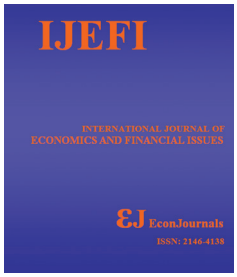

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The Effect of External Debt on Life Expectancy Through Foreign Direct Investment: Evidence from Turkey

Emrah Bese[1]*, Haven Swint Friday[2]

[1]Near East University, North Cyprus, Turkey, [2]Tamus, Rellis Campus, USA. *Email: phdebese@gmail.com

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ABSTRACT

This is the first study in the single country studies that analyze the relationship between life expectancy, short-term external debt, and long-term external debt for Turkey for the period from 1974 to 2017. This study analyzed the direct effect of long-term debt and short-term debt on life expectancy in Turkey. General tendency in the literature is to analyze the relationship between growth and life expectancy. According to the results in this study, long run relationship is confirmed between the variables. The causal relationship is found from life expectancy to long-term debt and short-term debt but no causal relationship is found from long-term debt and short-term debt to life expectancy. The reason behind this result may result from that Turkey's increasing life expectancy leads to population increase and the increase in population leads to the increase in the construction of new buildings. For the last 20 years, Turkey started to renew its construction infrastructure and at the same time establishing new buildings for its increasing population. Resulting from that, Turkey needed funding to fund its investments, and it currently is, and there has been a gap between investments and savings in Turkey. Turkey may have used external debt to fund the gap between investments and savings. This article recommends further analysis for the direct relationship between external debt and life expectancy for developing countries.

Keywords: Life Expectancy, ARDL Model, Foreign Direct Investment, Long-term External Debt, Turkey, Short-term External Debt
JEL Classifications: I18, F10, F40, F20

1. INTRODUCTION

The aim of this study is to analyze the effect of long term external debt (EXTL) and short term external debt (EXTS) on life expectancy (LEP) through foreign direct investment (FDI) following the study of Alam et al., (2016) for Pakistan. Alam, Raza, Shahbaz and Abbas confirmed that FDI and trade openness (TO) had positive impact on LEXP and there was unidirectional causality running from FDI and TNP to LEP in the short run in Pakistan for the period 1972 to 2013. Alam, Raza, Shahbaz and Abbas stated the study of Pakistan was the first study to examine the relationship between LEP, TO and FDI. This study used model of LEP-trade openness-FDI and dropped trade openness from model and added external debt (EXT) by dividing it into its subcomponents as EXTL and EXTS.

There is a research gap in the literature for analyzing the relationships between LEP, EXTL and EXTS for developing countries. The contribution of this study is that it is the first study that analyzes relationships between LEP, EXTL and EXTS for Turkey. This study breaks down external debt (EXT) into EXTS and EXTL and examines the direct effect of EXT on LEP through FDI for Turkey for the period 1974-2017.

External debt is analyzed by its two subcomponents which are long-term external debt (EXTL) and short-term external debt (EXTS). EXTL is debt which is defined as having original or extended maturity of more than one year and consists of public, publicly guaranteed, and private nonguaranteed debt. EXTS is debt which is defined as having original maturity of year or less.

LEP in Turkey increased continuously for the period 1974-2017 (Figure 1). By beginning 1980s, FDI, EXTL and EXTS started grow as Turkish government started to apply open market economic system. Today, FDI, EXTL and EXTS are still growing (Figures 2-4).

For similar studies in the literature Saungweme and Mufandaedza (2013) examined the relationship between external debt (ET) and poverty for Zimbabwe for the period 1980 to 2012. Saungweme and Mufandaedza found that income per capita and infant mortality rate had negative relationship and income per capita and LEP had positive relationship. Loko et al. (2003) found that ET had significant impact on poverty in low-income countries. N'zue (2020) examined the relationship between ET/gross domestic product and economic growth in the ECOWAS region for the period 1990-2016. N'zue found that ET had a positive effect on economic growth up to a certain level of ET. Babu et al. (2014), Clements et al., (2003) and Malik et al., (2010) found negative relationship between economic growth and ET ratio. Soyres et al. (2019), Kharusi and Ada (2018) and Çiftçioğlu and Sokhanvar (2018) found positive relationships between economic growth and ET ratio in the literature.

Zaghdoudi (2018) examined the relationship examined the relationship between human development index and ET for a panel of 95 developing countries for the period 2002 and 2015. Zaghdoudi found that up to a certain level of ET, ET affected positively human development index. After that certain level of ET was exceeded, ET affected human development index negatively. Zaghdoudi provided recommendations for low level and high level ET regime countries.

Sheikh and Alam (2013) found that ET had a significant positive effect on poverty in Pakistan for the period 1985 to 2010. Novignon et al. (2012) examined the relationship between health status and vulnerability to poverty in Ghana and found that health status had a significant effect on vulnerability to poverty.

Debt overhang hypothesis, Dual gap theory implication and the crowding-out hypothesis are among the hypotheses examined in the literature. Debt overhang hypothesis refers a problem for an entity or organization that this entity or organization has such a big debt burden so it cannot further get debt to finance another project or investment. Dual gap theory states that the development of developing countries is constrained by two gaps, which are gaps between exports and imports, and between domestic savings and investment. Crowding-out hypothesis is for that government's domestic borrowing leads to higher interest rates for borrowing and that situation drives down or eliminates private sector spending.

Literature for population health studies are analyzed by TO-population health nexus, growth-population health nexus, foreign aid-population health nexus, FDI-population heath nexus, FDI-TO nexus, determinants of FDI, FDI-sustainable development nexus, import of medical products-population health nexus and determinants of LEP. This study investigated population health-EXTL-EXTS nexus in Turkey.

