Long-run Estimates of Openness of Trade and Total Factor Productivity for India and Iran
A Comparative Study using the ARDL Bounds Approach

Sanjay Kumar

Asst. Prof & HOD, Department of Economics, Deoghar College, Deoghar

Abstract: The present study empirically investigates the long-run and short-run impact of trade openness (percent of GDP) and urbanization on total factor productivity, including industrialization in a multivariate framework. For this purpose, we have employed the Autoregressive Distributed Lagged Model (ARDL) for the period of 1960 to 2023 for India and Iran. The study from the ARDL bounds approaches exposes a strong correlation among the variables under investigation in both countries. Long-run parameter of trade openness is positive and statistically significant, suggest that this variable have important implication in the framing of productivity enhancement for both countries. The total factor productivity attributes to the technological progress taking place in a country. The TFP in Iran is reinforced by the positive interaction between human capital and trade policy. The policy to synchronize urbanization and industrial infrastructure spread should be taken into consideration. In the Indian context, the low-quality human capital dampens TFP as it couldn't much effectively synergize with pro-trade policies. Further, industrialization is missing the urbanization of India, which should be tackled.

JEL classifications: D24, F14, F40.

Keywords: TFP, Openness of trade, Urbanization, Industrialization, ARDL, Cointegration.

Introduction

Over the past few decades, there has been a tremendous economic expansion in economic activities worldwide. The industrial era, which began in the late 1770s in Europe and changed the economic structure, was followed by the rest of the

world. Consequently, there has been a declining trend in the availability of resources for their effective allocation in the process of economic advancement. Therefore, the trade-off between the satisfaction of unlimited needs and limited resources has raised an important issue of efficient productivity in recent times. Thus, the challenge is to produce more output with less quantity of input.

In general, productivity implies the efficiency of a factor in the production process and is expressed as the aggregate output ratio to a single or an aggregate input. It is influenced by several factors like innovation (to create new technology and adopt them), educational attainment to spread the knowledge throughout the economy and to develop a workforce to assimilate them, efficient market structure to promote such effective and flexible resource allocation, and well-developed infrastructure to support economic activities, and institutions to provide socio-economic stability, and to defend property rights and civil rights. The role of factor productivity has been liberal a long time ago and has been mentioned in the works of Adam Smith and Ricardo (gains from trade via division and liberalization of the market), Schumpeter, 1942 (need for constant innovation as a solution for creative destruction), Solow, 1956 (technological advancement), and several other economists like Kuznets, 1957; Chenery, 1960; Lewis, 1954 (structural transformation in underdeveloped countries). However, in the present scenario, it is being liberalized that technological advancement has a significant role to play to raise factor productivity. Hence, more emphasis is given to trade policies, which is a crucial source of the creation and adoption of technological progress.

Trade openness is measured as the ratio of exports and imports to GDP. Its significance has increased with time, where it is considered one of the essential components of the growth and development of a nation. A liberal trade policy leads to liberalization, economies of scale via efficient allocation, thereby resulting in overall gains from trade. Its foster imitation and technological spillovers across firms where ideas related to technology are embodied in traded goods. It enhances competition worldwide, resulting in diversity in preference and improvement in quality and overall consumer welfare. The export sectors generate positive externalities in the non-export sector via improved production techniques. Besides, in prevents foreign exchange constraints, thereby providing greater access to international markets. There is long-run growth by increasing returns to scale, productivity spillovers, technological innovation, and dynamic learning from abroad.

However, the debate regarding liberal trade policies has been controversial. While trade liberalization enhances efficiency, on the other hand, it deteriorates the economic gains, especially for less developed countries (Prebisch Singer hypothesis), therefore calling effective and protective measures. Trade openness proves to be dangerous for middle income countries as there are constant threats of volatilities in the exchange rate and macroeconomic stability. In recent decades, the middle east Asian countries have shown a tremendous and rapid acceleration in the pace of growth and development. The adoption of outward-oriented trade policies has gained momentum in the 80s, resulting in the transition of the Asian countries from 'Developing' to 'Developed.' It was further supplemented by the investment in physical and human capital, which rises total factor productivity sharply.

