Management Science and Business Decisions

ISSN 2767-6528 / eISSN 2767-3316
2021 Volume 1 Issue 2: 57–66
https://doi.org/10.52812/msbd.16

Does Innovation, Investment and Trade influence Labour Productivity? Empirical Evidence from Selected Countries

Cornelia Caroline[1,*]

[1] Binjiang College of Nanjing University of Information Science and Technology, Wuxi, China
*Corresponding author: caroline.cornelia14@gmail.com

Received 27 September 2021; *Revised* 20 October 2021; *Accepted* 21 October 2021

Abstract: Labour productivity is linked to improved living standards of a country, where higher productivity is usually seen as a competitive advantage for the country. The current study aims to identify the influence of investment, trade, and innovation on labour productivity using multi-regression. The sample involved four countries: the United States, Russia, Japan, and China. The results reveal varying degrees of relationships between labour productivity and other variables. In general, investment showed a strong correlation, trade showed a weaker relationship, and innovation showed insignificant relationship. When needed, the policymakers may consider raising labour productivity by improving investment or trade.

Keywords: Labour productivity; foreign direct investment; patents; innovation; trade

1. Introduction

Improving the standard of living in the form of increased consumption is directly related to labor productivity. The growing economy's labour productivity will produce more goods and services by the same relative work. This rise in output affects the possibility to consume more goods and services for a more sensible price. Generally, productivity refers to the economy of a corporation. It is estimated as the rate of output to input (Owyong, 2001). The most common indicator to measure productivity is Labor productivity, which corresponds to feedback acquired from the labour force or determined as the value-added per hour worked (Lieberman & Kang, 2008). Factors of labour productivity are divided into human capital, technological change, and economies of scale that reduce manufacturing costs. Human capital derives from the acquired knowledge such as knowledge and experience, skill, and average experience of workers in economic processes. In comparison, technological change occurs through innovations and inventions that encourage the advancement of new goods and services and increase productivity. Ultimately the other determinant of labour productivity is economies of scale that reduce manufacturing costs (Kagin *et al.*, 2016).

Considering the vagueness in the relationships of labour productivity with other factors, the current study will analyze the relationship of labor productivity to foreign direct investment, patents, and trade-to-GDP ratio among four selected countries (the U.S., Japan, China, and Russia).

After the introduction, the literature is reviewed in which these four variables are reviewed. Later, research methodology is reported, followed by data analysis and results. In the last part, the study concludes with important implications.

2. Literature review

2.1 Labour Productivity

Labour productivity is an important indicator representing the efficiency with which an economy produces goods and services. Van Tam *et al.* (2018) considered labour productivity to be one of the most important factors influencing the competitive capacity of national economies generally and of businesses and organizations particularly. Jorgenson (1988) points out an increase in labour and capital input in the United States occurred from 1947 to 1985. Whereas the rise in capital input is the prominent element of output growth, the increase in labour output is the other root after capital. However, with the perspective that an increase in productivity is insignificant, it should concentrate on mobilizing the sources associated with capital and labour instead of productivity improvements. Baily *et al.* (1996) affirmed the average labour productivity decreases throughout recessions and rose during booms. Heshmati (2013) studied the Least Square Dummies Variables (LSDV) method concerning China between 2000 and 2009, resulting in an essential impact of labour productivity on economic growth, based on the results obtained from the analysis. Alani (2012) noted that the reduction in the economic growth of Uganda from 1972 to 2008 might be triggered by increased productivity. Sequentially, unemployment and the reduction of capital stock were triggered by the rise in productivity. Tabari and Reza (2012) examined the potential influences of technology and education in the sector of agriculture on Iran's labour productivity in 1961-2007 by using the ARDL method. It showed education and technology positively affect labour productivity in the agriculture sector. Thus, technology and education can be concluded as important factors that can affect labour productivity. For a detailed review of labour productivity the works by Patel *et al.* (2017), and Yi and Chan (2014) are recommended.

