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The Impact of Domestic and Foreign-Invested Enterprises Trade on Life Expectancy in China

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Abstract: *Health is fundamental for human well-being and economic growth and the development of an economy. Particularly, poor health has a perpetually damaging effect on the well-being of people and consequently, lowers life expectancy. Our study explores the influence of trade openness (domestic-invested enterprises (DIEs) and foreign-invested enterprises (FIEs) trade) on life expectancy in China and across gender using Chinese provincial panel data. The results reveal that trade openness significantly promotes life expectancy. We find a positive relationship between trade openness (DIEs and FIEs trade) and life expectancy in China and across gender. Our findings are robust to the inclusion of other control variables for the overall and female cases but not the male. The policy implication is that the government should open the economy more for international trade to benefit more, especially in the health sector and improve the health of its population.*

Key Words: Domestic and Foreign-invested Enterprises Trade, Trade Openness, Health, Life Expectancy, China

Introduction

Trade openness plays a vital role in enhancing economic growth of developing countries and this role has been extensively studied in the existing research. The share of China's exports in global trade increased from 2%-13% between 1978-2015 (Zheng, 2018). Trade openness is predicted as a key factor that promotes the health status of a population (Blouin et al., 2009) as measured by the indicator of life expectancy. Overall life expectancy increased during 1950-2000. The world disparity in life expectancy reduces noticeably after 1930, owing to the improvement in population health (Bourguignon & Morrisson, 2002). In existing research, the association between trade openness and life expectancy is inconclusive (Bussmann, 2009).

The new millennium has seen increasing concerns about the health of the population as life expectancy increases in developing countries. The new millennium debate has observed the sources of improvement in the population health system on whether it has progressed with the improvement of living standards or whether exogenous sources rather than income as responsible. Economic theory authorizes that trade openness is crucial for the development of economic growth and this, in turn, is probable to settle other sectors (Levine & Rothman, 2006) such as the health sector of the economy (Smith, 2015). In existing research, trade openness affects life expectancy in different ways, including enhancing the economic growth of a country which in turn increases the per capita GDP. So, the enhancement of income allows the households to afford better nutrition and healthcare services that result in an improvement in life expectancy (Yanikkaya, 2003). However, the study by

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Bussmann (2009) revealed that trade openness does not appear to promote life expectancy. Trade openness promotes female life expectancy not more than the male life expectancy (Batool & Saghir, 2013). So, these different impacts of trade openness on male-female life expectancy inspire our study to investigate the effect of trade openness across gender. The World Health Assembly approved a resolution in 2006 on international trade and health, stressing the need to produce evidence on the association between trade openness and population health (World, 2006). However, existing studies on life expectancy have used the annual data (e.g.Tahir, 2020) rather than the census data, as time series data is considered to be less predictable for capturing the true picture of life expectancy. The use of life expectancy data from the census is more reliable (Huang et al., 2020) as it provides comprehensive detail about life expectancy. So, our study uses census data on life expectancy to capture the core picture of life expectancy.

China remained successful in improving the average life expectancy of its population from 35-73 years during 1949-2008 (WorldBank, 2010), but there exists a larger disparity in life expectancy across provinces, municipalities, and autonomous regions (Xinming et al., 2010). For example, 80 years mean life expectancy in Shanghai and 67 years in Tibet during 2005 (Fang et al., 2010). The census estimates revealed that the gains in life expectancy in China (comprised of 31 provinces, municipalities, and autonomous regions) have remained uneven for decades as coastal and eastern regions gain more from life expectancy than inland and western regions. Moreover, greater disparities exist across the regions (i.e. rural and urban) in China (Chou & Wang, 2009). So, there is a greater need for a more disaggregated study that captures the core trends of life expectancy as disparity exists in life expectancy across the provinces of China (MOH, 2004), and this study investigates the trade openness impact on life expectancy at a disaggregated level (i.e. province level).

