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A SYSTEMS MODEL TO MEASURE LABOUR MARKET DYNAMICS*

ABSTRACT

The deeper and underlying causes of labour market dynamics in an economy reveal painful truths about the way the global economy works. Labour market shifts such as rising unemployment, decreasing job availability, instability and uncertainty, technological changes, growing number of working poor, and so on have major consequences for certain groups of individuals. Labour market disruptions caused by pandemic, the war in Ukraine and other global events, overtly or covertly, affect labour market flows (job-finding rates, job-exit rates, job-to-job transition rates) differently across the globe. Moreover, numerous driving forces, channels, and processes influence labour, jobs and economic activities in a unified one-world. Since labour market is a system in persistent change, its functioning in a global economy is determined within the prevailing forces of global economic system that fabricates various channels through which the dynamics of labour market are influenced. It is lucid that labour market dynamics are heterogeneous among different countries. Then, what are the fundamental underlying forces behind labour market performances that might help in explaining these differences? What is more, how can we model the dynamics of labour market by taking into account the forces of global economic system affecting globalized labour and jobs? Considering this, the present paper purports at proposing a systems model to measure labour market dynamics inspired by systems thinking approach. The proposed measurement system of labour market dynamics subsumes a conceptual model, operational model, a multivariate structural model and a measurement model within the boundaries of global economic system. It also provides a theoretic framework to study the causality and mechanisms among various critical latent variables of the model. The interplay between the pathways of global economic system and labour market dynamics have been, for the first time, outlined by constructing a robust, structural and multivariate causal pathways system to understand and analyse the dynamics of labour market. This paper contributes to this domain

* This paper is dedicated to a renowned economist, true scholar and esteemed Editor in Chief of the review *Economia Internazionale/ International Economics*, Professor Amedeo Amato who sadly passed away on July 15, 2021.

of research by building and offering a multivariate framework that pinpoints the driving forces that determine the dynamics of labour market and reveals how the key labour market aggregates/outcomes are statistically related to various internal and external shocks, failures and interventions in a global economy.

Keywords: Labour Market Dynamics; Multivariate Model; Global Economic System; Economic Liberalisation; International Migration; Science and Technology Inventions; Shocks; Failures and Interventions
JEL Classification: C1; C3; E24; J6; P42

RIASSUNTO

Un modello per misurare le dinamiche del mercato del lavoro

Le cause alla base delle dinamiche del mercato del lavoro di un'economia evidenziano dolorose verità circa le modalità con cui opera l'economia globale. Il mercato del lavoro cambia in maniera tale per cui la crescente disoccupazione, la minore offerta di lavoro, l'instabilità e l'incertezza, i cambiamenti tecnologici, il crescente numero di lavoratori poveri ecc. hanno conseguenze maggiori per determinati gruppi di persone. I problemi nel mercato del lavoro causati dalla pandemia, dalla guerra in Ucraina ed altri eventi globali, hanno influenzato i flussi lavorativi in maniera più o meno chiara e differente nei diversi paesi (per esempio le percentuali di assunzione e di uscita dal lavoro, la percentuale di cambio di occupazione). Inoltre, in un mondo unificato sono molte le forze trainanti, le reti e i processi in grado di influenzare il lavoro, l'occupazione e le attività economiche. Essendo il mercato del lavoro in perenne cambiamento, il suo funzionamento in un'economia globale è determinato all'interno di forze prevalenti nel sistema economico globale il quale realizza le reti in grado di influenzare il mercato del lavoro. È ovvio che le dinamiche del mercato del lavoro sono eterogenee fra diversi paesi. Quali sono quindi le forze fondamentali di base al di là delle performance del mercato che potrebbero spiegare queste differenze? E inoltre, come possiamo modellare le dinamiche del mercato del lavoro tenendo conto delle forze del sistema economico globale che influenzano il lavoro e l'occupazione? A tal fine, questo articolo propone un modello per misurare queste dinamiche basato sul pensiero sistemico. Questo sistema di misurazione delle dinamiche del mercato del lavoro include un modello concettuale, operativo e strutturale all'interno del sistema economico globale. Esso fornisce anche un modello teorico per lo studio della causalità e dei meccanismi tra le varie variabili latenti del modello. Per la prima volta l'interazione tra il sistema economico globale e le dinamiche del mercato del lavoro è stata delineata tramite un modello strutturale multivariato. Il

contributo di questo articolo in questo ambito di ricerca è un modello multivariato che identifica le forze trainanti che determinano le dinamiche del mercato del lavoro e che rivela come le principali variabili del mercato del lavoro siano statisticamente correlate ai diversi shock interni ed esterni, agli insuccessi ed agli interventi in un'economia globale.

1. Introduction

Labour market plays a momentous role in shaping and understanding the economic, social and political structure of an economy. As labour market is in a persistent flux, the statistics of employment, unemployment and inactive (people outside the labour force) give only still picture at a point in time. Even the figures of gross or net flows of different states in a labour market do not help us to understand the driving forces behind the dynamics of labour market. The study and understanding of the complex dynamics of labour market require systemic analysis of the framework of the actual web of connections and contracts, formal or informal, in a labour market. In order to study deeper functional aspects of a labour market, it should be understood as a complex, interactive, and holistic living system by asking questions like why the indicators of labour market dynamics are weaker in one market than the others and how their structures evolve. How the functioning of global economy affects the dynamics of labour market in one economy? All this requires us to adopt an open-minded, systemic, and evolutionary approach, and to recognize the labour market as a complex living system within other systems. Considering this, the present paper uses a *systems thinking approach* to measure labour market dynamics in the context of global economic system.

The outline of this paper is as follows: Section 2 deals with the rationale of the present study. Section 3 reviews briefly the literature on the measurement of labour market dynamics. Section 4 discusses the background of interconnections between global economic system and labour market dynamics. Section 5 outlines the theoretical scaffolding of the measurement system of the present study. Section 6 describes the research methodology of this paper. Section 7 unfolds the theoretical structure of the systems model of labour market dynamics. Section 8 concludes.

2. Rationale

The dynamics of labour market in an economy have been a focus of scrupulous theoretical and empirical research over the past few decades. As the world is becoming increasingly more integrated and interconnected in terms of economic, political, social and cultural life, the outcomes of labour markets across the globe are also changing rapidly (Cahuc and Zylberberg, 2004). Since the global economic system affects us all in different ways, it somehow has been influencing, overtly or covertly, the labour market dynamics (LMD) in both developed and developing economies. More precisely, the process of globalisation and its forces such as trade liberalisation, capital mobility, global migration and circular migration, foreign direct investment, dissemination of scientific and technical knowledge, offshoring, outsourcing, skill-based technical change, and so on, have been deteriorating labour market performances (Ghosh, 2016). Foreign capital flees poorer countries at the first sight of instability causing mass unemployment and hunger as in the case of Sri Lanka this year. As a result, communities, individuals and social groups have been experiencing diverse labour market experiences. Some people in an area have been immensely benefited from globalisation while others have been marginalised or excluded. Therefore, globalisation has been witnessed as an uneven world market development. It has been negatively contributing to the drop in mobility of low quality manpower, rise in unemployment rates, fall in real wages, social exclusion, wage inequalities, discursive localisation of poverty in low-income as well as high-income economies, and the like (Dutt *et al.*, 2016; Stiglitz, 2002 and 2006).What is, nevertheless, controversial is the nature and degree of relationship between different elements comprising global market system and labour market outcomes. Considering the widely divergent claims made in the literature on global market system and LMD, there is a call for apposite theoretical framework that enables a systematic and scientific evaluation of empirical work on the problem in hand.

This paper focuses on the interplay between the pathways of global economic system and labour market dynamics. It is a theoretical study of causality and mechanisms among the elements of global economic system and labour market outcomes. It is comprehensible that labour market performances are heterogeneous among different countries. Then, what are the actual dynamics behind labour market outcomes that might help in explaining these differences? To this aim, it is understood that the functioning of labour market in an economy is determined within the prevailing global economic system that fabricates various channels through which the outcomes

of labour market are influenced. The fundamental aim of this paper is to propose a *new* theoretical structure to examine the relationship between global economic system in its current form and its effects on labour market flows. It, for the first time, introduces and constructs a robust, structural and multivariate causal pathways model to understand and analyse the dynamics behind labour market outcomes in a global economy. It contributes to this domain of literature and research by building and proposing a multivariate framework that reveals how the key labour market aggregates/outcomes are statistically related to various internal and external shocks, failures and interventions in a global economy.

The distinct processes of global economic system are essentially producing increasing international socio-economic, cultural and environmental integration, mobility of resources, and growing interdependency among national economies. Keeping this in mind, the present paper delineates diverse channels of global economic system associated with various activities in country that may inauspiciously affect the dynamics of labour market in a global economy. It investigates theoretical linkages between global economic system channels and labour market movements and flows. Based on systems thinking, structural equations modeling, and multivariate data analysis, this paper succinctly illustrates the theoretical scaffolding of multivariate structural model of labour market effects of global economic system in an economy with special reference to the causal pathways that involve distinct dimensions of global economic system, different movements and flows of labour market and environment of an economy. It outlines a chain of models that are both generic as well as specific in nature.

The conceptual notion of the phenomenon of global economic system is holistic, multidimensional and multidisciplinary. The paper further divulges how *critical* global economic system *forces* simultaneously intensify labour market outcomes in a multiplicative way or may interact producing reciprocal compensatory and attenuating effects. The constructs and relationships of the proposed structure can be rigorously tested by means of data derived from various sources for an empirical analysis. A *labour market dynamics matrix* may be constructed to illustrate the effects of economic liberalization, international migration, technology and innovations and shocks, failures and interventions. This theoretical framework that contains a conceptual model, operational model, latent variable structural model, measurement model and multivariate causal pathways model in order to drive the dynamics of labour market pertaining to a country within certain boundaries of the overall global economic system. For the purpose of the

practical use of the model, the measurement software based on Partial Least Squares method can be used to calculate and analyse the causal pathways, and to construction of overall labour market dynamics matrix from the collected information. Results from empirical analysis may be used to pinpoint the practical policy options to regulate and manage the outcomes of labour market in any economy.

3. Labour market dynamics: a succinct review

Over the last few decades, a considerable progress has been made in modelling the labour market dynamics, as opposed to stocks, characteristics of labour market. Across the globe, the labour market is currently undergoing major shifts such as polarization, exclusion, covid pandemic shocks, Ukraine war, rising unemployment, decreasing job availability, maintaining regular employment, technical change, economic crisis and instability and so on due to numerous global, national and local forces. However, the evaluation of labour market performance and subsequent design of welfare policy have heavily depended on single variable of unemployment rate (Barnichon *et al.*, 2012). However, most of the labour markets have been characterized by the churning of workers and jobs across the business cycles.

Keynes' General Theory (1936) and almost all other macroeconomic models postulated a minimum unemployment level or full-employment level of unemployment. Since then, various studies have been undertaken to study this phenomenon of labour market. In 1968, Edmund Phelps presented a theory of money-wage dynamics and labour market equilibrium by capturing the role of expectations.

Unemployment has been viewed as a dynamic phenomenon. Considering this, Clark and Summers (1979) emphasized on the role of turnover in understanding unemployment. The central theme of their work has been the instability of unemployment, the brevity of unemployment spells, and the large flows into and out of unemployment.

Over the last three decades, the literature can be seen to have developed into two different groups. Firstly, macroeconomic analysis of gross labour market flows over the business cycles. For example, Davis and Haltiwanger (1992), Blanchard and Diamond (1990, 1992), Antolin (1994, 1995), Burda and Wyplosz (1990, 1994), Abowd and Zellner (1985) and so on. Secondly, micro-econometric analysis of the determinants of individual labour market transitions. For example,

Clark and Summers (1979), Katz and Meyer (1990), Narendranathan and Stewart (1993), Peracchi and Welch (1994), Addison and Portugal (1998), and so on.

Gross labor market flows, the creation and destruction of specific jobs or the movement of workers into and out of employment, are the immediate outcomes of labor market processes. Firms create and destroy jobs. Workers enter and leave employment. Usually, all such developments are condensed into a single number, the net change in employment data. Joseph A. Ritter (1993) investigates several measures of gross flows of workers, which reveal some remarkable features of U.S. labor market and suggest new perspectives on how the economy operates.

Dale Mortensen and Christopher Pissarides (1994) model job-creation and job-destruction in the theory of unemployment with non-cooperative wage behavior. They show that an aggregate shock induces negative correlation between job creation and job destruction, whereas a dispersion shock induces positive correlation. The job destruction process has more volatile dynamics than the job creation process. In simulations, an aggregate shock process proxies reasonably well the cyclical behaviour of job creation and job destruction in the USA.

