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Research Article

The Impact of Trade Openness, FDI and Domestic Factors on Labour Productivity in China

Dehan Kang[1*] and Pornlapas Suwannarat[1]

[1] *Kasetsart Business School, Kasetsart University, Thailand*

[*] *Corresponding author. E-mail: kangdehan.xe@gmail.com*

ABSTRACT

This study aims (1) to ascertain the effects of foreign factors and domestic factors on labour productivity in China during 1983 to 2022, and (2) to measure and evaluate Chinese labour productivity across different sectors from 1978 to 2022. All discrete data in macro level have been analyzed via the ordinary least squares regression (OLS) method. Furthermore, the statistical t-test is also used to compare labour productivity index between the groups. The data of the study have been obtained from various sources such as National Bureau of Statistics of China, China Statistical Yearbook 2023, and so forth. The study reveals the complex effects of foreign factors on labour productivity; trade openness has been found to have a negative impact on labour productivity across sectors, while FDI's influence was mixed. It positively affected labour productivity in primary industrial sector, but it was found to have negative or non-significant effects in secondary and tertiary sectors. For the domestic factors, the capital-labour ratio, one-child policy, and number of graduates have been found their positive effect on labour productivity. Also, share of output value in the industry to the agriculture sector positively impacted on labour productivity in the secondary industrial sector, whilst share of output value in the service to agriculture sector showed the positive effect on labour productivity in tertiary sector. In addition, the study is found the significant increase of China's labour productivity after joining the WTO in all industrial sectors. However, when comparing the labour productivity before and after adoption of China's one-child policy, significant difference is found only in the primary industrial sector.

Keywords: Labour Productivity Index, Foreign Factors, Domestic Factors, Trade Openness, FDI

Introduction

Trade and investment have played an important role in China's national development, driving the country's rise from an agrarian economy to a global economic powerhouse (Huang, 2010). Among them, the liberalisation of trade openness and the strategic attraction of foreign direct investment (FDI) have played a key role in transforming China's economic landscape. As a very important external factor, it has driven the development of the entire Chinese economy, creating a very far-reaching impact (Whalley and Xian, 2010; Lin, 2011).

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Trade openness has been the cornerstone of China's economic strategy. Since implementing economic reforms in 1978, China has embraced globalisation and significantly expanded its trade horizons. The country's accession to the World Trade Organization (WTO) in 2001 further accelerated its trade growth, opened new markets, and fostered competitive industries (Morrison, 2001; Deckers, 2004). In 2022, China was the world's largest exporter, representing a value of up to US$3,714,245.28 million, trading in a wide variety of goods, from textiles to electronics (World Bank, 2024). Trade expansion has not only generated considerable income but also created millions of jobs and elevated living standards.

Investment, especially FDI, has also been crucial in China's development. The country has successfully attracted foreign investors by offering preferential policies such as tax incentives and establishing Special Economic Zones (SEZs). These SEZs have provided a favourable operating environment for foreign companies, bringing capital, advanced technology and managerial experience. The influx of investment stimulated industrial growth, increased productivity, and promoted technological innovation (Crane et al., 2018). In addition, such investment has catalysed the development of infrastructure, such as transportation and communication networks, which are crucial for continued economic growth. However, China's future economic development still faces many other challenges, especially in terms of population and the efficient labour force.

At present, China is the world's second most populous country after India and the world's second-largest economy after the United States. China began a policy of openness, reforming its economic system in 1978 and achieving rapid economic growth during 46 years, with a gross domestic product (GDP) of US$17 trillion in 2022. Technological development and skilled labour have been the main driving forces behind China's economic rise. Furthermore, with 733 million workers, China already had the largest number of employees in the world in 2022, indicating its potential to surpass all other countries in manufacturing. The tertiary industry accounts for 47.1% of all jobs and creates a GDP of US$9.5 trillion, making it the industry with the highest labour force ratio. The secondary industry, accounting for 28.8% of all jobs and its GDP is worth US$7.0 trillion. Finally, the primary industry accounts for 24.1% and is worth US$1.3 trillion (Figure 1) (National Bureau of Statistics of China, 2024)

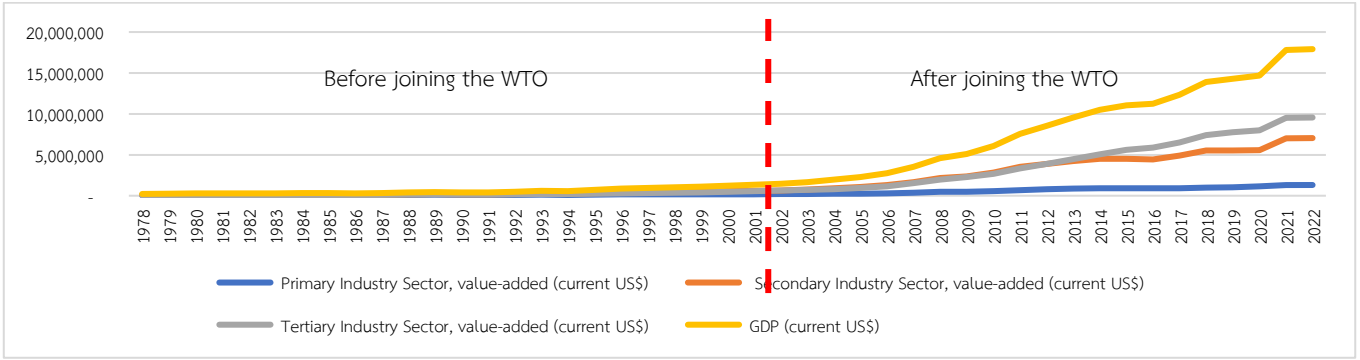

Figure 1 Gross Domestic Product classified by sector from 1978 to 2022
Source: National Bureau of Statistics of China (2024)

In 1960s, China was a poor country with a per capita income of only US$89.52–312.02 (1960–1980), so the Chinese government under Deng Xiaoping announced economic reforms from a centralised economic system to a market economic system in 1979, namely the "Reform and Opening" policy, which

was considered an important starting point for China's rapid economic growth. However, in that year, the number of poor people in China reached 770 million (Liu et al., 2001), accounting for approximately 79.76% of the total population of 969 million. Therefore, to ease the pressure on the poor population and improve their quality of life, the government was forced to implement the one-child policy to ease the rising fertility rate. This policy has had a lasting impact on China's economic development and labour productivity. It was also an important government policy at that time because of its potential to improve the overall living standards of the population. The primary driver of economic growth is the advancement of elements of production, with a special emphasis on labour. Labour is intricately connected to all sectors of the economy and encompasses both consumers and producers (Zhang, 2022).