2.2 Foreign Direct Investment

Studies have acknowledged the positive influence of FDI on the host country's gross domestic product (GDP) growth. Herzer and Nunnenkamp (2011) concluded that FDI has a distinct impact on long-term and short-term income inequality. Ng (2007) examines the relationship between investments and labour productivity within 14 nations in sub-Saharan Africa, considering it directly connected. It is believed that foreign direct investments increased labour's average productivity to implement efficient management and introduce new production technologies. Wacker and Vadlamannati (2011) analysed FDI toward labour market processes optimisation. The outcomes proved a labour standards reduction was a natural outcome of the negotiation process within firms and workers. Camen and Mihaela (2015), according to the data available in 2012 for the European Union countries, the analysis between FDI and productivity per hour highlighted a profound relationship between the quantity of outbound investment and productivity zones. Simultaneously, there is a lack of connection between inbound investment and average labour productivity. It can be noticed that the presence of a relationship between the inbound investment volume and the hourly productivity proved only for those countries with a higher value of gross domestic product per capita (Camen & Mihaela, 2015). For a detailed review of foreign direct investment the works by Al-Qaisi (2017) and, Ricker and Wickramarachi (2020) are recommended.

2.3 Trade to GDP Ratio

As an important measure of openness, international trade has significantly contributed to economic growth. Gross domestic product (GDP) is a popular measure of economic development, and trade plays an important role in most nations' economies. The value of international trade in a country's economics is indicated using the trade-to-GDP ratio. It is determined by dividing the aggregate value of imports and exports over a period by the GDP for the same period. Keho (2017) reported positive and significant complementarity between trade openness and capital formation in promoting economic growth. The outstanding economic performance of many nations like China's economic growth can be traced back to its increasing engagement in international trade and dynamic trade policy (Sun & Heshmati, 2010). Javed *et al.* (2021) argued that trade (e.g., exports) help achieve a country's comparative advantage in a certain period of its economic development; however, as the country's service sector grows its role begin decreasing. Arguments about international trade raising aggregate productivity at the country level are practically as old as economics. Besides, while international trade may raise aggregate productivity, there is a possibility that aggregate productivity can be raised by international trade. Therefore, empirical work has to distinguish the influence of trade on productivity rather than the other way round. Based on their estimation, the impact of trade on productivity stood at 5 percent, indicating a significant correlation (Frankel & Rose, 2000). Furthermore, Irwin and Tervio (2002) argued that the trade no longer significantly impacts average labour productivity once countries' distance to the equator is included in the empirical analysis. The outcome implies that spatially correlated omitted variables may positively encourage trade on productivity across nations (Frankel & Rose, 2000).

2.4 Innovation

Innovation plays an important role in sustainable development and economic growth, especially in developed and emerging economies. Solow (1957) empirically addresses the role of innovation in economic growth using a Cobb-Douglas production function and believes that the standard inputs of the production function (labor and physical capital), particularly describe a part of economic growth. Minasian (1969) first introduced technological progress by a research and development indicator and introduced it immediately toward production function.

Griffith (2003) stated several existing studies would undervalue the research and development social rate of return by dismissing this absorptive capacity dimension as not influencing the productivity of a country. Empirically, Crépon *et al.* (1998) built a model to explain productivity by innovation output and innovation output by research investments. Their results reveal innovation output surely encourages firm productivity and not innovation input.

According to Peeters and de la Potterie (2005), the influence of labor productivity significantly is the development of innovation, the sufficient standard of work to support innovative efforts, the capability to create new ideas, the determination of the most assuring innovation outlines, and the use of knowledge and external information obtained with either interacting informally with consumers, suppliers, consultant, and competitor, or through collaborate formally with scientific institutions like universities, research institutes, and public labs. Moreover, a similar study shows that the positive effect of those abilities upon labor productivity allows the organization to depart from constant returns to adjust and obtain economies of scale (Peeters and van Pottelsberghe, 2005). For a detailed discussion on the role of patents and innovations in economic growth the works by Maradana *et al.* (2017) and Khan (2015) are recommended.

