ERF Working Papers Series

The Nexus between Construction Investment and Economic Development: Evidence from MENA Countries

Hasan Murat Ertugrul and Burak Pirgaip

Economic Research Forum
منتدى البحوث الاقتصادية

Working Paper No. 1476
August 2021

THE NEXUS BETWEEN CONSTRUCTION INVESTMENT AND ECONOMIC DEVELOPMENT: EVIDENCE FROM MENA COUNTRIES

Hasan Murat Ertuğrul[1] and Burak Pirgaip[2]

Working Paper No. 1476

August 2021

Send correspondence to:
Hasan Murat Ertuğrul
Economic Research Forum
murat.ertugrul@hmb.gov.tr

[1] Assoc. Prof. Dr., Ministry of Treasury and Finance, 06490 Çankaya, Ankara, Turkey. Economic Research Forum, Research Fellow, Cairo, Egypt.
[2] Assoc, Prof. Dr., Hacettepe University, Department of Business Administration, 06800 Beytepe Çankaya, Ankara, Turkey. Email: burakpirgaip@hacettepe.edu.tr

First published in 2021 by
The Economic Research Forum (ERF)
21 Al-Sad Al-Aaly Street
Dokki, Giza
Egypt
www.erf.org.eg

Copyright © The Economic Research Forum, 2021

All rights reserved. No part of this publication may be reproduced in any form or by any electronic or mechanical means, including information storage and retrieval systems, without permission in writing from the publisher.

The findings, interpretations and conclusions expressed in this publication are entirely those of the author(s) and should not be attributed to the Economic Research Forum, members of its Board of Trustees, or its donors.

Abstract

We aim at scrutinizing the relationship between construction investments and economic development for 10 greatest economies in the Middle East and North Africa (MENA) region, namely, Saudi Arabia, Turkey, Iran, United Arab Emirates, Egypt, Iraq, Qatar, Algeria, Kuwait, and Morocco, between 1970 and 2018. By employing second generation panel data modelling tools, we find that there is an inverted U-shaped pattern implying that the share of construction investments started to decline at some point in time as the economic growth reached a certain threshold. We argue that MENA countries should reconsider their construction-induced growth policies and incorporate alternative options supported by innovative and environmental-friendly technologies to attach much more importance to the role of construction in future economic development plans.

Keywords: construction; economic development; Bon curve; MENA; panel data.
JEL Classifications: L74; O10; C33.

1. Introduction

Due to its effects on employment and supply chains, the construction industry is a central component of the economy as being one of the main drivers of economic growth, and the activities within the industry are also of importance for attaining particular socio-economic development goals of a nation such as housing and infrastructure. This is true particularly for developing economies where construction industry acts as an engine or stimulus that contributes to national income more than other industries do (World Bank, 1984; Ofori, 1990).

The relationship between a country's development status and its level of construction activity has become a keen interest for many researchers so far. Previous studies, which date back to late 1960s and early 1970s, argue that there is a significant positive relationship between the two, i.e. the share of construction in gross domestic product (GDP) increases as GDP per capita increases (Turin, 1969), while the contribution of construction eventually starts to decline at some point when a sufficient level of national income is achieved (Strassmann, 1970) or when a stable rate of economic growth can be attained by a sufficient level of construction activity (Wells, 1986).

Following these preliminary findings, Bon (1992) articulates one of the most interesting hypotheses in construction economics suggesting that the nexus between construction and economic development has an inverted U-shape profile. The main aspect of the proposition is that, the share of construction in GDP increases in the early stages of economic development, but it slows down in the following stages as it starts to lose its significance in the overall economy. This series of 'stages' has different facets of economic development represented by three types of economies: (a) least developed countries, (b) newly industrialized countries, and (c) advanced industrial countries.

While this non-linear relationship, hereafter Bon curve, is later confirmed by Crosthwaite (2000), Yiu et al. (2004) and Girardi and Mura (2014), the related literature has not produced a consensus of convincing evidence supporting the hypothesis, particularly for the case of developing economies. For instance, Ruddock and Lopes (2006) find that Bon curve holds only for the share of construction in the economy. Upon 75 countries between 1994 and 2000, the authors reveal that construction activity does not switch from relative to absolute decline in further stages of economic development. Wong et al (2008) complements these findings for Hong Kong. In addition, Choy (2011), using a sample of 205 economies from 1970 to 2009, states that the inverted U-shaped relationship could be observable mainly within most developed countries.