The implementation of the one-child policy has had a significant impact on the birth rate of China's population (Bongaarts and Greenhalgh, 1985). In the years before the implementation of this policy, between 1960 and 1979, China had an average birth rate of 28.98 per 1,000 individuals and an average population growth rate of 1.97%. In the period between the implementation of the policy in 1979 - 2016, China had an average birth rate of 16.37 per 1,000 individuals and an average population growth rate of 0.97%. Despite the Chinese government's announcement concerning the abolition of the one-child policy in 2016, its effects continue to persist. In 2021, China's birth rate per 1,000 people was only 7.52%, while the population growth rate averaged only 0.09%. This growth rate is expected to decrease due to factors such as the economic downturn, the high costs of raising children, and the changing social environment. These factors directly impact the growth rate of the population. Between 1991 - 2023, the labour force experienced an average growth rate of 0.59%. However, in 2023, there was a negative growth rate of -0.25%. Assuming that the population birth rate and labour growth rate continue to decline, the labour force will be affected in the primary, secondary and tertiary sectors of the country (Figure 2).

In response to the foregoing issues, this study uses the method of measuring labour productivity index (LPI) with discrete data from the perspective of macro data. It examined foreign and domestic factors affecting labour productivity. Also, this study will examine the Chinese labour productivity across different sectors for 1978 to 2022; it is divided into two periods: before and after joining the WTO, and during and after the one-child policy.

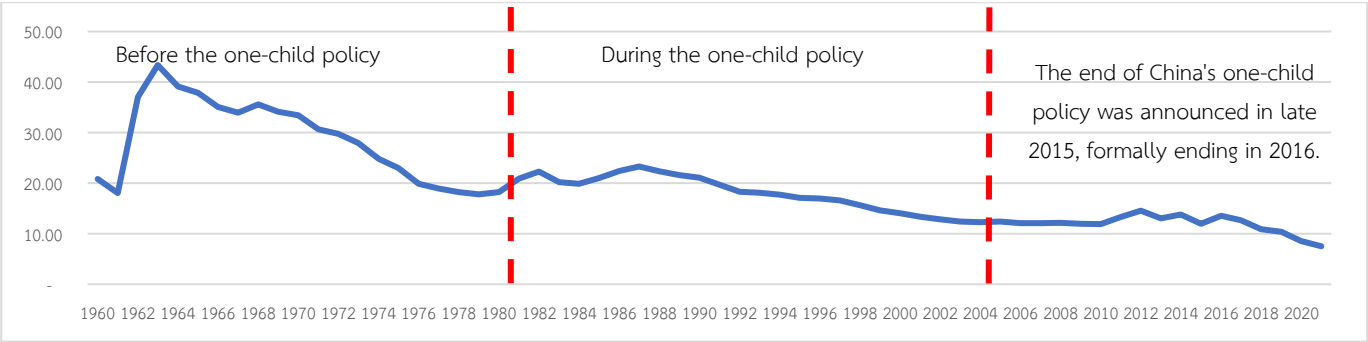

Figure 2 Birth rate, crude (per 1,000 people), from 1960 to 2022

Source: World Bank (2024).

Research Objectives

1. To ascertain the effects of foreign and domestic factors impacting labour productivity in China for 1983 to 2022.

2. To measure and evaluate Chinese labour productivity across different sectors for 1978 to 2022.

Research Methodology

Labour productivity is measured using discrete data, quantified by the ratio of output volume to input quantity (Sawangloke, Santipolvut, and Thamma-Apiroam, 2019); this can be seen in Table 1. To examine the effects of both domestic and foreign factors on labour productivity in China, the Augmented Dickey-Fuller (ADF) test and the Phillips-Perron (PP) test are adopted to test whether the domestic and foreign factor variables are stationary (Table 5). In addition, we also utilized a portmanteau test to assess the autocorrelation in the residuals of the fitted time series model. The Regression Normalization Error Test (RESET) is chosen to conduct to test the presence of normalization error in the regression model. The normality test also has been used to verify whether the residuals follow a normal distribution, a common assumption in regression analysis (Table 6). As well, this study utilises the Ordinary Least Squares (OLS) approach, implying that the analysis creates a model for establishing a relationship between one or more explanatory variables and a continuous or interval outcome variable. The purpose of the model is to minimise the total squared errors, where an error is defined as the discrepancy between the observed and predicted values of the outcome variable (Mahbobi and Tiemann, 2015).

The comparison of labour productivity in this study is divided into three sectors: labour productivity index of primary industry (LPIP), labour productivity index of secondary industry (LPIS), labour productivity index of tertiary industry (LPIT), and total average (LPITO). Comparing labour productivity in each period in this study, it can be divided into two period types: 1) before and after being WTO member; China's entry into the World Trade Organization (WTO) in 2001. This could accelerate trade growth and opened new domestic and foreign markets; 2) the comparison between the period in which China implemented the one-child policy from 1979 to 2015 to control population growth, and after 2015 when the one-child policy was stopped. Furthermore, the statistical t-test is used to compare labour productivity index.

