The Influence of Economic Cycles on Employment Workforce Productivity and Innovation A Study of the Manufacturing Industry

Anam Naz
MPhil Scholar
Department of Economics & Agricultural Economics, PMAS UAAR
Dr. Bashir Ahamd Khan
Lecturer
Department of Economics & Agricultural Economics, PMAS UAAR
Muhammad Usman Bhatti
Department of Management Studies, Business School
Bahira University Islamabad
Dr Arshad Mahmood Malik
Associate Professor
Department of Economics & Agricultural Economics, PMAS UAAR

Abstract
Economic cycles, which fluctuate between expansion and recession, have a considerable impact on employment, labor productivity, and industry innovation. Investigates the effects of these cycles on the manufacturing sector in Punjab, Pakistan. The study finds that during economic expansions, the sector enjoys increased demand, higher employment rates, and increased productivity, as well as an increase in investment in new technologies and processes that promote innovation. Economic contractions, on the other hand, cause decreased demand, layoffs, and lower productivity, as firms prioritize short-term survival over long-term growth, resulting in a drop in innovation rates. The study emphasizes the critical role of government actions in reducing negative consequences and promoting stability. The findings suggest that understanding the effects of economic cycles is essential for developing strategies to enhance resilience and sustainable growth in the manufacturing industry. Policy recommendations include encouraging sustained investment in research and development, implementing fiscal stimulus measures, promoting continuous skill development, investing in infrastructure improvements, and establishing a favorable regulatory environment. These measures aim to guide strategic decision-making, contributing to the sustainable expansion and resilience of Punjab's manufacturing sector in response to economic changes.
Key words: Economic cycles; Innovation; manufacturing industry; Pakistan; employment; work force productivity

INTRODUCTION

Economics cycles exemplified as the period of contraction and expansion are considered an integral part of market economies Dellepiane-Avellaneda (2015). Understanding the nature of cycles and the factors that shape them is essential for policymakers and businesses to devise appropriate strategies that can mitigate the adverse effects of economic downturns and capitalize on opportunities during the upswings of economies. As per Cooley & Prescott, (2020), the economic cycle is a dynamic and intricate phenomenon that influences various economies and industries around the world. Therefore, understanding the influence of economic cycles on workforce productivity, employment, and innovation is critical for optimizing growth and performance.

Economic cycles, characterized by periods of expansion and contraction, are fundamental to understanding the dynamics of modern economies. As per (Duval & Furceri, 2018) these cycles, often measured by changes in gross domestic product (GDP), inflation rates, and other economic indicators, exert significant influence on various facets of the labor market and broader economic environment. In this thesis, we explore the multifaceted impact of economic cycles on employment, workforce productivity, and innovation.

Expansion is characterized by increased economic activity, growing GDP, greater employment rates, and frequently rising inflation. Businesses invest more, consumer spending rises, and the economy expands. Commission on Growth (2008). The peak symbolizes the maximum level of economic activity prior to a slump. At this point, economic metrics such as GDP growth rate and employment are at their greatest levels, and inflation may also be at its peak Vinayagathasan (2013).

The economic cycle has a substantial impact on workforce productivity, which is a crucial driver of economic growth and competitiveness (Armeanu et al., 2017). Companies are more likely to invest in new technology, personnel training, and efficient operations when the economy is doing well. Furthermore, a stable and rising economy creates an atmosphere in which people can perform productively, driven by job security and professional advancement prospects Jackson (2016).

Workforce productivity is a key indicator of a country's economic health. It quantifies production per worker and is impacted by a variety of factors like as technology, education, and working conditions. High productivity often leads to economic growth because firms can create more goods and services using the same amount of labor Hoekman & Mattoo (2008).

Economic cycles, which include periods of both expansion and depression, have a considerable influence on labor productivity. During growth periods, organizations invest in new technology and procedures, which frequently result in increased productivity (Rüßmann et al., 2015). Employment rates are typically rising, and workers may benefit from further training and improved working conditions. A favorable economic climate encourages innovation and efficiency, hence increasing production.