Figure 1: LEP in Turkey

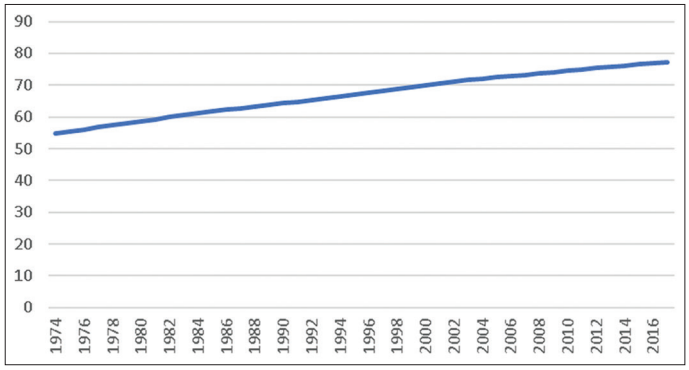


Figure 2: FDI in Turkey

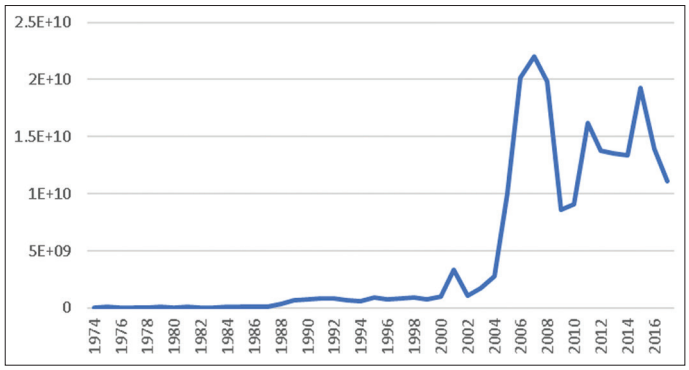


Figure 3: EXTS in Turkey

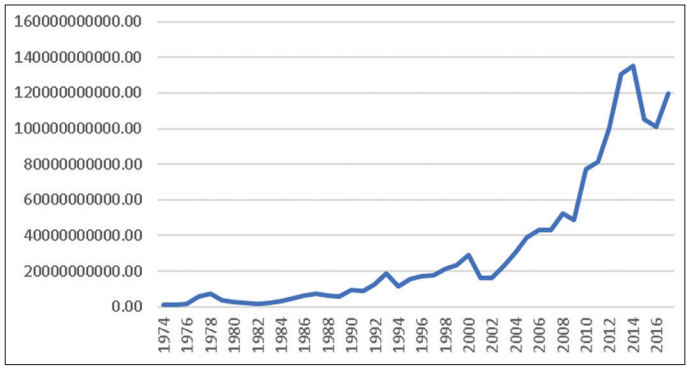
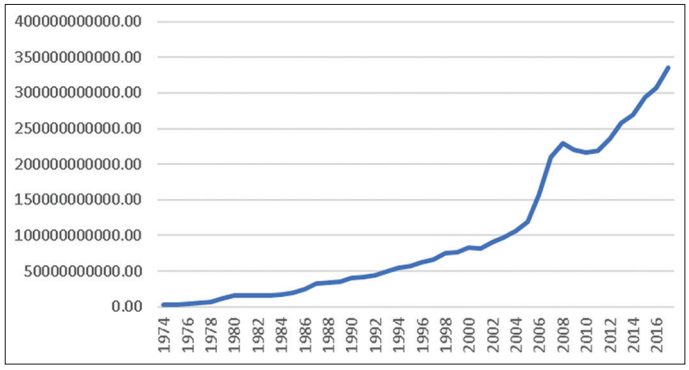


Figure 4: EXTL in Turkey



Following hypotheses are examined in order to investigate the relationships between LEP, LEXTL and LEXTS.

H_1: There is significant and positive impact of EXTL on LEP in Turkey
H_2: There is significant and positive impact of EXTS on LEP in Turkey
H_3: There is unidirectional causality running from EXTL to LEP in Turkey
H_4: There is unidirectional causality running from EXTS to LEP in Turkey
H_5: There is unidirectional causality running from LEP to EXTL in Turkey
H_6: There is unidirectional causality running from LEP to EXTS in Turkey

Relationship between LEP, LEXTL and LEXTS is examined by Augmented distributed lag (ARDL) model by Pesaran et al., (2001) and symmetric cointegration is analyzed. Since cointegration is found between the variables by ARDL model, Toda and Yamamoto model (1995) is applied to investigate the causality between the variables.

In section 2, literature review is discussed. In section 3, methodology and data of this study are explained in detail. In section 4, results are discussed, and conclusion is in section 5.

2. LITERATURE REVIEW

2.1. Relationship between to and Population Health

2.1.1. To-population health nexus depending on gender

Bussmann (2009) investigated the effect of TO on female LEP, female education and female labor force participation and distribution in sectors for a panel of 134 countries for the period 1970-2000. Bussmann confirmed that the effect of TO on women's LEP was insignificant. TO did not directly affect women's LEP. TO had a positive effect on female education attendance levels. Bussmann analyzed the effect of TO by separating male and female data. TO negatively affected female labor force pariticipation in developed countries. There was no significant effect difference of TO on men and female.

Stevens et al. (2013) investigated the relationship between TO and health outcomes for a panel of countries for the period 1970-2005. Stevens, Urbach and Wills found that TO positively affected the under-one infant mortality (IM) rate and the under-five IM rate. Stevens, Urbach and Wills found that TO affected positively LEP for female and male, and the effect of TO for LEP was higher for female than male. Increase in gross domestic per capita negatively affected the positive effects of TO on health outcomes.