Despite their mixed outcomes, these studies are unequivocal in the sense that the Bon curve may still provide an important paradigm for demonstrating the role of the construction sector in economic development. In this regard, we aim at verifying the validity of Bon curve with the data of 10 greatest economies in the MENA (Middle East and North Africa) region, namely, Saudi Arabia, Turkey, Iran, United Arab Emirates, Egypt, Iraq, Qatar, Algeria, Kuwait, and Morocco, between 1970 and 2018. Construction sector is vital for these developing nations in their economic progress in that it has particularly strong prospects, and investments in public infrastructure plays a critical role that establishes more favorable conditions to increase the level of investments and to expand activities in the economy as a whole.

We employ second generation panel data models for empirical analysis. First, we use a battery of tests in order to investigate for cross-sectional dependence in errors and slope heterogeneity in the panel regression model we establish. Based on the findings, we employ specific unit root and co-integration tests that are able to handle these two important issues. Then we use dynamic common correlated effects mean group technique in order to identify the long-term relationship between construction and economic development. As a last resort, we utilize various models for robustness check. Our findings confirm Bon curve, since there is an inverted U-shaped pattern in the relationship between construction and economic development.

The paper is organized as follows. Section 2 presents data and methodology. Section 3 discusses our findings and Section 4 concludes.

2. Data and Methodology

In order to uncover the relationship between construction investment and economic development, we obtain relevant data from United Nations Conference on Trade and Development's (UNCTAD) UNCTADstat web site, where GDP, value added by kind of economic activity, and GDP per capita data are reported. All absolute values are denominated in US dollars at current prices and have annual frequency spanning from 1970 to 2018. Table 1 shows the average values per country derived from the original data that our analysis is based on as follows.

Table 1. Average GDP and CVA values among countries from 1970 to 2018

Countries	Income level*	GDP (in millions)	GDP per capita	CVA (in millions)
Algeria	Upper middle	77,848.39	2,496.34	7,579.48
Egypt	Lower middle	90,404.49	1,194.95	4,149.63
Iraq	Upper middle	55,132.73	1,968.92	3,171.29
Kuwait	High	53,276.22	21,334.99	1,242.40
Morocco	Lower middle	45,703.21	1,558.61	2,296.07
Qatar	High	45,780.83	33,768.33	3,656.29
Saudi Arabia	High	253,409.21	11,593.68	14,706.93
United Arab Emirates	High	130,018.63	31,359.41	12,562.27
Iran	Upper middle	194,281.45	3,018.88	14,371.57
Turkey	Upper middle	130,018.63	4,969.32	22,712.14

Note: This table shows GDP, GDP per capita and construction value added (CVA) for each country in the sample. GDP and CVA data are reported in millions. All data are denominated in US dollars at current prices.
* Income level information is retrieved from World Bank.

As Table 1 suggests, Saudi Arabia (Morocco) has the highest (lowest) GDP, Qatar (Egypt) has the highest (lowest) GDP per capita, and Turkey (Kuwait) has the highest (lowest) CVA on average. Figure 1 represents the average progress in GDP and CVA among countries throughout years.

