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**Article**

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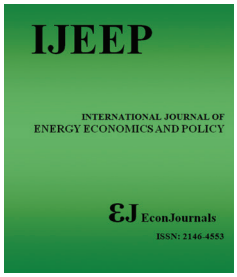

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# The Effect of External Debt on Emissions: Evidence from China

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**ABSTRACT**

In this study, the effect of external debt (EXD – current US$) on carbon dioxide emissions ($CO_2$ – metric tons per capita) is examined by taking the environmental Kuznets curve (EKC) hypothesis as a basis for China. The relationships between $CO_2$, gross domestic product per capita (GDP – constant 2010 US$), square of GDP (GD), energy consumption (EM – kg of oil equivalent per capita) and EXD is examined. The autoregressive distributed lag (ARDL) model and nonlinear ARDL model are used to examine symmetric and asymmetric relationships between the variables respectively for the period of 1978-2014 by including a structural break. China has had a growing EXD to support economic growth especially after the 2008 financial crisis. The results show that EXD and EM significantly and positively affect emissions (EMS). The asymmetric relationship between growth (GW) and EMS is confirmed. The EKC hypothesis is not confirmed for China. The results of the study are in line with the current economic structure of the Chinese economy. The Chinese economy is still over reliant on construction, heavy industries and real estate. Although China's current EXD is 13% of GDP, EXD is growing because private companies and local governments continue to invest heavily in construction and real estate, and have increased borrowing from abroad to cover operational costs since the central government's deleveraging policies have made borrowing from domestic markets more difficult.

**Keywords:** Environmental Kuznets Curve, External Debt, China, Nonlinear ARDL, ARDL
**JEL Classifications:** Q4, Q5, O5

## 1. INTRODUCTION

China is the second largest economy in the world and has had a period of highly appreciated GW since 1978. Although China was affected by the 2008 crisis, it managed to create GW over a certain percentage. In this study, the effect of EXD on China's EMS is analyzed for the period of 1978-2014. The effect of EXD on EMS is analyzed by taking the EKC hypothesis as the basis. The EKC hypothesis examines an inverted U-shaped relationship between GW and EMS. As GW increases, EMS in the environment increase initially and, after the peak level of EMS and a certain level of GDP have been achieved, EMS start to fall as GDP continues to increase. In this study, the relationships between GW and EMS are analyzed by symmetric and asymmetric cointegration models and include a structural break. China's EXD is currently discussed with its trade war with the USA, devaluation of the yuan against the US dollar and China's foreign reserves. An additional consideration is the abilities of Chinese companies to pay their debts and the risks born by international investors when lending to Chinese companies. Although China has a foreign debt equal to 13% of its GDP, China's foreign debt continues to grow even with the Chinese government's efforts to restrict the Chinese economy.

China's economic growth has continued after the 2008 crisis aided by the Chinese government's credit boom policy. State-owned enterprises have used loans from the government for construction and capacity expansion. Local governments have created financing vehicles to use loans from the government. As local governments could not get enough loans and support from the central government to finance their operations, they started to borrow heavily from abroad to finance their operations, especially for construction and

labor-intensive operations. Purely private companies that cannot benefit from loans from the central government also borrow heavily from abroad, especially after the 2008 financial crisis, in order to finance real estate business. Non-financial corporate debts consist of the debt incurred by state-owned enterprises, private companies and local governments. Non-financial corporate debt represents 70% of non-financial debt in China. Private companies own 30 % of non-financial corporate debt in China. Construction and real estate are the main sectors for which corporate companies in China borrow. As borrowing from domestic markets gets more difficult, local governments and private companies borrow more from foreign markets. The real estate sector's debt was 30% of GDP in 2008 and had increased to 60% of GDP by 2015. The construction sector's debt was 11% of GDP in 2008 and had increased to 18% of GDP by 2015. China currently has a growing foreign debt situation and the aim of this study is to examine whether growing foreign debt affects EMS in China.

The hypotheses below are tested in this study.

- $H_1$: There is symmetric cointegration between EMS and GW in China
- $H_2$: There is asymmetric cointegration between EMS and GW in China.
- $H_3$: EXD has a positive effect on EMS in China
- $H_4$: The EKC hypothesis exists in China.

There is a research gap in the literature for examining the effect of EXD on EMS. The contribution of this study is to examine the effect of EXD on EMS in China. China has a problem with growing EXD through local governments and private companies. This study examines this problem by taking the EKC hypothesis as its basis.

In the following sections, literature review, materials and methods, results and discussion, and conclusion are explained respectively.

## 2. REVIEW OF LITERATURE

As far as we know, the effect of EXD on EMS is not analyzed in the literature. The following studies are the most recent research analyzed in the literature for China.