3. Research methodology

3.1 Data collection

The study involved three independent variables and one dependent variable. The dependent variable was Labour Productivity. The independent variables were Inbound FDI, Outbound FDI, Patents (a proxy for innovation), and Trade-to-GDP Ratio. The data for Labour Productivity was collected from OWID (2021). The data for Inbound FDI, Outbound FDI, Trade to GDP, and Patents were collected from World Bank (2021a), World Bank (2021b), World Bank (2021c), and World Bank (2021d), respectively. Time scale of data was from 2004 to 2017. The sample involved four countries: the United States, Russia, Japan, and China. The data sets are shown in Tables 1, 2 3 and 4.

Table 1. The United States' data from 2004 to 2017.

Year	Labor	FDI inflow	FDI outflow	Trade to GDP	Innovation
2004	56.12	1.75	3.06	24.35	189536
2005	57.30	1.09	0.40	25.56	207867
2006	57.92	2.16	2.05	26.90	221784
2007	58.59	2.40	3.63	27.96	241347
2008	59.20	2.32	2.34	29.89	231588
2009	60.89	1.11	2.16	24.64	224912
2010	62.60	1.76	2.33	28.06	241977
2011	62.72	1.70	2.81	30.79	247750
2012	63.18	1.55	2.33	30.57	268782
2013	63.72	1.72	2.34	30.01	287831
2014	64.19	1.44	2.21	29.96	285096
2015	64.56	2.81	1.66	27.76	288335
2016	64.72	2.53	1.60	26.54	295327
2017	65.51	1.88	2.08	27.18	293904

Table 2. Russia's data from 2004 to 2017.

Year	Labor	FDI inflow	FDI outflow	Trade to GDP	Innovation
2004	12.83	2.61	2.33	56.58	22985
2005	14.7	2.03	2.34	56.71	23644
2006	17.06	3.80	3.03	54.73	27884
2007	19.79	4.30	3.45	51.71	27505
2008	22.58	4.50	3.35	53.38	27712
2009	20.68	2.99	3.54	48.44	25598
2010	23.42	2.83	3.45	50.36	28722
2011	26.71	2.69	3.27	48.04	26495
2012	27.81	2.29	2.21	47.15	28701
2013	28.13	3.02	3.77	46.29	28765
2014	27.46	1.07	2.77	47.80	24072
2015	24.14	0.50	1.62	49.36	29269
2016	23.37	2.55	1.75	46.52	26795
2017	23.91	1.81	2.33	46.88	22777

Table 3. Japan's data from 2004 to 2017.

Year	Labor	FDI inflow	FDI outflow	Trade to GDP	Innovation
2004	37.81	0.16	0.84	23.92	368416
2005	38.69	0.11	1.09	26.52	367960
2006	38.74	-0.05	1.28	30.33	347060
2007	39.35	0.48	1.62	33.09	333498
2008	39.05	0.49	2.26	34.40	330110
2009	38.69	0.23	1.41	24.49	295315
2010	40.08	0.13	1.40	28.61	290081
2011	39.67	-0.01	1.90	30.39	287580
2012	40.03	0.01	1.90	30.64	287013
2013	40.97	0.21	3.02	34.15	271731
2014	41.29	0.41	2.84	37.55	265959
2015	42.42	0.12	3.15	35.64	258839
2016	42.94	0.83	3.63	31.54	260244
2017	43.35	0.39	3.57	34.57	260292

Table 4. China's data from 2004 to 2017.