Data Collection

This study employs retrospective data from 1983 to 2022 obtained from reliable international sources. The data has been extracted from the databases of the World Bank, National Bureau of Statistics of China, and United Nations (Table 1). The data used are divided into three different categories: 1) data on the assessment of labour productivity, 2) data on foreign factors affecting labour productivity, and 3) data on domestic factors affecting labour productivity.

Table 1 Description and measurement of the variables used in this study

Dimension	Variables	Description/Measurement	Source of Data
Labour productivity	LPIP, LPIS, LPIT and LPITO	Labour Productivity Index $= \frac{Q_{t,i}/Q_{0,i}}{L_{t,i}/L_{0,i}}$	Authors' calculation from the National Bureau of Statistics of China
Foreign Factors			
Trade openness	TR	Trade openness ((import + export)/GDP	Authors' calculation from the National Bureau of Statistics of China
Investment	FD	Foreign Direct Investment Actually Utilised Value (percentage of GDP)	National Bureau of Statistics of China
The country's accession to the World Trade Organization	WTO	Dummy variable 1, if joining the WTO, 0 if not joining the WTO	Morrison (2001) Deckers (2004)
Domestic factors			
Capital-labour ratio	KL	Capital-labour ratio (gross fixed capital formation per labour force)	Authors' calculation from the World Bank
Human capital	HE	Government health expenditure	National Bureau of Statistics of China
	ED	Government education expenditure	National Bureau of Statistics of China
	NG	Number of graduates from regular institutions of higher education	National Bureau of Statistics of China
Population structural change	LI	Life expectancy at birth (year)	World Bank
	BI	Birth rate, crude (per 1,000 people)	World Bank
Economic structural change	IA	Share of output value in the industry to the agriculture sector	Authors' calculation from the World Bank and United Nations
	SA	Share of output value in the service to agriculture sector	Authors' calculation from the World Bank and United Nations
One-child policy	CHILD	Dummy variable: 1 if using the one-child policy, 0 if the one-child policy is cancelled	Bongaarts and Greenhalgh (1985)

The Conceptual Framework

The conceptual framework for this research is divided into two parts; the first part of the study examines the foreign and domestic factors influencing labour productivity through a comprehensive assessment of the literature. The categorisation of foreign factors involves two fundamental components: trade openness and investment, whilst the factors influencing domestic labour productivity can be categorised into four main elements: capital-labour ratio, human capital, economic structural change, and demographic structural change, as depicted in Figure 3. Further, measuring and comparing labour productivity at the macro level by type of data can be depicted as shown in Figure 4.