Morrison (2019) asserts that in the early 1990s, trade and investment reforms and motivations increased FDI inflow. Such flows have been a main source of productivity gains, as well as trade and economic growth of China. By 2010, number of registered foreign-invested enterprises (FIEs) in China was 445,244 engaging 55.2 million workers (15.9%) of the urban labor force (China Statistical Yearbook, 2012). FIEs accounted for a major China's industrial output share that increase from 2.3%-35.9% during 1990-2003 but in 2011 decrease to 25.9%. Moreover, a significant level of China's foreign trade was accounted for by FIEs. They accounted for 58.3% of Chinese exports and 59.7% of imports in 2005, but these levels have subsequently fallen, attaining 41.7% and 43.7%, respectively, in 2018. From 2005 to 2018, both the share of Chinese exports and imports dropped steadily, but China's real GDP rose at a much rapid pace from 1979 to 2018. China's annual real GDP increased by 9.5 percent on average. The Chinese economy was severely impacted by the global financial crisis that began in 2008. From 2008-2010, real GDP averaged growth of China 9.7%. However, GDP growth rate slowed for the next six consecutive years, falling from 10.6% in 2010 to 6.7% in 2016. Real GDP indicated up to 6.8% in 2017, but slowed to 6.6% in 2018, (although it rose to 6.8% in 2017). The gap between China's GDP and trade has continuously widened from 2005 to 2020, owing to the country's continued rise in real GDP and the constant decline in its share of trade accounted for by FIEs. Since China's real GDP is growing at a faster rate, mean domestic trade is playing a significant role in this scenario.

Moreover, China has been attempting to exploit its competitive advantage of low-cost, high-quality labor to attract foreign investment and grow processing trade since the opening-up policy, which has resulted in China grabbing a large share of global trade volume. Since foreign-funded export-oriented companies are mostly manufacturing enterprises, their investments in China have primarily been in labor-intensive industries (Wei et al., 2012) and this indicates that domestic trade surpasses foreign trade in overall trade. So, we decided to divide trade openness into two variants to better understand the position of domestic trade: foreign-invested companies' trade

openness (ratio) and domestic-invested enterprises' trade openness. As existing studies have investigated the role of foreign vs. domestic capital investment (Yang et al., 2013), domestic and foreign trade (Xie et al., 2017), domestic and foreign investment (Elmarzougui et al., 2016), domestic and international integration (Poncet, 2003), this study also uses these two variants so as to be able to evaluate the contribution of each to life expectancy in China and across gender.

Our study finds that trade openness (domestic & foreign-invested firms) is a crucial factor that promotes life expectancy. We find that the association between life expectancy and trade openness is positive and significant in China and across gender. Moreover, the findings of our robustness checks after including several controls such as economic growth, public education investment, education development, eco-environment development, and healthcare development show that these variables are positively associated with life expectancy. However, our results are robust for the overall and female cases but not the male. Our findings are consistent with the study of Bergh and Nilsson (2010), Stroup (2007) and contrast the study of Aigheyisi (2019), Batool and Saghir (2013); Bussmann (2009).

This study adds to the existing research in many ways: First, we explores the effect of trade openness (domestic-invested enterprises (DIEs) and foreign-invested enterprises (FIEs) trade) on life expectancy in China. Second, our study uses the provincial panel data of China to address the issue as disparity exists in life expectancy across provinces. Third, our study uses life expectancy data from China's census that is better as compared to time-series data. Fourth, we examined the association between trade openness (domestic-invested enterprises (DIEs) and foreign-invested enterprises (FIEs) trade) and life expectancy across gender (female and male) to investigate whether the life expectancy of male and female is equally affected by openness to trade or not.

This paper is outlined as: Section two describes conceptual framework of the study. Section three presents the econometric strategy and data sources. Section four describes the empirical results, and the last section concludes the study.