Coming to the Indian context, upto the 80s, India's trade policies were restrictive and rigid in nature. India followed a closed model of development with direct control on trade activities, with protective measures and complex licensing structures, etc. With the reforms of 1991, its industrial production experienced a sharp growth with improved efficiency in production factors. Today, India is one of the vital manufacturing hubs due to its increased infrastructure development. Therefore, the focus has now shifted to energy-efficient raw materials to reduce the Green House Gas emissions and other environmental hazards. Thus, the goal is to achieve economic development, which is also socially and environmentally sustainable.

There are multiple channels, such as industrialization and urbanization in which India is lagging behind the Iranian economy. India's urbanization is 11% which is relatively lower than the Iranian economy (30%). However, the TFP of India is lower than the Iranian economy, as shown in figure no 1. Hence, it is very important to have scientific research on how openness, urbanization and industrialization impact TFP.
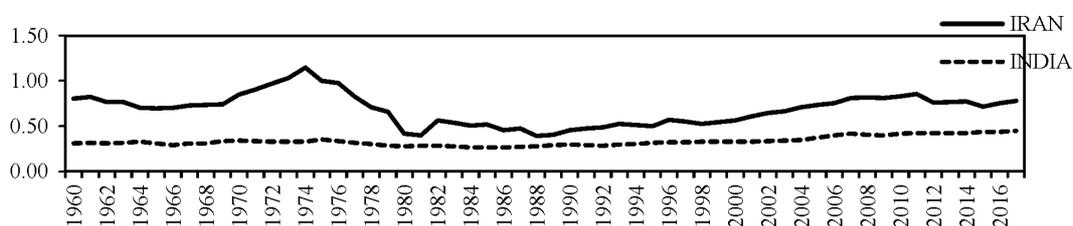

Figure 1: Trend of TFP

Related Studies

The nexus between trade openness and total factor productivity growth occupied a significant position in both theories and empirical studies in the past few decades. While identifying the sources of TFP growth, trade openness (familiarly known as export-led growth strategy) has attracted a striking place in the list of sources. Research by Alimoradi et. al., (2003), the annual growth rate of TFP was around 8.12% from 1966 to 2000 in the Iranian economy. They also noted that 10.8% and 1.83% annual growth in labour force and capital stock input. In the world-famous endogenous growth model, Romer (1994) and Lucas (1988), have articulated that the productivity spillover, technology innovation, increasing returns to scale and dynamic learnings, which achieved through international trade are resulting in long-term growth. Later, Grossman and Helpman (1991) and Rivera Batiz Romer (1991) have endorsed the same. In the existing literature, there were three major channels have identified by experts (Feder, 1983, Helpman & Krugman, 1985 and Esfahani, 1991) through which export performs as a growth enhancer. According to Feder (1983), positive externalities can be achieved in the non-export sector as a result of improved techniques and efficient management. The opinion of Helpman and Krugman (1985) slightly differs from the previous view and revealed that productivity can be improved by export expansion and economies of scale. While Esfahani (1991) exposed that the international market can be accessed due to elimination of foreign exchange constrain through export expansion and the final result is the growth of total factor productivity. Further, the quintessence of empirical studies conducted by Edwards (1998) for 93 countries, Wu (2000) for APEC countries, Miller and Upadhyay (2000) for 83 developing and developed countries and Alcal´a & Ciccone (2004) for the developing world revealed that trade openness has a statistically significant and robust (positive) effect on the total factor productivity in different periods.

The existing literature argues that there are good number of literatures attempted to capture the relationship between agglomeration economics and overall growth (Meihong Dai, 2017). But hardly limited studies have attempted to measure the effect of urbanization on productivity. Among the available research works, Feldman (1999) found through his econometric models that as firms access diversified knowledge and bettor promotion strategies in urban cents, they positively influence the total factor productivity. In the case of French firms, Martin,