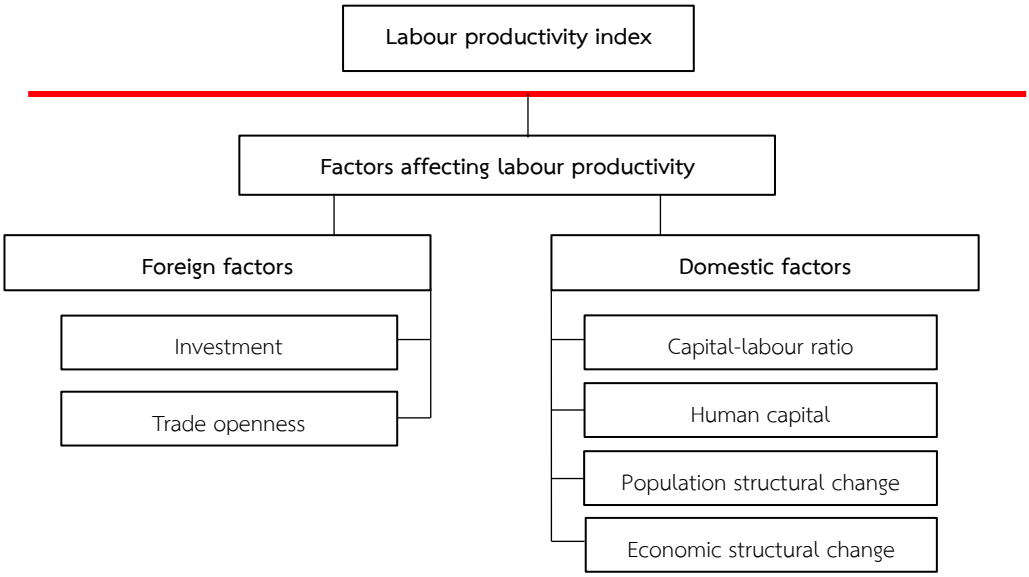

Figure 3 Conceptual Framework of Part 1: Factors affecting labour productivity

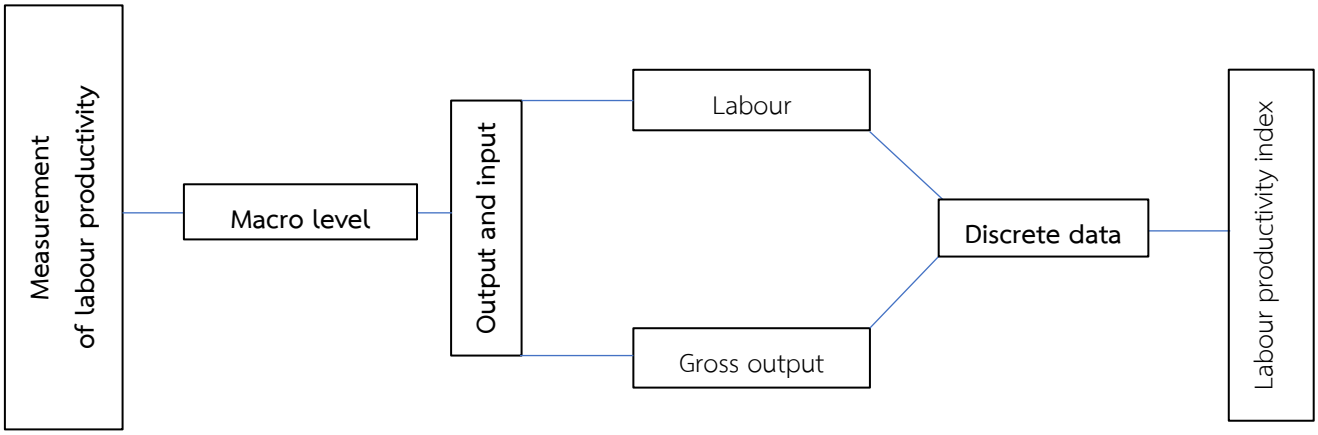

Figure 4 Conceptual Framework of Part 2: Labour productivity measurement

Research Results

The descriptive statistics for the variables prior to empirical analysis are presented in Table 2 showing the mean and standard deviations, as well as the maximum and minimum levels of all variables. However, according to the above-mentioned descriptive statistics, the variables have different units, and this study, therefore, uses various log transformations.

Table 2 Summary of available descriptive statistics used in this study for 1983 to 2022

Variables	Mean	Minimum	Maximum	Std. Deviation
LPITO	1175.04	107.68	4487.14	1347.28
LPIP	880.80	118.95	3536.75	1022.60
LPIS	638.74	77.67	2223.55	652.24
LPIT	709.93	92.60	2513.34	756.08
TR	0.38	0.14	0.64	0.12
FDI	70,203.31	920.00	189,132.41	56,590.23
KL	2643.82	133.69	10215.66	3165.01
HE	73,881.28	1,101.65	341,165.23	101,481.89

Table 2 Summary of available descriptive statistics used in this study for 1983 to 2022 (continue)

Variables	Mean	Minimum	Maximum	Std. Deviation
ED	196,035.83	4,791.18	589,810.51	210,868.78
NG	3,320,662.58	287,000.00	9,672,565.00	3,037,915.34
LI	72.67	65.90	78.59	4.01
BI	15.03	6.77	23.33	4.26
IA	3.50	1.36	5.63	1.46
SA	3.58	0.71	7.60	2.22

Source: Researchers' computations.

Prior to data analysis, the Augmented Dickey-Fuller (ADF) test and the Phillips-Perron (PP) test (Table 5) are employed in this study to assess the stationarity of domestic and foreign factor variables, to avoid mean and variance in stationarity during different periods and to prevent spurious regression due to the use of secondary time series data. The ADF test is used to check for the presence of a unit root in a time series. It extends the Dickey-Fuller test by incorporating lagged differences to address higher-order serial correlation, and to enhance its robustness. The null hypothesis of the ADF test posits that the time series has a unit root (is non-stationary). If the test statistic is sufficiently negative, the null hypothesis is rejected, suggesting the series is stationary. The PP test, like the ADF test, examines the null hypothesis of a unit root. However, it differentiates itself by using non-parametric methods to correct for serial correlation and heteroskedasticity in the error terms, making it a robust alternative when these issues are present. Unlike the ADF test, the PP test does not include lagged difference terms but instead modifies the test statistics directly, except for LPIS stationarity at the beginning level. Therefore, the study of factors affecting labour productivity uses variables at the 1st Diff level.

Table 3 Unit root test

Variable	ADF		PP	
	Level	1st Diff	Level	1st Diff
lnLPIP	-2.52	-4.26***	-2.46	-4.17***
lnLPIS	-3.70**	-5.78***	-3.79**	-5.76***
lnLPIT	-2.41	-5.79***	-2.41	-5.78***
lnLPITO	-2.77	-5.18***	-2.77	-5.10***
lnTR	-2.16	-5.21***	-2.18	-5.16***
lnFDI	-2.39	-3.23*	-2.21	-3.25*
lnKL	-1.92	-3.52**	-2.11	-3.52**
lnHE	-4.83	-7.62***	-4.79	-8.98***
lnED	-2.07	-5.66***	-1.97	-5.63***
lnNG	-1.11	-3.68**	-1.67	-3.87***
lnLI	0.21	-5.57***	0.13	-5.59***
lnBI	-0.78	-5.55***	-1.40	-5.71***
lnIA	-0.96	-5.86***	-0.76	-5.92***
lnSA	-2.46	-4.26***	-2.60	-5.32***

Source: Researcher's computations.

NB: ***p<0.01, **p<0.05, *p<0.10

Table 4 shows that the models pass all the diagnostic tests. The next part of the analysis is the estimation of the long-run coefficients.

Table 4 Diagnostic tests

Test	Total Industry Sector	Primary Industry Sector	Secondary Industry Sector	Tertiary Industry Sector
Autocorrelation	No Autocorrelation	No Autocorrelation	No Autocorrelation	No Autocorrelation
Portmanteau Test	11.67 (0.47)	9.14 (0.69)	6.49 (0.89)	8.34 (0.75)
RESET test	2.38 (0.12)	0.25 (0.86)	2.67 (0.09)	2.25 (0.11)
Normality	1.20 (0.54)	0.98 (0.61)	0.90 (0.64)	0.31 (0.85)

Source: Researchers'computations.

NB: The figures in parenthesis ( ) are p-values.

Table 5 indicates the variance inflation factor (VIF) values informing that multicollinearity is not a severe issue in your model, as all VIFs are below 10 (Gujarati and Porter, 2009; Montgomery, Peck, and Vining, 2021).