Gui et al. (2019) used spatial linkage analysis for the period of 2006 to 2015 for 285 Chinese cities and did not confirm a waste Kuznets curve. Increases in GDP per capita leads to increases in waste generation.

Song et al. (2019) explored the relationship between GW and EMS for China and the USA for the period of 1965 to 2016 and confirmed the EKC hypothesis for both China and the USA.

Zhou et al. (2019) examined the effects of social urbanization (UBZ), spatial UBZ, population UBZ and economic UBZ on EMS for the Yangtze River Delta region for the period of 1992 to 2013 and confirmed the EKC hypothesis.

He and Lin (2019) examined the relationship between income levels and pollution for a panel study in China for the period of 2003-2017 and confirmed the EKC hypothesis relationships between income levels, energy intensity and EMS, and non-linear relationships between income levels and EMS.

Cohen et al. (2019) confirmed the EKC hypothesis for a panel study in China for the period of 1990 to 2012, confirmed a cyclical relationship between GW and EMS, and found that the cyclical relationship is symmetric.

Chai et al. (2019) investigated the relationship between coal consumption (CCS) and GW in China for the period of 1965 and 2016. Although Chai et al. found a phased inverted U relationship between CCS and GW, the last cycle between CCS and GW does not have an inverted U relationship. Chai et al. stated that energy and industrial structure are the main contributors for the future of CCS in China.

Kacprzyk and Kuchta (2020) investigated the relationship between GW and EMS for the period of 1992-2012 and confirmed the EKC hypothesis for a panel of 161 countries. The turning point of the EKC curve is found within the evaluated time range of the study.

Liu and Lin (2019) used the comprehensive environmental pollution index to examine the relationship between pollution and GW of Chinese provinces for the period of 2000 to 2015. An inverted N relationship is found between pollution and GW for Chinese provinces, and industrial structure and R&D investment have a significant impact on pollution. The impact of foreign direct investment (FIN) on pollution is insignificant.

Nie et al. (2019) examined the relationships between EMS and GW for the Western, Eastern and Central regions of China for the period of 1995-2014. Nie et al. confirmed the nonlinear relationship between EMS and GW for the examined regions of China.

Wang and He (2019) examined the relationship between EMS and GW by taking into consideration the spatial distance and economic distance for the period of 1995-2013 in China. An N-shaped curve relationship is confirmed between EMS intensity and GW.

Xie et al. (2019) confirmed the EKC relationship between GW and PM2.5 EMS in China by using data from 249 cities. Traffic development, industrialization, population density and UBZ positively affect EMS. The impacts of green coverage and technological innovation are not significant on EMS.

Liu et al. (2019) confirmed the EKC hypothesis and did not confirm the pollution haven hypothesis in China for the period of 1996-2015.

Yao et al. (2019) tested the role of renewable EM in the EKC hypothesis and examined the renewable energy Kuznets curve for a panel of 17 countries including China for the period of 1990 to 2014. Yao et al. confirmed the renewable energy Kuznets curve for the panel countries.

Liang and Yang (2019) examined the relationships between environmental pollution, UBZ and GW in China for the period

of 2006-2015. The EKC hypothesis is confirmed for the panel provinces and an inverted U relationship is found between pollution and UBZ.

Tan (2019) examined the relationships between EMS from household electricity consumption (HC), GW, UBZ and population density for the period of 2005-2015 in China. An inverted N-shaped relationship is found between EMS from HC and GW. UBZ and population density positively affect EMS from HC. Tan suggested that energy conservation policies are very important to reduce EMS from HC.

Mele and Randazzo (2019) found cointegration between GW, EM and trade (TE) for China for the period of 1980-2017. Mele and Randazzo found short-run causality from GW to TE, TE to EM and EMS to GW.

Ahmad et al. (2019) examined the relationship between GW, EM, urban population and EMS for China for the period of 1971-2014. An N-shaped relationship is found between GW and EMS. Urban population has a significant and negative effect on EMS. EM has a positive effect on EMS. Bidirectional causality is found between GW and EMS, EM and EMS, and GW and EM.

Ahmad et al. (2020) examined the relationships between SO2 EMS, energy investment (EINV) and GW in China for the period of 2001 to 2017. A long-run relationship between the variables is confirmed. The EKC hypothesis for the relationship between GW and EMS is confirmed by cubic EKC equation. Bidirectional causality between EINV and GW is found. Bidirectional causality is found between GW and EMS.

Hao et al. (2019) examined the relationship between EMS and GW in China for the period of 2007 to 2016. Hao et al. found that an EKC relationship exists between EMS and GW. A different decoupling status is found for individual provinces. The turning point of the EKC curve is found beyond the sampling period.