Measuring unemployment remains highly controversial. A non-employed person who displays a marginal attachment and desire to work, available for work but not searching the work, should be classified as unemployed or non-participant. Jones and Riddell (1995) empirically investigate this phenomenon. They explored the measurement of labour force dynamics using longitudinal data, focusing in particular on the Canadian Labour Market Activity Survey. They conclude that the non-employed are heterogeneous, so that any single division into unemployment and out of the labour is unlikely to completely capture the variety of degrees of labour force attachment.

Pissarides (2000) puts emphases on the modeling of the transitions in and out of unemployment, given the stochastic processes that break up jobs and lead to the formation of new jobs, and on the implications of this approach for macroeconomic equilibrium and for the efficiency of the labor market. He assumes that firms and workers maximize their payoffs under rational expectations and that wages are determined to exploit the private gains from trade. Artola and Bell (2001) evaluate the appropriateness of alternative strategies, the retrospective and matched files approach, frequently used in the literature to measure labour market dynamics in the Spanish case.

Paull (2002) uses British Household Panel Survey to systematically investigate the impact of recall on measured labour market behavior and to highlight how and to what extent the biases reported in the reported data may affect the estimation of models of labour market dynamics. The results allow analysts to judge whether conclusions drawn from such models are likely to be compromised by the reporting biases.

Clayton and Mousa (2004) presented an overview of the USA data, their sources, and their current and potential uses in order to explain the dynamic nature of labour market, together with an emphasis on accountability and performance measures in all government programs. The data has been presented as a useful tool for generating labour market dynamic indicators as well as in analyzing labour market behavior, performance measures and economic shocks. However, Clayton has not presented any structured framework to achieve that.

The role of labour force participation has widely been ignored in the analysis of labour market fluctuations. Elsby *et al.* (2015) show that flows-based analyses imply that the participation margin accounts for around one-third of unemployment fluctuations established by a novel stock-flow apparatus. They conclude, firstly, that the role of the participation margin appears robust to adjustments for spurious transitions induced by reporting error. Secondly, conventional stocks-based analyses are subject to a stock-flow fallacy, neglecting offsetting forces of worker flows on the participation rate. Thirdly, increases in labor force attachment among the unemployed during recessions are a leading explanation for the role of the participation margin.

Robert Shimer (2012) by using aggregate time series measures the probability that an employed worker becomes unemployed and the probability that an unemployed worker finds a job, the ins and outs of unemployment. In the USA, the job finding probability has accounted for three-quarters and the employment exit probability for one-quarter of the fluctuations in the unemployment rate. Fluctuations in the employment exit probability are quantitatively irrelevant during the last two decades. Shimer (2012) shows that the results are not due to compositional changes in the pool of searching workers, nor are they due to movements of workers in and out of the labor force. Chopra (2016) analysed the dynamics of labour market in a global economy by utilizing the multivariate causal pathways model. Fiaschi and Tealdi (2021) suggest a general methodology to measure labour market dynamics, motivated by the search and matching framework, based on the estimate of the transition rates between labour market states.

They illustrate how to estimate instantaneous transition rates starting from discrete time observations provided in longitudinal datasets, allowing for any number of states using Italian labour market data. Firstly, they decompose the unemployment rate fluctuations into inflow and outflow driven components; then, they evaluate the impact of the implementation of a labour market reform, which substantially changed the regulations of temporary contracts.

Del Rio-Chanona *et al.* (2021) propose a network model of labour market dynamics that analyses how workers move through an empirically derived occupational mobility network in response to automation scenarios. At a micro level, the model provides occupation-specific estimates of changes in short and long-term unemployment corresponding to specific automation shocks. At a macro level, the model reproduces the Beveridge curve. They conclude that the network structure plays a crucial role in determining unemployment levels, with occupations in particular areas of the network having few job transition opportunities. In an automation scenario with low wage occupations more likely to be automated than high wage occupations, the network effects are also more likely to increase the long-term unemployment of low wage occupations.

Donovan *et al.* (2022) built a new data set of harmonized microdata from rotating panel labour force surveys covering 80 million people from 49 countries. They constructed standard labour market flows, such as employment-exit rates, and show they are negatively correlated with development. Higher flows in developing countries largely represent more frequent transitions to, from, and between self-employment and informal/low earnings wage work as opposed to movements up the job ladder. The cross-country patterns of labor market dynamics are consistent with the view that information frictions are a particularly important barrier in labor markets in developing countries. Leinonen *et al.* (2022) introduce a conceptual framework of the work-to-retirement process to guide its future measurement. It highlights the complexity of the work-to-retirement process, bringing forth its multifaceted, multiphased and multidirectional features. Accounting for such complexity in later-life labour market dynamics helps to elaborate what is actually addressed when investigating retirement.

The above adumbrated concise literature review reveals that there has not been any significant attempt to propose and develop a framework to study and analyse labour market dynamics in any economy within the prevailing global economic system. Since labour market is a system in constant change, its functioning in a global economy is determined within the prevailing forces of

global economic system that fabricates various channels through which the dynamics of labour market are influenced. It is lucid that labour market dynamics are heterogeneous among different countries. Then, what are the fundamental underlying forces behind labour market performances that might help in explaining these differences? What is more, how can we model the dynamics of labour market by taking into account the forces of global economic system affecting globalized labour and jobs? Considering this, the present paper purports at proposing a systems model to measure labour market dynamics inspired by systems thinking approach.

4. The background

Global economic system has been defined as a set of processes that increase integration and interdependencies among national economies by reducing barriers to flows of trade, migration, capital, ideas, technology and other aspects. It enhances international mobility of national resources and increases inter-reliance of national economies (Chanda, 2007; Das, 2004). Thus, three main characteristics of global economic system are: increasing international economic integration, mobility of resources and growing interdependency. Global economic system is understood here as a process of increasing interconnectedness fostered by accelerating communications and the emergence of global systems of banking, trade, legal arrangements and diverse forms of cooperation amongst areas of the world previously separated to varying degrees by geography, culture, language, religion, politics and numerous other distinctions (Chopra, 2016).

A labour market is a system in continual movement and is a key part of the economy. The long-term trends have major implications not only for the economy but also for society more generally. Since the beginning of the 1980s, the labour markets in many economies have witnessed many drastic changes in terms of rise in unemployment, increase in self-employed, proletarisation of labour, feminization of labour market, widening wage gap between skilled and unskilled workers, shrinking gender gap in earnings, and so on (Goos and Manning, 2003; Bernhardt *et al.*, 1995). These changes have coincided with the processes and outcomes of the third and current wave of rapid globalisation[1] with falling barriers of international economic transactions between

[1] The World Bank stated that the first wave of globalisation began in 1870 and ended at the beginning of World War I in 1914. It was characterized by a reduction in trade barriers and improvement in transportation technologies, which resulted in major migration of about 10% of the world's population. The next wave occurred from 1950 to 1980 during which multiple trade agreements occurred between developed nations which left out the developing world. The final

developed and developing countries, integrating economic ideas and many other fast changes in the emerging markets. All of this may be both a consequence and cause of globalisation.

There has been a debate regarding the flexibility and polarisation of labour market (Schmidt and Hersh, 2016). Some authors have used vigorous polemic to examine and analyse the social goals based on values. McLaughlin (1994) confronts the notion that unemployment represents a lack of flexibility in the labour market, and that successful policies against unemployment have been those which engender a higher degree of flexibility. Macnicol (1987) critically examines the view that the core of unemployment is an 'underclass' based on anti-social, anti-work values and welfare dependence. McLaughlin particularly focused upon the evidence that non-employment is becoming a problem on a par with unemployment, and argues that when this is taken into account, the apparent successes of flexible labour market policies tend to evaporate. Similarly, Macnicol points to the complex and large-scale changes in fertility, family formation and lone parenting which are taking place, changes which transcend simplistic notions of an 'underclass' or of welfare dependence.

The basic question is: what drives the changes in the outcomes of labour markets across the world? However, there is no straight and clear-cut universally applicable answer to the question. Building on David Ricardo's theory of comparative advantage in international trade, Heckscher–Ohlin model has been used to analyse the effects of international trade on labour market in terms of real wages in a two factors, two products and two countries framework (Ohlin, 1933; Leamer, 1995)[2]. Trade with the South causes the North to specialize in the production of skill-intensive manufacturers, in which it has a comparative advantage because of its relatively large supply of

(and current) wave of globalization (beginning 1980) in contrast has been characterized by the willingness of developed nations to remove trade barriers in order to attract foreign capital.

[2] The original model was based on two countries, and had two commodities that could be produced. Since there are two (homogeneous) factors of production this model is sometimes called the "2×2×2 model", assuming that the only difference between countries was the relative abundances of labor and capital. It has *variable factor proportions* between countries: highly developed countries have a comparatively high ratio of capital to labor in relation to developing countries. This makes the developed country capital-abundant in relation to the developing nation, and the developing nation labor-abundant in relation to the developed country. With this single difference, Ohlin was able to discuss the new mechanism of comparative advantage, using just two goods and two technologies to produce them. (One technology would be a capital intensive industry, the other a labor intensive business. The model has been extended since the 1930s by many economists. These developments did not change the fundamental role of variable factor proportions in driving international trade, but added to the model various real-world considerations - such as tariffs - in the hopes of increasing the model's predictive power, or as a mathematical way of discussing macroeconomic policy options. Notable contributions came from Paul Samuelson, Ronald Jones, and Jaroslav Vanek, so that variations of the model are sometimes called the Heckscher-Ohlin-Samuelson model or the Heckscher-Ohlin-Vanek model in the neo-classical economics.

skilled labour, and to reduce production of labour-intensive manufacturers. In the North, there is a rise in the relative price of skill-intensive goods and the relative demand for skilled labour, and a widening of the wage gap between skilled and unskilled workers and vice-versa in the South (Wood, 1998). Although Heckscher-Ohlin model is still a useful framework to understand international trade, it is not a suitable model with regards to the recent changes in labour markets due to globalisation process as it ignores unemployment and has little predictive power (Bernstein and Weinstein, 2002).

It will be worthwhile to review the relevance of the theories of international trade developed since Heckscher-Ohlin model in context with the changes in labour markets in the North (Greenaway and Nelson, 2000). Stopler-Samuelson model (1941) of international trade and lower wages questions: what is the effect of changes in the prices of goods, caused, for example, by changes in tariffs, on the prices of factors of production? The model concluded that if the world price of capital-intensive goods increases, it will increase the relative rental rate as well as decrease the relative wage rate (the return on capital as against the return to labour). Also if the price of labour intensive goods increases, it will increase the relative wage rate as well as decrease the relative rental rate (Deardorff and Stern, 1994). Thus, when import-competing goods are relatively labor-intensive, wage-earners gain and capital-owners lose, irrespective of which bundle of goods they consume. Put simply, protection unambiguously raises real wages (Neary, 2004). The model has also been applied to a range of empirical issues, including to address the "trade and wages" debate (Leamer, 1995 and Feenstra, 1988), the effects of increased globalisation on income distribution in developed countries (Jones, 2000), and the long run political allegiances of classes and interest groups (Rogowski, 1989). However, Stopler-Samuelson model is not relevant in fully capturing the totality of the labour market changes both in Western and developing worlds.

The Rybczynski theorem (1955) states that at constant relative goods prices, a rise in the endowment of one factor will lead to a more than proportional expansion of the output in the sector which uses that factor intensively, and an absolute decline of the output of the other good. The theorem is useful in analyzing the effects of capital investment, immigration and emigration within the context of a Heckscher-Ohlin model. Paul Samuelson (1948) and Abba Lerner (1952) independently developed a factor price equalization theorem which states that the prices of identical factors of production, such as the wage rate, or the return to capital, will be equalized across countries as a result of international trade in commodities. When two countries enter a free

trade agreement, wages for identical jobs in both countries tend to approach each other and this is what is happening recently in various countries of the European Union. However, further contribution to the debate of international trade and wages were made by Leontief paradox (Leamer, 1980)[3] in 1954 and Linder hypothesis[4] in 1961.

In 1958, William Phillips, by using a single-equation empirical model, observed an inverse relationship between money wage changes and unemployment in the United Kingdom during the period 1861-1957 (Phillips, 1958).