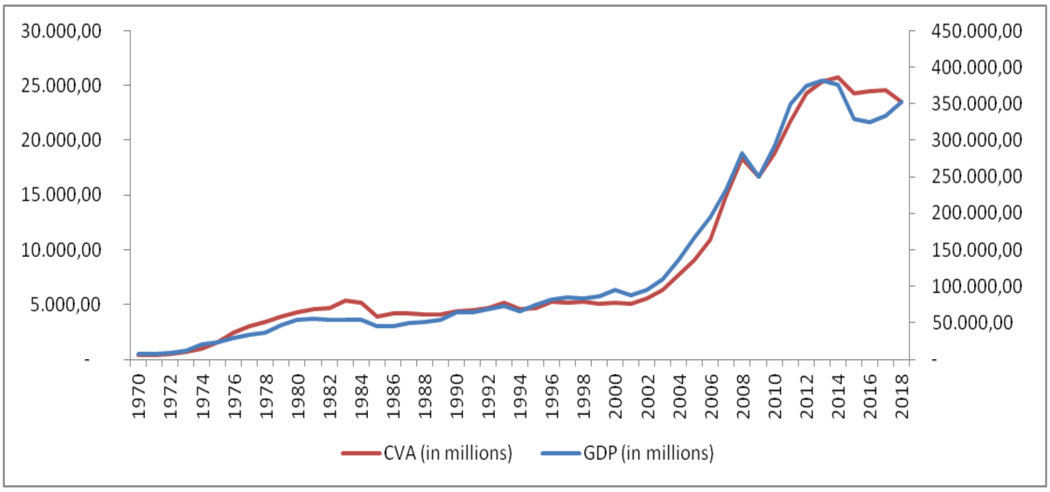

Figure 1. Average GDP and construction values across countries from 1970 to 2018
Note: This figure shows the average improvement in GDP (on the right side) and CVA (on the left side) values among countries. Data are reported in millions and are denominated in US dollars at current prices.

What Figure 1 implies is that the correlation (99.17%) between GDP and CVA is very high for MENA countries. As an attempt to find out whether the situation is similar in the case of the share of construction in GDP, we divide CVA by GDP and plot the results in Figure 2 below.

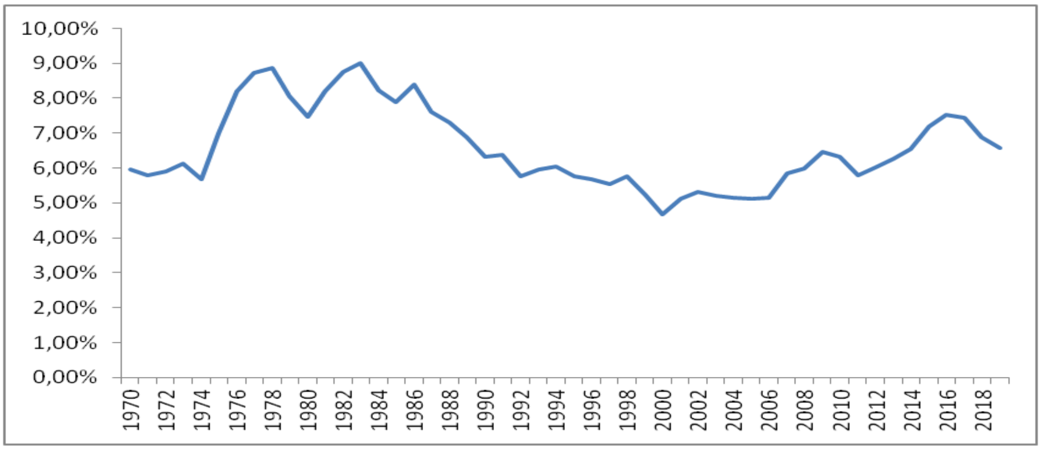

Figure 2. Average construction share in GDP across countries from 1970 to 2018
Note: This figure shows the average improvement in construction share in GDP among countries.

It is apparent from Figure 2 that there is a downward trend in construction share in GDP across MENA countries over the full sample period. Average construction share in GDP is 6.58%, while the highest point is 9.01% and the lowest point is 4.67% attained in 1983 and 2000, respectively. The most recent data show 6.89%, which is slightly above average, as of 2018 year-end. The decline in construction share in GDP consequently appears to evoke the existence of Bon curve in the case of MENA countries.

To investigate the proposition empirically, we employ the standard panel data model displayed in the following Eq. (1):

$$LCONS_{it} = \lambda_i d_t + \alpha_{1i} LGDPPC_{it} + \alpha_{2i} LGDPPC\text{^}2_{it} + u_{it}$$
$$u_{it} = \theta_i f_t + \varepsilon_{it}\ , \qquad t=1,2,\ldots T \text{ and } i=1,2,\ldots,N \qquad (1)$$

where LCONS, LGDPPC and LGDPPC^2 denote for the natural logarithms of construction share in GDP, GDP per capita and GDP per capita squared, respectively; $d_t(f_t)$ shows observed (unobserved) common effects and u_{it} and ε_{it} are relevant error terms. The quadratic term, i.e. LGDPPC^2, is included in order to detect the non-linearity in the relationship between construction and economic development. Table 2 presents descriptive statistics of the variables of interest.

