases in wages of full-time labor. On the other side, part-time employment rises in relation to an increasing ratio of full-time wages for the wholesale and finance industries. These outcomes link with scale effects for increasing the wage rates of full-time labor. In the same way, the full-time cross-price elasticities are positive for construction and wholesale. Adverse values are obtained in the cases of electricity, transport, and finance. Additionally, the agriculture and manufacturing divisions indicate contrary values for the cross-price elasticities of the above employment categories. Most of these elasticity estimates are convincing and statistically sufficient for devising industries.

[7]The worker's wage rate declines sharply in 2001–02 due to a higher unemployment rate (Irfan 2009).

5.4 Robustness Analysis

The regression analysis of employment and wage rate for part-time and full-time employment reveal seasonal arrangements in five industrial divisions: electricity, construction, wholesale, transport, and finance. To examine the robustness of these industrial divisions' outcomes, I re-evaluates the model estimates using de-trended and de-seasonalized data. The parametric estimates are displayed in Table 7. The positive estimated coefficient predicts that the overall adjustment is rapid for part-time employment in these divisions. The impressive effect of seasonality for part-time employment is intended in electricity, construction, and transport, because the overall adjustment of part-time employment is rapid as compared to full-time employment. Above of all divisions, part-time employment is considered a variable component in the construction industry, while the speed of full-time adjustment varies in the electricity and transport divisions. The overall speed of adjustment for both part-time and full-time employment is slow in the wholesale division. By contrast, the pace of adjustment ratios in finance is slow for part-time, but faster for full-time employment. All the coefficients for part-time and full-time adjustment are positive and statistically significant. In manufacturing, electricity, and transport, part-time and full-time labor behaves as dynamic p-complements (Hamermesh 1993). These estimates emphasize the presence of dynamic interactions of employment patterns in the relevant industries.

5.5 Concluding Remarks

This chapter includes estimated results of suited econometric approaches. Out of all these techniques, the estimates of the SUR method are considered plausible and satisfactory. According to these parametric estimates, the adjustment ratio of part-time workers is small as compare to that of full-time workers. These results prove the efficacy of the claim proposed in the theoretical model of Chapter 3. The results are valid for five out of seven industrial divisions for both employment categories. These divisions are electricity, construction, wholesale, transport, and finance. The proposed estimates also predict dynamic interaction among these industries. In the next chapter, conclusions will be presented based on these results. Policy recommendations will also be made.

CHAPTER 6

Conclusion and Policy Considerations

6.1 Conclusion

The adjustment strategies of industries express changes in the demand arrangement of labor force, between full-time and part-time employment, for production activities under the provision of lower adjustment cost and dynamic flexibility. Most industries observe these employment categories as dynamic complements for each other. The disturbance in one type of employment changes the adjustment of other types. In this analysis, these specifications observe by driving dynamic labor demand models, including adjustment cost which is based upon labor's expected wage rate and working hours. It predicts the claim of quick adjustment for part-time labor contrasting to full-time labor, which observes fewer wages and discards from social benefits. This cheap labor helps industries maximize their profits as well as minimize their production costs.

Under this theoretical framework, an empirical model is developed which estimated by using the SUR technique. The estimation is conducted using aggregate level data for seven industrial divisions. The parametric estimates relative to overall adjustment are significant for the divisions of electricity, construction, wholesale and retail trade, transport, and finance. These estimates predict the rapid adjustment of part-time employment within and across divisions, which verify the claim of the theoretical model in Chapter 3. Additionally, the dynamic interrelation among part-time and full-time labor is scrutinized in the electricity, construction, and transport divisions. Sensitivity analysis is conducted by using de-trended and de-seasonalized data, and it confirms the robustness of the regression estimates. Based on these estimates, the extensive outcome is that part-time employment behaves as a competing variable in relation to full-time employment, due to its availability on simple and accessible conditions in industry.

6.2 Policy Considerations

The theoretical and empirical work underscores the existence and importance of diverse employment patterns in the labor market. In this scenario, the adjustment relationship between part-time and full-time labor reveals adequate policies to achieve industrial growth. For this purpose, it is considered that industry hires part-time labor as a cheap factor of production relative to its counterpart. This will reduce the production cost and increase the productivity of industries. Raising productivity levels maximizes the profit and surge investment in relative industry to attain growth. The government should generate radical policies for the labor force, including part-time which assists industrial development in the economy. The evidence shows that part-time employment supports industrial growth in the developed economies.

On the other side, the economic progress requires increase in percentage of employment ratios with the growing ratio of labor force. Part-time employment behaves as a source to increase employment levels in the industry, as a major sector of the economy. The policymaker or government should develop employment expansion policies by allowing part-time labor under legal rules and regulation in industry. It will assimilate a huge bulk of the young labor force in production activities, which is a burden on the progress of economic activity. In addition, the government should introduce wages per working hour in minimum wage policies to preserve the right of labor force in accordance to their production activity. All of these policies direct towards industrial growth, which explicitly links with economic development.

