



Article

# The Relationship between Export and Growth: Panel Data Evidence from Turkish Sectors

Alper Aslan and Ebru Topcu \*

Department of Economics, Nevsehir Haci Bektas Veli University, Nevsehir 50300, Turkey;  
alperaslan@nevsehir.edu.tr

\* Correspondence: ebruerdogan@nevsehir.edu.tr; Tel.: +90-384-228-1000

Received: 29 October 2017; Accepted: 16 March 2018; Published: 2 April 2018



**Abstract:** The aim of this study is to examine the impact of sectoral exports on economic growth in Turkey over the period 2000–2015. To this end, empirical models are estimated using panel data techniques in which quarterly data are gathered for eight sectors. Findings in the case of the pooled panel indicate the validity of the export-led growth hypothesis. Disaggregated evidences, on the other hand, reveal the validity of export-led growth hypothesis in the case of (i) agriculture and forestry; (ii) fishing; (iii) mining and quarrying; (iv) manufacturing; (v) electricity, gas and water supply; and (vi) wholesale and retail trade while it is found to be invalid in the case of (i) real estate, renting and business activities; and (ii) other community, social and personal service activities. The sectors that have the highest growth contributions are listed as follows: (i) agriculture and forestry; (ii) mining and quarrying; and (iii) manufacturing. Causality results also provide a strong support in favor of an export-led growth hypothesis for four sectors in addition to the feedback hypothesis which is valid for three sectors.

**Keywords:** export; economic growth; export-led growth hypothesis; Turkey; panel data analysis

**JEL Classification:** F11; O4

## 1. Introduction

Although the basis of the relationship between international trade and economic growth dates back to the Mercantilist period, the theoretical setting of this relationship has been proposed by Adam Smith and David Ricardo in line with international trade theories. The empirical studies have been the center of interest since the 1970s (Kravis 1970; Michaely 1977; Balassa 1978, 1981, 1982, 1985; Heller and Porter 1978; Krueger 1978; Williamson 1978; Fajana 1979; Tyler 1981; Feder 1982; Salvatore 1983; Kavoussi 1984; Jung and Marshall 1985; Ram 1985; Darrat 1986; Chow 1987; Hsiao 1987; Ram 1987; Bhagwati 1988).

From 1923 when the Republic was declared up to date, different foreign trade policies such as liberal or protectionist have been applied in Turkey according to the necessities of the period. Implementation of export-oriented growth policy with the 24 January 1980 Decisions was a milestone in Turkey. Export promotion policies in this period have largely been aimed at increasing exports of the manufacturing sector. While the sector which had the largest share in total exports in 1980 was the agricultural sector, the share of the manufacturing sector has started to increase since 1981. Over the analysis period (2000–2015), manufacturing, mining and quarrying, agriculture and forestry, wholesale and retail trade sectors have the highest export values as a share of total exports. On the other hand, sectors of real estate, renting and business activities and other community, social and personal service activities have the lowest shares. Sustainable economic growth is seen as a growth based on net export within the current global and local conditions in Turkey. Accordingly, “rebalancing in the economy”

policies have been implemented in the Turkish economy since 2012 in order to ensure growth based on net export (Turkish Exporters Assembly TEA, p. 30). In this context, a number of empirical studies addressing the sample of Turkey have been conducted in order to assess whether the export-based growth strategy has achieved its goal since 1980. When these studies are examined, it is seen that a large part of the work is at the macro level while the number of studies dealing with the relationship at the micro (sectoral) level is rather limited. Macro-scale studies commonly measure the aggregated impact; the differentiated impact of each sector with different export volumes cannot be measured. Therefore, the problem of aggregation bias may arise, in which the findings might be inconsistent.

Given the aforementioned motivation<sup>1</sup>, the aim of this study is to examine the impact of sectoral exports on economic growth in Turkey over the period 2000:Q1–2015:Q4 within the panel data framework. For this purpose, two hypotheses have been proposed accordingly. The first one is that “exports will affect growth in the micro-base as well as in the macro-base”. As these effects may change with respect to the export and production potential of the concerned sector, the second hypothesis is that “sectors that increase export volume more will contribute to economic growth more”. To test these hypotheses, the impact of eight different sectors’ export volumes on economic growth is analyzed using quarterly data covering the period 2000–2015 by employing panel time series estimator.