(2011) identified the positive (but meager) effect of urbanization on productivity. Using panel smooth transition regression model, Cainelli et al. (2014) concluded that urbanization has a desirable impact on firm productivity in the case of Italy. While identifying the channels of urbanization-productivity nexus, Cervero (2001) highlighted that the labour productivity is more or less proportional to the size of the urban centers. But Meijers & Burger (2010) in the case of cities in the United States observed that balanced distribution of urban population enhances the total factor productivity. Wang et al. (2017) mentioned that the compactness of urban centers facilitates an increase in the total factor productivity. In the recent study by Hai-dong Yu et. al., (2004) using DEA and panel data model on the data collected for 30 provincial cities in China concluded that there was a positive and significant correlation between urban facilities and total factor productivity for the study period. Though a considerable amount of studies attempted to estimate the long-run relationship between trade openness and total factor productivity, the research on the Indian and Iranian context has not exist in the literature. Hence, the present study is an attempt to fill the gap by estimating the trade openness and total factor productivity nexus in the presence of additional determination such as urbanization and industrialization.

Data, Variables & Econometrics Method

Following Haider et al., (2019), and Sankaran et at., (2019), the relation between Total Factor Productivity *(TFP)*, openness of trade (TO), urbanization (*URB*), and Industrialization (*IN*) can be specified as followed:

$$lnTFP_t = \alpha_1 + \alpha_2 lnTO_t + \alpha_3 lnURB_t + \alpha_3 lnIN_t + \varepsilon_t \qquad (1)$$

Where, ε_t is error term. All variables are expressed in natural logarithmic form and the variables such as *TO, URB* and *IN* have been sourced from World Bank Indicators (WDI), World Bank. The variables such as TO and IN expressed as a percent of GDP. URB is taken as urban population as a percentage of total population. The *TFP* has been collected from Penn World Trade version 9.1. The model (Equation 1) is estimated for both countries (India and Iran) in the time series horizon for the time period of 1960-2023.

The data has been subjected to go through stationarity checking to know the nature (mean and variance) of data series specified in the model, before selecting the time-series model Ewing et al., (2007). Thus, we have incorporated Augmented

Dickey-Fuller (Dickey & Fuller, 1979) and Phillips-Perron (1988) tests. The result of unit root tests (Table No. 2) revealed that all variables are integrated of order one [I(1)] at 1% level except URB, which is integrated of order zero I(0). Due to mix nature of data series, the ARDL bounds methods of cointegration was adopted (Pesaran et al., 2001). This model takes care of long run cointegration association and structural break in the data series. This method is viewed as a conventional and much better technique to accommodate small sample size and it has ability to incorporate short and long-run elasticities (Islam et al., 2013). It also tests for the cointegration by adopting F-test. Pesaran et al., (2001) two sets of critical value. If the calculated F-stats are found to be higher than the upper bound of critical value then null hypothesis of no cointegration is rejected, which confirms that variables under study have long-run associations.

$$\Delta lnTFP_t = \alpha_0 + \sum_{i=0}^{n} \alpha_1 \Delta lnTFP_{t-i} + \sum_{i=0}^{n} \alpha_2 \Delta lnTO_{t-i} + \sum_{i=0}^{n} \alpha_3 \Delta lnURB_{t-i}$$
$$+ \sum_{i=0}^{n} \alpha_4 \Delta lnIN_{t-i} + \sum_{i=0}^{n} \beta_1 lnTFP_{t-i} + \sum_{i=0}^{n} \beta_2 lnTO_{t-i}$$
$$+ \sum_{i=0}^{n} \beta_3 lnURB_{t-i} + \sum_{i=0}^{n} \beta_4 lnIN_{t-i} + \delta ECT_{t-i} + \mu_t$$

(2)

Where, δ detect speed of adjustment, Δ denotes first deference. ECT_{t-i} indicate disequilibrium, which is depicted by the value of parameter δ and should be negative and statistically significant Shahbaz et al., (2013). The above model (equation 2) includes both short-run and long-run variables. For the short-run elasticities, the lag length n is chosen by Akaike Information Criterion (AIC) (Lutkepohl, 2006), and estimated at these optimum lags for both the models.

Empirical Results

The summary result presented in Table No. 1. The table 1 shows that the mean value of *TFP, TO and URB* of India is 0.33, 23.11 and 25.24 respectively that is lower than the average value of Iran that is 0.68, 41.11, and 55.50, respectively. While industrialization is higher in India in comparison to Iran, that is 15.89 and 12.35 respectively. The data set of India has less variation than the Iranian economy, evident by standard deviation. The standard deviation of the variables is much higher in the instance of Iran, pinpointing the volatility is more in Iran and the

set of variables attributed to India maintain a comparatively much better standard deviation property.