Conceptual Framework

According to economic theory, trade openness has a favorable effect on the economic growth of a country (Sachs et al., 1995), which directly or indirectly affects the population's health status i.e. life expectancy (Smith, 2015). The existing studies identify various channels through which trade openness affects life expectancy including the effect of income, education, healthier nutrition, lifestyle change, superior access to goods as well as services, and public health measures (Herzer, 2017). It is anticipated that countries opened to international trade are likely to translate the openness effects positively on economic growth (Sakyi et al., 2017). These positive impacts improved the economic growth of an economy (Dreher, 2006) and lead to the enhancement of incomes of the population that permits the households to spend more on health (Herzer, 2017). Undeniably, an increase in healthcare expenditure is a practice that has better health outcomes and promotes life expectancy (Arthur & Oaikhenan, 2017). On the other hand, trade openness may also have positive effects on the education level, the opportunity of working in a foreign country which may enhance the education premium and consequently strengthen the education enticements, as proposed by Stark (2004). This higher literacy level would lead towards a better health system and this collective response will improve life expectancy (Blouin et al., 2009).

Nations opened to international trade can promote their health systems by importing new technology into the country. This suggests that increased openness to trade can beneficially affect the healthcare system of the country by improving access to pharmaceutical services and medical treatments (Owen & Wu, 2007). Particularly, this is imperative for the developing economies because of the non-availability of vibrant pharmaceutical plants in these poor economies. Thus, trade openness makes possible access to vaccines and antibiotics

and result in better health (Mendez & Popkin, 2004). In developed economies, new drugs and medical technologies are considered an essential element to improve life expectancy (Lichtenberg, 2005). But the issue is that these medications invented in the developed (industrial) nations are generally not affordable for the people of developing nations. Papageorgiou et al. (2007) demonstrate that advanced pharmaceutical is largely produced only in a small group of nations that export these medicated commodities to the rest of the world, and contend that the diffusion of technology may play a momentous role to improve life expectancy in developing nations (Bergh & Nilsson, 2010).

The conceptual association between population health and trade openness could also be indirect as opening up an economy creates more opportunities for an individual to work in the labor market. This will improve the living standard of the population that can now make better healthcare decisions. The enhancement of a household's income enables it to adopt better health services and improve its nutritional status (Bussmann, 2009). Nevertheless, not always the same case in which trade openness positively affects health. Welander et al. (2015) stated that openness to trade may rapidly spread diseases such as AIDS/HIV. Health and trade openness could also be inversely associated through the openness effect on the income distribution as the studies of Bergh and Nilsson (2008) and Dreher and Gaston (2008) suggest that openness increases income inequality within a country. Also, there are some indications that inequality in income distribution influence health negatively (Karlsson et al., 2010). The other essential element may be that even if openness enhances the GDP per capita (PC), it does so by varying the economic structure; this structural adjustment can be excruciating for those in labor force who must switch jobs, which in turn might influence health. Further, openness to trade may also possibly affect the environment and in turn health (Owen & Wu, 2007).

Consequently, as the theoretical association shows ambiguity, this calls for an econometric investigation.

Theoretical framework

This study follows the Grossman (1972) that developed a health production function. The production function took into account the social, environmental, and economic factors as inputs similar to Grossman (1972). The health production function is specified as:

Health = f (X) 1

In the health production function (1), health (H) is the output of individual health, and vector X is the inputs of individuals' health production function. The vector (X) contains nutrient intake, public goods consumption, income, healthcare procedure, preliminary stock, education, and environment.

The health production function of equation (1) indicates the micro-level health function. To take into account the macro-level production function of health, Fayissa and Gutema (2008) represent equation (1) including the vector (X) as per capita variables and then rearrange them into sub-sector vectors of economic, social as well as environmental factors. The health production function of macro-level is as:

Health = f (S, Y, V) 2

Where health (H) is an aggregate health outcome of population, S, Y, and V are the vectors of per capita social variables, per capita economic variables, and the environmental factors respectively. The transmuting of equation (2) to its scalar form is rewritten as:

Health = f (S_1, S_2, ..., S_n; Y_1, Y_2, ..., Y_n; V_1, V_2, ..., V_n) 3

In the above equation (3), health (H) is the population health status proxied by life expectancy, S = (S_1, S_2, ..., S_n); Y = (Y_1, Y_2, ..., Y_n); V = (V_1, V_2, ..., V_n) and n is the number of variables of each sub-group respectively. By assuming the Cobb-Douglas production function, equation (3) can be described as:

$$h = \Omega \Pi_{i=1}^{n} s_i^{\alpha_i} \Pi_{j=1}^{n} y_j^{\beta_j} \Pi_{k=1}^{n} v_k^{\gamma_k} \quad 4$$

The elasticities in equation (4) are α_i, β_j, and γ_k. The Ω term estimates the preliminary health stock as indicated by Grossman (1972). It computes the population health status that would have been noticed had there been no health depreciation or

improvement in health due to amendments in environmental, economic, and social factors utilized in the production process. Similarly, $(\Pi_{i=1}^{n} s_i^{\alpha_i} \Pi_{j=1}^{n} y_j^{\beta_j} \Pi_{k=1}^{n} v_k^{\gamma_k} - 1) \times 100$ calculates the % change in health status cause by economic, environmental, and social factors. Taking the logarithm of equation (4) as well as rearranging yields the below-presented equation (5) as:

$$lnh = ln\Omega + \Sigma\alpha_i(lns_i) + \Sigma\beta_j(lny_i) + \Sigma\gamma_k(lnv_i) \quad 5$$

In equation (5), i = 1, 2, .., n; j = 1, 2, .., m; k = 1,2, .., l and Ω is an estimate of preliminary health stock. In our study, we include the variable of trade openness as the component of an economic variable in the theoretical formulation.

Econometric Strategy

To empirically investigate the impact of trade openness (domestic-invested enterprises (DIEs) and foreign-invested enterprises (FIEs) trade) on the population's health as measured by the indicator: life expectancy at birth in China and across gender we used the random effect econometric technique as suggested by the Hausman test to examine the following model:

$$LE_{pt} = \beta_0 + \beta_1 TO_{pt} + \beta_2 X_{pt} + \varepsilon_{pt} \quad 6$$

Equation (6) indicates LE is life expectancy at birth in province p at time t. TO indicates the trade openness (DIEs and FIEs trade) and it is the main explanatory variable of interest calculated as domestic-invested firms' trade/GDP and foreign-invested firms' trade/GDP in our study. Vector X indicates the control variables considered to be major determinants of life expectancy. The health status of the population is measured by the most important indicator of life expectancy at birth (Egidi & Spizzichino, 2012). For robustness checks, we include several control variables in our model including economic growth as one of the important factors affecting life expectancy and the expected sign is positive. The existing research on the association between economic growth and life expectancy found that economic growth improves life expectancy (Timothy, 2018; Tsai, 2007).

The other control of our study is the public education investment and our study emphases on public education investment for the reason that investment in public education is a fundamental element that contributes to human capital accumulation (Qian & MIU, 2014). The theory of human capital holds that education improves competence and cognition, ultimately causes an increase in productivity, and endogenous growth theory proposes that a higher level of human capital significantly contributes to the technology progress (Aghion et al., 1998). Thus, investment in education is a major contributing factor of human capital as well technological progress that results in the development of the health system and improves life expectancy.

Education development is an essential element in social development, that significantly affect life expectancy (Laaksonen et al., 2008). Existing studies demonstrated that development in education could enormously contribute to life expectancy, but marginal increasing effect was commonly lesser than that of the economic development (C Chen et al., 1997). Some studies contended that the marginal increasing education effect is the crucial element for life expectancy improvement (Gulis, 2000). Further empirical indications proposed that there was a non-significant impact of education development on the health indicator of life expectancy. Thus, to clear this ambiguity we include education development as a control that guides us about this puzzling evidence and the expected sign is positive (Mirowsky & Ross, 2003).