Year	Labor	FDI inflow	FDI outflow	Trade to GDP	Innovation
2004	4.39	3.48	0.41	59.51	65786
2005	4.84	4.55	0.60	62.21	93485
2006	5.26	4.51	0.87	64.48	122318
2007	5.72	4.40	0.48	62.19	153060
2008	6.12	3.73	1.24	57.61	194579
2009	6.63	2.57	0.86	45.18	229096
2010	7.53	4.00	0.95	50.72	293066
2011	8.26	3.71	0.64	50.74	415829
2012	8.56	2.83	0.76	48.27	535313
2013	9.02	3.04	0.76	46.74	704936
2014	9.55	2.56	1.18	44.91	801135
2015	9.75	2.19	1.58	39.46	968252
2016	10.07	1.56	1.93	36.89	1204981
2017	10.68	1.35	1.12	37.63	1245709

3.2 Multiple regression

Multiple-linear regression analysis is one of the most powerful tools widely used as one of the most abused statistical techniques (Mendenhall & Sincich, 2003). It involves a group of techniques for studying the straight-line associations among two or more variables. The multiple regression model is compelling since it estimates the influences of varying one variable while taking the other explanatory variable constant on the dependent variable without truly having the other variables constant (Smith, 2015). It is "a linear transformation of the *X* variables such that the sum of squared deviations of the observed and predicted *Y* is minimized" (Salkind, 2010: p. 391). Generally, it can be represented as,

$$Y_j = \beta_0 + \beta_1 X_{1j} + \beta_2 X_{2j} + \cdots + \beta_p X_{pj} + \varepsilon_j$$

The *X* denotes the estimate of independent variables, and *Y* denotes the estimate of dependent variables. The observation number is represented by subscript *j*, and the estimate of the unknown regression coefficient denotes as β.

Once the β's have been determined, various criteria are considered to define the authenticity of these measures. The standard authenticity criteria are the correlation coefficient, where the index was ranging from -1 to 1. When the value holds close to zero, this indicates the absence of a significant linear relationship. Meanwhile, as the correlation is near to positive or negative one, the relationship becomes more potent. The value of 1 or -1 demonstrates a perfect linear correlation between two variables.

The multiple regression analysis can manage certain variables by applying dummy variables whose values are 0 or 1, but it depends on whether the particular characteristic is true (Smith, 2015). The minor squares method identifies the coefficient calculations that minimized the number of squared forecast errors as with simple regression. The standard errors can be used for hypothesis tests and confidence intervals; R^2 measures the goodness of fit. If correlations among the explanatory variables affect the standard errors to be disappointingly high, it will cause multicollinearity difficulty. There is no natural cure besides collecting data that are not so highly intercorrelated.

4. Results and discussion

4.1 The United States of America

The United States is the world's largest economy. Data in Table 1 suggests that the labour productivity in the U.S. has been nearly constantly increasing around 1$/hour per year. On the other hand, the FDI inflow was relatively lower than the FDI outflow, with an average of 1.9 percent in the FDI inflow and an average of the FDI outflow was 2.2 percent. However, the trade to GDP ratio data showed the trade decreased in 2012 from 30.6 percent to 30 percent and continuously decreased until 2016. In 2017 there was an increase in trade around 0.6 percent from 26.6 percent to 27.2 percent. Ultimately, the patent application by the resident in the U.S. was constantly increasing each year. The results are shown in Tables 5, 6 and 7.

According to the regression analysis of the United States, results have shown that labour productivity negatively affects FDI inflow but has a strong relationship. Meanwhile, trade to GDP was negatively affected by labour productivity, and the correlation is weak. Conversely, FDI outflow correlation is relatively low yet positively affected by labour productivity. However, the correlation between intercept (labour productivity) and innovation is an insignificant relationship.

Thus, the sample of multi-linear regression, in this case, will be,

$$Y = 41.41 - 1.09(X_1) + 0.1(X_2) - 0.03(X_3)$$

where, Y represents labour productivity, X_1 is FDI inflow, X_2 is FDI outflow and X_3 represents trade to GDP ratio.

The goodness-of-fit given by F-statistic is 20.58. Hence the stated model can explain the United states reliably. Besides, the multiple R and R^2 is 0.95 and 0.90, indicating a strong correlation between the dependent and independent variables.

4.2 Russian Federation

Russia is one of the biggest economies in the world. Data in Table 2 suggests from 2004 to 2017, the labour productivity in Russia continuously rose from 2004 to 2014 and started decreasing around 3 $/hours in 2015. Furthermore, in 2015, both FDI inbound and outbound hit the weakest point, which stood at 0.5 percent for FDI inflow and 1.65 percent for FDI outflow. On the other hand, the trade increased around 1.56 in the same year, and the patent application by the residents went to the highest value at 29269 patent applications. The results are shown in Tables 5, 6 and 7.