The rest of the study is structured as follows: Section 2 reviews relevant literature, Section 3 describes model and data, Section 4 presents methods and results, and Section 5 concludes.

## 2. Literature Survey

As stated in the introduction section, most of the studies focus on the nexus between export and economic growth at the aggregate level. In addition to the regression approach, on the other hand, causality approaches are used in most of the macro level studies as well. Table 1 summarizes these studies.

Table 1. Aggregate Level.

| Author (s)                    | Country/Countries                           | Period                                       | Method                              | Findings   |
|-------------------------------|---|--|-------------------------------------|--|
| Sharma et al. (1991)          | Germany, Italy, Japan, USA and England      | 1960–1987                                    | VAR                                 | Germany and Japan; Export $\kappa \rightarrow$ Growth  |
| Thornton (1996)               | Mexico                                      | 1895–1992                                    | Cointegration and Granger Causality | Export $\rightarrow$ Growth (long run)   |
| Shan and Sun (1998)           | China                                       | 1987–1996                                    | Causality                           | Export $\leftrightarrow$ Growth  |
| Dhawan and Biswal (1999)      | India                                       | 1961–1993                                    | VAR                                 | Export $\rightarrow$ Growth (short run)  |
| Shan and Sun (1999)           | USA   | -  | Toda and Yamamoto Causality         | Export $\leftrightarrow$ Growth  |
| Hatemi-J and Manuchehr (2000) | Turkey, Greece Mexico, Ireland and Portugal | -  | VAR                                 | Mexico and Ireland; Export $\rightarrow$ Growth<br>Portugal: Growth $\rightarrow$ Export<br>Greece and Turkey; Export $\theta$ Growth  |
| Hatemi-J (2002)               | Japan                                       | 1960–1999                                    | Bootstrap Approach                  | Export $\leftrightarrow$ Growth  |
| Kónya (2004)                  | 25 OECD Countries                           | 1960–1997 (except Hungary, Korea and Mexico) | Granger Causality                   | Iceland, Ireland, Australia and Austria; Export $\rightarrow$ Growth<br>The Netherlands, Luxemburg, Denmark, France, Greece, Hungary, Norway; Export $\theta$ Growth<br>Canada, Japan, Korea, Finland, USA and Portugal; Growth $\rightarrow$ Export |

<sup>1</sup> The novelty of the study is also presented thoroughly at the end of the literature section.

Table 1. Cont.

| Author (s)                       | Country/Countries  | Period    | Method   | Findings  |
|----------------------------------|--|-----------|--|---|
| Awokuse (2005)                   | Japan  | -         | VAR and DAG                                      | Export ↔ Growth   |
| Awokuse and Christopoulos (2009) | Canada, Italy, Japan, England and USA                                      | -         | STAR Model                                       | Canada, Italy, England and USA;<br>Export → Growth<br>Italy and Japan;<br>Growth → Export   |
| Tang et al. (2015)               | Asian's Four Little Dragons (Hong Kong, Singapore, South Korea and Taiwan) | -         | Johansen Cointegration and MWALD Causality Tests | Bivariate Model:<br>Hong Kong and Singapore;<br>Export → Growth<br>South Korea and Taiwan;<br>Growth ↔ Export<br>Trivariate model:<br>Export ↔ Growth (for all countries) |
| Ee (2016)                        | Sub-Saharan Africa Countries (Botswana, Equatorial Guinea, Mauritius)      | 1885–2014 | Panel Cointegration                              | Export → Growth   |

Note: → indicates unidirectional relationship, ↔ indicates bidirectional relationship, θ indicates no relationship.

Unlike the studies at the aggregated level, studies at the disaggregate level are relatively limited. Table 2 reviews sectoral level studies based on the causality approach.