Life expectancy is influenced by numerous factors, and eco-environment development is considered as perhaps the main element (Blum, 1974). It captivates the researchers' attention as environmental development plays an increasing role in affecting life expectancy. Our study also used eco-environment development as a control and the expected sign is positive. On the basis of developed and postsocialist countries' evidence, Feachem (1994) observed that environmental disadvantages generate various detrimental effects on life expectancy among the inhabitants of postsocialist nations. Moreover, it is stated that a improved

aquatic environment could most significantly enhance life expectancy than the improvement in education and economic development (Gulis, 2000). On the other hand, control variable of healthcare development is also a leading factor that promotes life expectancy as the development of healthcare inputs is directly related to population health. Prior to China economic reform in 1978, healthcare development remarkably contributed to the enhancement of life expectancy (Sen, 1999). Afterward the 1978, the existing studies contended that due to unequal distribution in healthcare services and resources in China, there were some disparities for life expectancy (Yang, 2015). Yan and Zhiyong (2010) stated that for the promotion of life expectancy, it was not the enhancement of healthcare provision but the enhancement in practice of healthcare services that mattered. However, investment in healthcare had little impact on life expectancy promotion as argued by (van den Heuvel & Olaroiu, 2017).

Data

This study used panel data from 2001-2011 across the 31 provinces of China to analyze the impact of trade openness on life expectancy. The regressand of our study is life expectancy at birth. Life expectancy (LE) indicates the average number of years a person is expected to live and it varies from country to country based on their health systems (WHO, 2006). The data on life expectancy comes from the census of 2000 and 2010 China's National Bureau of Statistics (CNBS). Life expectancy provides the health status of the population (Tian, 2011). There has been an increase in life expectancy approximately from 35-74 years between 1950-2010 in China due to the advancement in medical treatments, innovation, technology, dietary behavior, environmental conditions, and lifestyle (Martín Cervantes et al., 2020).

In our study, the core regressor is the trade openness ((TO) domestic-invested enterprises (DIEs) and foreign-invested enterprises (FIEs) trade) measure by using the domestic firm's trade/GDP for domestic trade and foreign firms' trade/GDP for foreign trade. Data on trade openness are obtained from the (CNBS). It is deliberated that openness to trade is a crucial factor affecting the population's health of the integrated economies (García-Dorado et al., 2019) and promotes life expectancy (Stroup, 2007).

Our study includes several control variables for the robustness check of core findings. The control variables include economic growth (Herzer, 2015), measured by the log of GDP per capita (GDPPC). Next, we include public education investment (PEI) (Sun et al., 2018), measured by the log of public investment in the education sector, and the data on PEI is taken from the study of Sun et al. (2019). Next, we add education development (Denney et al., 2010), measured by the indicator: illiteracy rate [negative] (%) and schooling years per capita. Next, we include healthcare development (Crémieux et al., 1999), measured by the indicator: no. of hospital beds per 1000 persons, no. of doctors per 1000 persons, and per person healthcare expenditure (CNY). Finally, we include the eco-environment development (Zaman et al., 2016), measured by the indicator: emission load of SO_2 and smoke and dust per capita [negative] (kg), and forest coverage rate (%). The data for education, healthcare, and eco-environment development is taken from the study of Jiang et al. (2018). The descriptive statistics of variables are described in Table 1 and domestic and foreign trade trends over time are shown in Figure 1.

Table 1. Descriptive Statistics

Variables	N	Average	S.D	Mini	Maxi
Overall LE	62	73.075	3.4826	64.37	80.26
Female LE	62	75.311	3.8056	66.15	82.44
Male LE	62	71.067	3.2590	62.52	78.28
DIEs (DTO)	62	0.2788	0.3276	0.0410	1.441

FIES (FTO)	62	0.1326	0.2161	0.0007	0.986
Log GDPPC	62	9.5918	0.8825	7.8867	11.239
Log PEI	62	13.9576	1.2562	11.1532	16.036
Education Development	62	0.4462	0.1226	0.064	0.654
Healthcare Development	62	0.1676	0.1678	0.002	0.922
Eco-environment Development	62	0.6765	0.2433	0.182	1.09

Source: Author's calculation. DTO indicates domestic trade openness and FTO indicates foreign trade openness.