Zhang et al. (2019) applied spatial correlation analysis to examine the relationship between GW and pollution in China for the period of 2005-2015. Air pollutants for environmental pollution are NOx, PM2.5, PM10, SO2 and VOCs. An EKC relationship is found between pollution and GW. An EKC relationship is not confirmed for $SO_2$. CCS positively affects pollution.

Tzeremes (2019) examined the EKC hypothesis in China for the period of 1997-2012. For individual analysis of 23 of the 30 Chinese provinces, the EKC hypothesis is confirmed in one province, and an N-shaped relationship between GW and EMS is confirmed in the majority of the 23 Chinese provinces. The EKC hypothesis is confirmed in the Sichuan region.

Fang et al. (2019) analyzed the relationship between EMS, energy intensity, TE, UBZ and GW for the period of 1995-2016 for China. There is an inverted N-shaped relationship between GW and EMS in the Eastern China, Western China and Central China regions.

Bouheni et al. (2019) investigated the relationships between EMS, GW, EM, globalization and financial development (FDEV) for China for the period of 1970-2015. The effect of GW on EMS is symmetric through social, political and overall globalization. The effect of GW on EMS is asymmetric through economic globalization.

Munir and Riaz (2020) examined the impact of oil, electricity, coal and gas consumption on EMS for the USA, China and Australia for the period of 1975-2018. Gas, oil and coal consumption increase EMS in the USA and China. Coal and oil consumption increase EMS in Australia.

Alam et al. (2016) examined the relationships between EMS, EM, income and population growth in Brazil, Indonesia, China and India for the period of 1970-2012. The EKC hypothesis is confirmed for China, Brazil and Indonesia.

Jian et al. (2019) examined the relationships between EMS, GW, FDEV and EM for China for the period of 1982-2017. Bidirectional causality is confirmed between EMS and EM in the long run. Causality from EM to FDEV is found for China in the long run. Bidirectional causality exists between EMS and GW in the short run. Causality from GW to EM exists in the short run.

Huang et al. (2019) examined the relationships between EMS, TE and FIN in China for the period of 1997-2014. The EKC relationship between GW and EMS is confirmed in the most and least polluted provinces. The effects of FIN and TE are significant and negative on EMS.

Wang et al. (2020) examined the relationships between EMS, exports, imports, FIN and GW in China for the period of 1997-2015. Causality from GW to EMS is found in the central and eastern provinces. Causality from EMS to GW is found in the western provinces. Bidirectional causality is found between EMS and GW.

Literature review shows that some studies confirmed the EKC hypothesis while some studies did not. Besides carbon Kuznets curve, renewable energy Kuznets curve and waste Kuznets curve were analyzed as well. Some studies examined the EKC hypothesis and pollution haven hypothesis in the same study. Impact of economic growth on emissions were examined through different variables. Besides linear relationships, non-linear relationships between economic growth and emissions were examined as well. Relationships between economic growth and emissions were examined for air pollutants other than carbon dioxide emissions. One study examined coal consumption Kuznets curve for China.

Analysis of the most recent research shows that there is a research gap for the analysis of the effect of external debt on emissions. Internal regulations of countries may affect their emission intense industries to finance their operations from overseas. This may requires these countries to adapt additional policies to control the debt financing for these industries and fight against climate change. This study considers this perspective to analyze the effect of external debt on emissions for China. Additional consideration may be considered for other developing countries such as Turkey and Brazil in the future studies in the literature. Besides the

effect of external debt on emissions, the non-linear relationships between economic growth and emissions may be considered for future studies. The tendency in the literature is the analysis of the symmetric relationships between economic growth and emissions. Further studies are needed to analyze the non-linear relationships between economic growth and emissions. Another perspective is the analysis of the relationship between coal consumption and economic growth. Coal consumption Kuznets curve is analyzed in the literature but the number of studies are very limited. Further studies are needed to study the relationship between coal consumption and economic growth by taking emissions from coal consumption as basis instead of overall air pollutants such as carbondioxide emissions. Coal consumption is still one of the main energy resources for energy production in the world. Since the most of the countries in the world aim for economic growth, the analysis of emissions from coal consumption and economic growth is important for the policies for emission reduction.

