



Macroeconomics of Artificial Intelligence: Structural Unemployment and Labor Market Shifts in the Global Economy

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Abstract

Structural unemployment has been leading to the development of a long term and intricate problem in the labour market all over the world which is not triggered by arbitration, but instead structural change in the economy. This review examines the complex nature of causes and effects of structural unemployment and we look at technological development, globalization, skill mismatch and institutional reaction. The literature review is a synthesis of evidence to track how the automation and artificial intelligence have been depriving humans of their routine-based jobs, and globalization has resulted in offshoring of labor and regional inequality. One of the most important themes is loss of relevance between education systems and labor needs that results in an increase in mismatch of skills and more unemployment durations. Another issue discussed in the review is how effective active labor market policies (ALMPs), reskilling programs, and other emerging policies such as Universal Basic Income are in dealing with long-term unemployment. Even after various interventions, structural unemployment persists particularly in the developing economies where institutions are weak and the labor markets informal. The paper then draws conclusions on recommendations of long-term integrated, inclusive, and futuristic reforms of the labor market which should align education, technology, and policy innovation. The implications of the findings confirm the necessity of international collaboration and flexible policy systems in order to respond to the changing patterns of employment.

Keywords: Structural Unemployment; Technological Disruption; Artificial Intelligence, Labor Market Shifts; Automation; Globalization; Skill Mismatch; Active Labor Market Policies (ALMPs); Reskilling

1. Introduction

Labor in the global market has transformed greatly in recent decades and this has been characterized by development in technology as well as globalization and the changing nature of production and consumption. A major result of such transformations was structural unemployment- the form of long-term joblessness which is caused by deep changes in the economy which shift the demand of skills and occupations. Structural unemployment unlike cyclical unemployment is associated with the shifts in the economy such as movements between supply and demand due to skill definitions that do not go along with the dynamics of employers (Nickell et al., 2005).

Both the developed and developing economies have found it necessary to concentrate on structural unemployment because of its enduring character and the inability to solve the problem using the conventional macroeconomic instruments. As an example, the spreading use of automation and artificial intelligence (AI) has eliminated significant parts of routine jobs, especially in the manufacturing and administrative fields (Acemoglu & Restrepo, 2019). These technological upheavals have further stoked the already existing skill mismatches to the extent where large numbers of workers are rendered unemployable in a sector that currently requires a completely new set of skills.

Globalization as well has been instrumental in redefining the labor markets through the relocation of these productions away to those having competitive advantages especially in terms of labor cost. This has resulted in job loss in high earning countries and the informalization of labour in the lower earning countries (Autor et al., 2013). Globalization has been used to advance economic growth but at the same time, enhancing inequities as it has led to the polarization of employment opportunities. Empirical evidence suggests that there has been a significant contribution of regional employment shocks and wage conversion in developed economies because of the exposure to developing economies through trade (Pierce & Schott, 2016).

Moreover, there are more complexities brought about by demographic changes and evolving nature of work. New workers expanding into the labor markets do not have the experience or training skills needed to handle emerging jobs, and the older workers are also not able to switch to the new high-tech industries (Lindley & Machin, 2013). These trends have become even more pronounced with remote work and digital platforms in the post-COVID world that has brought new forms of employment opportunities but has also aggravated disparities among those without digital abilities or access to the digital world (ILO, 2021).

Alteration of the landscape of the labor market has also taken place with the fourth industrial revolution, which is typified by infusion of digital, biological, and physical systems. Studies have indicated that automation enhances some of the high skill occupations, but tends to replace low-skilled ones, a trend that causes more segmentation in the labor market (Bessen, 2019). Additionally, the rate and magnitude of technological advancement have exceeded the systems of education and professional training in numerous nations, and a considerable part of the labor market has been at danger of being dispensable (Arntz et al., 2016).

Considering these are multi-dimensional as well as interdependent factors, there has been an increasing necessity to review the literature of structural unemployment and global shifts in the labor markets systematically. This review will aim at synthesis of current studies, pinpointing the drivers and impacts, and examining policy interventions meant to address such problems. The study will examine historical patterns, changes brought about by technology and globalization, the problem of skill match and policy responses on various economies.

Such is the importance of the theory of structural unemployment in a global economic scenario not only to those belonging to the fraternity of economists, those of labor theorists, but even the policymakers, teachers, and development services in so far as they are concerned with the design of inclusive labor market policies. The world is increasingly coming into a highly computerized and automatized economy, that ensures that regardless of the level of automation, there is still retainment of a responsive workforce with transferable skills. Based on extensive research in scholarly literature, this paper aims to provide suggestions regarding the dynamism of work and unemployment and propose the course towards equitable and sustainable systems of employment in the global economy.