Table 5 Variance Inflation Factor (VIF)

Variable	VIF
ΔlnTR	2.22
ΔlnFDI	2.74
ΔlnKL	3.08
ΔlnHE	3.55
ΔlnED	3.96
ΔlnNG	1.96
ΔlnLI	1.88
ΔlnBI	1.32
ΔlnIA	4.15
ΔlnSA	3.18
WTO Dummy variable	2.83
One-child policy Dummy variable	2.25

Table 6 indicates factors affecting labour productivity by production sector using robust estimation models; the data reveal that trade openness (TR) has negative impact on the total sector, primary, secondary, and tertiary sectors, with coefficient values of -0.19, -0.14, -0.24, and -0.18 and t-statistic values of-3.09, -2.85, -2.85, and -1.89 signifying considerable negative relationships at the 1% and 10% significance level respectively. The impact of FDI on labour productivity is positive in the total and primary industry sectors, while it is found the negative association in the secondary, and tertiary industry sectors. However, these relationships are not statistical significance that are the same as birth rate (BI) and joining WTO (Dummy WTO), which do not have significant effects either.

Capital-labour ratio (KL) has positive impact on the total sector, primary, secondary, and tertiary sectors, with coefficient values of 0.70, 0.81, 0.61, and 0.70 and t-statistic values of 5.07, 6.68, 4.63, and

3.80 respectively signifying strong positive relationship at the 1% significance level. Government health expenditure (HE) has negative impact on the total sector, primary, and secondary sectors, with coefficient values of-0.31, -0.33, and -0.34 and t-statistic values of -2.38, -2.76, and -2.23 correspondingly informing strong negative relationship at the 1% and 5% significance level. Government education expenditure (ED) has negative impact on the total sector, primary, and tertiary sectors, with coefficient values of-0.20, -0.25, and -0.23 and t-statistic values of-2.49, -3.32, and -1.85 respectively revealing strong negative relationship at the 1%, 5%, and 10% significance levels. Number of graduates from regular institutions of higher education (NG) has positive impact on the total sector and primary sectors, with coefficient values of 0.20 and 0.20 and t-statistic values of 1.89 and 2.13 illustrating strong positive relationship at the 5% and 10% significance levels. Also, life expectancy at birth (LI) has negative impact on the total sector, primary, and secondary sectors, with coefficient values of -8.97, -11.41, and -10.39 and t-statistic values of -2.06, -2.09, and -1.97 signifying strong negative relationship at the 5% and 10% significance levels. Share of output value in the industry to the agriculture sector (IA) has both negative and positive impact on the primary and secondary sectors respectively, with coefficient values of-0.78 and 0.46 and t-statistic values of -3.86 and 1.79 at the 1% and 10% significance level. Share of output value in the service sector to agriculture sector (SA) has negative and positive impact on the primary and secondary sectors respectively, with coefficient values of -0.42, -0.48, and 0.46 and t-statistic values of -3.19, -3.34, and 2.20 at the 1% and 5% significance levels. For one-child policy (Dummy CHILD) has positive impact on the total and primary with coefficient values of 0.04 and 0.06 and t-statistic values of 2.22 and 3.57 at the 1% and 5% significance levels.

Table 6 Factors affecting labour productivity by production sector using robust estimation models

Variable	Total Sector	Primary Sector	Secondary Sector	Tertiary Sector
Δln TR	-0.19 (-3.09)***	-0.14 (-2.85)***	-0.24 (-2.85)***	-0.18 (-1.89)*
Δln FDI	0.01 (0.26)	0.05 (1.28)	-0.01 (-0.13)	-0.05 (-0.66)
Δln KL	0.70 (5.07)***	0.81 (6.68)***	0.61 (4.63)***	0.70 (3.80)***
Δln HE	-0.31 (-2.38)**	-0.33 (-2.76)***	-0.34 (-2.23)**	-0.23 (-1.33)
Δln ED	-0.20 (-2.49)**	-0.25 (-3.32)***	-0.15 (-1.73)	-0.23 (-1.85)*
Δln NG	0.20 (1.89)*	0.20 (2.13)**	0.15 (1.55)	0.26 (1.64)
Δln LI	-8.97 (-2.06)*	-11.41 (-2.09)**	-10.39 (-1.97)*	-12.00 (-1.54)
Δln BI	-0.01 (-0.23)	0.01 (0.10)	-0.07 (-0.92)	-0.03 (-0.30)
Δln IA	-0.07 (-0.32)	-0.78 (-3.86)***	0.46 (1.79)*	-0.36 (-0.99)
Δln SA	-0.16 (-0.98)	-0.42 (-3.19)***	-0.48 (-3.34)***	0.46 (2.20)**
WTO Dummy variable	0.01 (0.71)	0.02 (1.52)	-0.01 (-0.40)	0.01 (0.24)
One-child policy Dummy variable	0.04 (2.22)**	0.06 (3.57)***	0.02 (1.00)	0.02 (0.69)
Cons	0.04 (1.45)	0.04 (1.69)	0.06(1.94)*	0.02 (0.45)
R-squared	0.92	0.94	0.93	0.82
Durbin–Watson d-statistic	2.01	1.74	2.15	1.78
F-statistic	43.87***	73.68***	39.87***	9.69***

Source: Researchers'computations.

NB: ***p<0.01, **p<0.05, *p<0.10; the figures in parenthesis ( ) are p-values.

To measure and evaluate Chinese labour productivity across different sectors, the results of the study at Table 7 reveals that before joining the World Trade Organization (WTO) (1978–2000), China's total average labour productivity index (LPITO) is 160.07, with an average growth rate of 6.05%. After joining the WTO, the LPI rises to 2,102.07, with an average growth rate of 12.07%. In addition, a comparison of the LPIs by sector reveals that before joining the WTO, the average LPI of the primary industry (LPIP) is the highest at 158.61, with an average growth rate of 4.56% followed by the secondary industry (LPIS) at 122.17, with an average growth rate of 4.79%; and the tertiary industry (LPIT) at 124.71, with an average growth rate of 4.40%. According to the data, after joining the WTO in 2001, China's LPI increases significantly compared to previous years (LPITO = 2,102.07; LPIP = 1,555.54; LPIS = 1,104.93; LPIT = 1,204.61). This increase can be attributed to a number of inter-related factors after joining the WTO, which have jointly improved the efficiency and output of China's labour force.