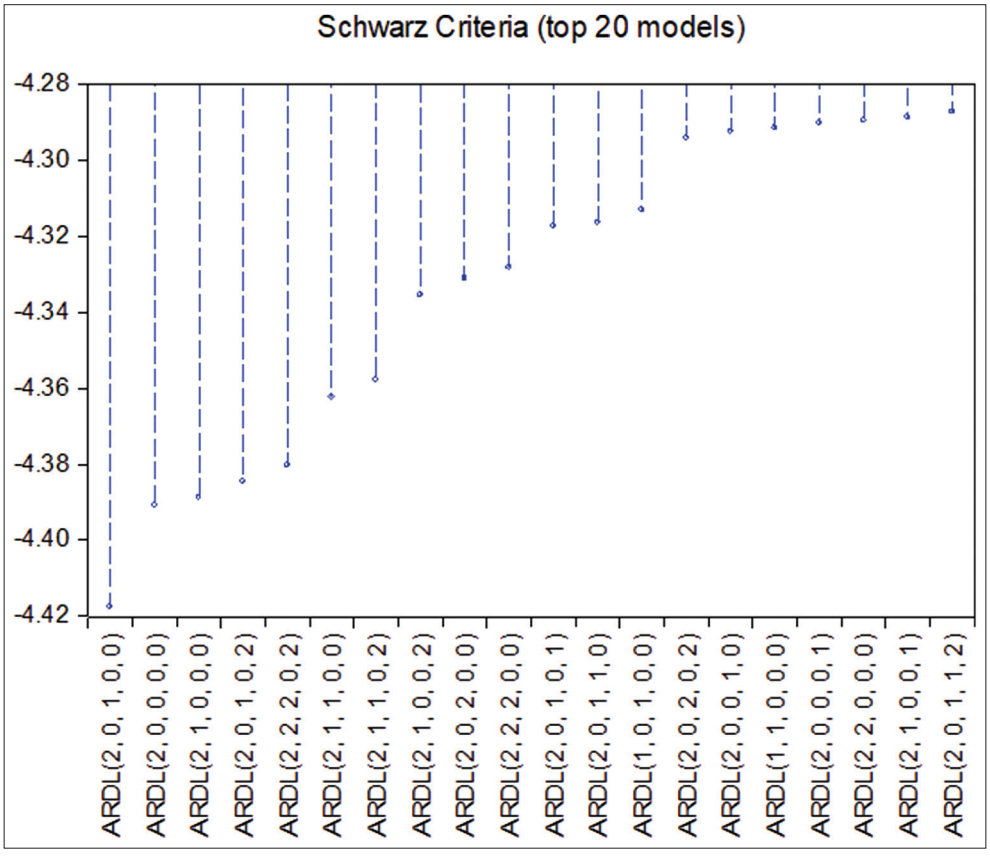
## 3. MATERIALS AND METHODS

The ARDL model is applied to examine the symmetric relationships between the variables. The ARDL model was introduced by Pesaran et al. (2001) to analyze the relationships between variables that have a combination of level and first difference stability levels. The ARDL model is not applied if one of the variables have I(2) level stability. This study utilizes the unit root test by Zivot and Andrews (1992) (ZU test) which takes into consideration the structural breaks in the variables. The ZU test considers three scenarios: the break in the intercept, the break in the trend and the break in the intercept and the trend. In this study, as suggested by Sen (2003), the two scenarios that are applied are the break in the intercept and the break in the intercept and the trend. Since the ARDL model assumes that the relationship between the independent and the dependent variable is symmetric, the nonlinear ARDL model is applied to examine the asymmetric relationships between the variables. The nonlinear ARDL model was introduced by Shin et al. (2014) to examine the asymmetric relationships between the variables. The nonlinear ARDL model is also used to examine the relationships between variables that have a combination of level and first difference stability levels. In this study, the ARDL and nonlinear ARDL models are used to examine the relationship between EMS and GW. EM and EXD variables are used as control variables, and their effects on EMS are analyzed as well. The relationships between the variables are analyzed by taking the EKC hypothesis as the basis.

The Breusch-Pagan-Godfrey Heteroskedasticity test (Test 1), Ramsey Reset test (Test 2), White Heteroskedasticity test (Test 3), Arch Heteroskedasticity test (Test 4), Breusch-Godfrey Serial Correlation LM test (Test 5), normality test (Test 6), CUSUM test (Test 7) and CUSUM of Squares test (Test 8) are used to test the stability of the models.

Schwarz Information criteria is used for number of lag selection (Figures 1 and 2).

