From Growth to Jobs: Empirical Inquiry into China's Employment Elasticity and Its Macroeconomic Drivers

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Abstract

China has remained one of the fastest growing economies of the world for an appreciable period; however, there are concerns around the employment content of these growth achievements. These concerns become more important keeping in view demographic profile of China. To this end current study attempts to estimate employment elasticity of China's economic growth and examine its macroeconomic determinants. The study uses annual time series data for the period of 1980–2019. Time varying Kalman filter is used to estimate employment elasticity and ARDL is used to examine its macroeconomic determinants. The results of the study revealed drastically low level of employment elasticity in China during the study period. Further the study found that inflation and openness had a negative impact while depreciation had a positive impact on employment elasticity in the long run. Additionally, human capital formation and services sector share have positive but insignificant impact. Further, as a robustness check, the Dynamic Ordinary Least Squares (DOLS) estimation was conducted, and its results were found to be consistent with the ARDL model.

Keywords	***DOI***	***JEL code***
Economic growth, employment growth, employment elasticity, TVP approach, China	*https://doi.org/10.54694/stat.2025.23*	*E24, O40, C32, F62, J2*

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INTRODUCTION

China has witnessed a tremendous growth in recent decades making it one of the fastest growing economies of the world. This remarkable economic performance over the past four decades has been characterized by rapid industrialization, technological advancement, and urbanization. China's GDP grew 38.8 times between 1978 and 2020, and, therefore, the economy was ranked second globally, Zhou et al. (2023). After reaching a peak of 14.2% in 2007, China's economic growth rate started to decline, falling to around 6% in 2019. This halt in development has been dubbed as China's "New Normal" by the government and academicians, Wu et al. (2022).

On the other hand, mining jobs in China have steadily decreased as the country moves toward environmentally sustainable growth, dropping from 6.36 million in 2013 to 3.41 million in 2022 – almost half the workforce lost since the coal industry's peak in 2012. As a result of this manufacturing jobs have also decreased dramatically (Zhang et al., 2024). Expectedly, the unemployment rate in China has kept on increasing especially since 2000.

After surpassing the growth rate of 0.9% in 2015, China's labor force growth rate decreased annually between 2013 and 2020 due to the country's population aging process. Additionally the proportion of the population in the age group of 65 and older increased from 9.7% in 2013 to 13.5% in 2020, Hsu et al. (2018). Keeping this in view encouraging high-quality economic development and quickening the shift from the demographic dividend to the talent dividend have emerged as major priorities, Zhao and Said (2023).

Table 1 depicts the economic growth and employment growth performance of China for the period of 1980–2017. From 1980 to 2017, China's witnessed and average GDP growth rate of 7.22%; however, employment growth lagged behind significantly, averaging only1.42% during the same period. For the decade of 1980–1990, GDP grew at 5.59%, along with it; employment growth was relatively higher at 3.21%, indicating an appreciable job creation economy. However, in subsequent decades, employment growth sharply declined – from 1.06% (1991–2000) to 0.59% (2001–2010) and further to 0.28% (2011–2017). All this happened despite the GDP growth peaking at 9.94% during 2001–2010. This widening gap points to dismissive employment performance of Chinese economy, highlighting a structural shift that limits employment opportunities despite sustained economic growth.

Table 1 Employment and economic growth (averages)

Time period	1980–1990	1991–2000	2001–2010	2011–2017	Overall (1980–2017)
GDP growth	5.59	7.04	9.94	5.57	7.22
Employment growth	3.21	1.06	0.59	0.28	1.42