2. Methodology

This review article uses narrative and thematic approach as a means of synthesizing and critical appraisal of the scholarly literature concerning structural unemployment and changing fate of labor in the world market. In the review, the peer-reviewed journal articles, working papers, policy reports, and institutional publication have been discussed to provide historical context and currency. The academic databases, including Google Scholar, JSTOR, EconLit, ScienceDirect, and SSRN, were identified as the sources together with reports of authoritative organizations, which are the International Labour Organization (ILO), World Bank, OECD, and World Economic Forum (WEF). The strategies used in search, comprised keywords, as well as Boolean logic (structural unemployment, labor market transformation, technological unemployment, automation and jobs, globalization and employment, and skills mismatch). Selection of articles included publications that were related to the topic of the study, the strength of the methodology, and the geographical differentiation, and the preference was given to the empirical studies, meta-analyses, and reviews of policies. The inclusion criteria stipulated that the sources were to directly look into the causes, implications, and the policy responses to structural unemployment or look into the major changes in the composition and the dynamics of the labor market worldwide. The focused selection of scholarly articles and policy reports resulted in a common theme strain of 55 scholarly articles and 18 policy reports that were categorized into five fundamental dimensions, i.e., (1) the historical progression of structural unemployment, (2) the state of technological development and automation, (3) globalization and displacement of labor, (4) education and skills mismatch and (5) labor policy and institutional responses. The thematic synthesis used in this paper gives an orderly method in determining the research patterns, theoretical growth, important findings, gaps in research and future direction of labor market decisions.

3.1 Historical Context of Structural Unemployment

The problem of structural unemployment is not novel in the economy, with the genesis of the same as far back as the century of giant industrial and technological changes. The integration of industrial systems, which replaced agrarian systems in the 19th and 20th centuries, already demonstrated the displacement causes of large-scale mechanization. It was however in the 1970s and 1980s that structural unemployment became more pronounced due to the oil shocks, globalization and also the recession of manufacturing sectors that has resulted in the dramatic shifts in labor markets in the advanced economies. Nickell, Nunziata, and Ochel (2005) point out that the OECD countries experienced the characteristics of long-term unemployment which was not sensitive to the standard macroeconomic measures thus causing the researchers to distinguish between structural and cyclical unemployment. According to Saint-Paul (1994), rigid institutions of labor, including the high power of the trade unions and high rate of unemployment pay played a large role in the continued high unemployment within the European continent since it inhibited the harmony and flexibility of the economy to adapt to the industrial changes.

In addition, the transformation of the occupational structure was also caused by coming of the service-based economies. Sectors that used to employ huge chunks of the population started becoming smaller with improved productivity and outsourcing. It was during this period that the phenomenon of jobless growth, that is where the economy increases but employment does not increase, became common (Gordon, 1997). The structure of structural unemployment has changed in the 1990s when post-communist countries were actively privatized and the high pace of privatization caused massive job losses due to lack of large safety nets and retraining schemes (Boeri, 2000). These historical events emphasize how structural unemployment is ongoing and how institutional set-ups, technological shifts, and the spread of globalization are some of the factors key in this phenomenon.

3.2 Technological Advancement and Automation

The 21st century has brought about a series of technological advancements that have all been termed as the Fourth Industrial revolution whose effects have tremendously changed the required labor in practically all industries. The application of automation, artificial intelligence (AI), machine learning and robotics has resulted in a huge decrease in mundane manual and mental efforts. The first categorization of jobs as routine or non-routine and how jobs are disproportionately impacted by automation is with Autor, Levy and Murnane (2003). This job polarization contributes to a hole effect of the labor market where both profession jobs at high-skilled end and service jobs with low skill increase, whereas middle-class employment is deteriorating.

This was further opened up by Acemoglu and Restrepo (2019) that informed how industrial robots have already replaced human labor in such a way that employment ratios to people and average wages have dropped in some industries such as automobile industries and logistics. In less developed countries, automation has not reached labor markets to such an extent but there is a threat that more active use of AI might bypass the usual avenues of employment in one leap (Chiacchio, Petropoulos, & Pichler, 2018). Also, the COVID-19 pandemic has rapidly increased the rate of digitalization in all industries, compelling businesses to implement remote

work, digital customer services, and automatization. It opened up new possibilities in the sphere of IT and digital services but added to structural unemployment in those industries unable to move to online work, including the tourism industry, the hospitality industry, and the informal labour sector (ILO, 2021).