**Figure 1:** Lag selection - ARDL



The model of the study is as below. $r_1$, $r_2$, $r_3$ and $r_4$ are estimated parameters. T is times index. E is the error-correction term.

$$ln(CO_2)t=r_0+r_1\ ln(GDP)_t+r_2\ ln(GD)_t+r_3\ ln(EM)_t +r_4\ ln(EXD)_t+e_t \quad (1)$$

The ARDL model is specified as below for the EMS, GW, EM and EXD nexus.

$$\Delta LnCO2_t = R_0 + R_1 LnCO2_{t-1} + R_2 LnGDP_{t-1} + R_3 LnGD_{t-1} + R_4 LnEM_{t-1} + R_5 LnEXD_{t-1} + \sum_{i=1}^{s} R_{6i} LnCO2_{t-i} + \sum_{i=0}^{h} R_{7i} LnGDP_{t-i} + \sum_{i=0}^{g} R_{(8i)} LnGD_{t-i} + \sum_{i=0}^{z} R_{9i} LnEM_{t-i} + \sum_{i=0}^{w} R_{10i} LnEXD_{t-i} + \mu_t \quad (2)$$

$\mu_t$ represents white noise residuals. $R_1$, $R_2$, $R_3$, $R_4$ and $R_5$ are long-run coefficients. $R_6$, $R_7$, $R_8$, $R_9$ and $R_{10}$ are short-run coefficients.

The nonlinear ARDL model is specified as below for the EMS, GW, EM and EXD nexus.

$$\Delta LnCO2_t = R_0 + R_1 LnCO2_{t-1} + R_2 LnGDP^{+}_{t-1} + R_3 LnGDP^{-}_{t-1} + R_4 LnGD_{t-1} + R_5 LnEM_{t-1} + R_6 LnEXD_{t-1} + \sum_{i=1}^{s} R_{7i} LnCO2_{t-i} + \sum_{i=0}^{h} R_{8i} LnGDP^{+}_{t-i} + \sum_{i=0}^{v} R_{9i} LnGDP^{-}_{t-i} + \sum_{i=1}^{s} R_{10i} LnGD_{t-i} + \sum_{i=0}^{w} R_{11i} LnEM_{t-i} + \sum_{i=0}^{y} R_{12i} LnEXD_{t-i} + \mu_t \quad (3)$$

$\mu_t$ is for white noise residuals. $R_1$, $R_2$, $R_3$, $R_4$, $R_5$ and $R_6$ are long-run coefficients. $R_7$, $R_8$, $R_9$, $R_{10}$, $R_{11}$ and $R_{12}$ are short-run coefficients.

For ARDL and nonlinear ARDL models, the hypothesis of no cointegration is that long-run coefficients are zero and are all equal to each other. The hypothesis of cointegration is that are not zero and are not all equal to each other.