Owen and Wu (2007) investigated the relationship between TO and IM, LEP of females and LEP of males for a panel of 219 countries for the period 1960-1995. Owen and Wu found that TO positively affected IM, LEP of females and LEP of males. Owen and Wu also found that TO affected LEP of females higher than LEP of males in the poorest countries. Owen and Wu investigated the channels to explain positive relationship between TO and health outcomes. Owen and Wu confirmed increased availability of vaccinations due to TO affected positively health outcomes, but Owen and Wu did not find evidence for the import of pharmaceutical products to explain the positive relationship between TO and health outcomes. Owen and Wu found that the real reason for the developing countries increase import of pharmaceutical products from developed countries was due to bad health outcomes rather than TO.

2.1.2. To-child health nexus

Levine and Rothman (2006) investigated the relationship between TO and child health for a panel of 130 countries. Levine and Rothman found that TO positively affected IM, child mortality, malnutrition and LEP.

2.1.3. To-population health nexus

Herzer (2015) investigated the relationship between TO and LEP at birth by ARDL model for the period 1960-2011 for USA. Herzer found that TO had a positive impact on LEP. Herzer (2015) confirmed that there was a long-run causality running from TO to LEP.

Stevens et al. (2013) and Owen and Wu (2007) confirmed that there was nonlinear relationship between health outcomes and TO.

Herzer (2014) investigated the effect of TO on LEP and IM for a panel of 74 countries for the period 1960-2010. Herzer found that the effect of TO on health outcomes was higher in less developed and less regulated countries. Herzer found that there was bi-directional causality between TO and LEP. Herzer stated that there were six channels for the impact of TO on health outcomes which are income, inequality, access, insecurity, pollution and aid.

Talukdar and Parvez (2017) confirmed that LEP, TO and population positively affected gross FDI inflows in the long run for 46 developing countries over the period 1996-2011.

Qadir and Majeed (2018) investigated the impact of TO on LEP and IM in Pakistan for the period 1975-2016. The study concluded that TO had a negative impact on LEP and IM in Pakistan.

2.1.4. To-population health-growth nexus

Ling et al., (2017) investigated the relationship between LEP, GDP per capita, exports and imports for Malaysia for the period 1960-2014. Ling, Ahmed, Muhamad, Shahbaz and Loganathan found that LEP had positive impact on GDP per capita, exports and imports in the long run. Ling, Ahmed, Muhamad, Shahbaz and Loganathan also found that GDP per capita, imports and exports had positive impact on LEP in the long-run. Ling, Ahmed, Muhamad, Shahbaz and Loganathan confirmed unidirectional causality from TO and LEP, unidirectional causality running from imports to LEP and economic growth and bi-directional causality between economic growth and LEP in the long-run.

2.2. Relationship between Growth and Population Health

2.2.1. Growth-population health nexus

Croix and Licandro (1999) investigated the dynamics between LEP and economic growth. Croix and Licandro found that LEP was positive for economies with low level of LEP, but this effect could be negative for developed economies.

Acemoglu and Johnson (2007) investigated the relationship between population, GDP and LEP. Acemoglu and Johnson found that LEP had a positive effect on population, but LEP did not have a positive effect on GDP and may have lowered the economic growth.

Azomahou et al., (2009) carried out panel study of 18 countries to investigate the relationship between growth rate of GDP per capita and LEP at birth for the period 1820 to 2005. The results of the study show that the relationship between GDP and LEP was increasing and concave.

Cervellati and Sunde (2011) analyzed sample of countries for the relationship between income per capita and LEP according to demographic transition. The study confirmed that LEP negatively affected income per capita but sometimes insignificant in pre-transitional countries, and positively affected income per capita in countries which experienced the onset of the transition by 1940. The post transitional countries in 1940 are the ones which have higher LEP or lower crude birth rates.

Mahumud et al., (2013) investigated the impact of GDP per capita and health care expenditure on LEP in Bangladesh for the period 1995-2011. Mahumud, Hossain, Hossain, Islam and Rawal found that higher economic growth and health care expenditure positively affected LEP.

Kunze (2014) examined nonlinear relationship between LEP and economic growth with over-lapping generations model. The study concluded that higher LEP may have reduced human capital investment and may have unambiguous effect on economic growth. Investigation was done for 107 developed and developing countries.

Ngangue and Manfred (2015) investigated the relationship between gross national income per capita and LEP with the variables of human capital, gross fixed capital formation and good governance for 141 developing countries for the period 2000-2013. Ngangue and Manfred found that LEP positively affected income growth in low-income and high-income developing countries. LEP did not affect income growth significantly in middle income developing countries.

Aghion et al., (2011) confirmed that LEP had a positive effect on economic growth for OECD countries for the period 1960-2000. Aghion, Howitt and Murtin stated that significant component of LEP that had impact on economic growth was the decline in mortality rate under age of 40 for OECD countries. Aghion, Howitt and Murtin also confirmed that LEP had positive effect on economic growth for a sample of developed and developing countries. Aghion, Howitt and Murtin found that economic growth and exports had positive impact on LEP.

Cervellati and Sunde (2011) analyzed sample of countries to analyze the relationship between LEP and economic growth by taking into account demographic transition. Cervellati and Sunde confirmed that LEP positively affected economic growth. Cervellati and Sunde also confirmed that effect of LEP on economic growth depended on demographic transition of the sample country.

Bloom et al., (2014) confirmed that improvements in population health positively affected economic growth.

Howitt (2005) stated the channels for the impact of health outcomes on economic growth as productive efficiency, LEP, learning capacity, creativity, coping skills and inequality.

2.2.2. Growth-population health-pollution nexus

Ebenstein et al. (2015) investigated the relationship between health, pollution and income for China for the period 1991-2012. LEP was measured in terms of LEP at birth, LEP at age five, age-adjusted death rate from cardiorespiratory mortality, and age-adjusted death rate from all other causes of death. The study concluded that Chinese counties with greater pollution increased, experienced slower LEP increase.