Table 1: Descriptive statistics of variables under-study

	TFP	TO	URB	IN
India				
Mean	0.33	23.11	25.24	15.89
Maximum	0.45	55.79	34.03	17.87
Minimum	0.26	7.66	17.92	13.23
Std. Dev.	0.05	10.15	4.68	0.98
Iran				
Mean	0.68	41.11	55.50	12.35
Maximum	1.14	76.12	74.90	17.44
Minimum	0.39	14.14	33.74	7.47
Std. Dev.	0.17	11.65	12.52	2.69
Source: Authors calculation.				

Table 2: Unit root test result

India				
	ADF		PP	
Variables	Level	1ˢᵗ Diff	Level	1ˢᵗ Diff
TFP	-0.17	-5.53***	0.37	-5.51***
TO	-0.11	-6.03***	-0.30	-6.02***
URB	-0.21**	-	-0.55**	-
IN	-2.37	-7.08***	-2.37	-7.08***
Iran				
TFP	-1.51	-6.49***	-1.77	-6.52***
TO	-2.74	-5.20***	-2.35	-5.18***
URB	-3.24**	-	-8.52***	-
IN	-2.00	-7.63***	-2.00	-7.65***
Notes: ** and *** indicates statistically significate at 5% & 1% level, respectively.				

To test the long-run cointegrating equation among the variables under study, we have performed Bounds Test, presented in Table No. 2, reported the F-statistics (which follow asymptotic distribution) results for India and Iran. We confirm the long-run cointegration among the variables, if we reject the null hypothesis of no cointegration. Bounds test result rejects the null of no cointegration as calculated value of F-stats (4.90 and 5.33 for India and Iran respectively) exceed the upper critical bound at 5% level of significance for both countries. It confirms the existence

of long-run relationship among the variables. The long-run and short-run parameter estimates are quantified in equation no. 2

Table 3: Bounds test result

Dependent variable: TFP				
Country	F-stats	Significant	I(0)	I(1)
India	4.90	1%	4.29	5.61
		5%	3.23	4.35
		10%	2.72	3.77
Iran	5.33	1%	5.17	6.36
		5%	4.01	5.07
		10%	3.47	4.45

Table 4: Long-run and short-run estimates

Short-run estimates:							
Lag order							
India	0	1	2	Iran	0	1	2
ΔTFP	-	0.33***	-0.17	ΔTFP	-	-	-
ΔTO	0.05**	-	-	ΔTO	0.10**	-	-
ΔURB	-0.03	-	-	ΔURB	-0.10**	-	-
ΔIN	-0.22**	0.44**	-	ΔIN	-0.39**	-	-
ECT	-0.16***	-	-	ECT	-0.24***	-	-
Long run result Dependent variable: TFP							
Variables	TO	URB	IND			Constant	
India	0.36***	-0.20**	-2.17***			4.50***	
Iran	0.43***	-4.55***	0.59			13.08***	
Notes: ** % *** indicates statistically significant at 5% and 1% level, respectively.							

The short-run and long-run results are presented in Table No. 4. The first panel of Table 4 shows that the past value of TFP affects the current value. The past situations which instilled technological progress are supposedly acting as a positive externality encouraging current technological progress. The explanatory variables like TO, URB, and IN have an instantaneous and lagged impact on TFP. In both nations, Trade openness has a positive impact. In the Indian context, the impact is so negligible, i.e., less than 10 per cent. This reflects trade dos not foster technological progress in the short run. This may be because the technological absorption ability of India is less efficient in the short run. The technological absorption is crucially determined by industrialization and the collection of skilled manpower. As per

Human capital index 2020 prepared by the World Bank Group, India's Human Capital Index is 0.49 well below that of Iran and Iran ranked 71[st,] while India ranked 116 in the same index in 2018. But in Iran the short-run, technological progress is much better. The weak factors instigating low technology absorption in India is supposedly strong for Iran. For India and Iran, the error correction term (ECT) is negative and statistically significant at 1% level respectively, which exposes that Iran has more potential to adjust fastly the disequilibrium that occurs in the short-run since the elasticity of ECT is 24% higher than that of India 16%.