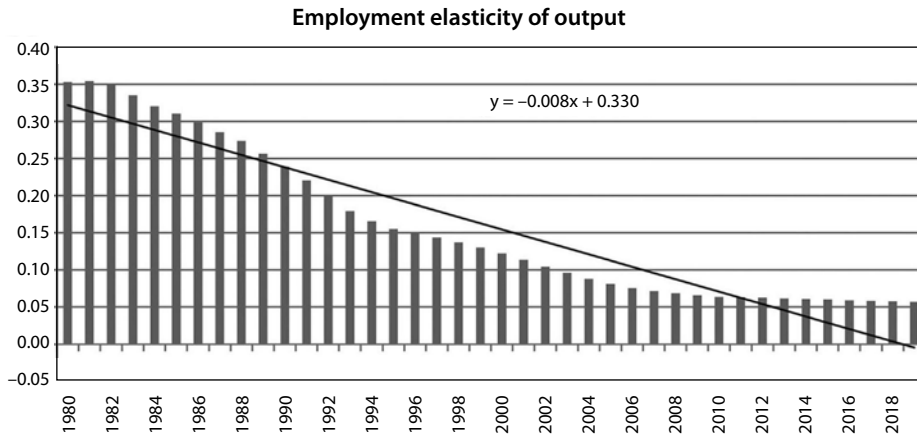
Source: Authors calculations

This empirical evidence suggests a clear case of decoupling between economic growth and employment generation which poses questions regarding China's labor market performance especially in terms of employment generation. During the 1990s, China's manufacturing sector experienced a significant decline in employment elasticity with respect to output. By the late 1990s, this elasticity was estimated to be around 0.10, Zhang and Cai, (2002). Numerous studies have examined the phenomenon of "jobless growth" in Chinese manufacturing, attributing it primarily to the reform of state-owned enterprises (SOEs). These reforms led to large-scale layoffs as part of efforts to enhance efficiency and performance, Zhang and Cai (2002).

For further clarity regarding employment content of economic growth, Figure 1 depicts the evolution of employment elasticity of economic growth in China over the period 1980–2019. Employment elasticity

has been estimated using time varying Kalman filter. This representation provides insights regarding employment intensiveness of economic growth at every point of time, enabling one to identify the periods with growth having higher employment content.

Figure 1 Estimated employment elasticity of economic growth (1980–2019)



Source: Authors estimations

Figure 1 represents evolution of employment elasticity of economic growth in China during the study period. The results revealed a significantly low and continuously declining employment elasticity of economic growth in China during the study period. The average elasticity during this period stayed around 0.15 which is markedly lower than globally accepted employment elasticity band of 0.3–0.5. As noted by Manning and Purnagunawan (2013), the "normal" range of employment elasticity from international comparisons is usually 0.3–0.5 for the economies experiencing 1–2 percent annual growth in labour force. This raises questions regarding the job creation capacity of China's economic growth which needs immediate attention.

In the past empirical literature Slimane (2015), estimated employment elasticity of economic growth for 90 developing countries for the period of 1991–2012, where he found employment elasticity was 0.10 for China. Also Lam et al. (2015), in IMF working Paper estimated employment elasticity for China, the authors found employment elasticity of 0.08 for the period of 1993–2013.

In the background of this puzzling issue, current study first aims to estimate employment elasticity of economic growth in China and secondly the paper seeks to explore the macroeconomic determinants of employment elasticity in China. By analyzing the structural, institutional, and policy factors that have shaped employment elasticity in China, the study aims to derive insights that can prove vital for policy makers to improve employment creation capacity of China's economic growth. To this end, we apply a time varying methodology i.e. state space Kalman filter to estimate employment elasticity keeping in view the dynamic nature of relationship between economic growth and employment. To the best of our knowledge no study on Chinese literature has applied this methodology for examining this particular issue.

The study is organized: Section 1 provides enlists review of literature, Section 2 discusses data and methodology used and Section 3 brings the results.

1 REVIEW OF LITERATURE

Economic growth and employment creation are studied under the framework of Okun's law approach and employment elasticity approach, while Okun's law associates reduction of unemployment due to

economic growth, employment elasticity links increase in employment to increase in output. Employment elasticity approach shows certain advantages over Okun's law as it avoids the issues related to estimation of unemployment rate, and labor force participation rate.

Employment elasticity measures the percentage change in employment associated with a percentage change in economic growth. This approach is suitable in situations when research aims to identify the determinants of employment intensiveness of economic growth.