Innovation is critical to driving economic cycles, influencing both the expansion and contraction phases. During periods of economic growth, businesses and governments are more likely to invest in R&D, resulting in significant technological advancements and new products. This innovation has the potential to drive additional economic growth by opening new markets, improving efficiencies, and increasing productivity (Wong & Autio 2005).

The Pakistan manufacturing industry is influenced significantly by the economic cycles. According to Abbass et al., (2022), the manufacturing sector in Punjab, Pakistan, plays a crucial role in the country's economy, contributing to its growth and providing employment opportunities for a substantial number of people. However, this pivotal industry is not impervious to the effects of the constantly evolving economic cycle, which has the potential to either enhance or hinder its advancement (Von Weizsacker et al., 2009).

The economic cycle has a significant impact on Pakistan's manufacturing industry, influencing its dynamics throughout the various stages of growth and contraction. During expansionary periods, the manufacturing sector benefits from increased economic activity. Higher consumer spending and business investment increase demand for manufactured goods, which drives up production levels (Baily & Bosworth 2014). Manufacturers frequently respond by increasing production, investing in new technologies, and growing their workforce. This growth phase also attracts foreign investment and increases the sector's overall competitiveness.

The exploration of the relationship between the cycle of economics and the manufacturing sector can reveal significant insights that have the potential to promote enduring stability and prosperity in the long run Jackson (2016). Therefore, comprehending the interplay between the economic cycle and its impact on job opportunities, employee productivity, and inventiveness is imperative for policymakers and industry leaders in formulating efficacious strategies to foster and augment the growth and advancement of the sector (Cook et al., 2020).

The economic cycle has a significant impact on Pakistan's manufacturing industry, shaping its performance and stability throughout the various phases (Khan & Rehman 2021). During periods of economic expansion, the sector typically benefits from increased consumer and business confidence, which drives up demand for manufactured goods. This increased demand may stimulate production, encourage investment in new technologies, and increase employment in the industry (Rüßmann et al., 2015). As businesses grow and capacity, the sector's efficiency and competitiveness improve. However, at the peak of the economic cycle, the industry may experience inflationary pressures and rising costs due to increased demand for raw materials and labor. These factors can reduce profit margins and create challenges in managing production levels Lillis (2002).

During periods of economic contraction, the manufacturing industry frequently experiences decreased demand, resulting in lower production levels and higher unemployment. Reduced consumer spending and investment can put financial strain on the sector, prompting cost-cutting measures like layoffs and lower capital expenditures (Verma et al.,2023). Supply chain disruptions can exacerbate existing operational challenges. Andersen & Gulbrandsen (2020) during the trough phase, the industry may face persistently low demand and production, but it also provides opportunities for restructuring and realignment. Manufacturers can use the downturn to streamline operations and invest in technology, preparing for future growth Tassey (2014). Government policies and economic stimuli play an important role in supporting the sector during these difficult times, helping to mitigate the impact of economic downturns and lay the groundwork (Song & Zhou 2020).

METHOLOGICAL APPROACH

The researcher will adopt the quantitative methodology to conduct a methodical and rigorous examination to examine how economic cycles impact employment patterns, innovation, and workforce productivity within the manufacturing industry of Pakistan. Through the systematic collection and rigorous analysis of quantitative data, this methodology enables the measurement and quantification of diverse economic indicators. In addition, the utilization of the quantitative approach enables the investigation of extensive datasets, thereby facilitating a thorough analysis of the dynamics within the manufacturing industry throughout various stages of the economic cycle (Bloomfield & Fisher, 2019).