Ultimately, the multiple-linear regression showed a significant but negative relationship in FDI inflow and trade to GDP. Meanwhile, the FDI outflow shown has a positive yet strong correlation. However, the innovation has shown a positive correlation with an intercept but a fragile relationship.

Hence, the sample of multi-linear regression, in this case, will be,

$$Y = 55.66 - 0.98(X_1) + 1.45(X_2) - 0.97(X_3)$$

where, Y represents labour productivity, X_1 is FDI inflow, X_2 is FDI outflow and X_3 represents trade to GDP ratio.

The goodness-of-fit given by F-statistic is 12.94. Thus, the stated model can explain the Russia Federation reliably. Besides, the multiple R and R^2 stands at 0.92 and 0.85, indicating a strong correlation among the variables.

4.3 Japan

Japan is one of the five biggest economies in the world. Data in Table 3 suggests that Japan's labour productivity was increased constantly, with an average annual change of 0.4 per year. Meanwhile, FDI outflow is higher than the FDI inflow with an average FDI inflow was 0.25, and FDI outflow stood at 2.14 percent. The trade of GDP ratio in Japan was constantly rose until 2014 and started to decrease in 2015, from 37.55 percent to 31.54 percent, then increased to 34.57 in 2017. Eventually, comparing the data of innovation (patent application by resident), the lowest

Table 5. The R statistics

	Multiple R	R Square	Adjusted R Square	Standard Error	Observations
USA	0.95	0.90	0.86	1.18	14
Russia	0.92	0.85	0.79	2.23	14
Japan	0.95	0.90	0.86	0.65	14
China	0.98	0.96	0.94	0.51	14

Table 6. The model fitness statistics

		df	SS	MS	F	Significance F
USA	Regression	4	114.51	28.63	20.58	0
	Residual	9	12.52	1.39		
	Total	13	127.02			
Russia	Regression	4	257.85	64.46	12.94	0
	Residual	9	44.84	4.98		
	Total	13	302.69			
Japan	Regression	4	35.12	8.78	20.87	0
	Residual	9	3.79	0.42		
	Total	13	38.91			
China	Regression	4	55.1	13.77	52.59	0
	Residual	9	2.36	0.26		
	Total	13	57.45			

number of patent applications occurred in 2015 while the highest number of patent applications was in the year 2004. The results are shown in Tables 5, 6 and 7.

Conditioned by the regression output of Japan data indicates a weak and negative relationship in FDI inflow and trade to GDP. Meanwhile, the FDI outflow has a positive yet very strong relationship with labour productivity. Nevertheless, the innovation showed there is no correlation with the intercept.

Hence, the sample of multi-linear regression, in this case, will be,

$$Y = 40.83 - 0.35(X_1) + 1.59(X_2) - 0.04(X_3)$$

where, Y represents labour productivity, X_1 is FDI inflow, X_2 is FDI outflow and X_3 represents trade to GDP ratio.

The goodness-of-fit given by F-statistic is 20.87. Thus, the stated model can explain Japan reliably. Besides, the multiple R and R^2 stand at 0.95 and 0.90, showing a strong relationship between the dependent and independent variables.

4.4 People's Republic of China

China is the second biggest economy in the world. Data in Table 4 suggest that from 2004 to 2017, the labour productivity in China was constantly increased with an average of annual change 0.47 $/hour. The FDI inflow was relatively higher than FDI outflow with an average FDI inflow of 3.18, and an average FDI outflow is 0.96. Interestingly, China's trade was dynamic, the higher value was in 2006, and the lowest value was in 2017. Meanwhile, the patent application by residents recorded an increase from year to year. The results are shown in Tables 5, 6 and 7.