The result of long-run elasticities is shown in the second panel of table no. 4, which reveals a positive impact of openness of trade *(TO)* means liberal trade policy leads to increment in factor productivity of both the nation. Liberal trade might have supposedly influenced the smooth technological transfer to both Iran and India which could boost productivity. The increment in total productivity as a result of trade openness should be understood in this line. The coefficient value of trade openness is higher in the case of Iran than that of India. Trade policy incentivized productivity increment supposedly exists and it could be through higher technological import. The impact of urbanization is negative in the case of both countries, which shows that urbanization has enabled to decrease total factor productivity in both countries. In India, urbanization and industrialization have both resulted in a decrement in total productivity. This should be read together. Urbanization should have mobilized skilled manpower for industrialization. But India's skilled manpower is very low. The low supply of skilled manpower resulted in negative returns emanating from urbanization and industrialization. The diseconomies of scale are supposedly operating on a large scale as India has a lot of sick industrial units. The positive impact of industrialization and the negative impact of urbanization signifies that, even though urbanization exists, industrialization has a very uneven relationship with urbanization as industrialization is supposedly existing in a very skewed pocket.

Table 5: Diagnostic check result

		India	*Iran*	
Test	Null Hypothesis	Statistics	Statistics	Decision
Ramsey RESET test	H_0: the model is correctly specified	0.27(0.78)	9.94(0.12)	Do not reject null
LM test	H_0: no autocorrelation	0.75(0.47)	0.26(0.76)	Do not reject null
Jarque-Bera test	H_0: normality of error term	0.25(0.88)	8.82(0.11)	Do not reject null
ARCH test	H_0: no heteroscedasticity	0.05(0.81)	0.01(0.89)	Do not reject null
Notes: The value in the parenthesis is the probability value.				

The diagnostic check results are shown in Table No. 5. Which depicts our model are free from miss specification as confirm by Ramsey-Reset test result. However, LM test confirm that model is not suffering from serial correlation. Further, Jarque-Berra and ARCH test result confirms the normality of series and heteroscedasticity issue respectively.

Country	CUSUM test	CUSUMSQ test
India		
Iran		
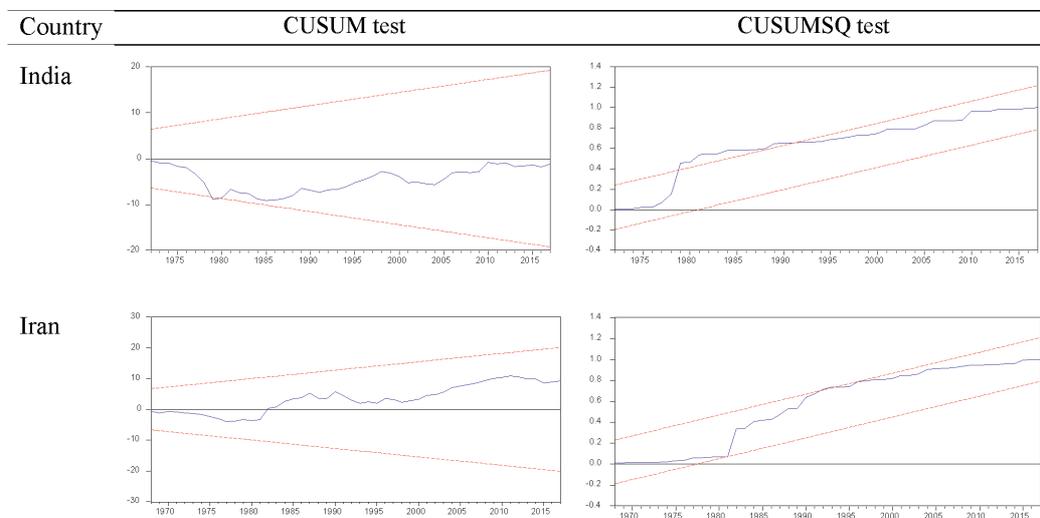
Figure 2: Stability test

Statistically significant at 5% level.