Inflation may increase uncertainty and costs for businesses, leading to lower investment and employment. Under conditions of uncertainty, firms find it in their interest to employment more of capital in comparison to labor in their production processes, as labor is more demanding and can raise hike in wages in line with increase in the rate of inflation.

Inflation affects employment elasticity by creating uncertainty in prices and economic activity, which in turn makes it feasible for producers to stop creating additional employment or even make them lay-off some workers (Judson and Orphanides, 1999; Ramey and Ramey, 1991; Imbs, 2007; Furceri, 2010). Inflation effects employment creation via two effects: the grease effect (Tobin, 1972), which aids adjustment to equilibrium, and the sand effect (Friedman, 1977), which causes resource misallocation, input substitution and employment declines.

Empirical literature suggests that grease effect dominates in developed countries, while developing countries experience stronger sand effects, Loboguerrero and Panizza (2003). Studies carried by (Kapsos, 2006; Bhat et al., 2022; Pattanaik and Nayak, 2014; Ghazali and Mouelhi, 2018) revealed that inflation uncertainty leads to decline in employment elasticity of economic growth. In Indian case, Pattanaik and Nayak (2014) using (Inflation WDI) as a proxy for economic uncertainty has found that inflation has a negative impact on employment elasticity of economic growth. Additionally, it has been found that macroeconomic policies that reduce macroeconomic uncertainty enhance long-term investments and employment by providing greater economic visibility (Furceri et al., 2012; Ali et al., 2017).

The studies of Bhat et al. (2022), Ben and Zmami (2021), and Victoria and Elias (2017) along with some others have attempted to examine the impact of services sector share on employment elasticity in different economies of the world. Kapsos (2005) and Furceri et al. (2012) have highlighted that employment elasticities are positively related to the share of services in the economy, indicating that countries with larger service sectors tend to have higher employment elasticity of economic growth. Padalino and Vivarelli (1997) found out that G-7 nations exhibited relatively higher employment elasticity in services sectors, which does mean the biggershare of services sector, the higher employment elasticity in the economy. Also Dopke (2001) noted that higher employment elasticity raised the importance of the role of services. Similarly, Löbbe (1998) and Mourre (2004) suggest that increased employment intensity is closely tied to the expanding role of services. Collectively, these findings underscore the service sector's capacity to enhance employment elasticity across different economies.

Regarding the impact of exchange rate, Nucci and Pozzolo (2010) have highlighted that exchange rate changes affect employment through appreciation and depreciation channels. This may happen due to a weaker currency that makes exports more competitive, potentially boosting labor-intensive industries. The findings are similar to Bhat et al. (2022) and a World Bank study (Asia, 2008), were it has been found that exchange rate appreciation lowers employment elasticity, which in other words, does mean that depreciation increases employment elasticity. In developing countries, currency depreciation does discourage imports, reducing reliance on capital-intensive imports and encouraging labor-intensive exports in sectors such as manufacturing and textiles. Campa (2005) identifies three key mechanisms: import penetration raises local market competition, potentially leading to firm closures and job losses; export orientation boosts sector-specific job growth in exporting sectors.

Depreciated currency boosts demand for labor-intensive exports and increasing employment in export-oriented sectors like manufacturing, textiles etc. Simultaneously, depreciation raises the cost of capital-intensive imports, encouraging domestic production of import-substituting goods, which can further stimulate labor demand. This dual effect shifts production toward labor-intensive activities. Additionally, depreciation reduces the competitive pressure on domestic firms by making imported goods more expensive, allowing high-cost domestic producers to survive and expand, thereby supporting job creation.