As the result of the regression analysis of China indicates a very strong and positive relationship between FDI inflow and labour productivity. However, the FDI outflow showed a negative yet strong correlation. The trade to GDP has a weak correlation and is negatively affected by labour productivity. Lastly, the innovation has shown there is a highly weak or no correlation.

Hence, the sample of multi-linear regression, in this case, will be,

$$Y = 11.65 + 1.19(X_1) - 0.58(X_2) - 0.18(X_3)$$

where, Y represents labour productivity, X_1 is FDI inflow, X_2 is FDI outflow and X_3 represents trade to GDP ratio.

The goodness-of-fit given by F-statistic is 52.59. Thus, the stated model can explain China assuredly. Besides, the multiple R and R^2 stands at 0.98 and 0.96 which, showing a strong relationship between the dependent and independent variables.

All in all, this showed the correlation between labor productivity with foreign investment, trade, and innovation. Where the results are reinforced by the value of R and R^2 is greater than 0.8. Furthermore, from the four different counties' analysis outcome, the investment strongly correlates with the dependent variable (labour productivity). On the other hand, most of the trade results

Table 7. The regression analysis

		Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
USA	Intercept	41.41	4.31	9.61	0	31.66	51.16
	FDI inflow	-1.09	0.71	-1.54	0.16	-2.69	0.52
	FDI outflow	0.1	0.5	0.2	0.84	-1.02	1.22
	Trade to GDP	-0.03	0.19	-0.17	0.87	-0.46	0.4
	Innovation	0	0	7.42	0	0	0
Russia	Intercept	55.66	14.71	3.78	0	22.39	88.93
	FDI inflow	-0.98	0.86	-1.14	0.28	-2.92	0.96
	FDI outflow	1.45	1.23	1.18	0.27	-1.33	4.23
	Trade to GDP	-0.97	0.2	-4.93	0	-1.42	-0.53
	Innovation	0	0	1.76	0.11	0	0
Japan	Intercept	40.83	3.45	11.83	0	33.03	48.64
	FDI inflow	-0.35	0.98	-0.36	0.73	-2.58	1.88
	FDI outflow	1.59	0.53	3.01	0.01	0.39	2.79
	Trade to GDP	-0.04	0.07	-0.58	0.58	-0.2	0.12
	Innovation	0	0	-1.01	0.34	0	0
China	Intercept	1165	2.18	5.33	0	6.71	16.6
	FDI inflow	1.19	0.4	2.94	0.02	0.27	2.1
	FDI outflow	-0.58	0.5	-1.18	0.27	-1.7	0.53
	Trade to GDP	-0.18	0.05	-3.87	0	-0.29	-0.08
	Innovation	0	0	4.71	0	0	0

have a negative and weak relationship with labor productivity. while for the innovation, shown the same outcome which is there is no correlation with labour productivity.

Some of our results are consistent with the earlier studies. For instance, important empirical literature dating back to Camen and Mihaela (2015) and Ng (2007) shows a strong relationship between investment and hourly productivity. Further, Irwin and Tervio (2002) argued that trade no longer significantly affects the average labour productivity. On the other hand, Peeters and de la Potterie (2005) showed that innovation was influenced by labour productivity, but productivity was not influenced by innovation.

5. Conclusion

The empirical evidence presented in the current study suggests a pattern where investment shows a strong relationship with labour productivity. Whereas in the case of trade, most results indicated a weaker relationship, but it is still possible for stronger relations, as shown in Russia's case. However, the innovation constantly shows insignificant results, which proves that innovation is not affecting labour productivity. It is recommended that efficient management and new production technologies may be deployed to increase the average labour productivity in lowly productive countries.

The capabilities found by this study significantly demonstrate variable impacts to raise labour productivity. In addition, policymakers may use this study to increase labour productivity since labour productivity influences the rise of the country's standard of living. Hence, through this study, policymakers may consider increasing investment. Besides, trade could increase labour productivity, even if its power is not as strong as the investment.

Although this work provides a better understanding of the influence of investment, trade, and innovation on labour productivity, however the findings should not be generalized without further testing as the study involved only four countries. In future, larger sample size and big data should be used to get a comprehensive overview of the problem.