The t-test statistic is computed to compare the difference in the LPI between before and after China's WTO membership. The results show that the t-statistic value for the LPITO equals to -6.62 with a p-value of 0.00, indicating a significant statistical difference between before and after China's WTO membership. When comparing each sector, the LPIP t-statistic value is shown as -5.92 with a p-value of 0.00, the LPIS t-statistic value equals -7.35 with a p-value of 0.00, and the LPIT t-statistic value is illustrated as -6.97 with a p-value of 0.00, indicating a significant statistical difference between before and after China's WTO membership.

Table 7 Comparison of the average LPI from 1978 to 2000 and from 2001 to 2023

LPI by Sectoral	China Joined the WTO	Mean	Std. Deviation	Std. Error Mean	t-Statistic	Average Growth Rate (%)
LPIP	1978–2000	158.61	42.18	8.80	-5.92***	4.65
	2001–2023	1,555.54	1,130.28	235.68		13.38
LPIS	1978–2000	122.17	42.86	8.94	-7.35***	4.79
	2001–2023	1,104.93	639.74	133.39		10.59
LPIT	1978–2000	124.71	36.43	7.60	-6.97***	4.40
	2001–2023	1,240.61	766.77	159.88		11.30
LPITO	1978–2000	160.07	63.54	13.25	-6.62***	6.05
	2001–2023	2,102.07	1,406.05	293.18		12.72

Source: Researchers'computations.

Note: *, ** and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

A comparison of the LPI before and after China's one-child policy reveals that before the policy (1978–2014), the LPITO index value is 538.37, with an average growth rate of 10.06%. However, following the termination of the one-child policy, the LPITO increases to 3,567.70, exhibiting an average growth rate of 6.69%. After rescinding its one-child policy (2015–2023), the LPIP value is shown as 2,735.53 with an average growth rate of 7.37%, followed by the LPIT index value of 2,034.18 with an average growth rate of 6.04% and LPIS value of 1,758.16 with an average growth rate of 5.90%, respectively.

The t-test statistic was applied to compare the difference in the LPI before and after China's one-child policy. The results showed that for the LPITO, the t-statistic was equal to -11.94 with a p-value of

0.59; for LPIS, the t-statistic was equal to -10.83 with a p-value of 0.97, while the LPIT had a t-statistic equal to -11.46 with a p-value of 0.94; these indicate that there are no significant statistical differences between the period of before and after China's one-child policy. However, when comparing the primary industry sector before and after China's one-child policy, the t-statistic value for the LPIP index equals -10.08 with a p-value of 0.04 at 5% of significance levels, indicating significant statistical difference between before and after China's one-child policy.

Table 8 Comparison of the average LPI from 1978 to 2014 and from 2015 to 2023

LPI by Sectoral	One-Child Policy	Mean	Std. Deviation	Std. Error Mean	t-Statistic	Average Growth Rate (%)
LPIP	1978–2014	400.16	461.14	75.81	-10.08**	9.30
	2015–2023	2735.53	656.61	218.87		7.37
LPIS	1978–2014	335.13	355.72	58.48	-10.83	8.16
	2015–2023	1758.16	342.08	114.03		5.90
LPIT	1978–2014	353.91	400.82	65.89	-11.46	8.44
	2015–2023	2034.18	364.39	121.46		6.04
LPITO	1978–2014	538.37	672.76	110.60	-11.94	10.06
	2015–2023	3567.70	726.91	242.30		6.69

Source: Researchers' computations.

NB: **p<0.05

Discussions

The results of this study that shows the rise of the LPI index since joining the WTO of China, which provides China with more access to the global market by reducing trade barriers and tariffs. The expansion of relaxed market access has stimulated a substantial increase in exports, leading Chinese manufacturers to expand production scale and improve operational efficiency (Branstetter and Lardy, 2006). Due to the incentives of global market competition, Chinese manufacturers have to adapt to the need of market, adopt advanced technologies, and optimise manufacturing processes to improve labour productivity. At the same time, joining the WTO has greatly increased China's attractiveness to foreign direct investment (FDI). Multinational corporations are more willing to invest in China, bringing large amounts of capital, state-of-the-art technology, and management experience (Hale and Long, 2011). FDI not only creates jobs but also promotes the transfer of skills and knowledge to the local workforce. The influx of FDI is crucial to the modernisation of Chinese industry and productivity improvement, especially in areas such as electronics and automobile manufacturing. Increased interaction with foreign companies and integration into the global supply chain have enabled Chinese companies to access cutting-edge technology and international best practices. This contact has brought significant technology transfer, promoting modernisation and productivity improvement (Hu and Jefferson, 2009). In addition, competitive pressure from foreign companies has also forced Chinese companies to further innovate and improve production processes, promoting the growth of labour productivity.

In addition, the increase in job opportunities since joining the WTO has led to a strong demand for all types of human resources, resulting in the Chinese government and the private sector investing

heavily in education and vocational training. At the same time, both the Chinese government and the private sector have focused on upgrading the skills of the workforce to meet the needs of a more complex economy (Fleisher et al., 2010). This emphasis on human capital development ensures that the workforce can effectively utilise new technologies and equipment, thereby improving productivity. China's rapid integration into the global economy has enabled companies to achieve economies of scale. Producing for a larger global market has enabled companies to reduce unit costs and improve efficiency (Whalley and Xin, 2010). Longer production cycles and spreading fixed costs over more production units have led to significant cost savings and productivity gains. Joining the WTO has also prompted China to improve its business environment, attracting and retaining investment. This includes better protection of intellectual property rights, a more transparent regulatory framework, and improved infrastructure (Zhao and Webster, 2011). These improvements have created a more favourable environment for companies to operate, enhancing productivity.