Annex A-D

Annex A: Derivation of Factorization Equations

In the theoretical model of Chapter 3, the solution of the factorization equation (11a) is given below:

$$[1-(-\frac{\varphi_1}{r})S+\frac{1}{r}S^2] = 1-(\alpha_1+\alpha_2)S+\alpha_1\alpha_2S^2$$

$$= 1-\alpha_1S-\alpha_2S+\alpha_1\alpha_2S^2$$

$$=1(1-\alpha_1S)-\alpha_2S(1-\alpha_1S)$$

$$=(1-\alpha_1S)(1-\alpha_2S)$$

Similarly, equation (12a) has the following expression:

$$[1-(-\frac{\varphi_2}{r})S+\frac{1}{r}S^2] = 1-(\beta_1+\beta_2)S+\beta_1\beta_2S^2$$

$$= 1-\beta_1S-\beta_2S+\beta_1\beta_2S^2$$

$$=1(1-\beta_1S)-\beta_2S(1-\beta_1S)$$

$$=(1-\beta_1S)(1-\beta_2S)$$

Annex B: List of Major Industry Divisions of Economic Activity[8]

1.	Agriculture, forestry, hunting, and fishing
2.	Mining and quarrying
3.	Manufacturing
4.	Electricity, gas, and water
5.	Construction
6.	Wholesale, retail trade, restaurants, and hotels
7.	Transport, storage, and communication
8.	Financing, insurance, real estate, and business services
9.	Community, social, and personal services

[8] The selection of these divisions based on their contributing share in the GDP for industrial growth.

Annex C: Tables

Table 1: Descriptive statistics

	n_{at}	n_{bt}	w_{at}	w_{bt}
1-Agriculture				
Mean	4.707	9.028	24.517	17.366
Min.	4.135	7.640	9.098	6.444
Max.	5.265	11.430	34.120	24.160
Std. dev.	0.330	1.087	5.262	3.727
2-Manufacturing				
Mean	0.562	4.627	40.097	28.402
Min.	0.343	4.079	29.710	21.044
Max.	0.803	5.149	45.432	32.181
Std. dev.	0.127	0.310	3.802	2.693
3-Electricity				
Mean	0.018	0.436	65.945	46.711
Min.	0.009	0.219	46.324	32.813
Max.	0.049	0.629	86.397	61.198
Std. dev.	0.009	0.102	12.148	8.605
4-Construction				
Mean	0.355	3.009	33.891	24.006
Min.	0.223	2.546	8.898	6.302
Max.	0.503	3.516	41.685	29.527
Std. dev.	0.075	0.341	7.728	5.474
5-Wholesale				
Mean	0.363	2.815	35.408	25.080
Min.	0.232	2.205	29.692	21.032
Max.	0.492	3.235	40.064	28.378
Std. dev.	0.066	0.244	3.089	2.188
6-Transport				
Mean	0.097	1.304	47.354	33.542
Min.	0.045	0.957	38.681	27.399
Max.	0.165	1.807	52.818	37.412
Std. dev.	0.036	0.248	3.814	2.702
7- Finance				
Mean	0.018	0.443	117.92	83.533
Min.	0.009	0.188	81.550	57.765
Max.	0.029	0.578	149.85	106.14
Std. dev.	0.008	0.102	15.094	10.692

Table 2: Results of unit root test

Variables	Level	First difference	Order of integration
1-Agriculture			
n_{at}	-3.535**	-4.523*	I(0)
n_{bt}	-1.452	-3.447**	I(1)
w_{at}	-2.944	-3.974*	I(1)
w_{bt}	-2.971***	-4.231*	I(1)
2-Manufacturing			
n_{at}	-1.843	-3.394**	I(1)
n_{bt}	-2.647***	-4.129*	I(1)
w_{at}	-1.862	-3.604**	I(1)
w_{bt}	-1.954	-3.824*	I(1)
3-Electricity			
n_{at}	-1.046	-6.390*	I(1)
n_{bt}	-2.300	-6.205*	I(1)
w_{at}	0.143	-5.363*	I(1)
w_{bt}	-0.731	-5.183*	I(1)
4-Construction			
n_{at}	-2.558	-4.374*	I(1)
n_{bt}	-3.185**	-4.607*	I(0)
w_{at}	-2.444	-3.745**	I(1)
w_{bt}	-2.396	-3.940*	I(1)
5-Wholesale			
n_{at}	-1.795	-5.196*	I(1)
n_{bt}	-2.402	-5.457*	I(1)
w_{at}	-1.496	-3.347**	I(1)
w_{bt}	-1.491	-4.115*	I(1)
6-Transport			
n_{at}	-1.799	-4.824*	I(1)
n_{bt}	-0.694	-5.301*	I(1)
w_{at}	-2.149	-2.160**[a]	I(1)
w_{bt}	-1.898	-3.819*	I(1)
7- Finance			
n_{at}	-2.486	-4.146*	I(1)
n_{bt}	-2.034	-5.825*	I(1)
w_{at}	-2.615	-3.423*	I(1)
w_{bt}	-2.674***	-3.625**	I(1)