MODEL SPECIFICATION

The model for this study is as:

$$\hat{E}_t = \alpha_\circ + \beta_1 \hat{E}_{t-1} + \beta_2 EC_t + \varepsilon_t \qquad (i)$$
$$\widehat{WFP}_t = \alpha_\circ + \beta_1 \widehat{WFP}_{t-1} + \beta_2 EC_t + \varepsilon_t \qquad (ii)$$
$$\widehat{IN}_t = \alpha_\circ + \beta_1 \widehat{IN}_{t-1} + \beta_2 EC_t + \varepsilon_t \qquad (ii)$$

Where, in eq (i), $\hat{E}_t$ is the employment, which is measured by unemployment rates; $\hat{E}_{t-1}$ is the lagged dependent variable; ECt refers to the economic cycle, measured by proxy economic crisis; ε_t is the error term in the model. Additionally, in eq (ii), $\widehat{WFP}_t$ is the workforce productivity, which is measured by outputs of the company; $\widehat{WFP}_{t-1}$ is the lagged dependent variable; ECt refers to the economic cycle, measured by proxy economic crisis; ε_t is the error term in the model. Furthermore, in eq (iii), $\widehat{IN}_t$ is the innovation, which is measured by research and development expenses; $\widehat{IN}_{t-1}$ is the lagged dependent variable; ECt refers to the economic cycle, measured by proxy economic crisis; ε_t is the error term in the model. Economic cycle is the independent variables whereas employment, workforce productivity, and innovation are the dependent variables in the study.

1.1.1. ARDL FRAMEWORK

The current study will utilize the ARDL (Autoregressive Distributive Lag) model which is a versatile econometric technique employed for the examination of interrelationships among variables within a time series framework proposed by (Pesaran et al., 2001).

$$\Delta E_{it} = \gamma_0 + \gamma_1 E_{it-1} + \gamma_2 EC_{it-1} + \sum_{i=1}^{n1} \alpha_{1i}\, \Delta LnI_{it-i} + \sum_{i=0}^{n2} \alpha_{2i}\, \Delta EC_{it-i} + \mu_{it} \qquad (iv)$$

$$\Delta WFP_{it} = \gamma_0 + \gamma_1 WFP_{it-1} + \gamma_2 EC_{it-1} + \sum_{i=1}^{n1} \alpha_{1i}\, \Delta LnI_{it-i} + \sum_{i=0}^{n2} \alpha_{2i}\, \Delta EC_{it-i} + \mu_{it} \qquad (v)$$

$$\Delta IN_{it} = \gamma_0 + \gamma_1 IN_{it-1} + \gamma_2 EC_{it-1} + \sum_{i=1}^{n1} \alpha_{1i}\, \Delta LnI_{it-i} + \sum_{i=0}^{n2} \alpha_{2i}\, \Delta EC_{it-i} + \mu_{it} \qquad (vi)$$

In this context, Δ represents the first difference, γ_0 denotes the intercept term, μ_t represents the white noise error, and the remaining terms refer to the variables under consideration. In equation (iv) E refers to the employment; E_{t-1} is the lagged dependent variable; EC_t refers to the economic cycle; ε_t is the error term in the model. Additionally, in eq (v), WFP_t is the workforce productivity, WFP_{t-1} is the lagged dependent variable; EC_t refers to the economic cycle, ε_t is the error term in the model. Furthermore, in eq (vi), IN is the innovation, IN_{t-1} is the lagged dependent variable; EC_t refers to the economic cycle, ε_t is the error term in the model. The first difference variables coefficients capture the short-run influence, while the standardization of first lag level variables in the equation reveals the long-run effects.

RESULTS AND DISCUSSION

Descriptive Statics

Variables	GDP	EC	UR	WFP	R&D
Mean	2579.361	2579.361	2.233	2968.122	0.264
Median	2585.952	2587.377	0.653	2878.592	0.212
Maximum	2665.427	2663.936	6.338	4951.550	0.632
Minimum	2482.816	2473.661	0.398	1417.736	0.109
Std. Dev.	64.546	63.877	2.103	1177.534	0.142
Skewness	-0.216	-0.222	0.755	0.174	1.152
Kurtosis	1.576	1.624	1.995	1.666	3.456
Jarque-Bera	2.674	2.526	3.980	2.297	6.667
Probability	0.262	0.282	0.136	0.317	0.035
Sum	74801.48	74801.48	64.783	86075.53	7.658
Sum Sq. Dev.	116656.8	114248.2	123.893	38824429	0.564