More recently two main factors that have contributed significantly in widening the wage gap between the skilled and unskilled workers in the Western world and increase in unemployment of unskilled workers are: the defensive innovation along with reducing costs in transport and communication and large immigration of unskilled workers into the West. Technology changes the skill structure in the economy and hence adversely affects the real wages and employment levels. It is well documented that the unskilled workers in most of the European countries are affected to a much greater extent than in the USA by low employment rather than low wages due to the introduction of minimum wage level (Blau and Kahn, 1996 and Nickell, 1997). Computer use has changed the wage structure (DiNardo and Pishke, 1997; Haskel and Slaughter, 1998). Recently there has been a debate between 'trade' (reduction in barriers in trade) and 'technology' (skill-biased technical change) as the driving forces (alternative and non-overlapping forces) of the recent changes in the labour markets in the Western world. Another debate being developed in this context is the technology hypothesis vis-à-vis globalisation hypothesis. In fact, trade, technology and globalisation are closely interlinked with one another. Therefore, it will be a very narrow approach just to rely on either 'trade hypothesis', 'technology hypothesis' or 'globalisation hypothesis' alone, rather they should be studied together under one analytic umbrella.

Lindbeck and Snower (1984, 1988) propounded the insider-outsider theory of employment and unemployment that examines the behaviour of insiders as more privileged than outsider workers of the firms. This behaviour results in two situations. The first is the absence of wage underbidding

[3] Wassily W. Leontief in 1954 did an econometric test of the H-O and model found that the US, despite having a relative abundance of capital, tended to export labor intensive goods and import capital intensive goods. This problem became known as the Leontief paradox.

[4] Linder hypothesis was proposed by Hans Martin Staffan Burenstam Linder, a Swedish economist, in 1961 as a solution to Leontief paradox and it outlines the international trade patterns as: the more similar demand structures of countries, the more they trade with one another.

even when many unemployed outsider workers are willing to work at lower wage rate as the firms do not want to replace the insiders with outsiders due to high replace costs or insiders do not co-operate with outsiders. The second is the existence of permanent higher unemployment after negative shocks and hence causing hysteresis (Blanchard and Summers, 1987). The issues of globalisation and labour market are also analysed from another point of view, taking into consideration expected migration flows from developing to developed countries. Another perspective from which the links between globalisation and labour market are analysed gives importance to the interaction between unfavourable macroeconomic policies and real labour market rigidities. Effects of global economic system on labour market dynamics are seen through labour mobility and the integration of the product market (Ederveen *et al.*, 2007). There have been various recent attempts in literature evaluating different aspects of the link between global economic system, economic integration and labour market (Fertig, 2003). These theories, however, are very narrow in their approach in addressing labour market changes in the presence of constant changes in global economic system, economic liberation, international migration, science and technological inventions and shocks, failures and interventions in an economy. Therefore, there is a need to take into account simultaneously all driving forces which stimulate labour market changes.

5. The theoretical scaffolding of the measurement system

The critical driving forces inherent in the process of the proliferation of global economic system are diverse and complex. They are intertwined and interconnected. Therefore, a study of these forces helps us to understand the global economy better and also the effects of global economic system on labour market outcomes. To the extent such forces of global economic system persist in an economy and the magnitude of their multivariate casual connections may cause negative or positive consequences for labour market dynamics. These critical forces hover around economic, financial, political, operational, socio-cultural, legal, religious, technological, linguistic and other factors of our global economy. The liberalisation, migration, financial and technological forces are by far the most important, even though the political and socio-cultural milieu cannot at all be neglected. The following are the critical forces of global economic system that influence labour market in an economy:

(a) Global Economic System

The key driving forces of globalisation that bring changes in labour markets lie within the prevailing global economic system that subsumes the networks, subsystems and arrangements that unite the economies of the world into one global marketplace. It is concerned with international economic relationships that exist among different countries in the world. Ever since the Industrial Revolution era, between 1820 and 1890, the global economic system has undergone various changes and transformations introduced by factors such as systematic application of science and technology; overseas trade; capital and population movements; creation of global financial system; emergence of international patterns of specialization in production and trade; and so on. However, a meeting of delegates from 44 nations in 1944 in Bretton Woods, New Hampshire, United States, laid the foundation for the modern global economic system. International organizations such as the International Monetary Fund (IMF) and the World Trade Organization (WTO) are important institutions in the global economic system. Global trade agreements such as the North American Free Trade Agreement (NAFTA) and the General Agreement on Tariffs and Trade (GATT) helped accelerate globalisation, opening markets around world to an expanding range of goods and services. Thus, the domestic and global economy, society and institutions have witnessed great renovation over the last many decades.

However, the main features of the prevailing global economic system include a liberal global trading order, international migration, capital movements into overseas territories, fluctuating exchange rate systems, elastic payment systems in globalised financial and capital markets, capital-embedded technology and energy intensive growth, high productivity specialized agriculture, global political and market institutional framework building, faceless communication systems, globalisation of production and consumption, rapidly rising economic and social inequalities both within and across nations, and so on. Ever since Industrial Revolution, the information and communication revolution is in the process of altering all aspects of the national and global economy, society and polity. It is transforming the industrial structure, industrial organisation, workplace, destroying old and creating new jobs, altering working patterns, permitting a new level of decentralization of productive employment, changing the international patterns of division of labour, new kinds of international firms in different fields have emerged. A liberal economic trading order is in process of being forged (Adelman, 1995).

Institutions are systems of established and prevalent social rules that structure social interactions (Hodgson, 2006). Economic institutions or organisations are those institutions that perform economic functions, regulated by formal regulating agencies, of establishing and protecting property rights; facilitating transactions; and permitting economic co-operation and organisation (Wiggins and Davis, 2006). The functioning of institutions depends upon many other factors such as administrative requirements, efficacy of legal systems, underlying norms of society, and individual freedom versus obligations to wider collectives, and so on. Institutions are often embedded in social and cultural characteristics of the particular context. Institutions affect economic growth, investment, human capital formation and technological innovations through secure intellectual property rights (Nabli and Nugent, 1989).

There are mainly four pathways through which a global economic system affects labour market outcomes such as economic liberalisation, international mobility of resources including human, information technology and communication innovations and shocks and stimulants. The extent to which the growth in an economy depends upon its political structure and the nature of economy also influences its labour market dynamics and pattern of employment. Thus, a global economic system allows economies to engage in international trade of goods and services and allowing labour, capital, technology, and ideas to move freely around the world.

(b) Economic Liberalisation

Strong wave of liberation induced by the World Trade Organisation (WTO) as well as unilateral negotiations and decisions undertaken by the countries world-over introduced the process of economic liberation in many countries. Economic liberalisation includes internal (domestic) and external (international) as well as stabilisation and structural adjustments. It refers to the process of the opening up of a country to the rest of the world with regards to international trade, international investments, regulations, taxation, capital mobility, legal issues, labour market flexibility, open market in terms of interbank trade in securities and other areas by reducing protectionist policies, relaxing barriers and relinquishing some control over the direction of the economy to the private sector (Kotz, 2002). This often involves deregulation and privatization of state owned companies.

The economic liberalisation dimension mainly includes real, monetary and financial liberalisation such as freedom in interregional and international trade, capital mobility, financial

remittances, foreign direct investment (inward and outward FDI flows), and multinational corporations. When FDI increases, unemployment increases or decreases depends on which sector the investment is being made. One possibility is that if FDI is made in state enterprises, the labour force in these enterprises might be laid off. Unemployment decreases as exports grow when exporting goods are produced with labor intensive techniques. However, the main indicators for economic liberation used in this study are intra-regional trade index ratio between the intra trade (internal trade of the region in which the country falls) and total trade; global trade index (ratio between total trade and the GDP, it measures the degree of participation of a country); financial market integration index; reforms in exchange rates, fiscal, monetary and labour market policies; opening up the economy to competition from abroad (global competitive index) or country contestability; lower taxes on the rich and foreign investors; trade deficit as a percentage of GDP; extent to which the economy is import-dependent for its production inputs and consumption activities; extent to which the economy is export-dependent for its earnings; extent of capital flows in terms of foreign aid, foreign direct investment and foreign loans.

(c) International Migration

Migration is a complex phenomenon and research on this subject mainly brings out three aspects. First, migration flows are spatial enabling us to distinguish between internal and international migration. The second facet distinguishes between microeconomic (individual decisions to migrate) and macroeconomic approach (role played by macroeconomic variables). The third aspect is concerned with the determinants of migration or to explore the consequences of migration. This paper focuses on the consequences of international migration flows, following a macroeconomic approach, on the labour market dynamics.

The globalisation of the market economy is the prime reason for migration that includes both spatial and occupational mobility of productive resources. Increasing globalisation has escalated the migratory flow of workers across the world. Human mobility include international networks of migrants (immigration and emigration) and diasporas (which facilitate trade and investment), circular migration, labour mobility, skill selectivity, productivity-wage mismatch, overseas educational opportunities, female migration, quest for better quality of life, better remuneration abroad, concerns about livability, political stability, human rights and media freedom, and remittances from expatriates living abroad constitute a significant proportion of foreign revenue for many developing countries. International migration affects both supply of labour and demand

for labour. It is also useful to distinguish among mobility of individuals, knowledge workers mobility, ambitious entrepreneurs, and managerial power.

(d) Science and Technology Inventions

With modern technology, the connections between economics, politics and environment are growing stronger every day and are frequently described within the framework of globalisation. Geographers' abilities to examine issues such as trade between nations, regional economic policies, global political networks and environmental issues give geographers an excellent understanding of global issues.

The endogenous relationships between labour market dynamics and skills, training and innovations are highly controversial with varying results and impacts (Pieroni and Pompei 2008). It is controversial as to if innovation creates many jobs or leads to productivity crisis. Technology is labour replacing, so a positive technology shock leads to a decline in labour inputs (Mandelman and Zanetti, 2008). Mortensen and Pissarides (1999) model of equilibrium unemployment asserts that 'skill-biased' technology shocks that increase the spread of labour productivities, interacting with different policy regimes, explain the rise in unemployment in Europe relative to the United States in the 1980s and 1990s. Moreover, labour market rigidities in terms of technological rigidity affect the age structure of a firm's work force in equilibrium. Firms using relatively flexible technology care only about total hours of labor input, but not hours of work per worker. Older workers with a desire for short or flexible hours of work are attracted by such firms. Firms using a more rigid technology involving team production impose a minimum hours constraint, and as a result tend to have a younger age structure (Blau and Shvydko, 2007). Thus, unemployment structure is also changing and unemployment is rising in the UK due to labour market rigidities.

Over the last three decades the gap between wages and unemployment rates of skilled and unskilled workers has widened in the UK (Wood, 1998; Allen and Velden, 2001; Autor *et al.*, 2003; Card and DiNardo, 2002; Bauer, 2000). The demand for skilled relative to unskilled has increased, relative to its supply. Due to the introduction of skill-using technological progress such as computers, internet, new products, new forms of business organisations, new processes and so on, both the relative demand for skilled workers and its relative supply have risen sharply more or less in similar magnitudes. This has resulted in the rise in income generated by the employment of highly skilled labour and through externalities even generating more needs and opportunities to

hire even more skilled workers. Capital is replacing labor in the production process as technology advances (Acemoglu, 2002). The growth in fixed capital investments was found to be positively correlating with unemployment. So producers are replacing machines for workers. For example, new technology platforms are replacing traditional high street banking branches and thus replacing labour, e.g., smart phone based current accounts. Most of the super markets have now introduced self-checking tills in their stores. This has further reduced the number of jobs available in the market.

In the digital global economy of the internet era, the faster and cheaper technology has broken the national barrier of time and space. Hence, technology and innovations have easily brought the national markets together. The main technological factors affecting labour market in an economy are the extent of technology transfer, investment in R&D, number of researchers per million population in R&D. Publication in scientific and technical journals can be taken as summary indicators that captures output in science and technology knowledge-creation, extent to which the country has the research expertise and trademark applications that offer the possibility of research that has commercial value, extent of technology transformation, and intellectual property rights.

(e) Shocks, Failures and Interventions

The role of the forces of shocks, failures and interventions in an economy can hardly be exaggerated. These are also likely to have profound influence on the patterns of employment and unemployment within and between economies (Nunziata, 2002). Shocks are the large unexpected and unpredictable external events that bring out changes in real economic growth; employment and inflation, as a result, produce significant negative welfare effects. For example, a shock in supply of staple commodities, such as oil, can cause prices to skyrocket, making expensive to use for business purposes. Similarly, a rapid devaluation of a currency would produce a shock for the import/export industry leading to job losses and business closures. Broadly, there are *aggregate demand side* shocks taking place due to economic downturn in a major trading partner, unexpected tax rises, financial crisis, etc, and *aggregate supply-side* shocks because of steep rise in commodity prices, political turmoil, natural disaster, unexpected breakthroughs in production technology and so on.