Table 3: Structural parametric estimates

Variables	Agriculture	Manufacturing	Electricity	Construction	Wholesale	Transport	Finance
γ_{11}	-0.008	0.082	2.177	1.128*	0.248	0.284	6.035**
	(-0.066)	(0.567)	(0.592)	(3.071)	(1.075)	(0.434)	(2.225)
γ_{12}	0.184***	0.014	0.461***	-0.011	0.040	0.020	0.064**
	(-1.648)	(0.485)	(1.664)	(-0.159)	(0.639)	(0.229)	(2.557)
d	-0.703***	17.872***	-832.57	20.690	9.929	70.651	-256.95
	(-1.718)	(2.696)	(-0.919)	(1.183)	(0.958)	(1.297)	(-0.649)
x_1	-0.003	-0.002	-0.009***	-0.008	-0.007	-0.012***	0.001
	(-0.319)	(-0.561)	(-1.581)	(-0.942)	(-1.168)	(-1.365)	(0.710)
x_2	-0.025***	0.008***	0.008***	0.010	0.006	0.014***	-0.004***
	(-1.329)	(1.536)	(1.455)	(1.018)	(0.946)	(1.425)	(-1.438)
γ_{21}	-0.256	-11.590**	138.26***	8.246*	1.005	3.016	185.71
	(-1.203)	(-2.083)	(1.741)	(3.127)	(0.240)	(0.400)	(1.299)
γ_{22}	0.768*	3.791**	13.163**	3.082*	0.583	4.793*	37.025*
	(6.386)	(2.551)	(2.169)	(4.955)	(0.568)	(3.867)	(3.915)
c	-0.877**	2.457	-5.124	0.021	0.657	2.430	257.15*
	(-2.385)	(0.771)	(-0.097)	(0.497)	(0.315)	(0.913)	(2.939)
y_1	0.053	-0.435***	-0.047	0.025	-0.090	0.025	0.232
	(0.908)	(-1.353)	(-0.301)	(0.422)	(-0.640)	(0.185)	(1.035)
y_2	-0.076***	0.398***	0.200***	-0.005	0.214	-0.036	-0.336***
	(-1.410)	(1.596)	(1.335)	(-0.074)	(1.314)	(-0.269)	(-1.640)
χ^2	12.144	11.545	14.186**	2.493	6.447	6.954	22.895**

*= 1% significance level, **=5% significance level, ***=10% significance level.

** describe rejection of the null hypothesis at 5% of significance level ($\chi^2 = 12.59$).

T-ratios are in parenthesis.

Table 4: SUR Model Parametric Estimates

Variables	Agriculture	Manufacturing	Electricity	Construction	Wholesale	Transport	Finance
γ_{11}	0.172* (3.029)	0.244*** (1.619)	0.471 (0.238)	1.460* (5.185)	-0.541* (-4.518)	1.003* (3.480)	2.980 (1.264)
γ_{12}	0.047 (1.193)	0.029 (0.746)	0.477* (2.787)	-0.081 (-1.075)	-0.049 (-1.222)	0.062*** (1.480)	0.368** (2.410)
ρ_1	0.001 (0.119)	-0.008 (-1.301)	-0.0002 (-0.033)	0.0009 (0.113)	-0.003 (-0.677)	0.006*** (1.355)	0.003 (0.923)
ρ_2	-0.006 (-0.712)	0.005 (1.220)	-0.0003 (-0.053)	0.001 (0.285)	0.006*** (1.480)	-0.0001 (-0.057)	-0.003*** (-1.954)
ρ_3	0.003 (0.246)	-0.013*** (-1.882)	-0.001 (-0.131)	0.004 (0.553)	-0.010** (-2.149)	-0.004 (-0.964)	0.005*** (1.625)
ρ_4	-0.021 (-1.034)	0.020** (2.142)	0.001 (0.125)	-0.001 (-0.106)	0.011*** (1.584)	-0.005 (0.882)	-0.005 (-1.2196)
γ_{21}	-0.149 (-0.812)	-12.427* (-3.538)	167.39* (5.431)	8.862* (4.421)	0.984 (0.468)	0.319* (0.051)	276.77** (2.088)
γ_{22}	0.677* (5.314)	2.668* (2.944)	18.245* (6.865)	3.119* (5.788)	0.291 (0.408)	5.551 (6.097)	23.851* (2.777)
θ_1	-0.102** (-2.417)	0.176 (1.119)	-0.271** (-2.408)	-0.046 (-0.773)	0.060 (0.707)	0.001 (0.017)	0.076 (0.397)
θ_2	0.058** (2.124)	0.071 (0.680)	0.210** (2.385)	0.015 (0.373)	0.019 (0.268)	0.021 (0.320)	-0.086 (-0.881)
θ_3	-0.039 (-0.860)	-0.053 (-0.325)	-0.243*** (-1.990)	-0.008 (-0.146)	0.008 (0.107)	-0.014 (-0.151)	-0.108 (-0.620)
θ_4	0.097*** (1.472)	-0.133 (-0.593)	0.432* (2.767)	0.059 (0.700)	0.036 (0.292)	-0.042 (-0.307)	0.068 (0.267)

*= 1% significance level, **=5% significance level, ***=10% significance level.