**Figure 2:** Lag selection – nonlinear ARDL

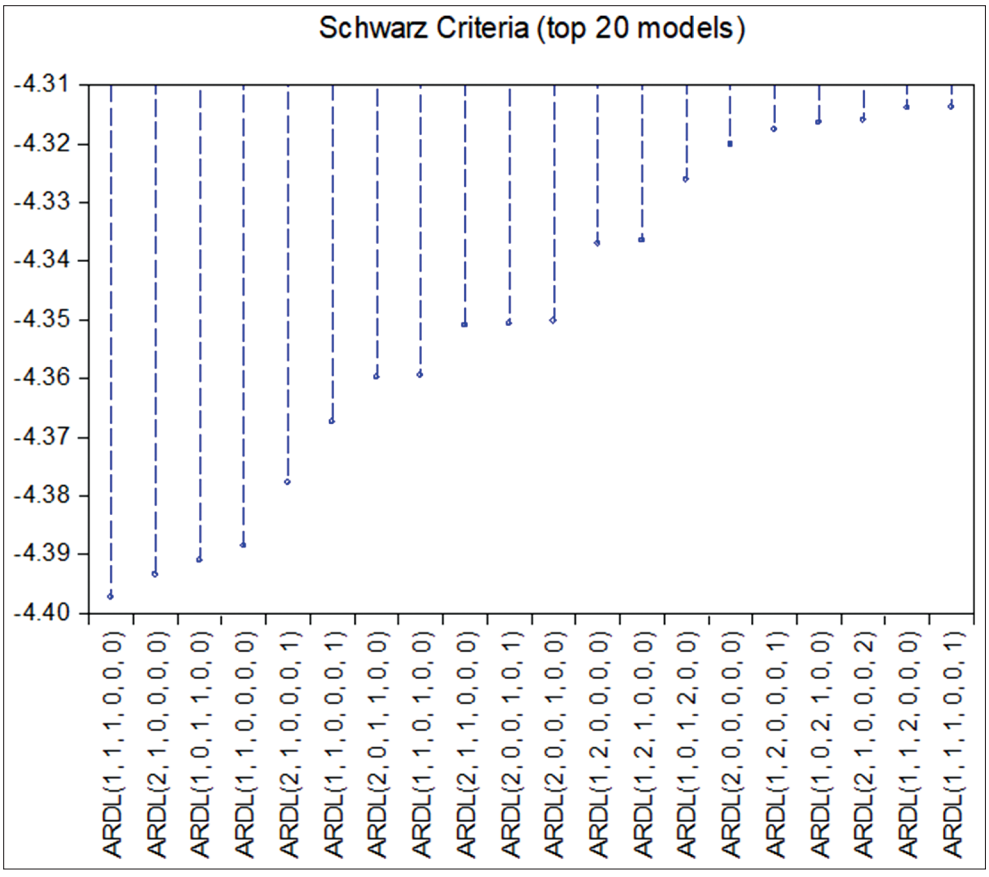



**Table 1: The ZU test**

| Variable | Intercept | | | Intercept + Trend | | |
|---|---|---|---|---|---|---|
| | Level | First difference | Break | Level | First difference | Break |
| $CO_2$ | −4.173916 | −4.822856*** | 2002 | −4.963225*** | - | 1997 |
| GDP | −3.258378 | −5.073593** | 1994 | −3.622182 | −5.028785** | 2007 |
| EM | −5.068243** | - | 2003 | -4.038738 | −5.359761** | 2003 |
| EXD | -3.630325 | −7.095942* | 1988 | −2.692407 | −6.808222* | 2001 |

## 4. RESULTS AND DISCUSSION

### 4.1. ARDL Model

The unit root test results show that none of the variables are at the level of I(2) (see Table 1). The F-statistics value (F value) is 8.91 which is higher than the I1 bound value of 1% which is 5.06. Symmetric cointegration between the variables is confirmed. Stability of the ARDL model is checked and confirmed (Table 2, Figures 3 and 4). The Durbin-Watson value, which is 1.752928, also confirms the stability of the ARDL model. The ARDL model test results show that EXD and EM have positive and significant effects on EMS in the long run (see Table 3). The EKC hypothesis is not confirmed since the coefficients of GDP and GD are not significant at the 5% level.

### 4.2. Nonlinear ARDL Model

Symmetric cointegration is confirmed but the coefficient of GDP is insignificant. Asymmetric cointegration is applied since there may be a hidden significant relationship between positive and negative components of GDP and EMS.

The nonlinear ARDL model test results show that there is asymmetric cointegration between the variables since the F value of the bounds test is 10.55 which is higher than the I1 bound value of 1% which is 4.68. Stability of the nonlinear ARDL model is tested and confirmed (Table 4, Figures 5 and 6). The Durbin-Watson value, which is 1.959260, also confirms the stability of the nonlinear ARDL model.

An asymmetric relationship between GDP and EMS is confirmed since the positive component of GDP has a significant impact on EMS in the long run and the negative component of GDP has an insignificant impact on EMS in the long run (Table 5 and Figure 7). EXD and EM have positive and significant effects on EMS in the long run.

The importance of the results is that the effect of external debt on emissions in China is significant and positive. According to

**Table 2: Stability test results – 1**

| Test type | F | P |
|---|---|---|
| Test 1 | 1.615020 | 0.1688 |
| Test 2 | 1.055943 | 0.3140 |
| Test 3 | 1.530317 | 0.1950 |
| Test 4 | 0.692603 | 0.5081 |
| Test 5 | 0.192516 | 0.8261 |
| Test 6 | 0.746618 | 0.688452 |

*P denotes probability value

**Table 3: ARDL model test results**

| Short-run coefficients | | | | |
|---|---|---|---|---|
| **Variable** | **Coefficient** | **Std. Error** | **t-Statistic** | **Prob.** |
| D(LCO2(−1)) | 0.279092 | 0.114407 | 2.439463 | 0.0218 |
| D(LGDP) | 0.135719 | 0.086324 | 1.572206 | 0.1280 |
| D(LGD) | −0.003200 | 0.009625 | −0.332464 | 0.7422 |
| D(LEM) | 0.579847 | 0.154685 | 3.748576 | 0.0009 |
| D(LEXD) | 0.078953 | 0.013892 | 5.683492 | 0.0000 |
| D(R2002) | 0.043082 | 0.025475 | 1.691178 | 0.1028 |
| CointEq(−1) | −0.585073 | 0.103492 | −5.653298 | 0.0000 |
| **Long-run coefficients** | | | | |
| LGDP | 0.231969 | 0.133424 | 1.738584 | 0.0939 |
| LGD | −0.020645 | 0.010279 | −2.008496 | 0.0551 |
| LEM | 0.991067 | 0.160418 | 6.178049 | 0.0000 |
| LEXD | 0.134945 | 0.019871 | 6.791005 | 0.0000 |
| R2002 | 0.073636 | 0.052072 | 1.414100 | 0.1692 |
| C | 4.201554 | 1.007396 | 4.170709 | 0.0003 |