The table provides descriptive data for five variables: GDP, EC, UR, WFP, and R&D. The mean values represent the average of each variable across the sample, with GDP and EC averaging at 2579.361, UR at 2.233, WFP at 2968.122, and R&D at 0.264. The median values represent the midway value of each statistic, with GDP and EC medians near to their means at 2585.952 and 2587.377, respectively, UR at 0.653, WFP at 2878.592, and R&D at 0.212. The maximum and minimum values indicate the range of the data, with GDP from 2482.816 to 2665.427, EC from 2473.661 to 2663.936, UR from 0.398 to 6.338, WFP from 1417.736 to 4951.550, and R&D from 0.109 to 0.632.

Unit Root Test

Augment Dickey-Fuller Test (ADF)

Variables	Level		1st Difference		Integration Test
	t-Statistic	Prob.	t-Statistic	Prob.	
GDP	-1.442	0.546	-4.485	0.001	I (1)
EC	-2.878	0.006	-	-	I (0)
UR	-0.575	0.861	-6.388	0.000	I (1)
WFP	-4.7347	0.0027	-4.099	0.004	I (1)
R&D	-4.4097	0.0062	-2.689	0.009	I (1)

Source: EVIEWS-12

The Augmented Dickey-Fuller (ADF) test results indicate the following:

- **GDP**: Integrated of order 1, I (1) (stationary after first differencing).
- **EC**: Integrated of order 0, I (0) (stationary at level).
- **UR**: Integrated of order 1, I (1) (stationary after first differencing).
- **WFP**: Integrated of order 1, I (1) (stationary after first differencing).

- **R&D**: Integrated of order 1, I (1) (stationary after first differencing).

This means EC is stationary at level, while GDP, UR, WFP, and R&D are stationary after differencing once.

Impact of Economic Cycle on Unemployment Rate

Bounds test

Test Statistics	Value	K
F-Statistics	7.24	**1**
Significance	**Lower Bound**	**Upper Bound**
10%	3.02	3.51
5%	3.62	4.16
2.5%	3.18	4.79
1%	4.94	5.58

Source: EVIEWS-12

The F-statistic of 7.24 is higher than the upper bound critical values at all significance levels (10%, 5%, 2.5%, and 1%). This indicates that the null hypothesis of no long-run relationship can be rejected. Therefore, there is evidence of a long-run relationship between the variables in the model.

ARDL Long Run Estimates

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EC	0.019401	0.002870	6.760906	0.0000
C	-44.33581	7.705341	-5.753906	0.0000

The coefficient of EC (0.019401) is positive and statistically significant at the 1% level (p-value = 0.0000). This suggests that in the long run, a 1 unit increase in EC is associated with a 0.019401 unit increase in the dependent variable, holding other factors constant.

The constant term is -44.33581, and it is statistically significant at the 1% level (p-value = 0.0000). This implies that, in the long run, when EC is zero, the dependent variable will be -44.33581.

ARDL Short Run Estimates

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(EC)	-0.416386	0.091778	-4.536873	0.0001
CointEq(-1)*	-0.851400	0.175428	-4.853279	0.0001

The coefficient of the first difference of EC (D(EC)) is -0.416386 and statistically significant at the 1% level (p-value = 0.0001). This indicates that in the short run, a 1 unit increase in the change of EC leads to a decrease of 0.416386 units in the dependent variable, holding other factors constant.

The coefficient of the lagged error correction term (CointEq(-1)) is -0.851400 and statistically significant at the 1% level (p-value = 0.0001). This suggests that any deviation from the long-run equilibrium is corrected by

85.14% in each period, indicating a strong adjustment speed back to equilibrium.