T-ratios are in parenthesis.

Table 5: SUR model parametric estimates (including dummy)

Variables	Agriculture	Manufacturing	Electricity	Construction	Wholesale	Transport	Finance
γ_{11}	0.172*** (2.985)	0.238*** (1.589)	0.520 (0.260)	1.534* (5.211)	0.529* (4.185)	1.080* (3.706)	2.973 (1.260)
γ_{12}	0.047 (1.192)	0.029 (0.760)	0.472*** (2.736)	-0.087 (-1.160)	-0.045 (-1.032)	0.061*** (1.496)	0.368** (2.411)
ρ_1	0.001 (0.107)	-0.007 (-1.145)	-0.0002 (-0.028)	-0.002 (-0.244)	-0.003 (-0.619)	0.005 (1.225)	0.003 (0.921)
ρ_2	-0.006 (-0.638)	0.004 (0.919)	-0.0004 (-0.083)	0.003 (0.551)	0.005 (1.195)	0.0006 (0.212)	-0.003*** (-1.937)
ρ_3	0.003 (0.187)	-0.011*** (-1.524)	-0.001 (-0.156)	-0.0001 (-0.013)	-0.009*** (-1.912)	-0.006 (-1.311)	0.005*** (1.526)
ρ_4	-0.021 (-0.839)	0.019*** (1.928)	0.001 (0.162)	0.005 (0.363)	0.010*** (1.511)	-0.004 (-0.631)	-0.005 (-1.188)
D	0.001 (0.007)	0.034 (0.499)	0.018 (0.216)	-0.112 (-0.747)	0.010 (0.292)	-0.038 (-0.987)	0.004 (0.074)
γ_{21}	-0.172 (-0.938)	-12.565* (-3.596)	171.11* (5.704)	8.690* (4.091)	0.216 (0.100)	-0.666 (-0.103)	273.74** (2.085)
γ_{22}	0.678* (5.407)	2.677* (2.977)	17.856* (6.882)	3.132* (5.793)	0.589 (0.793)	5.555* (6.107)	24.075* (2.829)
θ_1	-0.084*** (-1.759)	0.198 (1.226)	-0.269** (-2.463)	-0.039 (-0.574)	0.075 (0.907)	0.004 (0.047)	0.073 (0.388)
θ_2	0.047*** (1.585)	0.046 (0.407)	0.196** (2.285)	0.011 (0.254)	-0.019 (-0.242)	0.017 (0.254)	-0.080 (-0.824)
θ_3	-0.009 (-0.165)	-0.013 (-0.077)	-0.258** (-2.173)	0.002 (0.031)	0.041 (0.489)	-0.005 (-0.055)	-0.142 (-0.781)
θ_4	0.062 (0.767)	-0.168 (-0.726)	0.463* (3.015)	0.044 (0.415)	0.012 (0.104)	-0.049 (-0.347)	0.095 (0.371)
D	0.356 (0.356)	0.869 (0.540)	1.444 (1.112)	0.261 (0.241)	0.672 (1.092)	0.169 (0.198)	2.126 (0.607)

*= 1% significance level, **=5% significance level, ***=10% significance level & T-ratios are in parenthesis.

Table 6: Elasticity Estimates

	Part-time		Full-time	
	Own price	**Cross price**	**Own price**	**Cross price**
Agriculture	-0.070	0.064	0.111	0.180**
	(-1.207)	(1.168)	(1.232)	(2.484)
Manufacturing	-0.806	-1.646*	-0.295**	-0.352*
	(-1.607)	(-4.257)	(-2.207)	(-2.840)
Electricity	-1.721*	-1.261**	-0.806*	-0.872*
	(-3.174)	(-2.559)	(-3.451)	(-3.178)
Construction	-0.061	-0.232***	0.137***	0.174**
	(-0.462)	(-1.753)	(1.998)	(2.573)
Wholesale	-0.112	0.025	0.061	0.522**
	(-0.219)	(0.051)	(0.270)	(2.417)
Transport	-3.600*	-3.057*	-0.914***	-0.934**
	(-5.066)	(-3.438)	(-1.978)	(-2.245)
Finance	0.090	1.910**	-0.367	-0.201
	(0.110)	(2.708)	(-0.794)	(-0.414)

*= 1% significance level, **=5% significance level, ***=10% significance level.