Regarding the implementation of the one-child policy, the study is found significant differences in the LPI of China's primary industrial sector (including agriculture, forestry, fishery, and mining). This population policy had a profound impact on the labour force, resulting in significant changes in labour productivity before and after the policy is implemented. Before the implementation of the one-child policy, China's population has been grown rapidly, providing sufficient labour for the primary industry. The agricultural system was labour-intensive, with low mechanisation and productivity levels (Banister, 1987). The abundant labour supply kept wages low and hindered investment in productivity-enhancing technologies. However, the implementation of the one-child policy led to a sharp drop in the birth rate and a gradual decline in the working-age population (Feng, Cai, and Gu, 2013). This demographic change led to a labour shortage in the primary industry, especially in rural areas. The reduction in the labour force pushed up wages, incentivising farmers and other primary industry operators to invest in mechanisation and more efficient agricultural practices to maintain production levels.

According to foreign factors, trade openness and FDI, have impacted labour productivity across different sectors in China. This study highlights these factors' complex and often adverse effects on labour productivity in the total industry, primary, secondary, and tertiary sectors. The negative effects of trade openness can be attributed to several factors. The influx of foreign goods and services may outcompete local producers, leading to reduced domestic output and employment (Wang, 2012) This competitive pressure discourages investment in productivity-enhancing innovations and leads to a specialisation in lower value-added activities, depressing overall productivity levels. Moreover, trade openness exposes the primary sector to global commodity price volatility and external shocks, exacerbating the negative impact due to its reliance on traditional production methods and limited access to advanced technologies. Consistent with the research of Zhang, Chen, and Wang (2022), the present study reveals that although trade openness has several positive factors, it also has potentially negative effects on labour productivity, such as increased competition, misallocation of resources, worker displacement, short-term adjustment costs, and wage inequality.

The secondary sector faces intense competition from both developed and developing countries, leading to a "race to the bottom" in terms of labour costs and working conditions, undermining productivity growth. The tertiary sector, which includes services such as finance, education, and

healthcare, also faces challenges from trade openness. Increased competition from foreign service providers can lead to market saturation, downward pressure on wages, and inefficiency, particularly in lower-skilled jobs (Ismail et al, 2012; Fatima, 2020). FDI has been a critical driver of China's economic growth, bringing in capital, technology, and management expertise. However, the impact of FDI on labour productivity varies across sectors. This study reveals that FDI has a positive effect on labour productivity in the total and primary industry sectors, though the impact is not statistically significant (Choe, 2003; and Ciruelos and Wang, 2005). In contrast, the secondary and tertiary sectors experience negative effects, suggesting that while FDI can introduce advanced technologies and practices, the varying absorptive capacity of local industries affects overall productivity gains. FDI's benefits, such as technology transfer and management know-how, may take time to diffuse across all sectors, leading to an initially muted impact on labour productivity (Ciruelos and Wang, 2005). In addition, the findings reveal that there is no statistically significant impact across the total, primary, secondary, and tertiary sectors according to joining the WTO of China. While WTO membership likely exposes these sectors to global competition, prompting some improvement in efficiency and productivity, these changes may not strong enough to be conclusive.

Regarding the domestic factors, first of all, the capital-labour ratio, which measures the amount of capital available per worker, is a key determinant of labour productivity for this study. In China's rapidly developing economy, this ratio has significant implications across all sectors. A higher capital-labour ratio generally leads to increased labour productivity (Helpman and Krugman, 1987). These advancements illustrate how significant capital investment, coupled with technological progress, contributes to substantial labour productivity gains, promoting balanced growth across all sectors (Battisti, Del Gatto, and Parmeter (2018).

Government health expenditure is another crucial factor influencing labour productivity in China. According to the study, increased health expenditure often correlates with decreased labour productivity across various sectors. This relationship can be attributed to several reasons. High health expenditure may indicate underlying health issues in the workforce, leading to absenteeism, reduced work hours, and lower overall productivity (Smith, 1999; Bloom, Canning, and Sevilla, 2004). Additionally, substantial government spending on health might divert resources from other productive investments. In the primary industry, which relies heavily on manual labour, the negative impact of health expenditure is particularly pronounced. Poor health conditions, especially in rural areas, can lead to decreased physical capacity and productivity. Issues like malnutrition, occupational hazards, and limited access to healthcare facilities exacerbate the negative effects on productivity (Barro, 1996; Strauss and Thomas, 1998; Bloom and Sachs, 1998; Grossman, 2000).

Education is widely recognized as a critical driver of economic growth and productivity, but the relationship between government education expenditure and labour productivity in China is complex. This study reveals that increased educational spending does not immediately enhance productivity, potentially due to inefficiencies in fund allocation and a lag between investment and returns (Hanushek & Woessmann, 2008; Pritchett, 2001; Zhao & Liu, 2018). In primary industries, such as agriculture, which rely on manual labour, formal education has limited applicability, and the negative impact of education spending is more pronounced. Rural areas, where these industries are concentrated, often have poor

educational infrastructure, resulting in less effective outcomes (Psacharopoulos & Patrinos, 2004; Foster & Rosenzweig, 1995). In secondary industries like manufacturing and construction, the negative effect of education spending is less significant but still present. The tertiary sector, which requires higher levels of specialized skills, benefits more from education. However, if there is a mismatch between education outcomes and labour market demands, increased spending may not lead to proportional productivity gains (Heckman, Stixrud & Urzua, 2006).