2 DATA AND METHODOLOGY

Current study uses annual time series data on the economy of China for the period of 1980–2019. Data on employment and real GDP is taken from Penn World Table 10.01, while data on trade openness, Human capital, inflation, exchange rate and services sector share are taken from word development indicators, (WDI) World Bank database. For first step i.e. estimation of employment elasticity data on employment and GDP is regarded as growth rate (% change annual). Similarly, for the second step i.e. identifying macroeconomic determinants of employment elasticity of economic growth date on all variables is scaled by converting all data in terms of annual % change. This step is done for two purposes; firstly, to interpret results in terms of elasticity and, secondly, estimated employment elasticity falls within the band of 0-1, so to bring all the variables on single scale – this procedure is adopted.

2.1 Methodology

Employment elasticity estimated using the time varying Kalman filter. The time-varying parameter model with the Kalman filter is expressed in state-space form as follows:

$$Y_t = X_t b_t + u_t, \tag{1}$$

$$b_t = \emptyset b_{t-1} + e_t, \tag{2}$$

here: Y_t denotes employment, while X_t represents the explanatory variable gross domestic product (GDP). b_t is measure of employment elasticity. u_t is the error terms with zero mean and a constant covariance. Finally, u_t, and e_t are g × 1 vectors of serially uncorrelated residuals.

The model estimated in current study is as follows:

$$ES_t = \propto_0 + \propto_1 INF_t + \propto_2 OPN_t + \propto_3 HU_t + \propto_4 EXR_t + \propto_5 SS_t + \varepsilon_t, \tag{3}$$

where: ES represents employment elasticity, OPN represents trade openness (imports and exports % GDP), EXR represents official exchange rate, HU represents Human capital, SS represents services sector share in GDP and lastly ϵ represents error correction term. It is important to note here that all the variables are taken in annual % change form.

ARDL specification of underlying model is as:

$$\begin{aligned} \mathrm{ES_t} = \propto_0 + \sum_{i=1}^{n} \propto_{1i} \mathrm{ES_{t-i}} + \sum_{i=0}^{o} \propto_{2i} \mathrm{INF_{t-i}} + \sum_{i=0}^{p} \propto_{3i} \mathrm{OPN_{t-i}} + \sum_{i=0}^{q} \propto_{4i} \mathrm{HU_{t-i}} + \sum_{i=0}^{r} \propto_{5i} \mathrm{EXR_{t-i}} \\ + \sum_{i=0}^{s} \propto_{5i} \mathrm{SS_{t-i+\beta_1 INF_{t-1}}} + \beta_2 \mathrm{OPN_{t-1}} + \beta_3 \mathrm{HU_{t-1}} + \beta_4 \mathrm{EXR_{t-1}} + \beta_5 \mathrm{SS_{t-1}} + \epsilon_t . \end{aligned} \tag{4}$$

Short run specification of Formula (4) is expressed as:

$$\Delta ES_t = \propto_0 + \sum_{i=1}^{n} \propto_{1i} ES_{t-i} + \sum_{i=0}^{O} \propto_{2i} INF_{t-i} + \sum_{i=0}^{P} \propto_{3i} OPN_{t-i} + \sum_{i=0}^{Q} \propto_{4i} HU_{t-i} + \sum_{i=0}^{r} \propto_{5i} EXR_{t-i} + \sum_{i=0}^{S} \propto_{6i} SS_{t-i} + \lambda_1 ECM_{t-1} + \epsilon_t . \quad (5)$$

In the above equations, n, o, p, q, r, s represents lag structure and ECM represents the error correction term, illustrating the rate of adjustment and remaining variables in the equation are already explained in Formula (3).

3 EMPERICAL ANALYSIS

Before any econometric analysis it is important to examine the nature of data to be used in empirical analysis. To this end, we tested for normality of data using descriptive statistics, were the Jarque-Bera statistics confirmed the normality of data. Additionally, the presence of unit root is tested using augmented dickey fuller test (ADF). The results of augmented dickey fuller test are presented in Table 2.