Table 7: SUR Estimates for Robustness Analysis

Variables	Agriculture	Manufacturing	Electricity	Construction	Wholesale	Transport	Finance
γ_{11}	0.146* (2.898)	0.248*** (1.410)	0.244 (0.137)	1.394* (4.180)	0.539* (3.484)	0.654*** (1.754)	3.005*** (1.378)
γ_{12}	0.012 (0.453)	0.045** (2.160)	0.434* (5.089)	0.019 (0.498)	0.012 (0.107)	0.056*** (2.003)	0.237** (2.369)
ρ_1	0.006 (0.512)	-0.008 (-1.269)	-0.002 (-0.429)	5.34E-05 (0.006)	-0.002 (-0.454)	0.005 (1.176)	0.004*** (1.373)
ρ_2	-0.009 (-1.184)	0.005 (1.133)	-0.006 (-1.143)	-0.001 (-0.224)	0.003 (0.776)	-0.002 (-0.629)	-0.004** (-2.235)
ρ_3	0.002 (0.188)	-0.013*** (-1.564)	-0.009 (-1.167)	-0.0002 (-0.031)	-0.009** (-1.725)	-0.006*** (-1.373)	0.005*** (1.786)
ρ_4	-0.025*** (-1.355)	0.020** (2.145)	-0.003 (-0.363)	-0.0006 (-0.058)	0.009 (1.210)	-0.007 (-1.172)	-0.007*** (-1.741)
γ_{21}	-0.127 (-0.723)	-15.401* (-3.451)	156.939* (3.481)	8.977* (3.888)	4.457** (1.831)	13.368*** (1.877)	263.39** (2.113)
γ_{22}	0.659* (6.949)	4.015* (7.604)	27.966* (12.957)	3.170* (11.783)	1.259* (3.926)	3.897* (7.219)	14.017** (2.449)
θ_1	-0.101** (-2.477)	0.199 (1.157)	-0.450* (-2.812)	-0.056 (-0.966)	0.056 (0.702)	0.056 (0.637)	0.185 (0.985)
θ_2	0.051*** (1.868)	0.018 (0.155)	0.277*** (2.005)	0.017 (0.457)	0.024*** (0.383)	0.077 (1.275)	-0.092 (-0.872)
θ_3	-0.045 (-1.031)	-0.172 (-0.818)	-0.442** (-2.262)	-0.011 (-0.200)	0.111 (1.363)	0.096 (1.119)	0.014 (0.082)
θ_4	0.094*** (1.460)	-0.131 (-0.529)	0.486** (2.113)	0.073 (0.883)	0.052 (0.438)	0.026 (0.220)	-0.110 (-0.435)

*= 1% significance level, **=5% significance level, ***=10% significance level.

T-ratios are in parenthesis.

Annex D: Graphical Presentation

Figure 1: Growth trend of full-time and part-time employment in the agriculture division

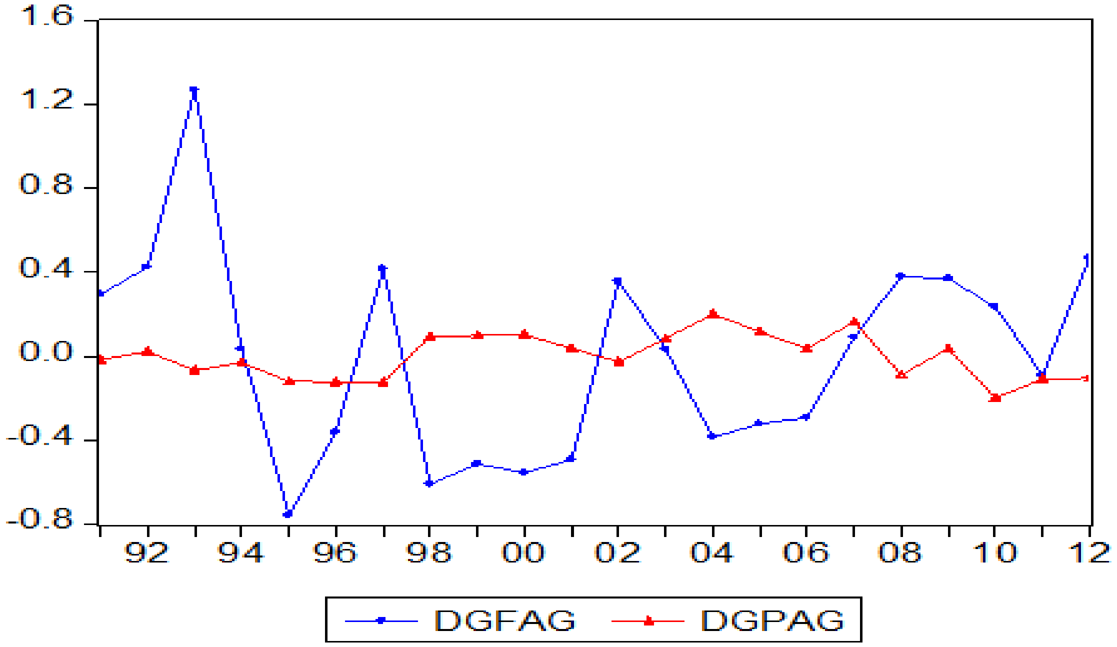


Figure 2: Growth trend of full-time and part-time employment in the manufacturing division