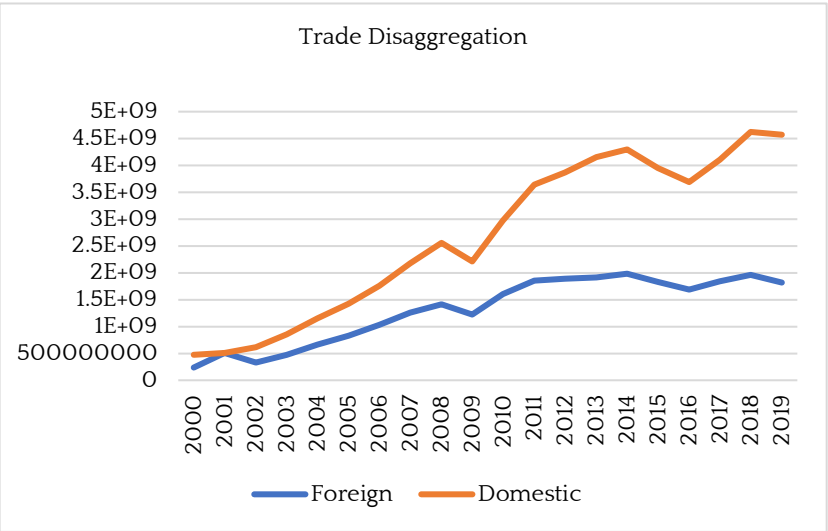

Figure 1: Domestic and Foreign Trade over Time in China

Results and Discussions

In this study, we found the issue of heteroscedasticity in our dataset by using the Modified Wald Test as shown in Table 2. Moreover, this section presents the results on the association between trade openness (domestic-invested enterprises (DIEs) and foreign-invested enterprises (FIEs) trade) and life expectancy, as shown in Table 3 (A, B, & C). The coefficient of trade openness is positive, showing a direct association between life expectancy and trade openness in China and across gender. We investigate the impact of trade openness (domestic-invested enterprises (DIEs) and foreign-invested enterprises (FIEs) trade) on life expectancy separately to check whether they both affect life expectancy equally or differently. Column (1) for domestic invested firms trade shows that trade openness upsurges the life expectancy, column (4) for foreign-invested firms trade also shows that trade openness upsurges life expectancy and the results are statistically significant. This shows that domestic invested enterprises trade as well plays a significant role in improving life expectancy as foreign-invested enterprises trade. The Chinese government could promote life expectancy by focusing on both domestic invested firms' trade as well foreign-invested firms' trade. These findings highlight the importance of both domestic as well as foreign-invested enterprises trade in promoting life expectancy. The coefficient of foreign-invested trade openness (8.913) is bigger than that of domestic-invested enterprises' trade openness (5.869), indicating that foreign-invested enterprises even play a bigger role in bettering life expectancy in china than do domestic firms.

Table 2. Modified Wald Test for Heteroscedasticity

	Overall	Male	Female
Foreign TO	7.8e+29***	7.4e+28***	4.3e+29***
	0.000	0.000	0.000
Domestic TO	4.9e+29***	5.1e+28***	1.9e+31***
	0.000	0.000	0.000

*Note: *show 0.05, **show 0.01, ***show 0.001. Wald test for the group-wise heteroscedasticity in RE (Random Effect) regression model.*