**Figure 3:** Lag Selection - ARDL

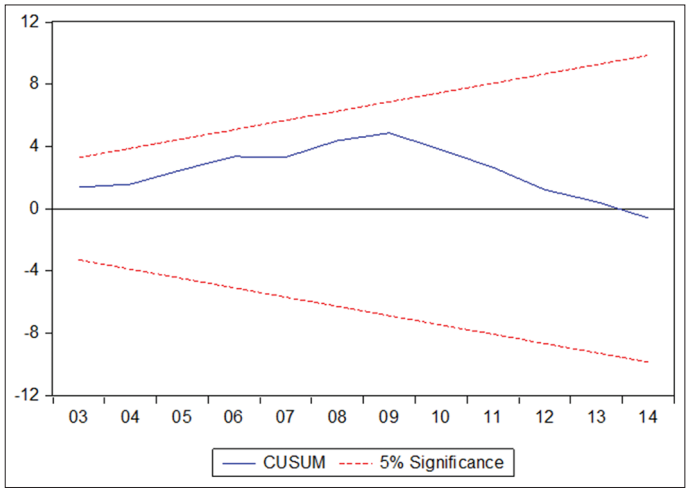



**Figure 4:** Test 7

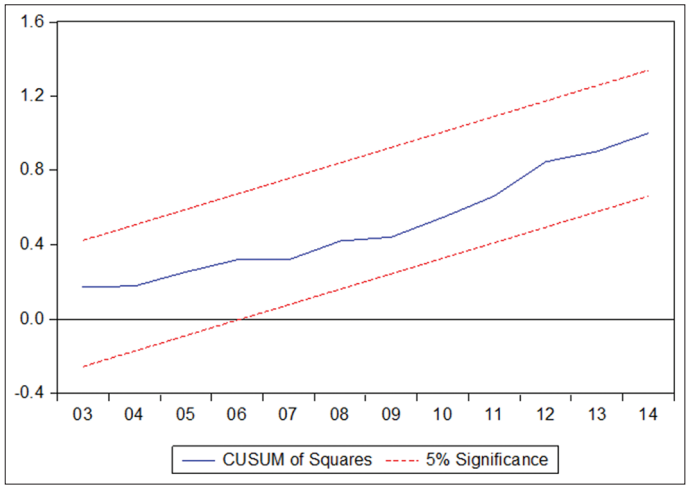



**Figure 5:** Test 8

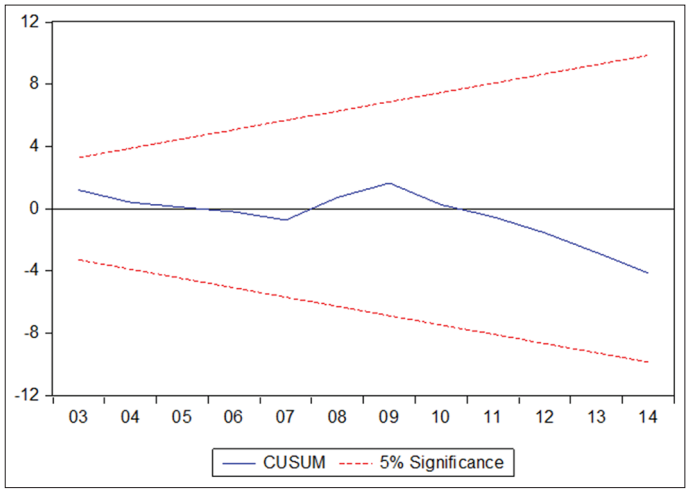


**Figure 6:** Test 8

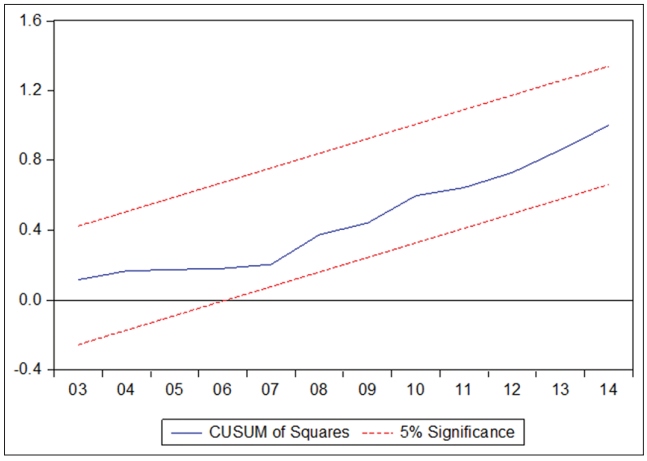



**Figure 7:** Multiplier graph

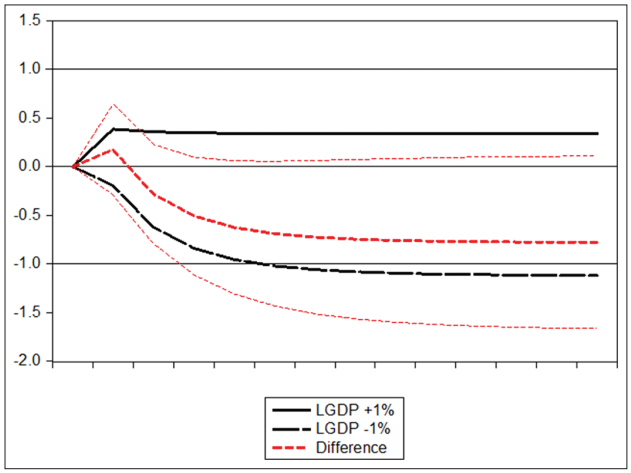



**Table 4: Stability test results - 2**

| Stability test | F | P |
|---|---|---|
| Test 1 | 1.135860 | 0.3755 |
| Test 2 | 3.353171 | 0.0795 |
| Test 3 | 0.955985 | 0.4973 |
| Test 4 | 0.000782 | 0.9779 |
| Test 5 | 0.009319 | 0.9239 |
| Test 6 | 0.269819 | 0.873795 |

**Table 5: Nonlinear ARDL model test results**

| Short-run coefficients | | | | |
|---|---|---|---|---|
| **Variable** | **Coefficient** | **Std. Error** | **t-Statistic** | **Prob.** |
| D(LGDP_POS) | 0.385611 | 0.077763 | 4.958820 | 0.0000 |
| D(LGDP_NEG) | 0.194112 | 0.255915 | 0.758504 | 0.4552 |
| D(LGD) | −0.018942 | 0.006374 | −2.971723 | 0.0065 |
| D(LEM) | 0.603123 | 0.146960 | 4.103983 | 0.0004 |
| D(LEXD) | 0.094793 | 0.017042 | 5.562206 | 0.0000 |
| D(R2002) | 0.062438 | 0.024824 | 2.515188 | 0.0187 |
| CointEq(-1) | −0.508425 | 0.110197 | −4.613800 | 0.0001 |
| **Long-run coefficients** | | | | |
| LGDP_POS | 0.339260 | 0.146876 | 2.309842 | 0.0294 |
| LGDP_NEG | 1.039483 | 0.522077 | 1.991054 | 0.0575 |
| LGD | −0.037256 | 0.012983 | −2.869719 | 0.0082 |
| LEM | 1.186257 | 0.171140 | 6.931514 | 0.0000 |
| LEXD | 0.186444 | 0.046009 | 4.052323 | 0.0004 |
| R2002 | 0.122806 | 0.068213 | 1.800338 | 0.0839 |
| C | 3.396964 | 1.324714 | 2.564300 | 0.0167 |

the results, Chinese government should take additional measures to stabilize the borrowing from foreign markets. These measures are important for Chinese government to restructure the economy, solve overcapacity problems and reach emission targets.

## 5. CONCLUSION

Main findings of this study are as below.