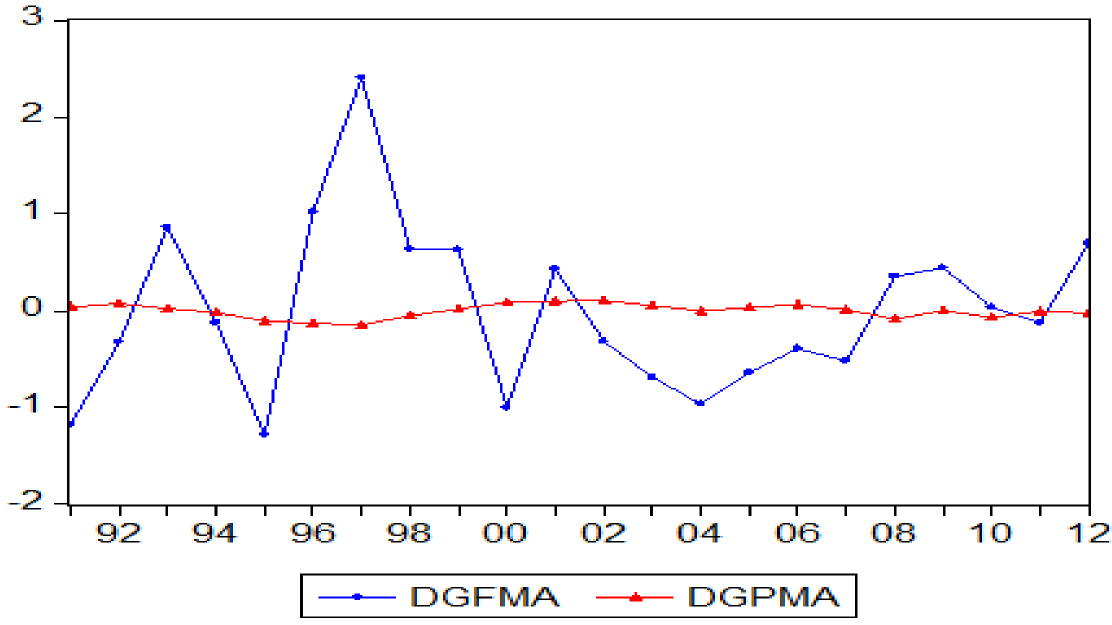


Figure 3: Growth trend of full-time and part-time employment in the electricity division

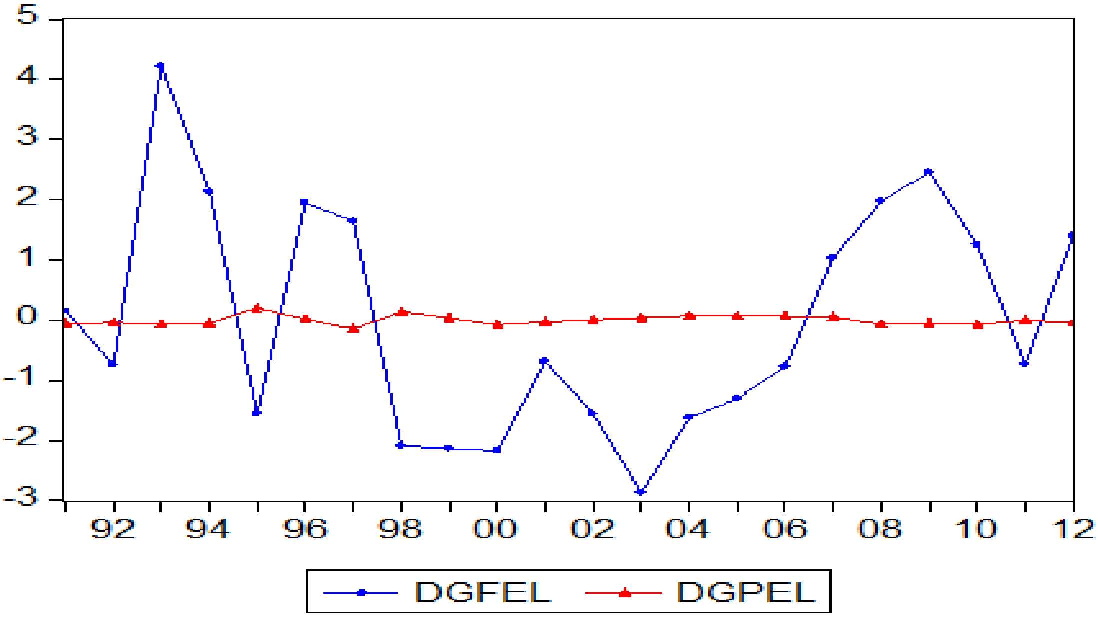


Figure 4: Growth trend of full-time and part-time employment in the construction division