2.3. Foreign Health Aid-population Health Nexus

Williamson (2008) confirmed that foreign health aid did not significantly affect health outcomes such as LEP, DPT and measles immunization, and IM for a panel study of 208 countries for the period 1973 to 2004.

Wilson (2011) investigated the effect of development assistance for health and water aid on IM rate for a panel of 74 countries and found no significant effect of development assistance for health and water aid on IM rate for panel countries.

Herzer and Nagel (2015) investigated the relationship between health aid and LEP for a panel of 42 countries for the period 1982-2012. Herzer and Nagel found long run causality running from health aid to LEP. In the short run health aid positively and significantly affected LEP. In the long run health aid negatively and significantly affected LEP for a panel of 42 countries for the period 1982-2012.

2.4. Relationship between FDI and Population Health

2.4.1. FDI-population health nexus

Giammanco and Gitto (2019) investigated the relationship between FDI and health for 28 European countries for the period 2000-2013. Giammanco and Gitto found that the percentage of public health expenditure on total health expenditure positively affected the inward stocks of FDI and the percentage of out of pocket expenditure on the total private healthcare expenditure negatively affected the inward stocks of FDI. Giammanco and Gitto confirmed that population health positively affected FDI input stock.

Herzer and Nunnenkamp (2012) examined the long run effect of net FDI inflow on LEP in developed countries for the period 1970-2009. Herzer and Nunnenkamp found that net FDI inflow had a significant and negative effect on LEP in the long run for panel countries.

Nagel et al. (2015) examined the relationship between FDI and population health for a panel of 179 countries for the period 1980-2011. Nagel, Herzer and Nunnenkamp confirmed that there was a nonlinear relationship between FDI and health. Real stock of FDI had a a positive effect on IM rate for countries with low level of income and real stock of FDI had a significant and negative effect on IM rate for countries with high level income.

Alsan et al., (2006) confirmed that LEP positively affected gross inflow FDI for a panel of 51 low and middle income countries.

2.4.2. FDI-population health-growth nexus

Burns et al., (2017) investigated the relationship between FDI and overall health for 85 low and middle income countries for the period 1974-2012. Burns, Jones, Goryakin and Suhrcke found that FDI inflow positively affected LEP and adult mortality, and FDI inflow had insignificant effect on IM rate under 5 and IM.

Shahid et al. (2019) investigated the relationship between health, income and FDI for panel countries of Pakistan, India, Bangladesh, Nepal, Bhutan and Sri Lanka for the period 1990-2016. Siddique and Liaqat used panel OLS model and fixed effect model. The study concluded that income affected IM negatively for the panel countries, and FDI, urbanization, number of physicians, income, secondary and tertiary education affected LEP positively.

2.4.3. FDI-human development nexus

Sharma and Gani (2007) examined the relationship between FDI and human development, and confirmed that FDI positively but insignificantly affected human development for low and middle income countries for the period 1975-1999. Proxy for human development was human development index. Sharma and Gani found that human development significantly and positively affected FDI for low income countries and insignifcantly and positively affected FDI for middle income countries.

Zhuang (2017) investigated the effect of FDI on human capital for a panel of 16 countries in East Asia for the period 1985-2010. Zhuang found that cumulative FDI inflow had positive impact on secondary schooling and negative impact on tertiary schooling. FDI from OECD countries had positive impact on secondary schooling and tertiary schooling.

Gökmenoğlu et al., (2018) investigated the effect of FDI on determinants of human development index which were school enrollment, LEP at birth and GDP per capita for Nigeria for the period 1972-2013. Long run relationship was confirmed between the variables. Bi-directional causality was found between FDI and LEP. Unidirectional causality was found from FDI to GDP per capita.

2.5. FDI-to Nexus

2.5.1. FDI-to-population health nexus

Alam et al., (2016) investigated the impact of FDI and TO on LEP in Pakistan for the period between 1972 and 2013. Cointegration was discovered between the variables. The study concluded that FDI and TO affected LEP positively, and FDI and TO caused LEXP in the short run.

Idrees and Bakar (2019) investigated the impact of FDI on LEP and IM rate under 5 for the period 1980-2017 in Pakistan. Idrees and Bakar found long run relationship between the variables. Idrees and Bakar found that FDI, TO and secondary school enrollment increased LEP in the long run, and FDI, TO and secondary school enrollment decreased IM rate under 5 in the long run in Pakistan. Government expenditure on health had insignificant impact on LEP and IM rate under 5 in the long run in Pakistan.

2.5.2. FDI-to nexus

Aizenman and Noy (2006) examined the relationship between FDI and TO for a panel of 205 countries by decomposing FDI and TO into their components. According to basic regression results, TO and economic growth had positive impact on FDI gross flows for developing countries, TO had insignificant impact on FDI gross flows for industrialized countries, and economic growth had positive impact on FDI gross flows for industrialized countries. TO had positive impact on FDI net inflows for developing and industrialized countries but TO did not have impact on FDI net outflows for developing and industrialized countries. Aizenman and Noy found that there was bidirectional causality between TO and FDI gross flows.

Martens (2008) examined 21 studies from the literature regarding the relationship between trade and FDI. Martens stated that FDI and trade complements and the studies in the literature showed bi-directional causality betweeen FDI and trade. Martens also stated that generally FDI was explained by trade in the literature.

2.5.3. FDI-trade liberalization nexus

Shah and Khan (2016) investigated the relationship between trade liberalization and FDI inflow for a panel of countries which were Brazil, China, India, Mexico, Russian Federation and Turkey for the period 1996-2014. Shah and Khan found that population, gdp per capita, primary education attainment level and preferential trade agreements positively affected FDI inflows for panel countries. Regional trade agreement had insignificant negative effect on FDI inflows. TO had insignificant positive effect on FDI inflows.

Binh and Haughton (2002) examined the relationship between bilateral trade agreement which between USA and Vietnam and FDI inflow. Binh and Haughton stated that FDI inflows of Vietnam would be up to 30% higher than no bilateral trade agreement scenario.