A failure is a condition wherein desired objectives are not met. It represents imperfections and structural rigidities in a system. With a globalisation of markets comes a globalisation of failures. A labour market failure is a situation in which a market fails to allocate resources efficiently, to provide a free movement of labour, to provide perfect information among buyers and sellers, monopsony power of employers leading to discrimination on the basis of race, gender, age, ethnicity, sexual preference, etc., and disincentive to find and take paid work due to income tax system, cost of travelling to work, cost of childcare, low wages, lack of qualifications and skills, and so on. Government interventions to resolve labour market failures can also fail to achieve the desired goals due to information failure, excessive bureaucracy, incentives, welfare benefits, and subsidies payments. Government price fixation creates distortions which may lead to shortages or surpluses; for example, setting a minimum wage is likely to create an excess of supply of labour in markets where the 'market cleaning equilibrium' is less than the minimum. Welfare benefits such as unemployment benefits lead to the problem of *moral hazard* as the unemployed individuals are less likely to improve their employability.

Even if there is no shock in an economy, labour market performance may be adversely affected by *coordination failure* as the real market conditions might prevent individuals and firms from coordinating their decisions properly, due to lack of complete knowledge (Mankiw and Romer, 1997). Therefore, two economies with same technologies, policies, labour forces and other conditions, could achieve different activity rates, unemployment rates and labour market performances (Cooper and John, 1988). The main sources of labour market coordination failures are the mismatch between hiring decisions of firms and the job search efforts of workers, the existence of multiple equilibria because of labour market policies, the lack of human capital accumulation due to loss of skills when unemployed, and the existence of various frictions in labour markets (Manning, 1992).

Besides coordination failure, labour markets suffer from collective action problem. Collective action occurs when a number of people work together to achieve some common objective. However, it was recognized as early as in 1740 by David Hume in his A Treatise of Human Nature, that individuals often fail to work together, e.g., two neighbours may agree to drain a common meadow, to have a thousand neighbours agree on such a project becomes too complex a matter to execute. Mancur Olson (1965) popularized the problems of collective action. A collective good, economically infeasible to exclude people from using it, such as collective wage bargain for an

industry by trade union, also poses *a problem of free ride* as the fruits of bargaining (wage increase, better working conditions, less working hours, etc.) are also enjoyed by the workers who do not contribute anything to union dues and are not part of union. In game theory, one shot 'prisoner's dilemma' game represents a series of more complex situations, where individual rational action leads to a suboptimal outcome. Thus, if the network effects are allowed in a game played by more than two parties, the possible outcome includes both cooperation and free riding.

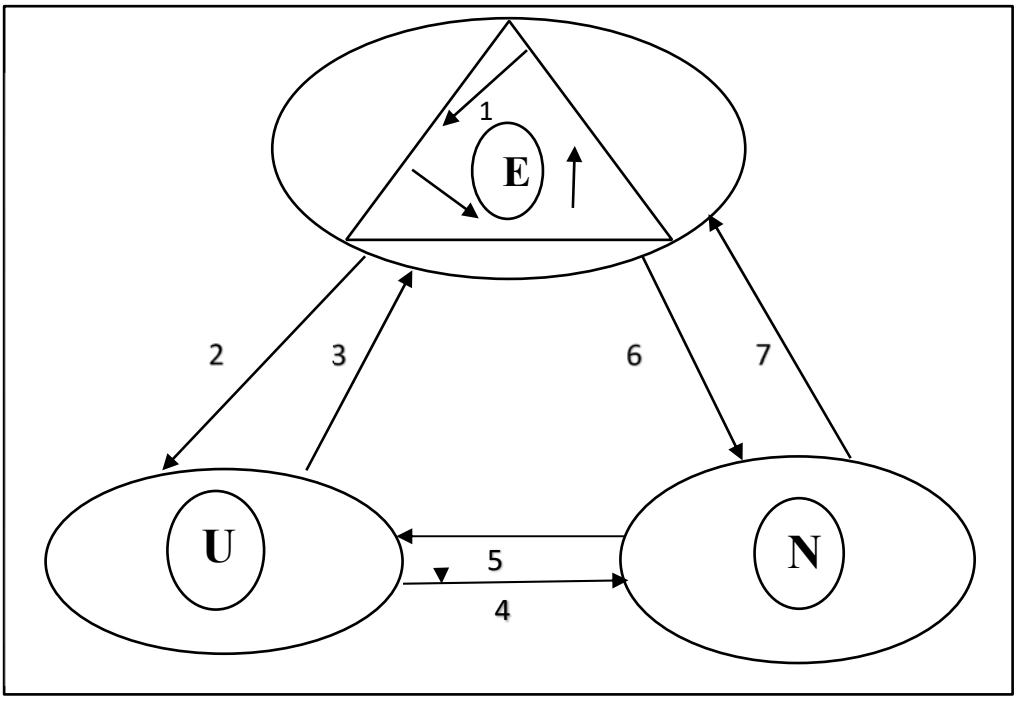
The labour market deficiencies such as costly information, adverse selection, and coordination and collective action failures call for job-searching and job-matching intermediaries or institutions like the 'medical match' that allocates young doctors completing medical schools to medical jobs/residencies (Autor, 2009). With a sharp fall in information costs, labour market intermediaries such as on-line job boards (information only intermediaries), job-search engines, newspaper advertisements, job banks, job centers, private agencies supplying workers to firms, temporary help agencies, and so on, step-in to co-ordinate between job vacancies and job seekers. However, labour market intermediation also suffers from many failures such as market congestion, expensive job co-ordination commission charged by private agencies both to workers and firms, cheap information not sufficient to solve labour market failures, pitfalls in the technology of job-matching, and so on.

(f) Labour market dynamics

Labour market dynamics simply means movements in labour markets. It may be defined as the outcomes of labour market in terms of the changes in jobs (number of jobs), changes in jobs of employed persons (flows within employment, i.e., between full-time and part-time employment; industries, occupations, between employee status) and self-employment and economic activity status of individuals (employed, unemployed and inactive) in an economy. A system labour accounting provides a comprehensive framework for the description and analysis of the state and dynamics of labour market and its interaction with the rest of the economy. Labour market dynamics is a measure of gross changes, movements and flows in the number of jobs and persons and their activities[5].

[5] This definition excludes the dynamics of income from employment, and the demography and dynamics of workplaces (entrepreneurial job-creating and job-destroying activity).

FIGURE 1 - *Labour Market Dynamics among Labour Market States*



Source: See, Chopra (2016), p. 184.

Figure 1 shows the gross flows between labour market states of employment (E), unemployment (U) and not in the labour force (N). The first set of dynamics, shown by 1 in Figure 1, is within employment (E), such as between jobs; full-time and part-time employment; industries; occupations; or between employee status and self-employment. The second set of dynamics is unemployment turnover, i.e., inflows and outflows of unemployment, represented by arrows 2, 3, 4 and 5 in Figure 1. The third set of dynamics is the labour and job turnover rates represented by herrings represented by arrows 1, 3, and 7 and separations (layoffs and quits) represented by arrows 1, 2, and 6.The aspects of labour market flexibility and mobility are represented by arrows 1, 2, 3, 4, 5, 6, and 7. The transition from full-time education into the labour force is represented by arrows 5 and 7. Similarly, the move from work into retirement is shown by 2, 4 and 6 arrows. Depending upon the work history records, the profile of individuals' earnings over time are represented by arrows 1, 2, 3, 4, 5, 6, and 7. Thus, the dynamics of labour market include the magnitude of labour force in an economy, unemployment turnover, full-time employment, extent of part-time unemployment, magnitude of self-employed individuals, job turnover rates, labour turnover rates, and the earnings profile of workers.

6. Research methodology

In this model, the global economic system provides the foundation for economic liberalisation, international migration, science and technological inventions and shocks and institutions. The way these are developed and supported will determine the degree of labour market dynamics; thus a major challenge for the policy makers to effectively manage the relationship among the globalisation components. In this case the latent variable structural model is used to represent the causal relationships among latent variables (global economic system, economic liberalisation, international migration, science and technological inventions and shocks, failures and interventions). The purpose of the approach is to estimate the strength of the causal connections among the latent variables and to test the goodness of fit of the structural model. For the requirements of labour market evaluation it is necessary for the system to deliver meaningful results in terms of causal (cause-effect) relationship and a structural approach; that is to say that the analysis shall be model-based. Structural equation modeling[6] (SEM) provides a means by which relationships can be tested. The purpose of the approach is to estimate the strength of the causal connections among the latent variables and to test the goodness of fit of the structural model. To estimate the strength of these causal connections, it is necessary for each of the latent variables to be operational in terms of manifest variables (measurement items). In reality, the manifest variables are measured by using measurement items, also, they serve as indicators of the latent variable.

A measurement instrument (i.e., questionnaire) is then developed and used to obtain scores from respondents on a variety of attributes that provide an empirical content to the model's constructs. The labour market matrix is obtained using structural equation models that simultaneously measure the impact of all the variables on globalisation. SEM traditionally has some assumptions, namely: independence of variables, random sampling of respondents, linearity of all relationships, multivariate normality of distribution, no kurtosis and no skewness, appropriate data measurement on interval or ratio scale, and sample size between 100 and 400. The other

[6] Structural equation modelling is also a multivariate technique combining aspects of multiple regression and factor analysis to estimate simultaneously a series of interrelated dependence relationships. Such models include one or more linear regression equations that describe how the endogenous constructs depend upon the exogenous constructs; their coefficients are called path coefficients. It is a powerful statistical approach in that it combines the measurement model and the structural equation model into a simultaneous statistical analysis. It provides parameters estimates of the direct and indirect association between observed variables and tests how well a model explains covariance in the data.

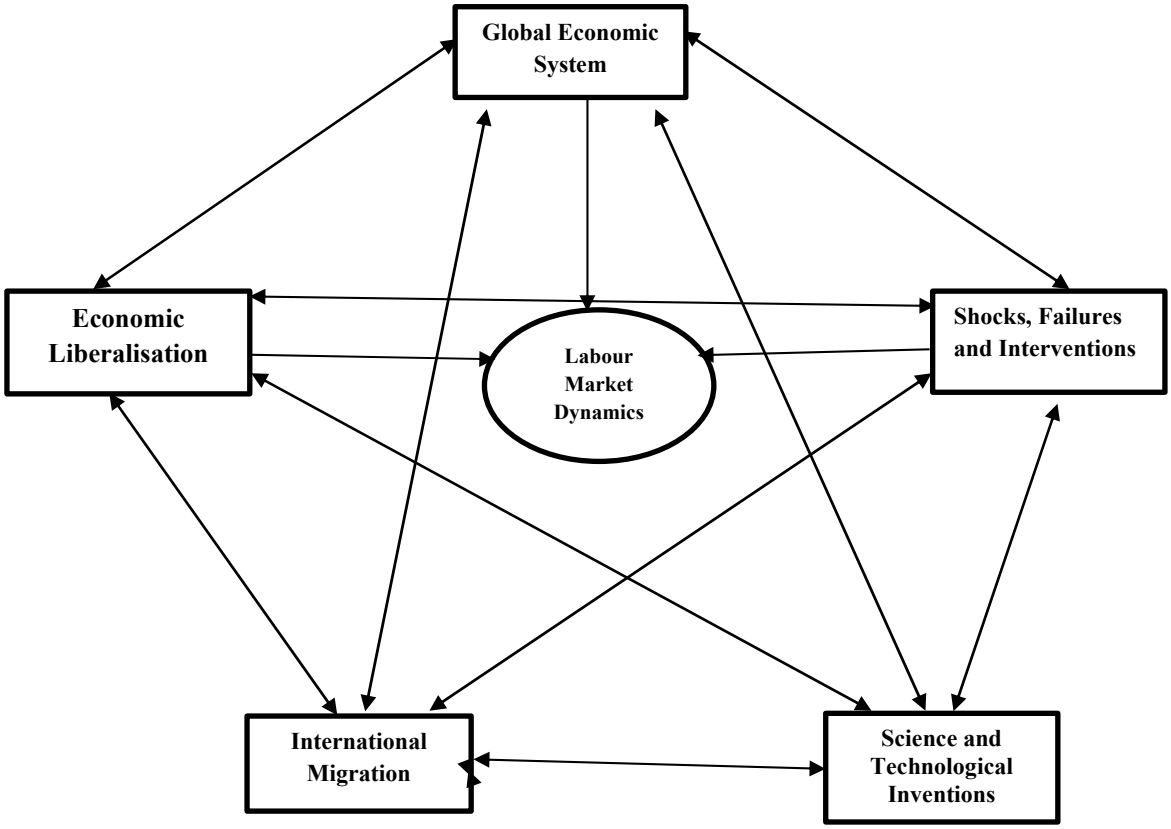
postulate of our model is that labour markets are characterized by the presence of a monopolistic structure and mechanisms.