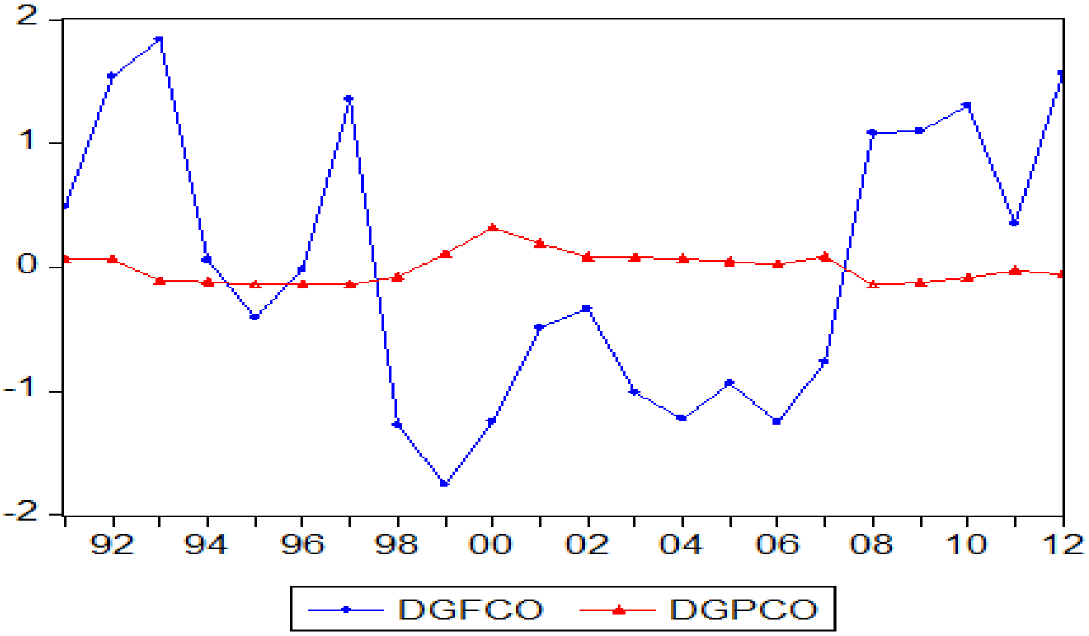


Figure 5: Growth trend of full-time and part-time employment in the wholesale division

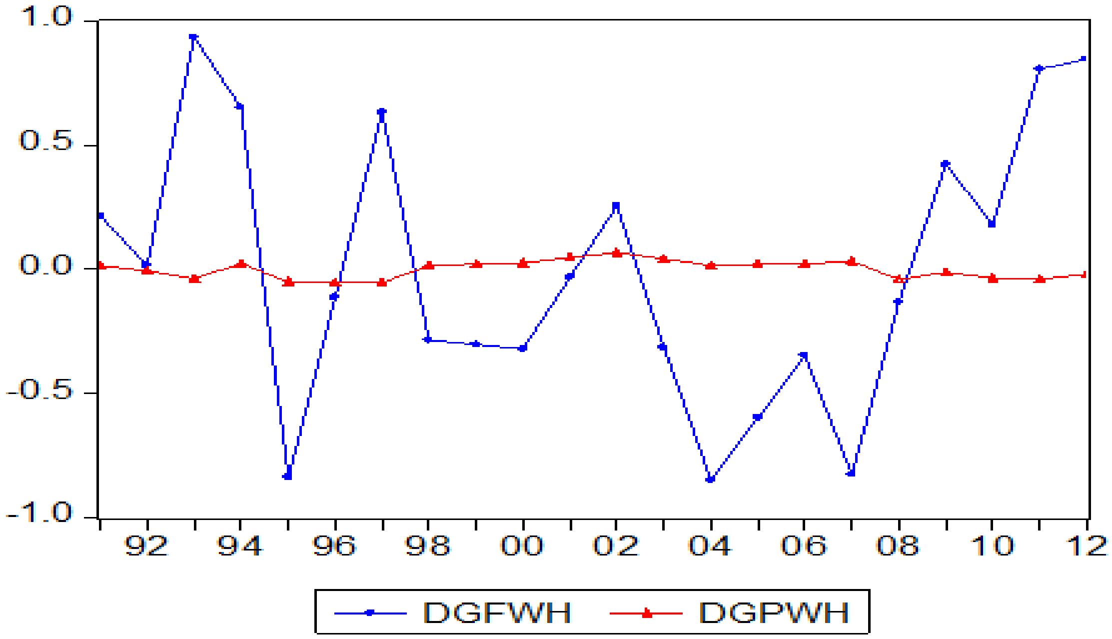


Figure 6: Growth trend of full-time and part-time employment in the transport division