Table 2. Disaggregate Level.

| Author                    | Country/Countries | Period                                   | Method   | Findings  |
|---------------------------|-------------------|--|--|---|
| Ghatak et al. (1997)      | Malaysia          | 1955–1990                                | Granger Causality                                      | Manufacturing Export → Growth   |
| Biswal and Dhawan (1998)  | Taiwan            | 1960–1990                                | Engle Granger Cointegration and Error Correction Model | Growth → Manufacturing Export   |
| Alam (2003)               | Mexico and Brazil | 1959–1990 (Mexico)<br>1955–1990 (Brazil) | ARDL-FMOLS   | Manufacturing Export θ Growth   |
| Herzer et al. (2006)      | Chile             | 1960–2001                                | Granger Causality                                      | Manufacturing Export → Growth   |
| Parida and Sahoo (2007)   | South Asia        | 1980–2002                                | Panel Cointegration                                    | Manufacturing Export → Growth   |
| Hennebery and Khan (2000) | Pakistan          | -  | 2SLS and OLS estimation                                | Agricultural Export → Growth  |
| Duc and Tram (2011)       | Vietnam           | 1997–2008                                | Vector Error Correction                                | Fishery Sector Export → Growth  |
| Shakouri and Yazdi (2012) | Iran              | 1959–2008                                | Cointegration and Granger Causality                    | Mining Export → Growth  |
| Cipamba (2012)            | South Africa      | 1990–2011                                | Cointegration and Granger Causality                    | Manufacturing Export → Growth (long run)<br>Manufacturing and Mining Export → Growth (short run)  |
| Sahoo et al. (2014)       | India             | 1981–2010                                | VECM Granger Causality                                 | Growth → Mining Export  |
| Uddin (2015)              | Bangladesh        | 1980–2013                                | Cointegration and Granger Causality                    | Agricultural Export → Growth  |
| Shafiullah et al. (2017)  | Australia         | 1990:Q3–2013:Q2                          | Granger Causality                                      | Long Run;<br>Mining and Fuels export → Growth<br>Agriculture Export → Growth<br>Manufacturing Export → Growth<br>Other Sector Export → Growth |
| Sjarif et al. (2011)      | Indonesia         | 1969–2005                                | Cointegration and Error-Correction Model               | Fishery Sector Export ↔ Growth  |
| Toyin (2016)              | South Africa      | 1975–2012                                | Granger Causality                                      | Agricultural Export θ Growth  |

Note: → indicates unidirectional relationship, ↔ indicates bidirectional relationship, θ indicates no relationship.

In the case of Turkey there are a limited number of studies using disaggregated data. In addition, the scope of the sectors discussed by the aforementioned literature is very scarce. Sectoral relationships on the export-led growth hypothesis in the case of Turkey are mostly investigated through causality approaches. Table 3 reviews sectoral level studies in the case of Turkey.

**Table 3.** Disaggregate Level for Turkey.

| Author                         | Country | Period          | Method                              | Findings   |
|--------------------------------|---------|-----------------|-------------------------------------|--|
| Abu-Quarn and Abu-Bader (2004) | Turkey  | -               | Granger Causality                   | Manufacturing Export → Growth  |
| Ciftcioglu and Nekhili (2005)  | Turkey  | 1987:Q1–2004:Q1 | Cointegration and Granger Causality | Mining Export → Growth   |
| Kurt and Terzi (2007)          | Turkey  | 1989:Q1–2003:Q4 | VAR Model                           | Manufacturing Export → Growth  |
| Yaprakli (2007)                | Turkey  | 1970–2005       | Cointegration and Granger Causality | Agricultural and Mining Export ↔ Growth, Manufacturing Export → Growth |
| Sandalcilar (2012)             | Turkey  | 1987–2007       | Panel Cointegration and Causality   | Agricultural export θ Growth   |
| Akbulut and Terzi (2013)       | Turkey  | 1980–2010       | Granger Causality                   | Growth → Agricultural export<br>Manufacturing Export ↔ Growth          |
| Onder and Hatirli (2014)       | Turkey  | 1994–2009       | Three Stage Least Squares Method    | Manufacturing Export ↔ Growth  |

Note: → indicates unidirectional relationship, ↔ indicates bidirectional relationship, θ indicates no relationship.

While studies are investigated in export-growth literature employing sectoral export data, two deficiencies are remarked: (i) the sectors covered by the sectoral studies are rather narrow in terms of sectors (ii) most of the sectoral studies use causality approaches<sup>2</sup>. This situation is still valid in studies conducted for Turkey. In this context, the main motivation of this study is to test the validity of the export led growth hypothesis using sectoral data for Turkey using panel regression approaches. To the best of our knowledge, this is the first study which investigates export-growth nexus with comprehensive sectoral data for Turkey employing this method.