i. Symmetric relationship between EMS and GW is confirmed for China
ii. Asymmetric relationship between EMS and GW is confirmed for China
iii. Significant positive effect of EXD on EMS in confirmed for China.

This study examined the effect of China's EXD on its EMS by taking the EKC hypothesis as its basis. For the hypotheses that are tested, hypothesis 1, 2 and 3 are confirmed. Hypothesis 4 is tested but is not confirmed. Although symmetric and asymmetric cointegration between the variables are confirmed, an EKC relationship between GW and EMS is not confirmed by the ARDL and nonlinear ARDL models. The main aim of this study is to examine the effect of EXD on EMS. Positive and significant effects of EXD on EMS are confirmed by the ARDL and nonlinear ARDL models.

The Chinese economy is still overly reliant on the heavy industries, real estate and construction sectors. The construction and real estate sectors have heavily contributed to corporate debt. Since the Chinese government's policies for deleveraging make borrowing from domestic markets harder, local governments and private companies have borrowed more from foreign markets and investors in order to invest in construction and real estate. The Chinese government has a plan for restructuring the economy known as the Made in China 2025 program to further develop various technological sectors, especially in the semiconductor sector. The Chinese government also has a policy for deleveraging efforts to reduce external debts. The Chinese government should increase its efforts to stabilize borrowing by local governments and private companies from foreign markets and investors. The Chinese government should also continue its efforts for restructuring the economy to reign in the real estate boom and to solve over capacity problems in heavy industries and to stabilize the construction sector.

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