Goldar and Banga (2007) examined the impact of trade liberalization in terms of import liberalization on FDI net inflows for a panel of 78 industries for the period 1991-1998 in India. Goldar and Banga found that trade liberalization had positive impact on FDI new flows.

2.6. Determinants of FDI

Asiedu (2002) examined the determinants of FDI for a sample of 71 countries. Asiedu found that higher return of investment and better infrastructure had positive impact on FDI for non-SSA(sub-Saharan africa) countries but had no impact on FDI for SSA countries. Asiedu confirmed that TO had positive impact on FDI for non-SSA and SSA countries but the impact of TO on FDI was higher for non-SSA countries.

Addison and Heshmati (2003) examined the determinants of FDI for a panel sample of 110 countries and 39 countries separately. Addison and Heshmati found that economic growth, TO, democracy and information and communication technology had positive impact on FDI inflows. Addison and Heshmati also found

that industrialization and indebtedness had negative impact on FDI inflows. The results of the study varied by region.

Azemar and Desbordes (2008) examined the determinants of FDI in Sub-Saharan Africa and developing regions. Azemar and Desbordes found that 1% increase in HIVwidespread presence decreased net FDI inflows by 3.5%. Azemar and Desbordes also found that malaria had a negative effect on net FDI inflows. FDI inflows was chosen since it was the only available data for long run.

Greenaway et al., (2007) examined the determinants of FDI inflows for a panel of 54 countries for the period 1990-2000. TO had a positive impact on FDI inflows for closed and open economies. FDI inflows had no significant impact on economic growth in closed economies but FDI inflows had positive impact on economic growth in open economies.

2.7. FDI-sustainable Development Nexus

Tvaronavičienė and Lankauskienė (2011) analyzed effect of FDI on sustainable development indicators and economic growth for a panel of 15 countries for the period 2000-2007, and 2000-2009. Tvaronavičienė and Lankauskienė found that effect of FDI on sustainable indicators were different for each time period. During the period 2000-2009, FDI inflows significantly improved sustainable development indicators of underdeveloped countries and effects of FDI inflows on economic growth were higher for underdeveloped and developing countries than for developed countries.

2.8. Import of Medical Products-population Health Nexus

Papageorgiou et al., (2007) investigated the relationship between import of medical products and population health for a panel of 63 countries for the period 1961 and 1995. Papageorgiou, Savvides and Zachariadis investigated the variables which were aggregate per capita medical imports, LEP, male mortality, IM, imports of medical machinery and equipment, distance-weighted foreign R&D, number of foreign students enrolled in medical studies in four frontier countries, exogenous component of initial GDP per capita, AIDS cases per thousand people, total daily calorie intake per person, number of physicians per thousand people, illeteracy rate, percentage of population with access to improved water facilities, percentage of population with access to improved sanitation facilities, TO, proportion of a country's land area that is subject to a tropical climate and index of Malaria ecology. Papageorgiou, Savvides and Zachariadis found that aggregate medical imports, imports of medical machinery and equipment, and pharmaceutical imports had positive impact on LEXP, negative impact on male mortality and no impact on IM.

2.9. Determinants of LEP

Shahbaz et al., (2016) investigated the determinants of LEP in Pakistan for the period between 1972 and 2012. The study concluded that economic decline and illiteracy affected LEP negatively, and health spending and urbanization affected LEP positively. The study also concluded that LEP caused health spending, food supply, economic misery, urbanization, and illiteracy.

3. MATERIALS AND METHODS

LEP is life of expectancy at birth for Turkey. FDI is net inflows in current$. The variables are used in log form in the analysis. EXTL is long-term external debt stocks in current$. EXTS is short-term external debt stocks in current$. The data for the variables is taken from World Bank's website. Time period for the analysis is from 1974 to 2017.

For the model,w_0, w_1, w_2, w_3 are coefficients for the examined variables and u_t is for error term.

$$\ln (LEP)_t = w_0 + w_1 \ln (FDI)_t + w_2 \ln (EXTS)_t + w_3 \ln (EXTL)_t + u_t \quad (1)$$

ARDL model is specified as below.

$$\Delta LnLEP_t = J_0 + J_1 LnLEP_{t-1} + J_2 LnFDI_{t-1} + J_3 LnEXTL_{t-1} + J_4 LnEXTS_{t-1} + \sum_{i=1}^{s} J_{5i} LnLEP_{t-i} + \sum_{i=0}^{h} J_{6i} LnFID_{t-i} + \sum_{i=0}^{c} J_{7i} LnEXTL_{t-i} + \sum_{i=0}^{m} J_{8i} LnEXTS_{t-i} + \mu_t \quad (2)$$

μ_t is for white noise residuals. J_1, J_2, J_3 and J_4 are long run coefficients. J_5, J_6, J_7 and J_8 are short run coefficients.

Hypothesis of no cointegration is $H_0 = J_1 = J_2 = J_3 = J_4 = 0$

Hypothesis of cointegration is $H_1 = J_1 \neq J_2 \neq J_3 \neq J_4 \neq 0$

When cointegration is confirmed, short-run coefficients, long-run coefficients, and error correction model of ARDL model are as below.