Table 2. Descriptive statistics

	LCONS	LGDPPC	LGDPPC^2
Mean	1.736	8.405	72.751
Med.	1.774	8.298	68.852
Max.	2.967	11.351	128.852
Min.	-0.957	5.464	29.850
St. Dev.	0.604	1.454	24.638
Skew.	-1.352	0.048	0.305
Kurt.	6.638	2.023	2.059
Jarque-Bera	419.486	19.691	25.704
Prob.	0.000	0.000	0.000
Obs.	490	490	490

Note: This table displays descriptive statistics that pertain to the construction share in GDP (LCONS), GDP per capita (LGDPPC) and GDP per capita squared (LGDPPC^2) variables in the sample period (1970-2018).

Our panel estimation model in Eq. (1) assumes cross-sectional independence of errors and slope homogeneity. The former assumption deserves attention because cross-sectional dependence may well exist due to spatial effects, omitted common effects and mutual effects (Chudik and Pesaran, 2013) and may lead to serious problems including inconsistency and bias in fixed or random effects model estimators (Sarafidis and Robertson, 2009) and important size distortions that affect conventional unit root tests results (O'Connell, 1998).

Therefore, we scrutinize whether errors are cross-sectionally dependent in the first step. To that end, we employ the Bias Adjusted LM test proposed by Pesaran et al. (2008). This test provides superior results against inconsistencies especially when time dimension is longer than the cross-sectional dimension (T>N) as it is in our case. As a second step, we investigate unit root properties of the variables by using the CIPS unit root test developed by Pesaran (2007) and co-integration relationship between the variables by using the Durbin–Hausman (DH) co-integration test proposed by Westerlund (2008), which both takes cross sectional dependency into account.

Under the latter assumption in Eq. (1), fixed and random effects or instrumental-variable estimators assume slope homogeneity as well. However, slopes are expected not to be homogenous when panels include large cross section and time dimension (Im et al., 2003; Pesaran and Smith, 1995). To address this point, we utilize Pesaran and Yamagata's (2008) slope heterogeneity test to analyze slope heterogeneity at the third step.

The fourth step in our analysis requires employing dynamic common correlated effects mean group (CCEMG) estimator developed by Chudik and Pesaran (2015) to obtain co-integration equation due to the fact that our initial results indicate both cross-sectional dependence of errors and slope heterogeneity. Dynamic CCEMG presents superior and robust results in dealing such cases (Atasoy, 2017). Common Correlated Effects (CCE) estimator was first proposed by Pesaran (2006) and then developed by Kapetanios et al. (2011). Methodologically, the CCE estimator produce robust results in case both structural break and unobserved common factors exist. On the other hand, the CCEMG estimator is derived by augmenting the CCE estimator with the cross-sectional averages of the dependent and independent variables. Chudik and Pesaran (2015) further augment the CCEMG estimator by adding lags of the dependent variable to the CCEMG model. The dynamic CCEMG estimator representation is formulated in Eq. (2) below.

$$y_{it} = \alpha_{0i} y_{it-1} + \alpha_{1i} + \beta_i x_{it} + \sum_{j=1}^{n} \delta_i \bar{y}_{it-j} + \sum_{j=1}^{n} \theta_i \bar{x}_{it-j} + \varphi_i f_t + \varepsilon_{it} \quad (2)$$

where y_{it} denotes for the dependent variable; α_{1i} is fixed group effect coefficients; x_{it} is the vector of independent variables; $\bar{y}_{it-j}$ and $\bar{x}_{it-j}$ are the lag of cross-sectional averages of y and x; β_i stands for the country specific slopes; f_t is the unobserved common factor and ε_{it} is the error term.

In the final step, we employ alternative models, namely the CCEMG, Augmented Mean Group (AMG) [1] and Panel ARDL[2] models, for robustness purposes.