Opponents estimate that automatization does not always eradicate the overall number of jobs as instead it changes them. Bessen (2019) focuses on stating that the new job opportunities are frequently brought on the demand side effects, i.e., the formation of data analysts, AI ethicists, and cloud architects but studies show that individuals who lose their job do not have sufficient abilities to work in a new position. As a result, it is not a mismatch based on the deficiency of jobs, but it is a mismatch based on the absence of correctly qualified candidates. This is a factor of impairing long-term unemployment and underemployment especially in older workers and workers lacking access to a life-long training.

3.3 Globalization and Labor Displacement

Along with the globalization, there have been the two faces of the game of labor market restructuring. On the one hand, it has enhanced economic growth through opening of trade and global distribution of resources. Conversely, it has been a major source of displacement of labor especially in the developed economies as industries are being challenged by the low wage nations. Autor, Dorn, and Hanson (2013) invented the phrase China Shock, which was used to refer to how the penetration of imports to the US via Chinese importation affected the jobs of manufacturing workers in the US negatively between 1990 and 2007. Their analysis revealed that areas that were most subjected to the Chinese imports had long-term unemployment, reduced labor force and the stagnating wages.

Rodrik (2018) points to the fact that whereas globalization contributes to economic effects in the macro-economic arenas, it has distributional effects to the specific regions, sectors and demographics. In developing economies, globalization has created a spur in demand of jobs that are labour intensive such as in the textiles and electronics sectors. This expansion is however risky, informal, and non-secure in nature. Moreover, even those industries, which are more labor-intensive, are vulnerable to this threat as the countries go higher in the chain of values or as they are pressured by automation (World Bank, 2020).

The other effect of globalization is that it has led to increasing labour migration and this on its own redefines domestic labour markets. The activities of migrant laborers supplement the shortages of skills in the high-demand areas and may even worsen the competition around the jobs that require low competencies, which is an additional issue in the structural unemployment case in the host countries (Borjas, 2014). Besides, any global economic shocks like the recent energy price volatility, or the 2008 financial crisis, can suddenly give rise to cross-border spillover effects with the labor markets shrinking in synchronicity and recovering long after.

3.4 Education, Skills Mismatch, and Employability

One of the greatest factors which have contributed to structural unemployment is the constant surplus of labor supply and demand. People tend to say that the education and the system of training cannot keep up with the changing nature of work as technology advances and globalization progresses. According to the OECD (2016), over one-third of employed members of countries are not in the occupation to which they obtained education. This mismatch is worse among the young and adults approaching old age in fast-changing economies since they may fail to retrain faster or rejoin the new sectors.

According to Goldin and Katz (2009), the outcome in the long run operation of labor market is said to be decided by a race between education and technology therefore indicating that those nations that allocate funds into the education system that is adaptable and skill based to provide education to its people are more enduring when it comes to labour interruption. Yet, even customary systems of education are being challenged in respect of relevance. Most curriculums used in academics are theoretical and obsolete and this has resulted in the failure of graduates because of their inability to adapt to the changing demands of the job market that requires technical skills, problem solving and digital skills.

Infrastructural and institutional weaknesses are problematic in developing economies. Technical and vocational education and training (TVET) programs are usually characterized by low quality, inadequate funding and lack of industry connection (UNESCO, 2021). In even the more developed economies higher education and the accumulating burden of student debts serve a barrier to upskilling. The competitors are the lifelong learning initiatives, industry-based skills certification training, and the online-based learning institutions, but they cannot work unless there is policy support and availability (Lindley & Machin, 2013).

3.5 Labor Policy and Institutional Responses

An economic stimulus alone is not sufficient to combat the structural unemployment; it needs interventions in labor markets which needs to be applied to specific areas of labor and over the long run. Training programs, job search assistance, public employment services and wage subsidies form part of Active Labor Market Policies (ALMPs) that have been greatly deployed. In a meta-analysis of 200 and more ALMP evaluations, Card, Kluve, and Weber (2018) concluded that short-term effects are not too great, whereas the impacts evaluated with an extended period in mind are positive, as well as programs addressing human capital development. Yet, it all depends on the region, the group of people to be affected and how the program is designed.

Universal Basic Income (UBI) is an extreme policy solution that would have alleviated the unemployment due to automation. Despite ambiguous findings of pilot studies in Finland and Kenya, UBI is considered one of the methods of stabilizing income in unstable labor markets (Standing, 2017). However, the other critics suggest that the unconditional transfers can discourage job search and dampen labor force participation.