Table 2 Unit root results

Variable	Level	First difference	Remark
Employment elasticity	–2.22	–3.90**	I(1)
Trade openness	–1.47	–3.52**	I(1)
Human capital	–0.62	–7.22**	I(1)
Inflation	–2.93*	–6.18**	I(0)
Exchange rate	–2.22	–5.32**	I(1)
Services share	–0.35	–4.42**	I(1)

Note: * and ** represents 5% and 1% levels of significance respectively.
Source: Authors estimations

Unit root results presented in Table 2 collectively suggest that underlying variables are combination of I(0) and I(1). The results specifically revealed that inflation is stationary at level and other study variables including employment elasticity, trade openness, human capital, exchange rate and services sector share are stationary at their first difference.

3.1 Cointegration test

Keeping in view stationary nature of study variables, ARDL is found to be optimal for estimation purposes. For estimating ARDL model, first step is to test for existence of long run relationship among study variables. Bounds test is used to identify whether there exists a long run relationship or not. The results of ARDL bounds test are presented in Table 3.

Bounds test results presented in Table 3 reveal the F-statistic value of 3.64, which is higher than upper bound values at all the levels of significance. This evidence suggests that there exists a long run relationship between employment elasticity and accounted determinants during the study period.

Table 3 Pesaran et al. (2001) test for cointegration

Significance level	Lower bound I(0)	Upper bound I(1)	K
10%	1.81	2.93	
5%	2.14	3.34	5
1%	2.82	4.21	
F-value	3,6		

Source: Authors estimations

3.2 Long run and short run results

Based on the evidence provided by bounds test results, we estimated long run relationship. The results of ARDL long run and short run Cointegration are presented in Table 4.

Table 4 ARDL long run and short run results

Variables	Coefficients	Std. error	t-statistic	P-value
Panel-A: long-run				
INF	–0.79	0.16	–4.74	0.00
OPN	–0.14	0.06	–2.31	0.02
HU	3.70	3.10	1.19	0.24
EXR	0.36	0.13	2.76	0.00
SS	0.07	0.11	0.66	0.51
Panel-B: short-run				
DINF	0.16	0.05	2.94	0.00
DOPN	0.12	0.06	1.74	0.09
DHU	1.28	0.70	1.82	0.06
DEXR	0.59	0.18	3.23	0.00
DSS	0.30	0.21	1.39	0.17
ECM(-1)	–0.43	0.16	–2.71	0.01
R-square			0.94	
Adjusted R-square			0.90	
CUSUM			Stable	
Durban-Watson stat.			1.99	
Model selection criteria			Akaike info criterion (AIC)	

Source: Authors estimations

Long run results presented in Table 4 revealed that inflation had significantly negative impact on employment elasticity in the long run with relatively strong relationship coefficient of –0.79. This does mean that a 1% increase in inflation decreases employment elasticity by 0.79%. Inflation negatively affects

employment elasticity by increasing uncertainty and production costs, discouraging firms from hiring more workers. Under inflationary conditions, businesses substitute labor with capital, as labor demands wage hikes in response to rising prices. This substitution lowers employment elasticity, reducing the responsiveness of employment to economic growth. The sand effect Friedman (1977) further worsens employment conditions by causing resource misallocation and inefficiencies. Empirical studies show that inflation uncertainty significantly lowers employment elasticity, especially in developing economies like India, Pattanaik and Nayak (2014). Reducing macroeconomic uncertainty through stable policies can enhance investment and employment growth, Crivelli et al. (2012).

Regarding the impact of trade openness, the results revealed a negative and significant relationship relatively weak coefficient of –0.14, meaning that a 1% increase in openness leads to decline in long run employment elasticity by 0.14%.

Openness tends to increase competition, which makes firms to go for least cost production processes. This mostly leads to substitutions of labour with capital in the process of production. Additionally, openness enables certain spillovers which push productivity up, and according to kapoos (2006) there is a trade-off between productivity increase and employment elasticity. Once productivity increases owing the process of openness, it ultimately shows a negative impact on employment elasticity.

Human capital reveals to have a positive but statistically insignificant impact on long run employment elasticity. Regarding the impact of exchange rate, the results show that currency depreciation has significantly positive impact on employment elasticity in the long run were 1% increase in currency depreciation increase employment elasticity by 0.36%.