7. THE SYSTEM MODEL OF LABOUR MARKET DYNAMICS

7.1 The Conceptual Model

The conceptual foundation of this model links the components of global economic system with labour market dynamics under one umbrella. However, global economic system is acomplex multidimensional phenomenon. It can be conceptualised as the combination of various interconnected and interwoven critical driving forces such as, economic liberalisation, international mobility of resources, science and technology inventions, shocks, failures and interventions that separately or jointly influence the labour market outcomes in a region, country or global economy. In turn, each critical dimension of global economic system is comprised of multiple sub-factors that are often a combination of subjective evaluations and more objective macroeconomic statistics. The extent to which the labour market of a country exhibits a risk to global economic system forces depends upon the system of positive and negative linkages.

FIGURE 2 - *The Conceptual Model of Labour Market Dynamics in a Global Economy*



Source: Own construction.

Figure 2 illustrates a complete conceptual model demonstrating the multivariate causal pathways (indicated by the arrows) interlinking the critical forces of globalisation with labour market dynamics. All these are interwoven with each other (as shown by double ⟷ pathway arrow) and they all are jointly leading to and contribute to labour market dynamics (as shown by the single pathway arrow ⟶). All these factors have multiple causal relationships with each other. Global economic system interacts with economic liberalisation, international migration, science and technological inventions, and shocks and stimulants and in turn, impacts the labour market dynamics. Similarly, international migration is also interwoven with other four constructs and contributes to labour market dynamics. It can be concluded that all these constructs are significantly interdependent and interwoven with each other and jointly contribute to overall labour market dynamics.

7.2 The Operational Model

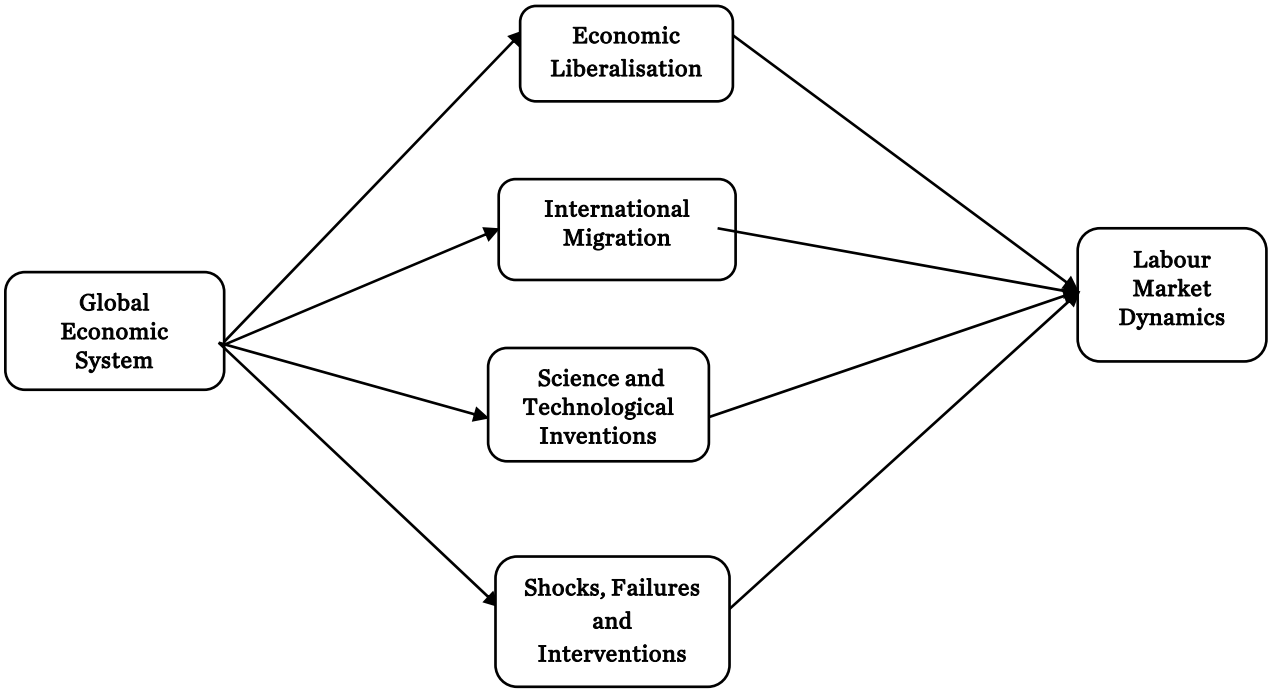
The second stage transforms the conceptual model into operational model by unfolding the complexity via looking deeper into all forces of liberalization causing labour market dynamics. It is at this stage that one needs to identify various critical factors generating labour market outcomes in a region, country or global economy. As adumbrated earlier, there is a whole range of critical factors contributing to labour market dynamics. The model identifies and takes into consideration 48 such factors that are key areas that maybe managed and which improve the overall conditions and performance of labour markets if managed properly. The choice and selection of such factors will depend upon the researcher's judgment, justifications, extensive literature review, emerging empirical evidences and so on. However, these factors can be arranged on the basis of their degree of importance. There may be different ways of assigning weights or importance to these factors. However, in the case of this model, the measurement of labour market dynamics will involve determining weights of these factors automatically by the measurement software. Depending upon the nature and type of the factors, they are grouped into the following six latent variables, namely, global economic system, economic liberalization, international migration, science and technology inventions, shocks and institutions and labour market dynamics (see Chopra, 2011).

7.3 The Latent Variable Structural Model

The third stage transforms the operational model into latent variable structural model that unfolds the complexity in each dimension of global economic system by looking deeper into different factors causing labour market dynamics. A latent variable structural model is a theoretical construct, that is an unobserved variable presumed to exist within a structural model but for which direct measurements are not available. A latent variable structural model is a graphical model that specifies the presumed structure of causal connections among latent and manifest variables (Chopra and Kanji, 2010 and 2011; Chopra, 2011, 2012 and 2015). The latent variable structural model is used to represent the casual relationships among latent variables (Figure 3). It is at this stage that one needs to identify various critical factors generating labour market dynamics in a region or country. The present study identifies and takes into consideration six dimensions and 48 critical factors. The choice and selection of these factors depend upon the

researcher's judgment, justifications, extensive literature review, emerging empirical evidence, and so on.

FIGURE 3 - *A Latent Variable Structural Model of Labour Market Dynamics*



The mathematical equations that express the relationships among latent variables are referred to as the *structural model*. In a latent variable structural model, the *inner model* is the part of the model that describes the relationships between the latent variables that make up the model. In this sense, the *path coefficients* are inner model parameter estimates (inner coefficients)[7].The inner models are also frequently referred to as the structural models. Latent variables as opposed to observed variables are variables that are not directly observed but are rather inferred (through a mathematical model) from other variables that are observed (directly measured). The latent variables will be measured by their manifest variables, which in turn will be represented by measurement items in a questionnaire. The purpose of this work is to estimate the strengths of

[7] In a structural equation modelling analysis, there are two models called as inner model (structural model) and outer model (measurement model). The inner model describes the relationships between the latent variables of model. The path coefficients of inner model are called as inner coefficients. The outer model illustrates the relationships between the latent variables and their indicators (manifest variables). The path coefficients of outer model are called as outer coefficients (weights and loadings).

the causal connections among the latent variables and to test the goodness-of-fit of the structural model. To estimate the strength of these causal connections, it is necessary to operationalise each of the latent variables in terms of manifest variables (measurement items). The manifest variables are measured using measurement items and serve as indicators of the latent variable. A latent variable structural model is expressed in a system of simultaneous equations known as structural equations for the original model. The structural equations generate hypothetical variance/covariance matrix of manifest variables. The degree to which a structural equation model reflects reality is given by the degree to which the hypothetical variance/covariance matrix is similar to, or has a good fit with, the empirical variance/covariance matrix for the same manifest variables. The chi-square for goodness-of-fit statistic is used to evaluate whether manifest variables are related to their respective latent variables. It is also used to test whether the structure among the latent variables is consistent with the data. This new model will provide a deeper understanding and greater theoretical knowledge about the management and the measurement of labour market dynamics.

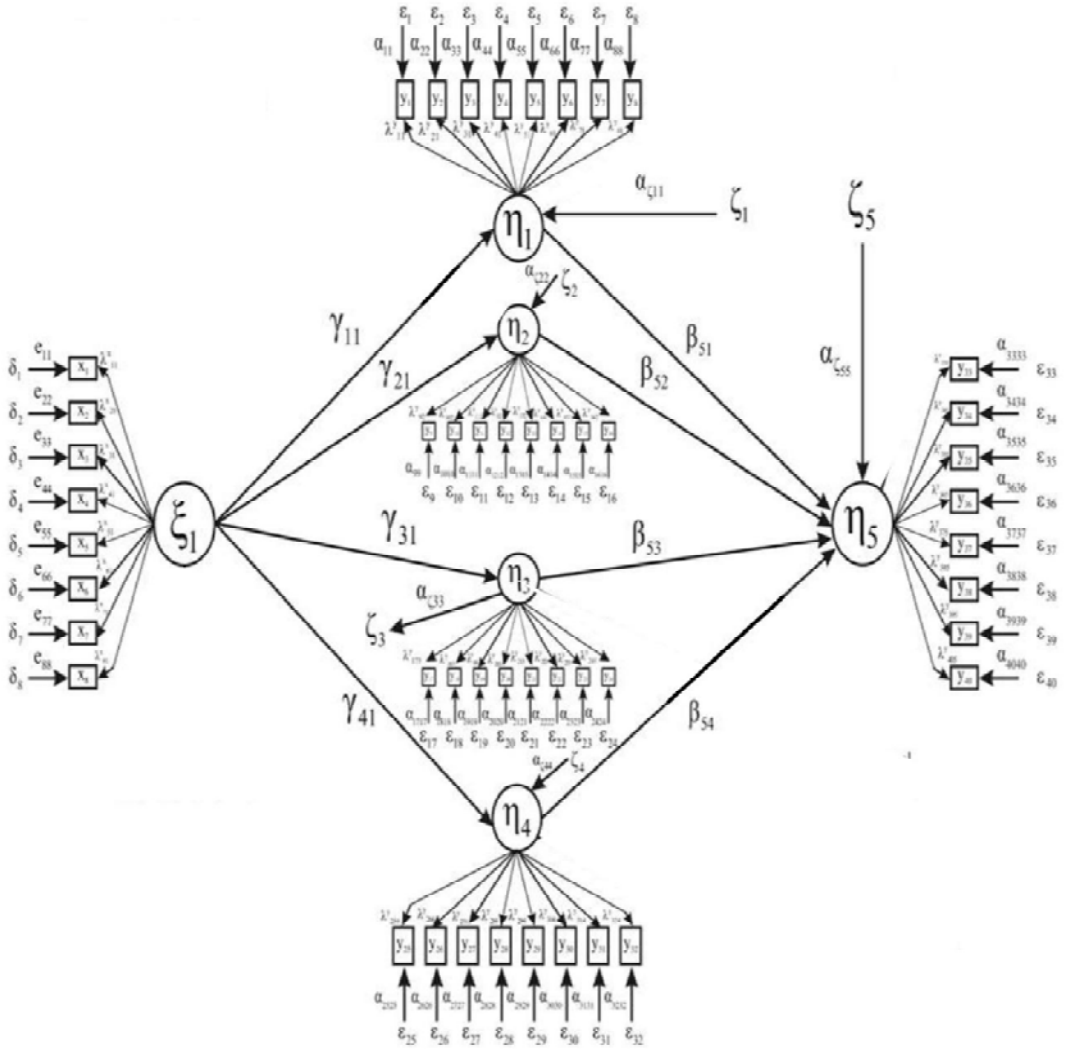
The model contains one latent exogenous[8] variable (ξ_1), five latent endogenous[9] variables (η_1 to η_5), eight observed (manifest) exogenous variables (x_1 to x_8) which feed the exogenous latent variables, and forty observed (manifest) endogenous variables (y_1 to y_{40}) which feed the endogenous latent variables resulting in total forty-eight manifest variables. Thus, ξ_1 is operationalised by eight indicator variables (x_1 to x_8) and is a cause of latent endogenous variables η_1, η_2, η_3, η_4, and η_5 as indicated by arrows from ξ_1 to η_1, η_2, η_3, η_4, and η_5. Eight manifest endogenous variables (y_1 to y_8) serve as indicators of η_1 as indicated by the arrows from η_1 to these variables in squares in Figure 4. The subscript numbers indicate a particular variable's location within the matrices, which are used for calculation purposes. Each operationalisation of the model's latent variables is made in a similar way. The model recognizes that the measures are imperfect, and we make an attempt to model this imperfection. Thus, the model includes terms representing measurement errors or structural disturbances or errors in equations. The measurement error terms associated with 'x' measures are labeled with the eight Greek character

[8] An exogenous variable is a variable that is not caused by another variable in the model. Usually this variable causes one or more variables in the model.
[9] An endogenous variable is a variable that is caused by one or more variable in the model. Note that an endogenous variable may also cause another endogenous variable in the model.