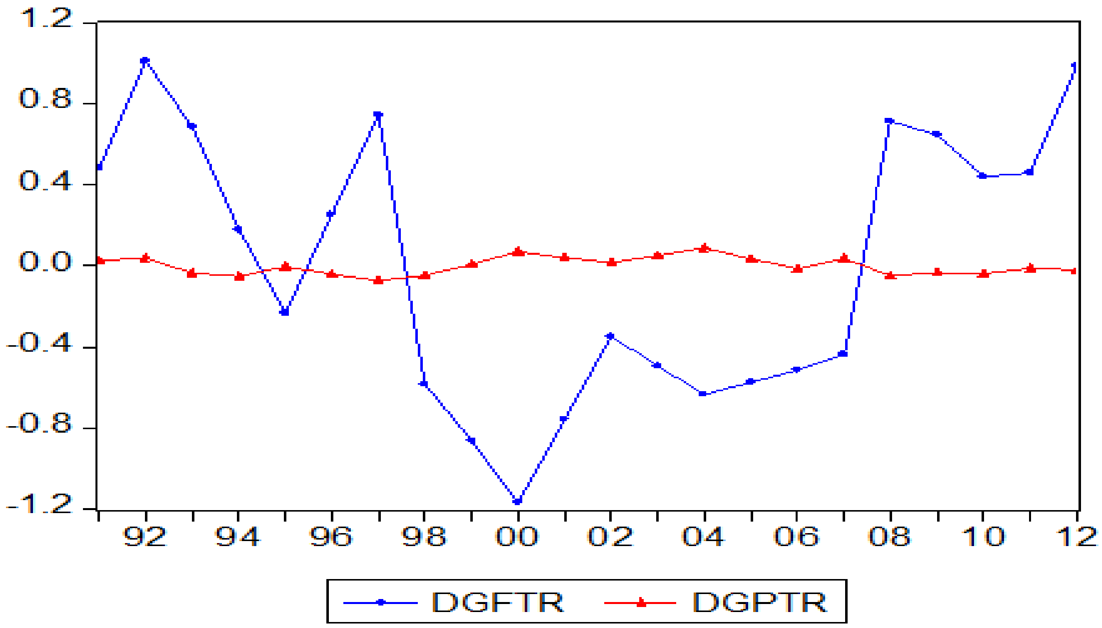
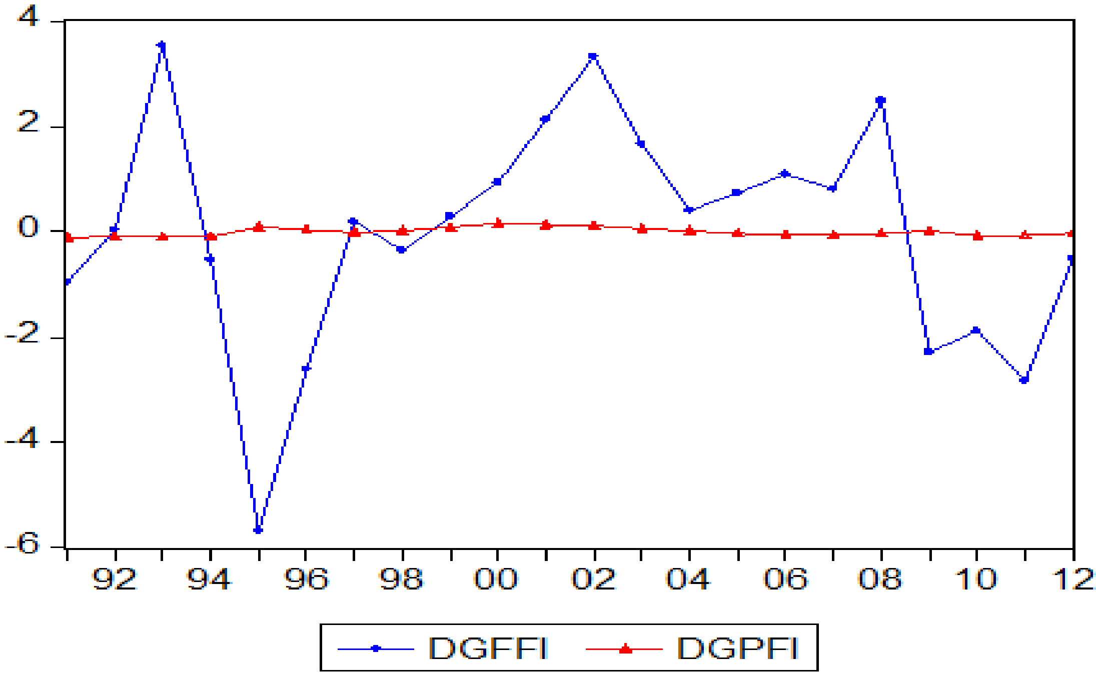


Figure 7: Growth trend of full-time and part-time employment in the finance division



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