3. Results

The first and second steps of our fourfold approach are based on the investigation of cross-sectional dependency properties of errors. First, we employ the Bias Adjusted LM test proposed by Pesaran et al. (2008). The results are presented in Table 3.

[1] AMG estimator is proposed by Eberhardt and Bond (2009) and Eberhardt and Teal (2010). It is also robust for cross-sectional dependence of errors and slope heterogeneity. The main difference between the CCEMG and AMG estimators is of the unobserved common factors' approximation methods (Atasoy, 2017).

[2] We use Pooled Mean Group (PMG) estimator developed by Pesaran et al. (1999) for the panel ARDL model estimation in line with the extant literature. The panel PMG estimator allows for long and short-term heterogeneity between variables (Güler & Özyurt, 2011).

Table 3. Cross-sectional dependency test results[3]

	Value
Bias Adjusted LM test	136.3*

Note: * indicates 1% significance. Null hypothesis: There is no cross-sectional dependency in the errors.

As revealed by Table 3, we reject the null hypothesis of no cross-sectional dependence at 1% significance level. Hence, our data analysis implies that there is cross-sectional dependence in the errors. Second, we follow Pesaran (2007) CIPS test for unit root analysis. Table 4 reports the results as follows.

Table 4. CIPS unit root test results

	Level		**First Difference**	
Variable	**Constant**	**Constant+Trend**	**Constant**	**Constant+Trend**
LCONS	-2.020	-2.348	(-5.814)*	(-5.901)*
LGDPPC	-2.125	-2.531	(-5.651)*	(-5.752)*
LGDPPC^2	-2.102	-2.621	(-5.602)*	(-5.696)*

Note: * indicates 1% significance level. Null hypothesis: There is unit root.

According Table 4, CIPS unit root test indicates that all variables become stationary after first differencing, meaning that they are I(1) in both the constant and constant-linear trend. Followingly, we employ DH co-integration test proposed by Westerlund (2008) for co-integration check. This test involves two tests: the DH panel test (DHp) and the DH group test (DHg). The former test (DHp) employs similar autoregressive parameters for cross sections, while the latter (DHg) allows the autoregressive parameters to change with alternative hypothesis. Null hypothesis under both tests suggests that there is no co-integration between the variables. Table 5 presents the Westerlund's DH co-integration test results.

Table 5. Westerlund‘s DH test results

	Value
DHg	2.690*
DHp	1.901**

Note: * and ** indicate 1% and 5% significance levels, respectively. Null hypothesis: No co-integration relationship exists.

[3] We also make use of Pesaran (2004) CD-test for variables and find no cross-sectional dependence. We do not report the CD-test results in order to save space. The results are available on request.

Our findings reported in Table 5 suggest that the null hypothesis for both tests is rejected indicating that there is a significant co-integration relationship between construction and economic development in the panel cross-sections. This strong evidence of a long-term equilibrium among the two confirms previous literature and justifies our motivation to investigate the impact of economic growth on construction investments.

In the third step, we investigate the slope heterogeneity properties of our model by using Pesaran and Yamagata's (2008) test, which is an updated version of Swamy Test (Swamy S) and provides more robust results in terms of both power and size (Juhl and Lugovskyy, 2014). Test results are represented in Table 6.

Table 6. Slope heterogeneity results

	Value
Swamy S	28.843*
$\tilde{\Delta}$	6.159*
$\tilde{\Delta}$adj	6.416*
$\hat{\Delta}$	4.216*
$\hat{\Delta}$adj	4.088*

Note: * indicates 1% significance level. Null hypothesis: Slopes are homogeneous.

All statistics in Table 6 reject the null hypothesis emphasizing that there is slope heterogeneity in the model.

Since our overall findings imply cross-sectional dependence and slope heterogeneity in the model, we opt for employing dynamic CCEMG estimators of Chudik and Pesaran (2015), which take both issues into account to avoid inconsistency and produce powerful results when cross-sectional dependence and slope heterogeneity exist. Table 7 presents the dynamic CCEMG model results.