'delta' (δ_1 to δ_8) and each 'x' is also associated with structural parameter[10] (regression coefficient) relating measurement error to manifest exogenous variable (e_{11} to e_{88}, i.e., these are used to indicate the effect of a disturbance variable on an exogenous manifest variable. The measurement errors associated with 'y' (y_1 to y_{40}) are labeled with Greek letter 'epsilon' (ε_1 to ε_{40}) and each 'y' is also associated with structural parameter (weight or coefficient) relating measurement error to manifest endogenous variable (α_{11} to $\alpha_{4040,}$ inner coefficients, i.e., these are used to indicate the effect of a disturbance variable on an endogenous manifest variable). The measurement errors associated with endogenous variables are labeled as ζ_1 to ζ_5 and the structural parameters relating these disturbance variables to latent endogenous variables are labeled as $\alpha_{\zeta 11}$, $\alpha_{\zeta 22}$, $\alpha_{\zeta 33}$, and $\alpha_{\zeta 44}$ (inner coefficients). The characters γ_{11}, $\gamma_{21,}$ γ_{31}, and γ_{41} are the structural parameters relating exogenous variables to endogenous variables (inner coefficients). The Greek characters β_{51}, $\beta_{52,}$ β_{53}, and β_{54} are structural parameters relating the endogenous variables to another endogenous construct.

[10] Structural parameter or coefficient is a measure of the amount of change in the effect variable expected given a one unit change in the causal variable and no change in any other variable. Although like a regression coefficient this coefficient may not be estimable by multiple regression.

FIGURE 4 - *A Multivariate Structural Model of Labour Market Dynamics*



Source: Own construction.

The model in Figure 4 can be expressed by a system of simultaneous equations. One variable is developed for each latent or manifest variable, which means that there are although fifty three equations. Each equation includes the latent and/or manifest variables that have a direct effect on the endogenous variable, including disturbance variables. Thus, the components of a structural equation are the latent variables, structural parameters and a disturbance term. Other endogenous variables will have similar equations. Latent variables structural model is expressed by a system of simultaneous equations. This system of equations is as follows:

$\eta_1 = \gamma_{11}\,\xi_1 + \zeta_1\,\alpha_{\zeta 11}$

$\eta_2 = \gamma_{21}\,\xi_1 + \zeta_1\,\alpha_{\zeta 22}$

$\eta_3 = \gamma_{31}\,\lfloor_1 + \zeta_1\alpha_{\zeta 33}$

$\eta_4 = \gamma_{41}\,\lfloor_1 + \zeta_1\alpha_{\zeta 44}$

$\eta_5 = \beta_{51}\eta_1 + \beta_{52}\eta_2 + \beta_{53}\eta_3 + \beta_{54}\eta_4 + \zeta_5\,\alpha_{\zeta 55}$

$x_1 = \lambda^x_{11}\,\xi_1 + e_{11}\,\delta_1$

$x_2 = \lambda^x_{21}\,\xi_1 + e_{22}\,\delta_2$

$x_3 = \lambda^x_{31}\,\xi_1 + e_{33}\delta_3$

$x_4 = \lambda^x_{41}\,\xi_1 + e_{44}\delta_4$

$x_5 = \lambda^x_{51}\,\xi_1 + e_{55}\delta_{58}$

$x_6 = \lambda^x_{61}\,\xi_1 + e_{66}\delta_6$

$x_7 = \lambda^x_{71}\,\xi_1 + e_{77}\delta_7$

$x_8 = \lambda^x_{81}\,\lfloor_1 + e_{88}\delta_8$

$y_1 = \lambda^y_{11}\eta_1 + \alpha_{11}\varepsilon_1$

$y_2 = \lambda^y_{21}\eta_1 + \alpha_{22}\varepsilon_2$

. . . . . .

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. . . . . .

$y_{37} = \lambda^y_{375}\eta_5 + \alpha_{3737}\varepsilon_{37}$

$y_{38} = \lambda^y_{385}\eta_5 + \alpha_{3838}\varepsilon_{38}$

$y_{39} = \lambda^y_{395}\eta_5 + \alpha_{3939}\varepsilon_{39}$

$y_{40} = \lambda^y_{405}\eta_5 + \alpha_{4040}\varepsilon_{40}$

In the above equations, we have the following definitions:

ξ_1 = global economic system (latent exogenous variable)

η_1 = economic liberalisation (latent endogenous variable)

η_2 = international migration (latent endogenous variable)

η_3 = science and technological inventions (latent endogenous variable)

η_4 = shocks, failures and interventions (latent endogenous variable)

η_5 = labour market dynamics (latent endogenous variable)

λ^x_{11}= structural parameter or regression coefficient linking exogenous construct to its measures (exogenous manifest variables)

λ^y_{11} = structural parameter (regression coefficient) linking endogenous construct to its measures (endogenous manifest variables)

γ_{11} = structural parameters (regression coefficients) relating exogenous variables to endogenous (inner coefficients)

e_{11} to e_{88} = measurement errors associated with manifest exogenous variables

ζ_1 to ζ_5 = measurement errors associated with endogenous variables

ε_1 to ε_{40} = measurement errors associated with manifest endogenous variables

Structural Errors

As it is very rare to expect to perfectly predict the dependent constructs, so it is important to include error term in the latent variable structural model, labeled as the Greek character 'zeta' (ζ). In order to achieve a consistent parameter estimation, these error terms are assumed to be uncorrelated with the model's exogenous constructs. The violation of this assumption comes about as a result of the excluded predictor problem. However, the structural error terms have been modeled as being correlated with other structural error terms. This specification indicates that the endogenous constructs associated with those error terms share common variation that is not explained by predictor relations in the model.

Matrix Equations

A matrix of equations representing the fifty-three-variable-model is created. *Dependent variables* are represented in a random vector η^* that may be portioned as $\eta^{*\prime} = [\eta', x', y']$, where η' is a (transposed) random sub-vector of latent endogenous variables, x' is a (transported) random sub-vector of manifest exogenous (independent) variables and y' is a (transposed) random sub-vector of manifest endogenous (dependent) variables. The number of latent dependent variables

in η' is indicated by m_1, the number of manifest exogenous variables is indicated by m_2, and the number of manifest dependent variables in y' is indicated by m_3. The total number of dependent variables is indicated by m, where $m = m_1 + m_2 + m_3$. The order of η' is thus $m \times 1$.

Independent variables are included in a single random column vector ξ^*. Thus, we may write $\xi^* = [\xi', \eta_1']$ where ξ' stands for a (transposed) sub-vector of latent exogenous variables, and η_y' stands for a (transposed) random sub-vector of manifest endogenous variables. The number of latent exogenous variables included in ξ' is n_1: the number of manifest endogenous variables in η_y' is equal to m (the number of dependent variables). The number of independent variables in ξ^* is thus $n_1 + m = n$, and so the order of ξ^* is $n \times 1$.

The *path coefficients* (inner) γ_{ij} that relate independent to dependent latent variables, path coefficients (inner) β_{ij} that relate pairs of dependent variables and path coefficients (outer) λ^x_{ij} and λ^y_{ij} that relate latent variables with their manifest variables are included in matrix A. Each row of A corresponds to one of the dependent variables and contains structural parameters corresponding to the variable's connections with independent variables that cause it. The *path coefficients* (outer path coefficient or structural parameter) λ^x_{ij} relate latent exogenous variable to its manifest variables and the path coefficients (outer) λ^y_{ij} relate latent endogenous variables to their manifest variables. The elements of diagonal of A are thus ordinarily zero, meaning that a dependent variable does not cause itself, i.e., a zero element of i^{th} row and k^{th} column means that the k^{th} exogenous variable is not the cause of the variable.

The *structural errors* (ζ_{ij}) associated with latent endogenous variables, structural errors (e_{ij}) linking measurement errors to manifest exogenous variables and structural errors (α_{ij}) linking measurement errors with manifest endogenous variables are contained in the matrix Γ^*. The matrix $\Gamma^* = [\Gamma: e: \Delta]$ is partitioned into 'm x 1'matrix; Γ into 'm x n' and 'm x m' for matrix Δ. The rows of Γ correspond to the different dependent variables. The column of Γ corresponds to only one exogenous variable. In the present example, Γ is a 5 x 1 sub-matrix. The sub-matrix 'e' contains measurement errors relating to manifest exogenous variables, and 'e' is a 8 x 8 sub-matrix. The sub-matrix Δ contains structural errors linking measurement errors to manifest endogenous variables. The rows of Δ, thus, also correspond to the different manifest variables, where the

columns correspond to different disturbance variables. In the present example Δ is a 40x40 matrix.

The *disturbance variables* are included in a single random column vector ε^*. This vector may be partitioned to distinguish between manifest and latent exogenous disturbance variables. Thus, we may write $\varepsilon^* = [\alpha_\zeta', \delta', \varepsilon']$ where α_ζ' stands for a (transported) sub vector of latent disturbance variables, δ' stands for a (transported) sub-vector of manifest exogenous disturbance variables, and ε' stands for manifest endogenous disturbance variables. The number of latent disturbance variables in α_ζ' is n_1, the number of manifest exogenous disturbance variables in δ' is m_1, and the number of manifest endogenous disturbance variables in ε' is equal to m_2. The number of disturbance variables in ε^* is thus $n_1+m_1+m_2$.

A more compact form for the general matrix formulation of the linear structural equation model with latent manifest variables is given by

$$\begin{bmatrix} \eta \\ x \\ y \end{bmatrix} = A \begin{bmatrix} \xi \\ \eta \end{bmatrix} + [\Gamma : e : \Delta] \begin{bmatrix} \alpha_\xi \\ \delta \\ \varepsilon \end{bmatrix}$$

or simply

$$\eta^* = A\xi^* + \Gamma^*\varepsilon^*$$

The goal of structural equation model is to show how relationships among manifest variables (given by either correlation or covariance) can be explained in terms of structural equations relating manifest variables to other (possibly latent) variables of the model. To reach this goal it is required that a certain 'selection' equation draws out manifest variables in the sub-vectors x and y, from the larger vectors η^* and y , of variables. The selection equation is

$$\mathbf{y} = [\mathbf{0}:\mathbf{I}] \begin{bmatrix} \eta \\ x \\ y \end{bmatrix}$$

or

$$y = G_y \eta_1^*$$

G_y = **[0:I]** is a partitioned (m_2 x m) 'selection' matrix with **0,** an m_2 x m_1 null matrix and **I**, an m_2 x m_2 identity matrix. In other words, G_y contains zero elements everywhere except for a single element of unity in each row placed in the appropriate column of G_y to 'select' a corresponding manifest dependent variable for η^*.