Higher education, however, has significantly boosted productivity in China. By equipping individuals with critical thinking, problem-solving skills, and technical expertise, higher education enables graduates to adapt to technological changes and innovate within their sectors (Barro & Lee, 2013; Hanushek & Woessmann, 2008). Research and development (R&D) activities in universities further contribute to innovation and labour productivity (Cohen, Nelson & Walsh, 2002). Life expectancy at birth, commonly seen as a positive indicator of socio-economic development, paradoxically negatively affects labour productivity in China. An aging workforce, less adaptable to new technologies and physically capable, contributes to lower productivity (Bloom, Canning & Sevilla, 2004). Additionally, a growing proportion of retirees increases financial burdens on the working-age population, diverting resources from productive investments (Cutler et al., 1990). Structural economic changes, particularly the shift from agriculture to industry and services, have also shaped labour productivity. The primary sector suffers from labour shortages and reduced investment, while the secondary sector benefits from economies of scale and technological advancements (Lewis, 1954; Timmer, 2009). The tertiary sector has seen productivity gains driven by education, specialized skills, and technological advances (Szirmai, 2012; Herrendorf, Rogerson & Valentinyi, 2014). China’s one-child policy has had varying impacts across sectors, positively influencing total industry productivity by shifting the workforce's age and experience distribution. However, its effect on secondary and tertiary sectors has not been statistically significant (Cai & Wang, 2010).

Originality and Body of Knowledge

The article is a comprehensive analysis of labour productivity across different industrial sectors, emphasizing external factors such as trade openness and foreign direct investment (FDI), alongside domestic elements including the one-child policy, capital-labour ratio, health and education expenditures, and demographic shifts. The study provides a distinctive viewpoint on China's economic development, especially presenting its entrance to the World Trade Organization (WTO), highlighting a significant rise in productivity propelled by improved market access, technology transfer, and structural changes. It reveals the varied effects of FDI, demonstrating beneficial impacts on the primary sector while yielding less consistent outcomes in secondary and tertiary businesses. The research underscores the problems presented by domestic causes, particularly the adverse impacts of health expenditure and an aging population on labour productivity. The findings offer significant insights into the impact of external integration and domestic policies on worker productivity, enhancing the comprehension of the elements affecting China’s economic growth and labour productivity trajectory.

Conclusions

The study indicates that Chinese labour productivity has been markedly increased after entry into the World Trade Organization (WTO) in primary, secondary, and tertiary sectors, propelled by augmented market access, FDI, technology transfer, and structural reforms, while the one-child policy has exerted a more complex influence, resulting in notable productivity enhancements in the primary sector due to mechanization and heightened efficiency driven by labour shortages. The research underscores the intricate impacts of trade liberalization and FDI on labour productivity. Trade openness typically exerted a detrimental effect across various sectors, although the impact of FDI was ambivalent, yielding beneficial outcomes for primary industries but negative or negligible effects on secondary and tertiary sectors. The study additionally investigates the influence of domestic factors, including the capital-labour ratio, human capital, demographic and economic structural changes on labor productivity. The findings indicate both negative and positive associations.

Recommendations

1. Policymaking Recommendations

1.1 In terms of trade openness policy, China's government may have to maintain policy stability and provide parallel support for the development of domestic industries by ensuring the robustness of the implementation process, avoiding excessive external competition affecting key industries, supporting the development of high-end manufacturing and innovative technology-based industries, and maintaining stable productivity growth to enhance competitiveness in the globalized market.

1.2 In terms of investment, the government may have to establish the restrictions on cross-sector foreign direct investment in the primary and secondary industries, using advanced equipment to promote improved production efficiency in the primary industry and achieve agricultural modernization. At the same time, it may promote the expansion and technological change of capital-intensive production methods in the secondary industry to improve efficiency and increase output. It may continue to open to high-end tertiary industries to attract new technologies and new capital.

1.3 By improving the healthcare system and enhancing the health outcomes of workers, this may ensure sustainable growth in labour productivity. The negative impact on labour productivity caused by poor health conditions can be addressed through targeted policies aimed at improving healthcare services in rural or labour-intensive industries. Reasonable medical expense reductions or subsidies by government may trigger to preventive health care or any collaborating schemes among government, enterprises, and industries.

1.4 Chinese government may strengthen the cooperation between schools, institutions, and enterprises to match the needs of education with those of institutions and enterprises. The state can increase support for vocational and technical training through policy guidance. For cultivating workers with different industry needs, special skill improvement measures are adopted, and assessments are conducted through certificates, experience, and years of experience, to improve workers' labour productivity, diversify their employment opportunities, and enhance the overall labour productivity of society.

1.5 The government may mitigate the negative impact of population aging on labour productivity by managing population changes and formulating relevant policies. This may include encouraging delayed retirement, investing in lifelong learning to keep older workers' skills up-to-date, and promoting automation and other technologies that can compensate for a shrinking workforce. Also, government may continue to encourage residents to have more children, increase parental benefits, reduce the burden of raising children; this could increase the birth rate.

1.6 During economic downturns, the government can promote structural economic change, cautiously guide structural economic change, and ensure that the transition from agriculture to industry and services does not result in productivity losses. The government has to continue investing in infrastructure, innovation, and human capital development in order to enhance productivity growth and minimize negative impacts on labour intensive industries in the long run.

2. Recommendations for Future Research

2.1 The findings of this study are specific to China and may not be applicable to other countries with different economic structures, cultural contexts, or policy environments. Therefore, future studies may have to modified to fit with the economies and societies of each country.

2.2 The study broadly categorises the economy into primary, secondary, and tertiary sectors. This generalisation may overlook the nuanced differences within each sector, such as variations in labour productivity within the sub-sectors of manufacturing or services. Therefore, future studies should consider variables directly related to each sector, such as capital-labour ratio, educational expenses of each sector, etc.

Limitations of This Study

The study has several limitations that could impact the generalisability and interpretation of the findings:

1. The study focuses on specific time periods, particularly before and after significant policy changes like China’s WTO accession and the one-child policy. While this provides valuable insights, the findings may not fully capture long-term trends or account for external factors such as global economic and political instability that influence labour productivity over extended periods.

2. The study primarily examines domestic and policy-related factors but may not fully account for the impact of global economic conditions, technological advancements, or international trade dynamics, which could also significantly affect labour productivity.

3. This study employs only quantitative analysis, so future study may use qualitative analysis or mixed method for covering more details.

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