Currency depreciation can impact employment elasticity positively by boosting exports and discouraging imports. A weaker currency makes exports more competitive, increasing demand in sectors like manufacturing and textiles, which are labor-intensive. Simultaneously, higher import costs encourage domestic production of import substitutes, creating more jobs. This shift toward labor-intensive industries raises employment elasticity, as seen in developing countries (Bhat et al., 2022; World Bank, 2008). Depreciation also reduces competitive pressure from cheaper imports, allowing domestic firms to expand and sustain employment (Campa, 2005).

Lastly, services sector share reveals to have a positive but statistically insignificant impact on employment elasticity of economic growth in China in the long run.

Short run results presented in panel-B of Table 4, suggest that inflation and openness have significantly positive impact on employment elasticity in the short run, while this impact turns negative in the long run, suggesting a non-linear impact of these two macroeconomic variables on employment elasticity of economic growth in China during the study period. Human capital has a significantly positive impact on employment elasticity in the short run. However, similar to the long run currency depreciation reveals to have positive impact in short run as well. Further increase in exchange rate (currency depreciation) has a positive impact on employment elasticity in short run. More importantly with a coefficient of –0.43, the ECM results suggest that disequilibrium is corrected at a speed of 43% per year.

The model statistics demonstrates a strong fit, with an R-squared of 0.94 and an adjusted R-squared of 0.90, indicating that 90% of the variation in the dependent variable is explained by the model after adjusting for the number of predictors. Durbin-Watson statistic of 1.99 suggests no serious autocorrelation in the residuals. Additionally, the CUSUM test confirms the stability of the model over time, supporting the reliability of the estimated long-run relationship. Lastly, the selection of the model based on the Akaike Information Criterion (AIC) further ensures optimal lag structure and model efficiency.

3.3 Diagnostic statistics

For diagnostic inspection, several statistical tests were used, such as the Breusch-Godfrey Lagrange multiplier (LM) test to verify serial correlation and the Breusch-Pagan-Godfrey (BG) test to confirm for

heteroscedasticity. Ramsey RESET Test examines model specification and Jarque-Bera tests for normality. These tests are used to check for the assumptions of the model and to ensure the validity of the results. Table 5 displays the outcomes of the diagnostic tests.

Table 5 Diagnostic tests

	Obs. *R-squared	Test-statistic	P-value
Breusch-Godfrey serial Correlation LM test	3.25	1.06	0.19
Breusch-Pegan-Godfrey heterokedasticity test	10.45	0.69	0.65
Ramsey RESET test		0.62	0.54
Jarque-Bera		2.17	0.33