The stability test of parameter of equation 2 entails CUSUM and CUSUMSQ technique (Pesaran et al., 1997). As per the Pesaran et al., (1997), if the plots lying within the critical bound then it ensures us the parameter are stable and more consistent. Our model plots and shown in Figure No. 2 which guarantees that CUSUM & CUSUMSQ plots are significant at 5% level respectively. This signifies that estimated parameters are stable, consistent and not biased.

Conclusions & Policy suggestion:

Even though both India and Iran are emerging market economies, both are still in different sub-stages of the same main development phase. Different micro-foundations channelize the total productivity in both nations in the context of liberal trade policy reforms.

In Iran in the long-run, there is a positive trade policy reform effect, which is supposedly interacted with the fairly good human capital formation has indicated by substantial higher ranking in human capital index that Iran has earned in comparison with a relatively much lower score. The phenomena of *Dutch disease* could be worrisome phenomena that might gripple the Iranian economy booming oil sector and a declining or stagnant non-oil traded goods sector (Jazayeri,1986, Manzoor,2012. The human capital could be skewed in this sector. Industrialization and urbanization evidently have an uneven relationship pinpointing large regional effects. This has brought a disheartening effect of industrialization on TFP. The policy suggestions in the instance of Iran tap the maximum level of the benefits springing-up from the best level of favourable trade policy and human capital, understand the nature of Dutch disease and tackle it. Further, introducing policies that could give vital sparks to bring in synergy between industrialization and urbanization is of paramount importance.

In the pretext of India, even though the trade policy reform has a favourable effect on the TFP through technology import, the deficiency of trained manpower is ailing the complementarity, which is supposed to result from the interaction of the duo. The policy should address turning the vast unskilled human resource into trained manpower and reap the potential gains at full stretch. This includes improving the quality of schooling, gross enrollment ratio, and bringing specialization compared to providing general education at a higher level. Further, lack of substantial industrialization to bring in complementarity between urbanization and industrialization has resulted in a negative effect emanating from the duo.

Reference

Alimoradi, L., Shirin Bakhsh, S., & Totonchian, I. (2003) "Measuring total factor productivity growth in the economy and determine its contribution to GDP growth" M.A. Dissertation, ALzahra university. 435–441.

Alcal´a, F. and Ciccone A., (2004) "Trade and Productivity" Quarterly Journal of Economics, 119 (2), , 613–646.

Cainelli, G.; Fracasso, A.; Marzetti, G.V. (2014) "Spatial agglomeration and productivity in Italy: A panel smooth transition regression approach" Pap. Reg. Sci., 94, S39–S67

Cervero, R. (2001) "Efficient Urbanisation: Economic Performance and the Shape of the Metropolis" Urban Stud, 38, 1651–1671.

Chenery, Hollis B. (1960) "Patterns of Industrial Growth" The American Economic Review 50 (4): 624–54. https://doi.org/10.1257/jep.6.3.79.

Dai, M., Li, X., & Lu, Y. (2017) "How urbanization economies impact tfp of r&d performers: Evidence from china". *Sustainability*, *9*(10), 1766.

Dickey, D. A., & Fuller, W. A. (1979) Distribution of the estimators for autoregressive time series.

Dong, W.X.; Zhu, S.L.; Guo, L.Z. (2017) "A Study on Urban Compactness and Total Factor Productivity—Based on the GMM Method of Panel Data" J. Yunnan Univ. Financ. Econ. 5, 128–136

Edwards, S., (1998) "Openness, Productivity and Growth: What do we really know" Economic Journal 108, , 383–398.

Esfahani, H.S., (1991) "Exports, Imports, and Economic Growth in Semi- Industrialized Countries" Journal of Development Economics 35, 93–116.

Ewing, B. T., Kruse, J. B., Schroeder, J. L., & Smith, D. A. (2007) "Time series analysis of wind speed using VAR and the generalized impulse response technique" *Journal of wind engineering and industrial aerodynamics*, *95*(3), 209-219.

Feder, G., (1983) "On Exports and Economic Growth" Journal of Development Economics 12, 59–73.

Feldman, M.P. (1999) "The new economies of innovation, spillovers and agglomeration: A review of empirical studies" Econ. Innov. New Technol. 8, 5–25.

Grossman, G. M., & Helpman, E. (1991) "Trade, knowledge spillovers, and growth" *European economic review*, *35*(2-3), 517-526.