$$LnK_t = G_0 + \sum_{i=1}^{s} G_{1i} LnLEP_{t-i} + \sum_{i=0}^{h} G_{2i} LnFDI_{t-i} + \sum_{i=0}^{c} G_{3i} LnEXTL_{t-i} + \sum_{i=0}^{m} G_{4i} LnEXTS_{t-i} + \mu_t \quad (3)$$

$$LnK_t = F_0 + \sum_{i=1}^{s} F_{1i} \Delta LnLEP_{t-i} + \sum_{i=0}^{h} F_{2i} \Delta LnFDI_{t-i} + \sum_{i=0}^{c} F_{3i} \Delta LnEXTL_{t-i} + \sum_{i=0}^{m} F_{4i} \Delta LnEXTS_{t-i} + \gamma ECT_{t-1} + \mu_t \quad (4)$$

$$ECT_t = LnLEP_t - \sum_{i=1}^{s} Z_{1i} \Delta LnLEP_{t-i} - \sum_{i=0}^{h} Z_{2i} \Delta LnFDI_{t-i} - \sum_{i=0}^{c} Z_{3i} \Delta LnEXTL_{t-i} - \sum_{i=0}^{m} Z_{4i} \Delta LnEXTS_{t-i} \quad (5)$$

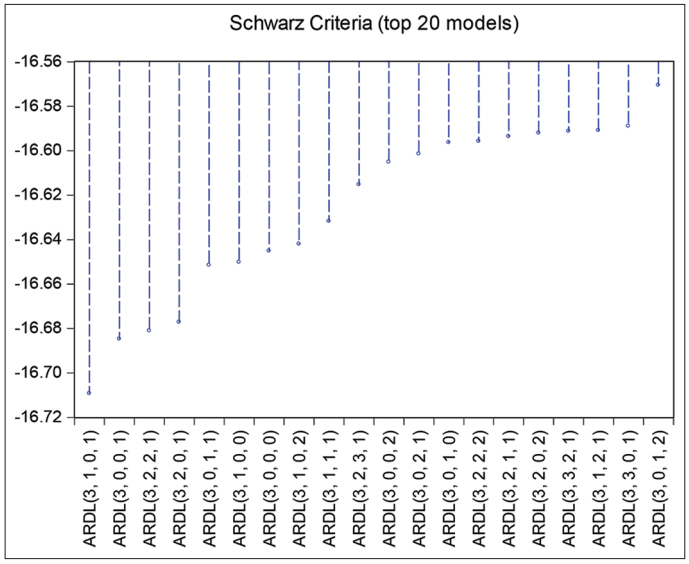
Equation 3 is to determine the long-run coefficients of ARDL model and equation 4 is to determine the short-run coefficients of ARDL model. Error correction model is specified in equation 5.

Table 1: Zivot-andrews unit root test results

Intercept	Level			First difference		
Variable	**Break**	**t-statistic**	**Result**	**Break**	**t-statistic**	**Result**
LOGLEP	1991	−2.876272	Unit root	1991	−11.99568*	Stationary
LOGFDI	1988	−4.535957	Unit root	2008	−6.749532*	Stationary
LOGEXTL	1985	−5.482989*	Stationary			
LOGEXTS	2001	−5.686696*	Stationary			
Intercept+Trend	**Break**	**t-statistic**	**Result**	**Break**	**t-statistic**	**Result**
LOGLEP	1995	−5.983891*	Stationary			
LOGFDI	2005	−5.625187*	Stationary			
LOGEXTL	1987	−5.681120	Stationary			
LOGEXTS	2001	−5.783768*	Stationary			

*Denotes 1% and ** denotes 5% significance

Figure 5: ARDL model selection



VAR Granger Causality/Block Exogeneity Wald Tests are applied to check causal relationship between the variables within Toda-Yamamoto Model.

Zivot and Andrews (1992) unit root tests are applied to check unit root levels of the variables. Intercept and intercept and trend models are used to check unit root of the variables as suggested by Sen (2003). Results show that the variables are at the levels of combination of I(0) and I(1) (Table 1). Structural breaks are taken into account as suggested by Perron (1990) for investigating unit root levels.

Schwarz Information Criterion (SC) are used to determine the maximum lag levels (Table 2). Maximum lag values are entered into ARDL model and the models choose lag values according SC (Figure 5).

Cusum (Stability Test I) and Cusum Squares (Stability Test II) tests are applied to investigate the stability of ARDL model as suggested by Brown et al., (1975) (Figures 6 and 7). Stability Test I is applied to investigate the stability of long-run coefficients as suggested by Pesaran and Pesaran (1997). The sign of the coefficient of error correction term is also checked to investigate the stability of long-run coefficients of ARDL model.

Break points, that are discovered in the unit root tests, are used in cointegration analysis and causality analysis by adding break dates to exogenous variables. Discovered break points are 1991, 2008, 1985 and 2001. Break date 1991 is the only break point that satisfies the stability tests for ARDL model. Pesaran et al., (2001) introduced ARDL model for the cointegration between the variables which are at I(0) and I(1) levels. Results of ARDL model is compared with critical bounds values of Narayan (2005) to determine the cointegration. Unrestricted intercepts and no trends followed model of Pesaran et al., (2001) is used in this study. 1991 is also used as break point for Toda-Yamamoto Model to investigate the causality between the variables. Ramsey reset test, Breusch-Pagan-Godfrey test, arch test, white test, Breusch-Godfrey serial correlation test and normality test are applied to check the stability of ARDL model. Durbin-Watson value is also taken into consideration.

For Toda-Yamamoto model, first VAR model is established and a proper lag selection is made by confirming the stability of the model, then a new model is established by adding exogenous variables with the lag of sum of current lag and maximum lag of the variables. The results of Toda-Yamamoto model are used to interpret for the causality between the variables.

For studies that use structural breaks in cointegration analysis and causality analysis, Alam et al. (2016) used structural break to check cointegration between FDI, TO and LEP for Pakistan for the period 1972 to 2013 by ARDL model and to check causal relationships between the variables by VECM model. Pala (2013) used structural break to check cointegration between crude oil price index and food price index by Johansen cointegration test and to check causal relationship between the variables by VECM model for the period 1990 to 2012. Malhotra and Kumari (2016) used structural breaks to check cointegration between gross domestic product, real exports, real imports, real gross capital formation and total labor force for China, Japan and South Korea for the period 1980 and 2012 by Johansen cointegration test. Malhotra and Kumari used structural breaks to investigate causal relationships between the variables by VECM model.