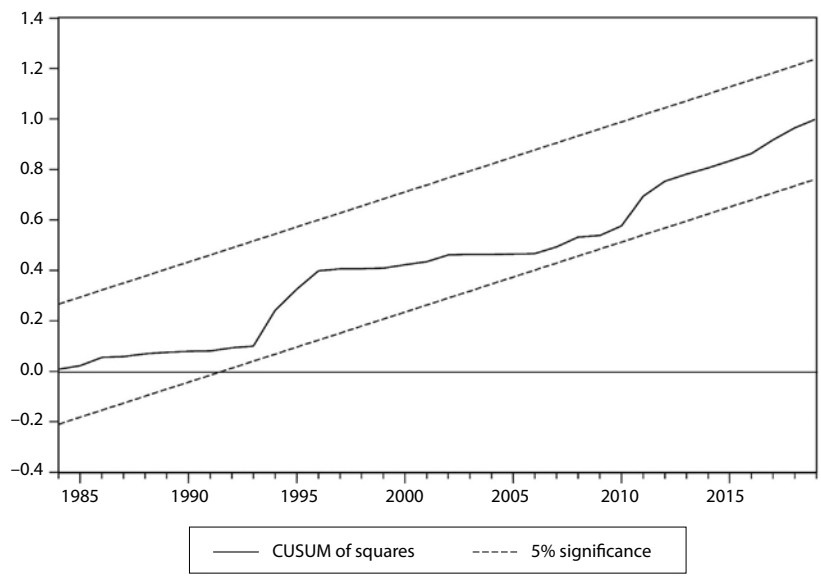
Source: Authors estimations

The Breusch-Godfrey test with (p-value 0.19) indicates no significant serial correlation in the residuals. The Breusch-Pagan-Godfrey test with (p-values 0.65) suggests that there is not any presence of heteroskedasticity in the model. Further, Ramsey RESET test (p-value: 0.54) does not indicate model misspecification. Lastly, the Jarque-Bera test with (p-value 0.33) suggests that residuals are normally distributed. Overall, the model appears to be well-specified, with no major econometric issues.

3.4 Parameter stability test

In order to examine parameter stability we used the CUSUM square test. Figure 2 represents the results of this step. There is a rule of thumb, if the blue line stays inside the red lines, one can conclude that parameters in estimated model are stable. Red lines represent 5% level of significance. The results of CUSUM square for the present study suggests that estimated model parameters are stable across the study period.

Figure 2 CUSUM Square



Source: Authors estimations

3.5 Robustness check

Further, in order to test for the robustness of the ARDL results we have applied the Dynamic Least Square (DOLS). The results of this econometric exercise are presented in Table 6.

Table 6 Dynamic Least Square (DOLS) (robustness check)

Variables	Coefficients	Std. error	t-statistic	P-value
INF	–0.31	0.11	–2.71	0.01
OPN	–0.24	0.05	–4.77	0.00
HU	3.46	0.71	4.87	0.00
EXR	0.12	0.05	2.40	0.03
SS				
R-square			0.94	
Adjusted R-square			0.88	

Source: Authors estimations

The results presented in Table 6 reveal that the DOLS estimates are consistent with the findings of the ARDL model in terms of direction of coefficients along with level of significance. These findings add to the reliability of our results, confirming the stability of the long-run relationship between the variables. This consistency across methodologies strengthens the overall validity of our empirical. Lastly, the convergence in results also implies that policy inferences drawn from the model are grounded in stable long-run dynamics, making them more dependable for real-world application.

CONCLUION AND POLICY IMPLICATIONS

China has witnessed a tremendous growth in the recent decades making it one of the fastest growing economies of the world. This remarkable economic performance has been characterized by rapid industrialization, technological advancement, and urbanization. However, there are concerns regarding employment performance of these growth achievements. Employment growth has shown a continuous decline from being around 2% for the period of 1980–2000 to just 0.43 during 2000–2017. In the background of this dismissive employment performance, current study attempts to examine this issue. We have used a tow step approach, first we estimated employment elasticity of economic growth using a time varying methodology, and, secondly, we have used estimated employment elasticity as dependent variable, in order to identify macroeconomic variables which are having impact on it.

The findings of the study revealed that China's economic growth has been least employment intensive with employment elasticity of just 0.15, which is lower than globally acceptable medium, range of 0.3–0.5. Regarding macroeconomic determinants of employment elasticity, we found that inflation and trade openness had significantly negative impact on China's employment elasticity while currency depreciation has a positive impact on employment elasticity of economic growth in China during the study period.

Keeping in view the findings of the study, it is advised that policymakers should focus on stabilizing inflation through prudent monetary policies to be able to boost job creation in the economy. While trade openness enhances efficiency, consumer welfare, and overall economic growth, its adverse effect on employment elasticity underscores that trade is not universally advantageous when viewed through the lens of inclusive and job-rich development. Strategic trade policies, such as targeted tariffs or incentives for domestic industries, can help mitigate the adverse effects of openness on job creation. Additionally, balancing capital-intensive investments with labor-driven growth by promoting labor-intensive industries

and incentivizing employment-generating sectors is crucial. Lastly, leveraging currency depreciation to enhance the competitiveness of labor-intensive exports can further stimulate job creation and improve employment elasticity in China.

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