References

Alani, J. (2012). Effects of Productivity Growth on Employment Generation, Capital Accumulation and Economic Growth in Uganda. *International Journal of Trade, Economics and Finance*, *3*(3), 170.

Al-Qaisi, K. M. (2017). Foreign Direct Investment and its Literature Review. *Journal of Reviews on Global Economics*, 6, 105-112. http://dx.doi.org/10.6000/1929-7092.2017.06.09

Baily, M. N., Bartelsman, E. J., & Haltiwanger, J. (1996). *Labor productivity: structural change and cyclical dynamics* (No. w5503). National Bureau of Economic Research. https://doi.org/10.3386/w5503

Crépon, B., Duguet, E., & Mairessec, J. (1998). Research, innovation and productivi [Ty: an econometric analysis at the firm level. *Economics of Innovation and new Technology*, *7*(2), 115-158. https://doi.org/10.1080/10438599800000031

Frankel, J. A., & Rose, A. K. (2000). *Estimating the effect of currency unions on trade and output* (No. w7857). National Bureau of Economic Research. https://doi.org/10.3386/w7857

Griffith, R., Redding, S., & Van Reenen, J. (2003). R&D and absorptive capacity: theory and empirical evidence. *Scandinavian journal of Economics*, *105*(1), 99-118. https://doi.org/10.1111/1467-9442.00007

Herzer, D., & Nunnenkamp, P. (2011). *FDI and income inequality: Evidence from Europe* (No. 1675). Kiel working paper. https://doi.org/10.1007/s10290-013-0148-3

Heshmati, A., & Su, B. (2013). Development and sources of labor productivity in Chinese provinces. *China Economic Policy Review*, *2*(02), 1350005. https://doi.org/10.1142/S1793969013500052

Irwin, D. A., & Terviö, M. (2002). Does trade raise income?: Evidence from the twentieth century. *Journal of International Economics*, *58*(1), 1-18. https://doi.org/10.1016/S0022-1996(01)00164-7

Javed, S.A., Bo, Y., Tao, L., & Dong, W. (2021). The 'Dual Circulation' Development Model of China: Background and Insights. *Rajagiri Management Journal*. https://doi.org/10.1108/RAMJ-03-2021-0016

Jorgenson, D. W. (1988). Productivity and postwar US economic growth. *Journal of Economic Perspectives*, *2*(4), 23-41. https://doi.org/10.1257/jep.2.4.23

Kagin, J., Taylor, J. E., & Yúnez-Naude, A. (2016). Inverse productivity or inverse efficiency? Evidence from Mexico. *The Journal of Development Studies*, *52*(3), 396-411. https://doi.org/10.1080/00220388.2015.1041515

Keho, Y. (2017). The impact of trade openness on economic growth: The case of Cote d'Ivoire. *Cogent Economics & Finance*, *5*(1), 1332820. https://doi.org/10.1080/23322039.2017.1332820

Khan, J. (2015). *The Role of Research and Development in Economic Growth: A Review*. Munich Personal RePEc Archive MPRA Paper No. 67303. https://mpra.ub.uni-muenchen.de/67303/

Lieberman, M. B., & Kang, J. (2008). How to measure company productivity using value-added: A focus on Pohang Steel (POSCO). *Asia Pacific Journal of Management*, *25*(2), 209-224. https://doi.org/10.1007/s10490-007-9081-0

Maradana, R.P., Pradhan, R.P., Dash, S., Gaurav, K., Jayakumar, M., & Chatterjee, D. (2017). Does innovation promote economic growth? Evidence from European countries. *Journal of Innovation and Entrepreneurship*, 6 (2017). https://doi.org/10.1186/s13731-016-0061-9

Mendenhall, W., Sincich, T., & Boudreau, N. S. (1996). *A second course in statistics: regression analysis* (Vol. 5). Upper Saddle River, NJ: Prentice Hall.

Minasian, J. R. (1969). Research and development, production functions, and rates of return. *The American Economic Review*, *59*(2), 80-85.