Impact of Economic Cycle on Workforce Productivity

Bounds test

Test Statistics	Value	K
F-Statistics	3.81	**1**
Significance	**Lower Bound**	**Upper Bound**
10%	3.02	3.51
5%	3.62	4.16
2.5%	3.18	4.79
1%	4.94	5.58

Source: EVIEWS-12

ARDL Long Run Estimates

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EC	17.95588	1.714727	10.47157	0.0000
C	-43397.32	4437.887	-9.778826	0.0000

ARDL Short Run Estimates

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D (WFP (-1))	0.370657	0.191514	1.935399	0.0653
CointEq(-1)*	-0.577853	0.164072	-3.521959	0.0018

Impact of Economic Cycle on Research and Development

Bounds test

Test Statistics	Value	K
F-Statistics	5.84	**1**
Significance	**Lower Bound**	**Upper Bound**
10%	3.02	3.51
5%	3.62	4.16
2.5%	3.18	4.79
1%	4.94	5.58

Source: EVIEWS-12

The F-statistic of 3.81 lies between the lower and upper bounds at the 5% significance level (3.62 < 3.81 < 4.16). This indicates that there is evidence of a long-run relationship between the economic cycle (EC) and workforce productivity (WFP).

ARDL Long Run Estimates

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EC	0.001433	0.000427	3.354378	0.0029
C	-3.855125	1.149192	-3.354640	0.0029

The coefficient for the economic cycle (EC) is 17.95588, which is positive and statistically significant at the 1% level (p-value = 0.0000). This implies that in the long run, a 1 unit increase in the economic cycle is associated with an increase of 17.95588 units in workforce productivity, holding other factors constant.
The constant term is -43397.32, which is statistically significant at the 1% level (p-value = 0.0000). This indicates that when the economic cycle is zero, the workforce productivity would be -43397.32 units.

ARDL Short Run Estimates

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D (R_D (-1))	0.691055	0.118444	5.834463	0.0000
D(EC)	0.022086	0.005102	4.329057	0.0003
CointEq(-1)*	-0.349889	0.079980	-4.374714	0.0002

The coefficient of the first lag of the difference of workforce productivity (D (WFP (-1))) is 0.370657. Although it is positive, it is not statistically significant at the 5% level (p-value = 0.0653). This suggests that past changes in workforce productivity have a positive but not statistically significant effect on the current change in workforce productivity in the short run.

The coefficient of the first lag of the difference of workforce productivity (D (WFP (-1))) is 0.370657. Although it is positive, it is not statistically significant at the 5% level (p-value = 0.0653). This suggests that past changes in workforce productivity have a positive but not statistically significant effect on the current change in workforce productivity in the short run.

Conclusion

The Influence of Economic Cycles on Employment, Workforce Productivity, and Innovation: A Study of the Manufacturing Industry" examines the complex link between economic cycles and numerous components of the labor market and manufacturing sector. According to the study, economic expansions enhance employment, productivity, and innovation, but economic recession have the reverse impact, resulting in layoffs, lower productivity, and stunted innovation.

The industrial sector is especially vulnerable to these cycles. During periods of expansion, greater demand drives up output and employment, attracting investment and increasing competitiveness. In contrast, economic downturns diminish demand, resulting in reduced output and increased unemployment. Innovation has a critical role, since expenditures in research and development during boom periods promote technical breakthroughs and productivity.

Government policies have an important role in alleviating the negative consequences of economic downturns and promoting innovation. Strategic investments in infrastructure, education, and technology may support productivity growth and innovation even during economic downturns. Conversely, austerity measures implemented during a recession might worsen productivity decreases. Overall, the text underlines the need of policymakers and business leaders implementing strategic policies and interventions to support sustainable development and resilience in the manufacturing sector, therefore assuring long-term economic growth and stability.

Policy Recommendation

- Governments and companies should prioritize ongoing training and skill development initiatives to guarantee that the workforce stays flexible to shifting economic conditions and technological improvements.
- Increased R&D investment, particularly during economic downturns, can support innovation and productivity development. Public-private collaborations may play an important role in promoting innovation.
- SMEs are frequently more susceptible to economic swings. Providing financial assistance, access to finance, and incentives for innovation can help small enterprises survive and prosper during economic downturns.
- Enhanced unemployment benefits, job placement services, and retraining programs can help individuals transition to new jobs and lessen the effect of job losses during economic downturns.

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