The ILO (2021) also stresses the significance of policies on inclusive digital transformation such as digital infrastructure, reskilling, protecting platform workers, and looking at gender-responsive employment programs. The plans for recovery by numerous governments in the post-pandemic climate contain numerous green jobs, increased healthcare, and online services that are hard to execute and bound by equitability.

It is important to reform institutions as well. The labor legislations should be flexible to adapt to flexible working, the ministry of education should be working with industry in designing the curriculum. In most of the lesser and middle-income countries, there is a gap between the agencies of the government, the private and the civil sector, which causes a lack of coordination when responding to labor market changes (World Bank, 2020).

4. Discussion

The assessment of the current literature demonstrates that the phenomenon of structural unemployment is not a sectoral or regional problem, but a strongly interdependent global process, which is influenced by stable macroeconomic developments, technological innovation, and the reaction of institutions. In advanced and developing economies that have experienced automation, globalization, education and policy environment, inability to overcome mismatches persists in the labor markets and is actively not solved by policymakers using traditional demand-side oriented policy initiatives.

One of the anchoring themes here is the all-pervasive technological change in the pattern of employment. With the increasing automation and the application of artificial intelligence, replacing human workforce in routine-driven operations, particularly in industries and administration activities, the global workforce experience increased exposure. Whereas the displacement effects are observed in the case of developed economies like the United States, Germany, or Japan, the developing countries also become less and less safe resulting in increasing use of labor-saving technologies in export-driven industries (Chiacchio et al., 2018; Acemoglu & Restrepo, 2019). Notably, job destruction due to technologies tends to go at a higher pace than job creation and when new jobs are created, they require skills that most of the dislocated employees do not possess.

It also points out another two-sided impact of globalization; touching on the fact that though it has helped spur growth of employment in other low- and middle-income countries by industrializing their jobs in the context of labour-intensity, it has also seen to it that in developed countries firms are outsourcing their production and creating losses as well as unemployment back home. Localized nature of these shifts has caused regional disparities within even such large countries as U.S., India, and the U.K., as once-successful industrial centers fall into the traps of chronic unemployment and socio-economic degradation (Autor et al., 2013; Rodrik, 2018). Globalization has had an unequal distribution of its benefits, which widens the inequality to causes social disillusionment and the inability of the labor markets to respond to the mobility of capital and the global value chains.

One of the key explanations to structural unemployment is a continuing skew of the workforce skills and labor market requirements. Digital transformation has created a greater distance between the compliance of educational institutions and the demands of industries. Although employers require training in STEM, data analysis, and digital tools, too many laborers are enrolled in the old-fashioned training systems. The result of the technological change is not the only detachment of innovation and adaptation but also the underinvestment in vocational education, access to lifelong learning, and co-ordination between industry and the education sector (OECD, 2016; World Bank, 2020). This issue is exacerbated by the fact that vulnerable population groups: women, country people, and older laborers, have more obstacles to retraining and returning to work.

The other important lesson learnt in the literature is that policy intervention in resolving structural unemployment practices vary in their effectiveness. Training programs and wage subsidies are Active Labor Market Policies (ALMPs) that have been promising especially when they are specifically designed as per the local labor requirements (Card et al., 2018). Yet, most of these projects have poor design, funding, or can never be scalable. As an example, retraining schemes will not necessarily give workers a secure, well-paid position in the workplace, particularly where the local economy is poorly diversified. Additionally, passive solutions such as unemployment benefits over a long period, which are needed as a safety net, may discourage people to reskill unintentionally unless accompanied along with active policies.

It is also highlighted in the discussion that newer policy paradigms like Universal Basic Income (UBI), digital labor protection, and industry-education collaborations appear. It is hoped that these new initiatives will broaden the labor market with stabilization of income, increase social protection, as well as enhance flexibility of the work force. Nevertheless, even such strategies depend on the political will, cross-sector cooperation, and the capability to predict future labor dynamics instead of supporting them on the reactive scale.

Notably, the COVID-19 pandemic has demonstrated to the world the necessity to reform the labor systems due to the urgency of the matter. The pandemic expedited remote work, the process of digitization, and automation, and structural changes in the labor market imposed yet further pressure. It also revealed strong weaknesses in the informal labor markets as well as the gig economy particularly in the Global South. Such changes necessitate innovative and prospective policies not limiting to the sheer number of the positions, but also focusing on their quality, sustainability and inclusivity.

Although the volume of literature analyzed is significant, there are several gaps evident, especially with regard to structural unemployment within the framework of developing economies, rural labor market, and an informal sector. The research has been largely focused on the high-income economies with very little empirical results provided in Sub-Saharan Africa, South Asia and Latin America. It is also missing long-term studies about the career progress of the displaced workers over a long period of time, and the effectiveness of retraining programs in the long-run.