To check the robustness of our core findings on the association between trade openness and life expectancy, we include several controls as crucial factors of life expectancy. The foremost important determinant of life expectancy in existing research is economic growth (Mahyar, 2016). Our study finds that the link between economic growth and life expectancy is positive and significant. Economic growth substantially improves life expectancy in the overall case of China as well as also across the gender as shown in columns 2&5 of Table 3 (A, B, & C). It has been noticed that there is a strong positive association between economic growth, measured by GDP per capita, and life expectancy in most developing nations. The higher the GDP per capita, the higher the life expectancy and vice-versa (Lea, 1993). However, countries remarkably improved life expectancy even with lower GDP per capita as found by the study of Sen (1999) for the Indian state. Whereas, public education investment is deliberated as another influential factor of life expectancy in existing research (Silles, 2009; Steingrímsdóttir et al., 2012). Our study finds that the influence of public education investment on life expectancy is positive in all cases but insignificant. Public education investment enhances life expectancy and these findings are useful for policymakers as life expectancy and education are closely related (Luy et al., 2019). However, the resource-rich countries despite accruing various social and economic benefits have failed to invest in it (Gulis, 2000).

Table 3A: Trade Openness and Life Expectancy in China (Overall Case)

Variables	(1)	(2)	(3)	(4)	(5)	(6)
TO (Domestic)	5.869***	0.986*	1.829*			
	(1.511)	(0.551)	(1.085)			
Log GDP-PC		1.745***			1.766**	
		(0.676)			(0.690)	
Log PEI		0.572			0.558	
		(0.466)			(0.477)	
TO (Foreign)				8.913***	1.351*	2.962**
				(1.731)	(0.759)	(1.483)
Education			19.41***			19.48***
Development			(2.123)			(2.177)
Eco-environment			2.175			2.024
Development			(1.552)			(1.540)
Healthcare			7.936***			7.782***
Development			(1.235)			(1.336)
Constant	71.44***	48.08***	61.10***	71.89***	48.17***	61.31***
	(0.579)	(1.201)	(1.623)	(0.4887)	(1.189)	(1.589)
Wald Statistic	15.08	770.90	351.43	26.50	720.27	349.38
P-Value	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Note: LE is the dependent variable in all RE (Random Effect) models. The robust standard errors are shown in parentheses. N is 62 in all columns. The number of asterisks shows a significance level at 10%, 5%, and 1%.

Further, we add education development as a control variable and find that the correlation between life expectancy and education development is positive in China and across gender as indicated in columns 3&6 in all cases. Education development significantly enhances life expectancy (Jiang et al., 2018). Evidence from Brazil suggests that education development could impressively improve life expectancy (Messias, 2003). Many studies have contended that education and healthcare development are more essential to promote life expectancy as developing nations can directly use the latest medical technologies from developed nations (Ma, 1989). Our study also finds that education and healthcare development enhance life expectancy in China and across gender. As expected, the enhancement of education and healthcare development has a strong positive and robust relationship concerning to life expectancy. From 1949-1978, Chinese residents benefited a lot from the improvement of essential healthcare services and education and improved the average life expectancy (Sen, 1999). Individuals with better education typically have a healthy lifestyle; in this manner, they remain successful in improving life expectancy (Yan & Zhiyong, 2010). The improvement of medical services and the development of essential clinical infrastructure directly guarantee the decrease of disease, infections, and death risks, and bring a significant improvement in life expectancy (Arthur & Oaikhenan, 2017). Existing research also found a positive relation between healthcare inputs and life expectancy in the context of Europe (Elola et al., 1995).

Table 3B. Trade Openness and Life Expectancy in China (Female Case)

Variables	(1)	(2)	(3)	(4)	(5)	(6)
TO (Domestic)	6.054***	1.414**	2.340*			
	(1.442)	(0.706)	(1.238)			
Log GDP-PC		2.165***			2.180***	
		(0.709)			(0.718)	
Log PEI		0.622			0.612	
		(0.474)			(0.481)	
TO (Foreign)				9.162***	1.990*	3.881***
				(1.712)	(1.020)	(1.723)
Education			21.335***			21.426***
Development			(2.512)			(2.544)
Eco-environment			1.910			1.821
Development			(1.704)			(1.693)
Healthcare			8.327***			8.069***
Development			(1.433)			(1.542)
Constant	73.62***	45.45***	62.44***	74.09***	45.58***	62.65***
	(0.617)	(1.593)	(1.682)	(0.532)	(1.569)	(1.65)
Wald Statistic	17.61	559.86	306.48	28.64	555.79	298.31
P-Value	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Note: LE is the dependent variable in all RE models. The robust standard errors are shown in parentheses. N is 62 in all columns. The number of asterisks shows a significance level at 10%, 5%, and 1%.