Ng, T. H. (2007). Foreign direct investment and productivity: Evidence from Sub-Saharan Africa. *Unpublished paper (Vienna: UNIDO)*. https://doi.org/10.1.1.547.2262

OWID (2021). *Productivity per hour worked*. Our World In Data. Retrieved from: https://ourworldindata.org/grapher/labor-productivity-per-hour-pennworldtable

Owyong, D. T., & Thangavelu, S. M. (2001). An empirical study on public capital spillovers from the USA to Canada. *Applied Economics*, *33*(11), 1493-1499. https://doi.org/10.1080/00036840010011925

Patel, B., Bhavsar, J. J., & Pitroda, J. (2017). A Critical Literature Review of Labour Productivity in Building Construction. *International Journal of Constructive Research in Civil Engineering*, *3*(4), 76-80. http://dx.doi.org/10.20431/2454-8693.0304007

Peeters, C., & de la Potterie, B. V. P. (2005). Innovation capabilities and firm labor productivity. In *DRUID Tenth Anniversary Summer Conference* (Vol. 32, No. 0, pp. 27-29).

Peeters, C., & Van Pottelsberghe, B. (2005). Innovation capabilities and returns to scale.

Ricker, D., & Wickramarachi, H. (2020). *A Review of Economic Literature on Foreign Direct Investment*. Economics Working Paper Series. Working Paper 2020–04–B. Washington, DC: The U.S. International Trade Commission.

Salkind, N.J. (2010). Encyclopedia of Research Design. SAGE Publications, Inc.

Smith, G. (2015). *Multiple Regression. Essential Statistics, Regression, and Econometrics, 301–337*. https://doi.org/10.1016/B978-0-12-803459-0.00010-8

Solow, R. M. (1957). Technical change and the aggregate production function. *The review of Economics and Statistics*, *39*(3), 312-320.

Sun, P., & Heshmati, A. (2010). *International trade and its effects on economic growth in China*. IZA Discussion Paper No. 5151. Institute for the Study of Labor

Tabari, N. A. Y., & Reza, M. (2012). Technology and education effects on labor productivity in the agricultural sector in Iran. *European Journal of Experimental Biology*, *2*(4), 1265-1272.

Van Tam, N., Huong, N. L., & Ngoc, N. B. (2018). Factors affecting labour productivity of construction worker on construction site: A case of Hanoi. *Journal of Science and Technology in Civil Engineering, 12*(5), 127-138. https://doi.org/10.31814/stce.nuce2018-12(5)-13

Wacker, K. M., & Vadlamannati, K. C. (2011). Do multinationals influence labor standards? A close look at US outward FDI. *A Close Look at US Outward FDI (September 26, 2011). Courant Research Centre Discussion Paper*, (98). https://doi.org/10.2139/ssrn.1938810

World Bank (2021a). *Foreign Direct Investment Inflows*. Data World Bank. Retrieved from: https://data.worldbank.org/indicator/BX.KLT.DINV.WD.GD.ZS?end=2017&locations=US-RU-JP-CN&start=2004

World Bank (2021b). *Foreign Direct Investment Outflows*. Data World Bank. Retrieved from: https://data.worldbank.org/indicator/BM.KLT.DINV.WD.GD.ZS?end=2017&locations=US-RU-JP-CN&start=2004

World Bank (2021c). *Trade to GDP Ratio*. Data World Bank. Retrieved from: https://data.worldbank.org/indicator/NE.TRD.GNFS.ZS?end=2017&locations=US-RU-JP-CN&start=2004

World Bank (2021d). *Patent Applications*. Data World Bank. Retrieved from: https://data.worldbank.org/indicator/IP.PAT.RESD?end=2017&locations=US-RU-JP-CN&start=2004

Yi, W., & Chan, A. P. C. (2014). Critical Review of Labor Productivity Research in Construction Journals. *Journal of Management in Engineering*, *30*(2). https://doi.org/10.1061/(ASCE)ME.1943-5479.0000194