Grossman, G.M. and Helpman, E., (1991) "Innovation and Growth in the Global Economy" Cambridge, MA: MIT Press, 1991.

Haider, S., Adil, M., & Ganaie, A. (2019) "Does industrialisation and urbanisation affect energy consumption: a relative study of India and Iran" *Econ Bull*, *39*(1), 176-185.

Hai-dong, H. U. A. N. G. (2004) "Retaliation and cross retaliation in WTO dispute settlement mechanism" *Journal of Dalian University of Technology (Social Sciences)*, 04.

Helpman, E. and Krugman, P.R., (1985) "Market Structure and Foreign Trade" Cambridge: MIT Press.

Islam, F., Shahbaz, M., Ahmed, A.U., Alam, M.M., (2013) Financial development and energy.

Jazayeri, A., (1986) "Prices and Output in Two Oil-Based Economies: The Dutch Disease in Iran and Nigeria" *IDS Bulletin*, *17*(4), pp.1-8.

Kuznets, Simon. (1957) "Quantitative Aspects of the Economic Growth of Nations: II. Industrial Distribution of National Product and Labor Force" Economic Development and Cultural Change 5 (S4): 1–111. https://doi.org/10.1086/449740.

Lewis, W. A. (1954) Economic development with unlimited supplies of labour.

Lucas Jr, R. E. (1988) "On the mechanics of economic development" *Journal of monetary economics*, *22*(1), 3-42.

Lütkepohl, H., (2006) Structural vector autoregressive analysis for cointegrated variables.

Manzoor, D., Haqiqi, I., & Aghababaei, M. (2012) Modeling Dutch Disease in the economy of Iran: A computable General equilibrium approach.

Martin, P.; Mayer, T.; Mayneris, F. (2011) "Spatial concentration and plant-level productivity in France" J. Urban Econ. 69, 182–195.

Meijers, E.J.; Burger, M.J. (2010) "Spatial structure and productivity in US metropolitan areas" Environ. Plan. A 2010, 42, 383–1402.

Miller, S.M. and Upadhyay, M.P., (2000) "The Effect of Openness, Trade Orientation, and Human Capital on Total Factor Productivity" Journal of Development Economics 63, 399–423.

Pesaran, M. H., & Pesaran, B. (1997) Working with Microfit 4.0: Interactive Econometric

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001) "Bounds testing approaches to the analysis of level relationships" *Journal of applied econometrics*, *16*(3), 289-326.

Phillips, P. C., & Perron, P. (1988) "Testing for a unit root in time series regression" *Biometrika*, *75*(2), 335-346.

Rivera-Batiz, L. and Romer, P., (1991) "Economic Integration and Endogenous Growth" Quarterly Journal of Economics 106 (2), 531–555.

Romer, P. M. (1994) "The origins of endogenous growth" *Journal of Economic perspectives*, *8*(1), 3-22.

Romer, P., (1986) "Increasing Returns and Long Run Growth" Journal of Political Economy, 94, 1002–1037.

Sankaran, A., Kumar, S., Arjun, K., & Das, M. (2019) "Estimating the causal relationship between electricity consumption and industrial output: ARDL bounds and Toda-Yamamoto approaches for ten late industrialized countries" *Heliyon*, *5*(6), e01904.

Schumpeter, Joseph. (1942) Capitalism, Socialism and Democracy. New York: Harper & Row.

Shahbaz, M., Lean, H.H., (2012) "Does financial development increase energy consumption? The role of industrialization and urbanization in Tunisia" Energy policy 40, 473–479.

Solow, R. M. (1956) "A Contribution to the Theory of Economic Growth" The Quarterly Journal of Economics 70 (1): 65–94. https://doi.org/10.2307/1884513.

Wang, H., Zhang, Y., Zhao, H., Lu, X., Zhang, Y., Zhu, W., ... & McElroy, M. B. (2017) "Trade-driven relocation of air pollution and health impacts in China" *Nature communications*, *8*(1), 1-7.

Wu, Y., (2000) "Openness, Productivity and Growth in the Asian-Pacific Economies: An alternative approach" 7th Convention of East Asian Economic Association, Singapore.