Finally, we add eco-environmental development as a control in our robustness checks model and column 3&6 indicates that the relationship is positive between life expectancy and eco-environmental development and insignificant in some cases. Eco-environmental development is associated with the enhancement of life

expectancy (Antweiler et al., 2001). The evidence suggests that environmental investment not only improves the environmental status but also promotes the health status of the population (Khan & Majeed, 2018).

Table 3C. Trade Openness and Life Expectancy in China (Male Case)

Variables	(1)	(2)	(3)	(4)	(5)	(6)
TO (Domestic)	5.623***	0.914*	1.355			
	(1.558)	(0.475)	(0.9519)			
Log GDP-PC		1.361**			1.385**	
		(0.679)			(0.694)	
Log PEI		0.569			0.553	
		(0.481)			(0.491)	
TO (Foreign)				8.536***	1.255*	2.058
				(1.746)	(0.725)	(1.275)
Education			16.73***			16.84***
Development			(1.867)			(1.916)
Eco-environment			2.283*			2.137
Development			(1.3750)			(1.375)
Healthcare			7.58***			7.511***
Development			(1.048)			(1.146)
Constant	69.50***	49.80***	60.40***	69.93***	49.89***	60.57***
	(0.554)	(1.055)	(1.475)	(0.461)	(1.062)	(1.459)
Wald Statistic	13.02	625.91	389.19	23.90	628.38	402.13
P-values	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)

Note: LE is the dependent variable in all RE models. The robust standard errors are shown in parentheses. N is 62 in all columns. The number of asterisks shows a significance level at 10%, 5%, and 1%

To sum up, our study finds that trade openness (domestic & foreign-invested firms) impact on life expectancy is positive and statistically significant in China. Similarly, a positive and significant association is found across gender. Our findings are consistent with the study of Bergh and Nilsson (2010); Stroup (2007) and contrast the study of Aigheyisi (2019); Batool and Saghir (2013); Bussmann (2009). Further, our findings of robustness checks, are in line of Luo and Xie (2020); Frankel and Romer (1999) for economic growth, Khan and Majeed (2018) for public education investment, Guralnik et al. (1993) for education development, Wang et al. (2013) for eco-environmental development, and Janssen (2005) for healthcare development. Though our findings are robust after the inclusion of controls, it is not in the case of male life expectancy.

Conclusion

In our study, we investigated the association between trade openness (domestic & foreign-invested firms) and life expectancy in China and across gender using province-level data from 2001-2011. Our study finds that trade openness is positively related to life expectancy and statistically significant in China, regardless of whether it is estimated with domestic or foreign-invested firms. In both the domestic and foreign-invested firms' trade, the coefficient is positive. Similarly, there is a positive and significant relation between life expectancy and trade openness across gender. Trade openness positively affects life expectancy but the gains from trade vary across gender, as we find that female affected more by trade openness than male in China. The controls have a statistically significant and positive influence for life expectancy in all cases except for the public education investment and eco-environment development that have mixed significance. These findings are in line with the results of existing literature.

The results of this research have significant policy insinuations as the core findings indicate that China trade significantly promotes life expectancy. So, government of China should open the economy more to international trade so as to benefit more especially in the health sector and improve the population health. Therefore, we propose that government should formulate more responsive policies towards trade openness and foreign investment projects that will ensure social and economic benefits. The policy implication is that the government should open the economy more to international trade to benefit more especially in the health sector and improve the health of its population.

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