4. RESULTS

4.1. Stability of the Models

4.1.1. ARDL model

The stability of ARDL model is checked with related stability tests which are detailed in Table 3. Also, stability test I and stability test

Table 2: Lag selection

Lag	LogL	LR	FPE	AIC	SC	HQ
0	12.56373	NA	7.66e-06	−0.428187	−0.259299	−0.367122
1	266.1345	443.7489	5.34e-11	−12.30673	−11.46229	−12.00140
2	348.0881	127.0280	2.03e-12	−15.60441	−14.08441	−15.05482
3	417.0421	93.08792*	1.53e-13*	−18.25211*	−16.05656*	−17.45827*
4	427.9689	12.56580	2.26e-13	−17.99845	−15.12735	−16.96035

*LR is sequential modified LR test statistic, FPE is final prediction error, AIC is Akaike information Criterion, SC is Schwarz Information Criterion and HQ is Hannan-Quinn Information Criterion

Figure 6: Stability test I

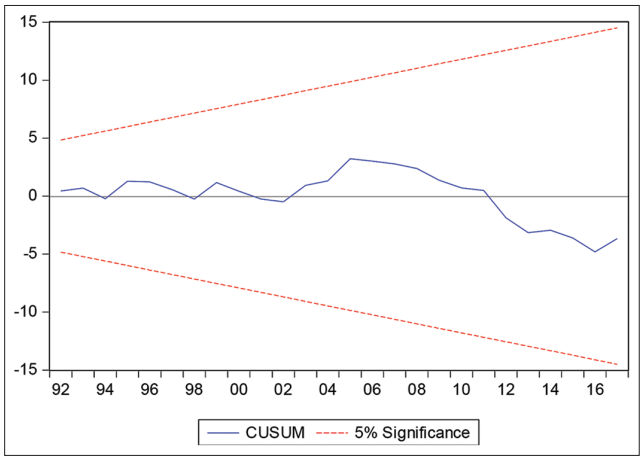
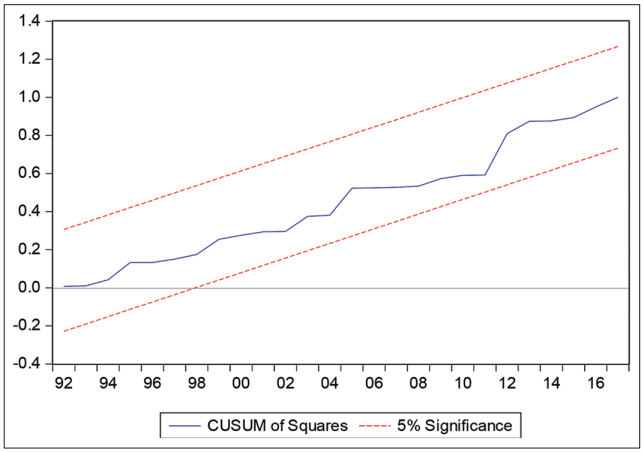


Figure 7: Stability test II



II are carried out to check the stability of ARDL model. Stability test I and stability test II show that ARDL model is stable since the lines are within the dotted lines in both tests (Figures 6 and 7).

4.1.2. Toda-yamamoto granger non-causality model

For the stability of Toda-Yamamoto model, VAR model is established with lag selection, and then roots of characteristic polynomial with certain stability tests are confirmed to continue with further steps to carry out causality tests between the variables (Figure 8 and Table 4). For figure 8, no root lies outside the unit circle and VAR model satisfies the stability condition.

4.2. LEP, FDI, EXTL and EXTS NEXUS

Variables are at I(1) and I(0) levels according Zivot-Andrews unit root test results (Table 1). Since variables are at I(1) and I(0) levels, ARDL model is used.

Table 3: ARDL model stability test results

Break		1991		
Stability test	F-stat	Prob.	JB	Stat.
Normality	-	0.817620	0.402716	-
Breusch-Pagan- Godfrey	0.329077	0.9586	-	-
Arch	2.262883	0.0988	-	-
White	0.343005	0.9529	-	-
Ramsey	0.851119	0.3636	-	-
Correlation	0.455184	0.7157	-	-
Durbin-Watson	-	-	-	1.970461

Table 4: Toda-yamamoto model stability test results

	LM-Stat	Prob.
VAR residual serial correlation LM test	20.79746	0.1864
	Jarque-Bera	**Prob.**
VAR residual normality test	6.454318	0.5965
	Chi-square	**Prob.**
VAR residual heteroskedasticity test	199.9946	0.0576