The matrix reflecting the variances and covariance among independent variables of the model is

$$\mathbf{\Phi = E(\xi^* \xi^{*\prime})}$$

The model requires that exogenous variables are independent of disturbance variables. This requirement is expressed mathematically by the requirement

$$E\ \varepsilon[\xi']$$

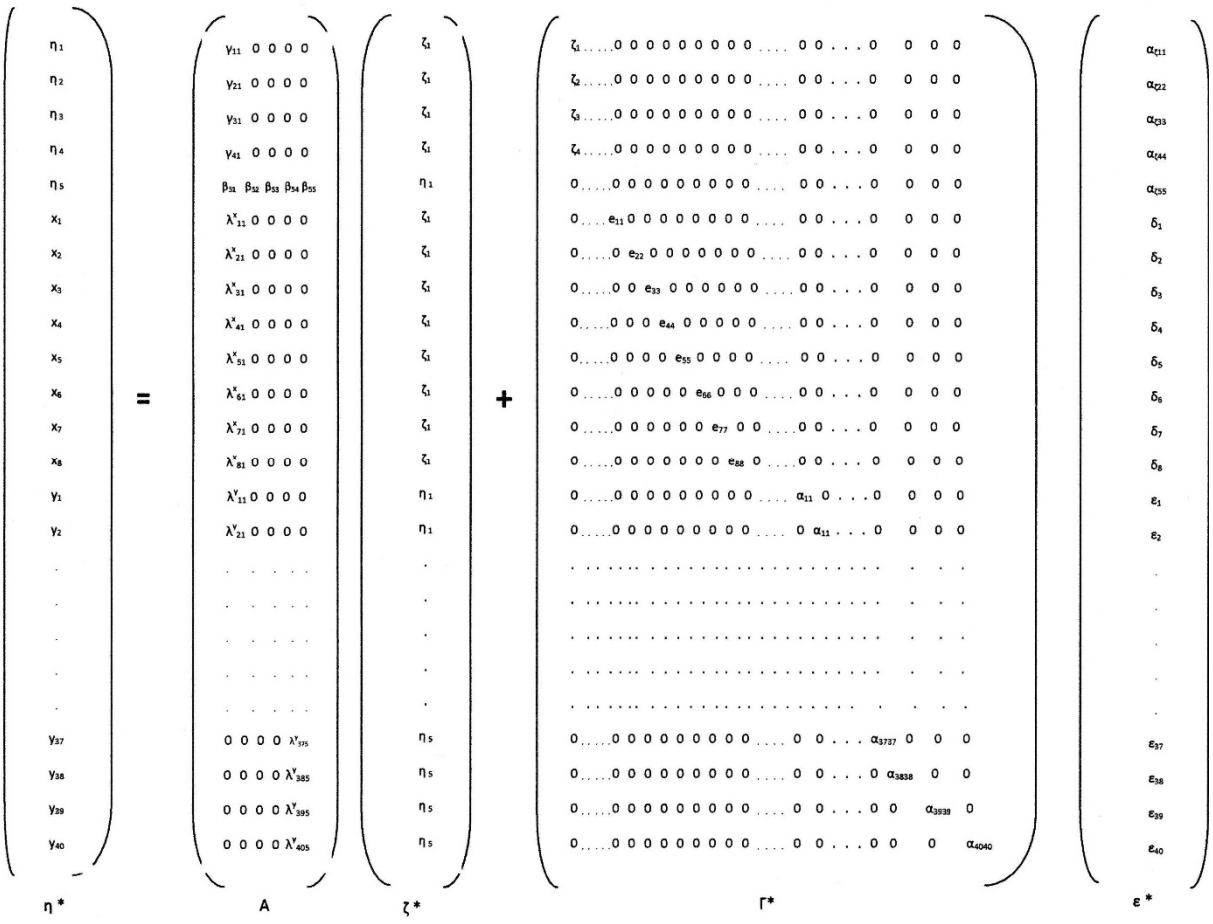
where, E is the expectation operator.

The effect of this requirement appears in the matrix and may be seen in a partitioning of this matrix as

$$\Phi = \begin{pmatrix} \eta & 0_{\varepsilon\varepsilon} \\ y & \Phi_{\varepsilon\varepsilon} \end{pmatrix}$$

where $\Phi_{\varepsilon\varepsilon} = E(\xi\xi')$ and $0_{\varepsilon\varepsilon} = E(\varepsilon\varepsilon')$.

The terms $E(\varepsilon\xi')$ and $E(\xi\varepsilon') = 0$ in above equation.



The variance/covariance matrix among manifest variables is given by

$$\Sigma_0 = \Sigma_{yy}$$

where according to the model,

$$\Sigma_{yy} = \Sigma(yy') = G_y B^{-1}\, \Gamma^*\, \Phi\Lambda^{*\prime} B^{-1'} G_y'$$

The above equation implies that a predicted or hypothetical variance/covariance matrix Σ_0 for the set of observed variables in random vector $\mathbf{y}$ may be derived from the parameter values of a hypothetical structural equation model. Therefore, the degree to which the hypothetical structural equation model reflects reality is given by the degree to which the hypothetical matrix Σ_0 is the same as the empirical variance/covariance matrix Σ for the same variables (in $\mathbf{y}$) obtained

from measurements of these variables in the world. To make the comparison between the hypothetical matrix Σ_0 and the empirical matrix Σ is the goal of a confirmatory analysis using structural equation models with latent and manifest variables. In practice, Σ_0 and Σ are replaced with sample estimates namely, Σ_0' and $\mathbf{S}$ respectively.

Model Identification and Path Coefficients

Before the values of path coefficients can be obtained, the structural equation model must be specified in such a way that the 'model' is 'identified'. Identifying a model involves fixing the values of some coefficients (fixed parameters) and using data to estimate values of other coefficients (free parameters) that would result in a unique hypothetical population covariance matrix of manifest variables (James *et al.,* 1982). The least squares estimation method is used to minimise the sum of squared differences between the elements of sample covariance matrix (S) and the hypothetical population covariance ($\Sigma 0'$) matrix for manifest variables.

Analysis of path coefficients begins with the outer path coefficients. For every relationship, all measurement items with values of path coefficients that are less than 0.1 is removed from the model. This is to ensure that only manifest variables that adequately reflect the empirical content of latent variables are retained for further analysis. Usually PLS has to be run several times to remove all manifest variables that are poorly linked to latent variables. The outer coefficients of remaining manifest variables are then used to compute critical food crisis factor and global food crisis indices for the study samples by using a mathematical expression that takes into account item mean scores and number of points in the scales. Following the analysis of outer coefficients, the research is then concerned with inner coefficients, which represents the amount of change in a dependent variable, expressed as multiples of standard deviation, when the value of its independent variable is changed by one unit.

Standardised inner coefficients cannot be compared across groups of sample, nor can those that are produced by the same population over time. However, standardisation of data simplifies the computation of path coefficients because correlation matrix of manifest variables is used instead of the covariance matrix. In the PLS method, the values of inner coefficients for causal connections that do not involve a single dependent variable can be easily determined by reading their values directly from the correlation matrix. The values of inner coefficients for causal

connections that involve a single dependent variable, however, have to be solved from the following equation (Namboodiri *et al.*, 1975):

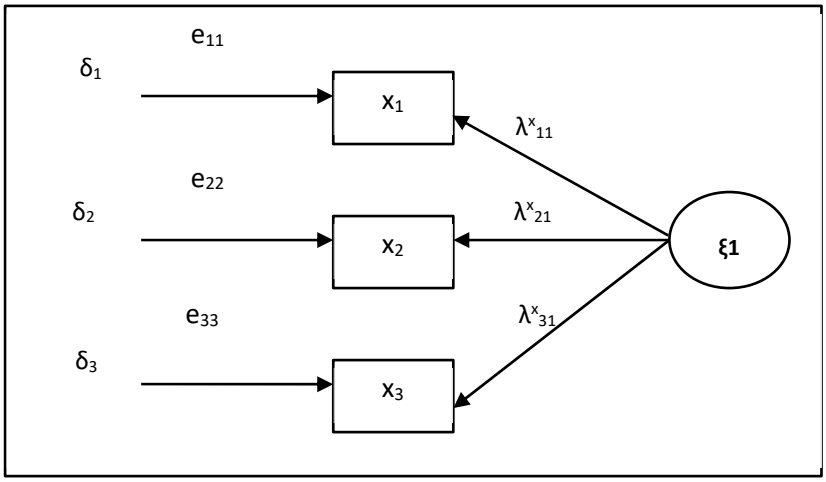
$$r_{ij} = \sum_{k} p_{ik} r_{kj}$$

where i = endogenous variable (I > k,j); j = causal variable; and k begins with I-1 and ranges down to 1 (i.e., η_1).

8. The measurement model of labour market dynamics

The fourth step in this model is to convert the structural model into a measurement model of labour market dynamics. The equations that express the relationships between latent variables and indicators are referred to as the *measurement model*. The *outer model* is the part of the model that describes the relationships between the latent variables and their indicators. The outer models are also frequently referred to as the measurement models. Thus, the outer models containing weights and loadings are also referred to as measurement models. At this stage, the latent constructs, which, though not directly measurable, are translated into a set of indicators (manifest variables). Each latent variable is usually associated with multiple measures. The measurement model is the mapping of measures onto theoretical constructs. The latent constructs are most commonly linked to their measures (manifest variables) through a factor analytic measurement model, i.e., each latent variable construct is modelled as a common factor underlying the associated measures. These 'loadings' linking latent constructs to measures are labeled with the Greek character 'lambda' (λ) and there are two separate 'lambda matrices', one on the X side (λ^x_{11}) and one on the Y side (λ^y_{11}) as shown in Figure 5. The labour market dynamics measurement model is the congeneric measurement model, where each measure is associated with only one latent construct, and all covariation between measures is a consequence of the relations between measures and constructs. Most of the models in use are indicative or non-prescriptive models, whereas measurement model is an improvement or prescriptive model. For the measurement of the phenomenon, the main objective is to develop a suitable latent variable structural model that shows relationship between latent variables, other intervening variables and ultimately labour market dynamics.

FIGURE 5 - *The Measurement Model of Labour Market Dynamics*



Measurement Error

Almost every measure is acknowledged to include some errors since the measures are imperfect and this imperfection is modelled by including terms representing measurement errors in the equation. These measurement error terms are uniquenesses or unique factors associated with each measure. Measurement error terms associated with X measures are labeled as the Greek character 'delta' (δ) while terms associated with Y measures are labeled with 'epsilon' (ε).

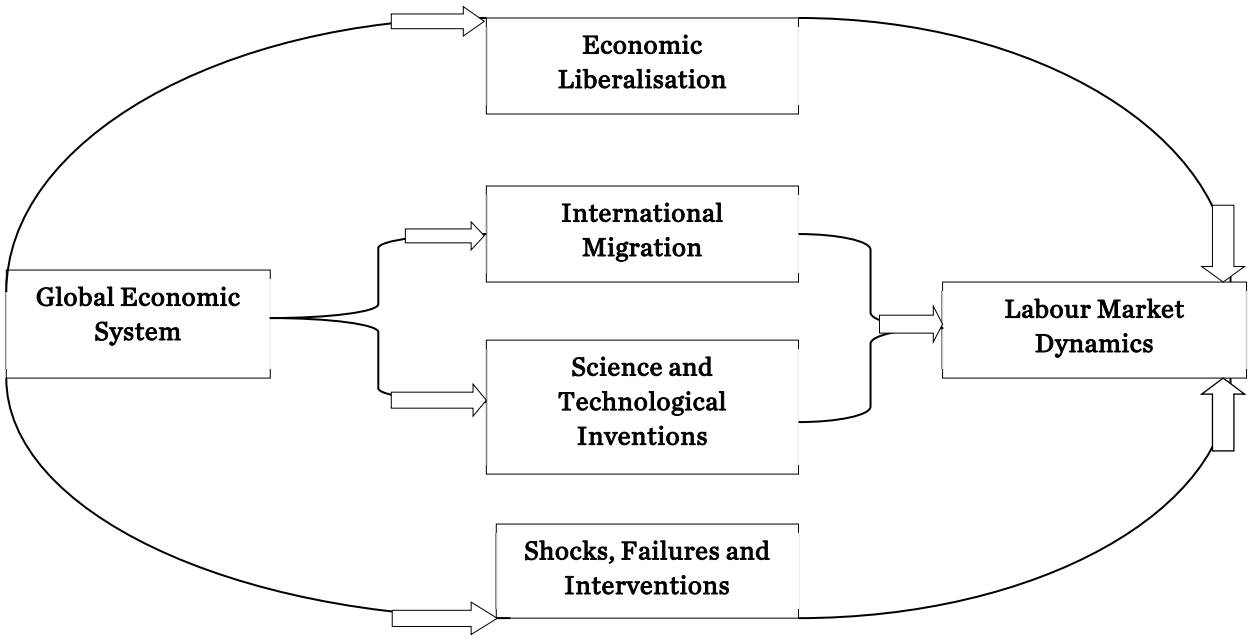
To estimate the strengths of causal relations, it is necessary to operationalise each of the latent variables in terms of manifest variables that are believed to be caused by a latent variable. In this sense, each latent variable has the role of a common factor, and the manifest variables serve as manifest indicators of the common factor. The empirical content of each manifest variable is reflected directly by assigning observable events to values on the measurement scale of the variables. The measurement model contains the followings:

Multivariate Casual Pathways Model of Labour Market Dynamics

Figure 6, a graphical representation of the model, matches the paths and interrelationships to the variables. In this step, a systems model is used to establish the set of structural and measurement elements that links the diagram to the constructs of the theory. Structural equations can be used to link the constructs. Variables were assigned to the specific constructs showing which variables measure which constructs. A set of matrices is used to indicate the hypothesized constructs from

the critical globalisation factors to the constructs or variables. The model has been designed to identify the manifest variables to the latent variable constructs.