To sum up, structural unemployment and the changes in the labour markets are multilayered problems that require concerted actions of policies, education, and industries. The problem could be solved through an active approach toward re-skilling, reformation of the institutions, universal digital infrastructure, and labor protection within various contexts. In the absence of these kinds of holistic responses, structural unemployment very easily can become a permanent factor in the economic scenes of the world- an increasing factor of inequality, low productivity, and even social unrest.

5.1 Conclusion

The review paper has addressed the nature of complex and correlated factors of structural unemployment and the concomitant changes going on in the global labor market, particularly technological change, globalization, skills mismatches, and the policy responses. The review of the sources has shown that structural unemployment is not simply cyclical or transitional aspect but a permanent character of contemporary economies that is determined by the long-run trends in macroeconomics and institutional inertia. High rates of technological transformations, notably in terms of automation and artificial intelligence, have changed labor demand dramatically in the industries, which caused job polarization and overlap of routine-based jobs. At the same time, globalization has disassembled supply of labor in the production sector and dislocated employment in major processing areas so as to create inequality and socio-economic division.

Mismatches between education and skills have been identified as some of the key reasons behind labor market rigidities signifying the inability of the current education and training systems to adapt to changes in the industry demands. Despite the cooperation of governments and international institutions, a wide range of policies have been put in place to address the challenges, including active labour market policies, reskilling campaigns and strategies to digitize job markets, but these have been sporadic and not focused enough on the local labour markets. In addition, the COVID-19 pandemic has exacerbated most of such issues, catalyzing automation, increasing digital divisiveness, and revealing the susceptibility in formal and informal labor markets.

Although the literature has largely established the findings to diagnose the root-causes of structural unemployment, there is a need to conduct more empirical studies in developing nations and in case of rural economy and informal sector of labor. Unless tailored and dominant responses are enacted, the problem of structural unemployment will persist to tear down productivity, worsen inequality, and threaten social harmony in both developed and emerging economies. Mutating these difficulties should involve a global coordinated initiative, which entails education reform and institutional development combined with futuristic labor policies that forecast and design the future of work.

5.2 Recommendations

Overall, the following suggestions can be offered as the basis of the literature reviewed to reduce structural unemployment and support adaptive and inclusive labor markets:

1. **Strengthen Alignment Between Education and Industry Needs:** School to higher education curricula should also be changed with a focus on skills that are required in the new labor market, especially digital literacy, critical thinking, problem-solving, and adaptability. There must be enhanced collaboration between industries and educational institutions so that the labor demands may be responsive in real-time.
2. **Expand Access to Lifelong Learning and Reskilling:** The governments are advised to invest in variable and modular training courses that will suit a wide range of workers of different age groups and abilities. Online learning platforms, micro-credentialing systems, and on-the-job apprenticeships are some mechanisms of continuous skill building which can be scaled up through public-private partnerships.
3. **Promote Inclusive Digital Transformation:** There should be work to bridge the digital gap through extension of access to digital infrastructure particularly in the marginalized groups and the rural community. Policymakers can avoid the intensification of informalization by making sure that the digital platforms offer decent wages, protection, and promotion to workers.
4. **Tailor Active Labor Market Policies (ALMPs) to Local Contexts:** Local-area job search, wage subsidy, and work- training policies should be founded on labor market data and involvement of the employer. Long-term effectiveness should be given through the programs which monitor performance and have performance feedback loops.
5. **Support Vulnerable and Displaced Workers with Social Protection:** Unemployment insurance, conditional cash and targeted UBI pilots should form the social safety nets to ensure income/stability and workforce re-integration. Particular focus needs to be made on the increased exposure of people to structural changes among women, young people, older workers, and low-skilled workers in the labor market.
6. **Foster Labor Market Resilience through Institutional Reform:** New types of work such as gig and remote employment should be captured by laws on labor. Labor inspection, resolution mechanisms, and collective bargaining institutions will enhance the security of the workers and also make the market efficient.

7. **Encourage Cross-Border Knowledge Sharing and Cooperation:** International agencies like ILO, OECD, and World Bank are required to promote joint research, pilot projects as well as exchange of data to enable nations to appreciate international good practice and put these in local contexts to fit local needs.

Incorporation of these multidimensional approaches enables governments and stakeholders to shift towards proactive governance of the labor market and hence deal with the causal factors of structural unemployment besides guaranteeing a fair involvement in the global economy as it transforms into its new face.

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