Table 5: ARDL bounds test, short run and long run results

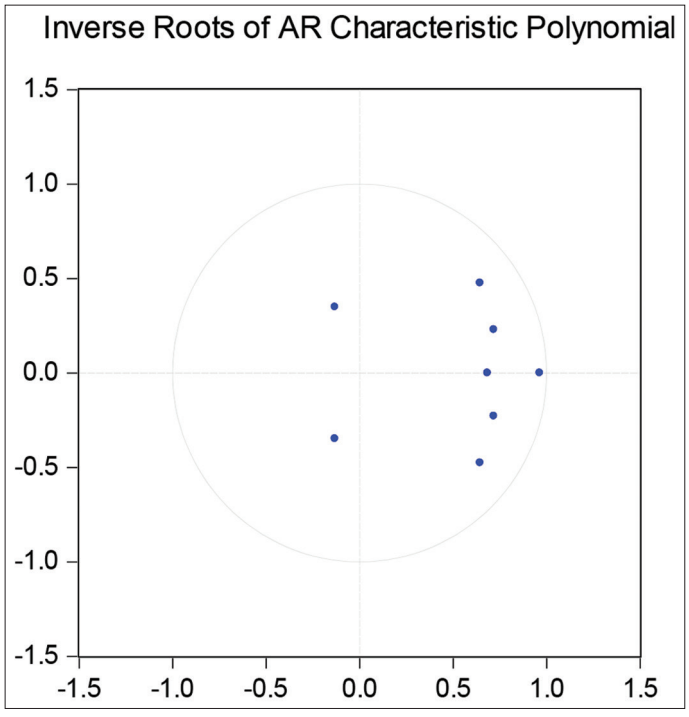
		1%	
Bounds Test	**F-Statistic**	**I0 Bound**	**I1 Bound**
	40.87438	4.29	5.61
Short run coefficients			
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
D (LOGLEP(-1))	1.751800	0.040658	43.085915	0.0000
D (LOGLEP(-2))	−0.839186	0.044369	−18.913586	0.0000
D (LOGFDI)	0.000032	0.000015	2.215757	0.0342
D (LOGEXTL)	0.000113	0.000075	1.520009	0.1386
D (LOGEXTS)	−0.000017	0.000032	−0.527006	0.6019
D (D1991)	0.000198	0.000038	5.186882	0.0000
CointEq(−1)	−0.004323	0.000928	−4.656594	0.0001
Long Run Coefficients				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOGFDI	0.014591	0.005147	2.835032	0.0080
LOGEXTL	0.026213	0.012569	2.085439	0.0454
LOGEXTS	−0.018595	0.007442	−2.498458	0.0180
D1991	0.045821	0.008044	5.696264	0.0000
C	3.810115	0.408154	9.334999	0.0000

1991, 2008, 1985 and 2001 are the structural breaks in the model. 1991 is the break date that is used in ARDL model. ARDL model with a structural break is stable according to stability test results (Table 3, Figures 6 and 7). Cointegration between the variables is found according to F-statistics results (Table 5). The stability of the coefficients of the long-run variables is confirmed since the coefficient of cointegration equation is negative and significant at 5 percent level. Date of 1991, which is also the date for disintegration for Soviet Union, has a positive and significant effect on LEP both

Table 6: VAR granger causality/block exogeneity wald tests results

Dependent variable: LOGLEP			
Excluded	**Chi-sq**	**df**	**Prob.**
LOGFDI	11.72219	2	0.0028
LOGEXTS	2.111769	2	0.3479
LOGEXTL	2.829449	2	0.2430
All	24.74151	6	0.0004
Dependent variable: LOGFDI			
Excluded	**Chi-sq**	**df**	**Prob.**
LOGLEP	9.650581	2	0.0080
LOGEXTS	4.777126	2	0.0918
LOGEXTL	4.403522	2	0.1106
All	21.73152	6	0.0014
Dependent variable: LOGEXTS			
Excluded	**Chi-sq**	**df**	**Prob.**
LOGLEP	6.794547	2	0.0335
LOGFDI	7.050754	2	0.0294
LOGEXTL	16.32247	2	0.0003
All	32.51355	6	0.0000
Dependent variable: LOGEXTL			
Excluded	**Chi-sq**	**df**	**Prob.**
LOGLEP	10.26046	2	0.0059
LOGFDI	11.43738	2	0.0033
LOGEXTS	9.604722	2	0.0082
All	58.37916	6	0.0000

Figure 8: Roots of characteristic polynomial



in the long-run and short-run. F-statistics of ARDL model is also significant at 1 percent level for bounds test (Table 5).

4.3. Causal Relationships between the Variables

1991, 2008, 1982, 1985, 2001 are the structural breaks in the model. 1991 is the break date that is used in Toda-Yamamoto model. Since cointegration is found, Toda-Yamamoto model is applied to analyze the causality between the variables (Table 6). No causal relationship is found from LEXTS and LEXTL to LEP. The causal relationship is confirmed from LEP to LEXTS and LEXTL.

5. CONCLUSION

This study investigated the relationships between LEP, EXTS and EXTL for Turkey for the period 1974-2017 through FDI.

Main findings of this study are as below.
There is significant and positive impact of EXTL on LEP in Turkey
There is significant and positive impact of EXTS on LEP in Turkey
There is no causality running from EXTL to LEP in Turkey
There is no causality running from EXTS to LEP in Turkey
There is unidirectional causality running from LEP to EXTL in Turkey
There is unidirectional causality running from LEP to EXTS in Turkey.

Hypothesis 1, 4, 5 and 6 are confirmed in this study. Hypothesis 2 and 3 are not confirmed for Turkey. There is unidirectional causality running from LEP to EXTS in Turkey.

The main contribution of this study is that it breaks down ET into its components as EXTL and EXTS to analyze the effect of ET on LEP as being different from the studies in the literature. The general tendency in the literature is to analyze the relationships between growth and LEP. There are very few studies in the literature that directly analyzes the impact of ET on LEP. These studies analyze the effect of ET on poverty or human development index.

The causal relationship is found from life expectancy to long-term debt and short-term debt, but no causal relationship is found from long-term debt and short-term debt to life expectancy. The reason behind this result may result from that Turkey's increasing life expectancy leads to population increase and this increase leads to the increase in the construction of new buildings. For the last 20 years, Turkey started to renew its construction infrastructure and at the same time establishing new buildings for its increasing population. Resulting from that, Turkey needed funding to fund its investments and there has been a gap between investments and savings in Turkey. Turkey may have used external debt to fund the gap between investments and savings. This article recommends further analysis for the relationship between external debt and life expectancy for developing countries.

The limitations of the study are the country of the study and the time period of the study. For future research directions, we recommend that new cointegration techniques that take into consideration structural breaks to be used such as Maki (2012) cointegration test and additional variables may be examined such as short-term debt and long-term debt as used in this study to analyze the relationship between LEP and ET from a different perspective for developing countries.

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