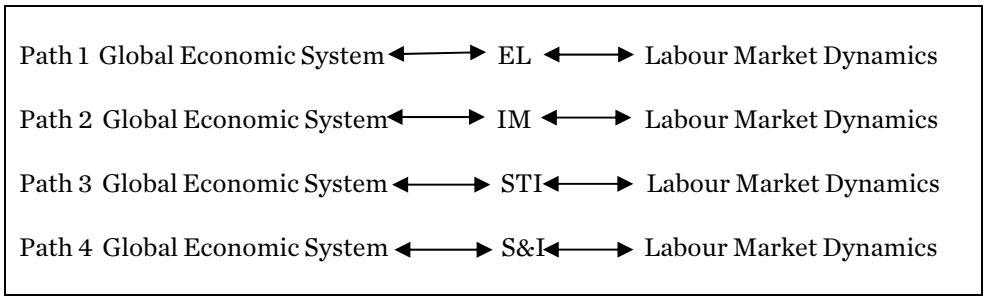
FIGURE 6 - *Multivariate Casual Pathways Model*



All the variables in the model are dependent variables except Global Economic System, which is an independent variable. All dependent variables are directly connected with independent variables except Labour Market Dynamics. Therefore, the dependent variable Labour Market Dynamics is indirectly linked with the independent variable Global Economic System through four causal pathways. In PLS, functional equations are formatted for every causal connection. These equations take into account path coefficients and variable mean scores. It is possible to calculate the contribution of each variable toward labour market dynamics from the value of path coefficients. The model has four pathways going through it each starting from Global Economic System and ending with Labour Market Dynamics, as shown in Figure 7.

The arrow ⟷ shows that the pathway is on both sides and that a unit change in Global Economic System produces changes in International Migration and subsequently in Labour Market Dynamics and vice versa.

FIGURE 7 - *The Four Pathways through the Causal Pathways Model*



Elements Measurement

The measurement of the elements is based on the Analysis of Covariance Structures. The model used matrix notation in a statistical package to set up the simultaneous equations. All structural parameters assume values that reflect the strengths of causal relationships. Specially, each structural parameter reflects the amount of change in an effect (endogenous variable) that results from a unit of change in a cause (exogenous variable or preceding endogenous variable) with all other causes of that effect held constant. A key objective of representing the model as a latent variable structural model is to do a confirmatory analysis to estimate the values of the structural parameters. The ε_i's associated with each endogenous variable are the 'disturbance terms'. Disturbance terms involve variation in an endogenous variable that is not to be attributed to the causes of that variable included explicitly in a structural model. In the structural model, the sources of variation include (a) random shocks and/or unmeasured or omitted causes, (b) random measurement errors in the effect and the causes, where the primary concern is error in one or more of the causes, and (c) non-random measurement, such as bias in scales of measurement and method variance. The inclusion of the disturbance variation in the model makes it a probabilistic model.

Functional Relations

The causal relations in the model can be expressed as functional relations, that is, a function having an effect on one or more causes. The functional relations are asymmetric because their causal directions are unidirectional. It can be observed from the structural model that there are four types of functional relations: (a) relation between an exothermic latent variable and an endothermic latent variable; (b) relation between an exothermic latent variable and manifest

indicator variables; (c) relation between an endothermic latent variable to one or more endothermic variable(s); (d) relation between a latent endothermic variable with manifest indicator variables. In structural models, functional relations are analysed by using structural equations.

Structural Equations

The above four types of functional relations can be expressed as a system of equations known as functional equations. For the model, there is one endogenous variable and forty eight manifest variables, which mean that altogether there would be forty eight equations in the system of functional equations.

Empirical Support for Functional Equation

The confirmatory analysis using manifest variables may proceed only if the manifest variables are reasonably accurate representations of the constructs. The objective of such an analysis is to check whether a structural model can be confirmed. Confirmation implies that a structural model and functional equations representing the model are useful for making causal inferences to explain how variables occur (excluding purely exogenous variables). Non-confirmation implies that the structural model (functional relations and equations) are not useful in this respect. The functional relations and equations in a linear structural model may be used to drive a set of predictions regarding the observed correlations (or variance/covariance) among the manifest variables. A structural model is confirmed if the predictions regarding correlations (variance/covariance) among manifest variables are consistent with the observed (i.e., empirically derived) correlations (variance/covariance) among manifest variables. Non-confirmation is implied if predictions and observed correlations (variances/covariances) are inconsistent.

Confirmation of predictions implies support for the structural model represented by the functional relations as equations. Non-confirmation of predictions implies that one or more components of structural model (functional relations and equations) is (are) false, in which case it is concluded that the structural model proposed originally is invalid. Predictions regarding correlations (variances/covariances) among manifest variables and confirmation/non-

confirmation of these predictions can be addressed empirically by testing predictions regarding the magnitudes of estimates of structural parameters.

Solutions and Estimates of Structural Parameters

Structural equation modeling (SEM) provides a means by which relationships can be tested. The purpose of the approach is to estimate the strength of the causal connections among the latent variables and to test the goodness of fit of the structural model. To estimate the strength of these causal connections, it is necessary for each of the latent variables to be operational in terms of manifest variables (measurement items). In reality, the manifest variables are measured by using measurement items, such as questionnaires; also, they serve as indicators of the latent variable. A measurement instrument is then developed and used to obtain scores from respondents on a variety of attributes that provide an empirical content to the model's constructs.

The importance of meeting these conditions depends on the estimation methods used. Some estimation methods can adjust for the violation of some of these assumptions. In structural models with latent variables, we make the assumptions that the distribution of the manifest variables is a function of their variance/covariance matrix. By making this assumption, it is possible to determine the non-fixed parameters of the model. The estimated and fixed structural parameters of a structural equation model determine a hypothetical variance/covariance (correlation) matrix for the manifest variables (Y_o) under the assumption that the model is valid. The structural parameters y and α computed are actually unstandardised regression coefficients of the structural equations. In the PLS method, the structural parameters of the structural equation linking latent variables and manifest variables are called structural weights.

Measurement Software

The statistical reasoning behind the model is relatively complex, but the user will not need to have any particular mathematical expertise, although some basic skills and statistical knowledge will help. To support the implementation of the model, there are many user-friendly statistical software products such as SPSS/AMOS, LISREL, EQS, SEPATH, and so on, that calculate the estimates of the parameters of structural equation models, all the associated indices and produce some standard graphics. It is based on a structural equation modelling technique which combines

aspects of multiple regression and factor analysis to estimate simultaneously a series of interrelated dependence relationships. The software essentially uses the Partial Least Squares (PLS) method in the simultaneous estimation of the weights of the constructs of the model, calculates these weights in a way that maximises the goodness of fit of the model and thus has the ability to explain labour market dynamics as the ultimate endogenous variable. It is not necessary to have any particular expertise to work with the software package. Anyone who feels comfortable working with Windows usual software programs will soon become familiar with this package. The software generates several types of outputs: outer coefficients (γ, a); inner coefficients (γ, a); Pearson correlation coefficient square (inner r2); Pearson correlation coefficient (inner r) and Cronbach coefficient (α).

Outer Coefficients (Structural Weights)

The outer coefficients are the unstandardised structural weights of manifest indicator variables. Structural weights must have values significantly different from zero for a confirmation or non-confirmation of a model. Specially, each structural weight reflects the amount of change in an effect (endogenous variable) that results from a unit of change in a cause (exogenous variable or endogenous variable), with all other causes of that effect held constant.

Inner Coefficient (Structural Parameter of Latent Variables)

Structural parameters are the coefficients of functional equations linking latent variables. Structural parameters must have values significantly different from zero for confirmation or non-confirmation of the model. These values reflect the strengths of causal relationships. Specifically, each structural parameter reflects the amount of change in an effect (endogenous variable) that results from a unit of change in a cause (exogenous variable or preceding endogenous variable), with all other causes of that effect held constant.

Variability Analysis

The variability analysis may be undertaken by taking into use: (a) *Standard Deviation:* The standard deviation is the standard error of sample estimate of a structural parameter associated

with a causal connection. It provides information on the spread of the parameter estimate from the mean.

Coefficients

The t-coefficient of a structural parameter is the confidence interval around the estimate of the structural parameter. By using the standard error of the parameter, if the confidence intervals constructed around the structural parameter differ significantly from zero, then it can be concluded that there exists a causal connection between the variables in question.

Causality Analysis

The causality analysis is done with the help of: (a) *Correlation Matrix (γ_{ij}):* This is the Pearson correlation, r, matrix among all the exogenous and endogenous variables in the model. Values in the matrix corresponding to latent variables that have cause and effect relationship provide additional indication of strength of their relationship. (b) *Coefficient of Determination (r^2):* The coefficient of determination (r^2) represents the proportion of regression sum of squares corresponding to latent variables. The regression model explains the proportion of the total variation due to the cause-variable and the proportion due to randomness and other variables. (c) *Pearson Correlation Coefficient (r):* Pearson correlation coefficient r is the correlation of latent variables that have causal connections. The closer this value is to ±1, the stronger is the relationship between the variables in both directions.

Cronbach Alpha (Coefficient α)

Coefficient α value provides an indicator of internal consistency of latent variables that are being empirically reflected by manifest variables. It is calculated using variance of individual questions and covariance between items. The formula is:

$$\alpha = \frac{k}{k\text{-}1} \left\{ 1 - \frac{\Sigma\sigma_i^2}{\Sigma\sigma_i^2 + 2\Sigma\ \Sigma\sigma_{ij}^2} \right\}$$

where, k = the number of items in the scale, σ_i^2 = the variance of item i, and σ_{ij} = the covariance of the items i and j. Computing alpha divides total variance into signal and noise components. In other words, the total variance that is equal to the signal is equal to alpha. The second term in brackets represents the noise in the model. A coefficient α value of more than 0.7 indicates the consistency of the questions as appropriate to the reliability of the measurement scale.

The Labour Market Dynamics Derived

The model uses a ten-step scale in order to provide reliable data. All these variables are scored based on the average score on their respective data. This average is useful when analysing how well labour market is performing in a country. Labour market dynamics are not the total average of all the variables, the dynamics are based on how well or badly all other dimensions of global economic system are performing. The labour market dynamics are dependent on how the variables correlate and thereby produce certain outcomes.

Knowing the relationship between critical global economic system forces and labour market dynamics is useful in examining the strength of these forces to determine which one needs to be controlled by policy options and by how much, and in what ways in order to improve labour market performance. The labour market matrix is also influenced by the structural weights and the scores of manifest variables that are linked to it as specified by the mathematical formula as follows:

$$\text{LMD} = \left[\frac{\sum_{i=1}^{n} w_i x_i - \sum_{i=1}^{n} w_i}{(N-1)\sum_{i=1}^{n} w_i}\right] \text{x } 100$$

where LMD = labour market dynamics; N = number of points on the scale; x_i = manifest variables for each latent variable; and w_i =outer coefficients. A step-by-step procedure for analyzing the dynamics of labour market is discussed in Chopra and Kanji (2011).

9. Conclusions

Strong demand for a systems model to measure the dynamics of labour market can hardly be exaggerated. The present paper endeavors to accomplish that demand by proposing a theoretical measurement system based on a systems thinking approach that can be applied in different situations across the world by utilizing the empirical data. The dimensional structure of this

model takes into consideration a whole range of factors and variables, both latent and manifest, such as economic liberalization, international migration, science and technological inventions, and shocks, failures and interventions and constructs a theoretical framework to analyse their simultaneous effects on the outcomes of labour market dynamics in an economy within the boundary of global economic system. In order to achieve this aim, it uses systems model approach and PLS path modeling as a way to build casual pathways for global economic system forces and to estimate the relationships between them. The procedure is free from the danger of tendency to overestimate or underestimate outer or inner relationships. The estimates so obtained are robust since when the number of observed variables and sample size increases, the quality of the PLS path modeling estimates increases. This paper develops a model encompassing four interlinked multivariate models of labour market dynamics. Since after specifying, the model needs to be identified, estimated, tested and manipulated, the relationships among the variables (both measured and latent) are shown in the measurement model. Only the relationships between the latent variables are shown in the structural model. One important benefit of using latent variables is that they are free of random error. The error associated with the latent variables is statistically estimated and removed in the structural equation modeling analysis. Only a common variance remains. Each construct of global economic system such as economic liberalization, international migration, science and technological innovations and shocks, failures and interventions is operational using collected data and the entire system is estimated using PLS method. This modeling methodology offers a number of advantages over other measures. First, the use of collected data for each construct increases the provision of the estimate of labour market dynamics. Second, the collected qualitative and quantitative data are converted and measured on a ten-point scale in order to enhance reliability. Third, the labour market dynamics are constructed by weighting the individual items such that the resulting matrix has a maximum correlation with critical global economic system forces. Last but not the least, the identification and assessment of various critical forces provide a feasible means for strategically integrating various concepts and captures, validates and distributes new knowledge fast enough to change strategic direction of labour market policy makers and resource allocation to manage labour market dynamics in a global turbulent environment.

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