Table 7. Dynamic CCEMG estimator results (Dependent Variable: LCONS)

Variable	**Value**
LCONS(-1)	0.611*
LGDPPC	0.475*
LGDPPC^2	-0.023**
C	-1.196

Note: * and ** indicate 1% and 5% significance levels, respectively.

Table 7 elucidates that GDP per capita has positive, while GDP per capita squared has negative and significant impact on construction. These results suggest that the inverted U-shaped relationship between the share of total construction in GDP versus GDP per capita, which we define it here as Bon curve, holds true across MENA countries over the period of 1970-2018. Table 8 denotes long-term coefficients obtained from Table 7.

Table 8. Long-term coefficients from Dynamic CCEMG model (Dependent Variable: LCONS)

Variable	Value
LGDPPC	1.221*
LGDPPC^2	-0.059**
C	-1.196

Note: * and ** indicate 1% and 5% significance levels, respectively.

From Table 8, we can argue that one percent increase in GDP per capita causes 1.221% increase and one percent increase in GDP per capita squared causes 0.059% decrease in construction investments for MENA countries.

Finally, we estimate CCEGM, AMG and Panel ARDL models for robustness check of our dynamic CCEMG model results above. Table 9 presents long-term coefficients obtained from these alternative models.

Table 9: Robustness check

Variable	CCEGM Model	AMG Model	Panel ARDL Model
LGDPPC	1.704**	2.017**	1.195*
LGDPPC^2	-0.089**	-0.130**	-0.074*
C	-2.873	-6.232***	-0.439*

Note: *, ** and *** indicate 1%, 5% and 10% significance levels, respectively.

All models in Table 9 produce similar results. In concrete terms, the impact of GDP per capita on construction investment is positive and statistically significant for all models and the elasticity coefficients are found between 1.195 and 2.017, implying that one percent increase in GDP per capita causes 1.195% to 2.017% increase in construction investments. The impact of GDP per capita squared on construction investment, likewise, is negative and statistically significant for all models and the elasticity coefficients range between -0.059 and -0.130. This indicates that one percent increase in GDP per capita squared causes 0.059% to 0.130% decrease in construction investments.

Overall, our quadratic specifications significantly validate Bon's proposition for MENA countries under various settings.

4. Conclusion

We attempt to discover the relationship between construction and economic development in 10 greatest economies in the MENA region between 1970 and 2018. Our analysis results show that there is an inverted U-shaped pattern as proposed by Bon (1992).

This is important for a number of reasons. First, although all of the 10 countries we consider in this study have developing status, they are different and have their own dynamics in their income levels, built environment and so on. Yet, even after controlling for such heterogeneities, our results appear to postulate that a minimum required level of investment in construction has been achieved to contribute to a sustainable economic growth. Put alternatively, increasing GDP per capita does not correspond to a relative increase in construction volume any more in economies of MENA countries in our sample, because it seems that these countries have become so mature that the relative importance of the construction activity has started to decline. Hence, the leading role of the construction industry in the economic growth of MENA countries is somewhat obscured. To continue to play its important role in the development strategy of countries, it would be an option for the construction sector to adjust to contemporary frameworks that promote innovative technologies, green economy, smart cities and etc.

Such structural changes would inevitably require the constraints of the construction industry's production factors to be removed. Moreover, these countries should develop strategies to create a more institutionalized sector that has easy access to financial markets and should facilitate doing business in a more competitive environment. Governments should also carefully consider their monetary and fiscal policies in order not to distort factor prices.

References

Atasoy, B. S. (2017). Testing the environmental Kuznets curve hypothesis across the US: Evidence from panel mean group estimators. Renewable and Sustainable Energy Reviews, 77, 731-747.

Bon, R. (1992). The future of international construction: secular patterns of growth and decline. Habitat international, 16(3), 119-128.

Choy, C. F. (2011). Revisiting the 'Bon curve'. Construction Management and Economics, 29(7), 695-712.

Chudik, A., & Pesaran, M. H. (2013). Large panel data models with cross-sectional dependence: a survey. CAFE Research Paper, (13.15).

Chudik, A., & Pesaran, M. H. (2015). Common correlated effects estimation of heterogeneous dynamic panel data models with weakly exogenous regressors. Journal of Econometrics, 188(2), 393-420.

Crosthwaite, D. (2000). The global construction market: a cross-sectional analysis. Construction Management and Economics, 18(5), 619-627.

Eberhardt, M., & Bond, S. (2009). Cross-section dependence in nonstationary panel models: a novel estimator.

Eberhardt, M., & Teal, F. (2010). Productivity Analysis in Global Manufacturing Production.

Girardi, D. and Mura, A. (2014) "The Construction-Development Curve: Evidence from a New International Dataset", The IUP Journal of Applied Economics, Vol.XIII, No.3

Güler, A., & Özyurt, H. (2011). Merkez bankası bağımsızlığı ve reel ekonomik performans: Panel ARDL analizi. Ekonomi Bilimleri Dergisi, 3(2), 11-20.

Im, K. S., Pesaran, M. H., & Shin, Y. (2003). Testing for unit roots in heterogeneous panels. Journal of econometrics, 115(1), 53-74.

Juhl, T., & Lugovskyy, O. (2014). A test for slope heterogeneity in fixed effects models. Econometric Reviews, 33(8), 906-935.

Kapetanios, G., Pesaran, M. H., & Yamagata, T. (2011). Panels with non-stationary multifactor error structures. Journal of econometrics, 160(2), 326-348.

Lopes, J., Ruddock, L., & Ribeiro, F. L. (2002). Investment in construction and economic growth in developing countries. Building Research & Information, 30(3), 152-159.

O'Connell, P. G. (1998). The overvaluation of purchasing power parity. Journal of international economics, 44(1), 1-19.

Ofori, G. (1990). The construction industry: aspects of its economics and management. NUS Press.

Pesaran, M. H. (2004). General diagnostic tests for cross-sectional dependence in panels. Empirical Economics, 1-38.

Pesaran, M. H. (2006). Estimation and inference in large heterogeneous panels with a multifactor error structure. Econometrica, 74(4), 967-1012.

Pesaran, M. H. (2007). A simple panel unit root test in the presence of cross- section dependence. Journal of applied econometrics, 22(2), 265-312.

Pesaran, M. H., Shin, Y., & Smith, R. P. (1999). Pooled mean group estimation of dynamic heterogeneous panels. Journal of the American statistical Association, 94(446), 621-634.

Pesaran, M. H., & Smith, R. (1995). Estimating long-run relationships from dynamic heterogeneous panels. Journal of econometrics, 68(1), 79-113.

Pesaran, M. H., Ullah, A., & Yamagata, T. (2008). A bias- adjusted LM test of error cross-section independence. The Econometrics Journal, 11(1), 105-127.

Pesaran, M. H., & Yamagata, T. (2008). Testing slope homogeneity in large panels. Journal of econometrics, 142(1), 50-93.

Ruddock, L., & Lopes, J. (2006). The construction sector and economic development: the 'Bon curve'. Construction Management and Economics, 24(7), 717-723.

Sarafidis, V., & Robertson, D. (2009). On the impact of error cross- sectional dependence in short dynamic panel estimation. The Econometrics Journal, 12(1), 62-81.

Strassmann, W. P. (1970). The construction sector in economic development. Scottish Journal of Political Economy, 17(3), 391-409.

Turin, D. A. (1969). The Construction Industry: Its Economic Significance and Its Role in Development, University College Environmental Research Group.

Wells, J. (1986). The construction industry in developing countries: Alternative strategies for development. Taylor & Francis.

Westerlund, J. (2008). Panel cointegration tests of the Fisher effect. Journal of Applied Econometrics, 23(2), 193-233.

Wong, J. M., Chiang, Y. H., & Ng, T. S. (2008). Construction and economic development: the case of Hong Kong. Construction Management and Economics, 26(8), 815-826.

World Bank (1984). The Construction Industry: Issues and Strategies in Developing Countries, Washington, DC: International Bank for Reconstruction and Development, The World Bank.

Yiu, C. Y., Lu, X. H., Leung, M. Y., & Jin, W. X. (2004). A longitudinal analysis on the relationship between construction output and GDP in Hong Kong. Construction Management and Economics, 22(4), 339-345.