### 3. Model and Data

In line with the theory which extended Neoclassical production function with foreign trade and empirical literature (see, for example: Feder 1982; Baldwin 1992; Ben-David and Loewy 2003; Gundlach 2007; Parida and Sahoo 2007; Awokuse 2008; Kristjanpoller and Olson 2014), economic growth ( $y$ ) is defined as a function of physical capital ( $k$ ), labour ( $l$ ) and exports ( $x$ ):

$$y = f(k, l, x) \quad (1)$$

In Equation (1), the growth, the capital and the labor are taken in aggregate forms<sup>3</sup>. The export consists of eight different sectors namely (i) agriculture and forestry; (ii) fishing; (iii) mining and quarrying; (iv) manufacturing industry; (v) electricity, gas and water supply; (vi) wholesale and retail trade; (vii) real estate, renting and business activities and (viii) other social and personal services. Function in Equation (1) can be written in panel data format as the following:

$$y_{i,t} = \beta_1 k_{it} + \beta_2 l_{it} + \beta_3 x_{it} + v_i + \varepsilon_{it} \quad (2)$$

<sup>2</sup> See, Hennebery and Khan (2000); Sentsho (2000); Alam (2003); Hossain and Karunaratne (2004); Duc and Tram (2011) among others for the micro level studies using regression approach.

<sup>3</sup> Since there is no sectoral data related to these variables, total values are used.

where  $i$  and  $t$  represents sectors ( $i = 1, \dots, 8$ ) and time period ( $t = 2000:Q_1, \dots, 2015:Q_4$ ), respectively. In addition,  $v$  and  $\varepsilon$  represents sector-specific variable and random error term, respectively.

To examine the effect of sectoral export on economic growth, we focus on the 2000:Q1–2015:Q4 period. Growth variable is represented using GDP by expenditure approach at 1998 fixed prices. Gross fixed capital formation is used as fixed capital at 1998 fixed prices according to the expenditure method. The labor variable is measured as the number of workers over the age of 15. Export variable comprises of sectoral export data according to ISIC. 3. All data in the model were obtained from the Turkish Statistical Agency database (<http://www.tuik.gov.tr/UstMenu.do?metod=temelist>). In addition, all variables are modeled as natural logarithms. This transformation ensures that the coefficients obtained after parameter estimation can be interpreted as elasticities.

## 4. Methods and Findings

### 4.1. Unit Root Analysis

In econometric applications, it is necessary to investigate whether the series contain unit root before testing any relation between the variables in the model. Granger and Paul (1974) point out that the results obtained using nonstationary variables might be biased and inconsistent. For this reason, determining the degree of integration of the variables in the model is an extremely important step.

Widely used unit root tests in panel data econometrics are LLC (Levin et al. 2002) and IPS (Im et al. 2003) tests. The alternative “ $H_A$ : serial unit does not contain root (serial is stable)” is tested against the null hypothesis “ $H_0$ : serial unit contains root (series is not stable)”. The mathematical notation of the LLC test with a test statistic with standard normal distribution is as follows:

$$\Delta y_{i,t} = \rho^* y_{i,t-1} + \sum_{L=1}^{\rho} \delta_{iL} \Delta y_{i,t-L} + z_{i,t} \gamma + \varepsilon_{i,t} \quad (3)$$

The IPS test also considers the same hypothesis with the LLC test. The mathematical notation of the IPS test is as follows:

$$\Delta y_{i,t} = \rho^* y_{i,t-1} + \sum_{L=1}^{\rho_i} \delta_{iL} \Delta y_{i,t-L} + z_{i,t} \gamma + \varepsilon_{i,t} \quad (4)$$

Table 4 shows the results of LLC and IPS panel unit root tests for variables in the system. The null hypothesis indicating unit root cannot be rejected at the level of 10% significance. Once we look at the first differences, the null hypothesis is rejected at the level of 1% significance. For capital variable, LLC and IPS tests yield different results. The LLC test indicates that the null hypothesis at the level of the capital variable may be rejected at the level of 5% significance, whereas the IPS test shows that the null hypothesis can only be rejected if the first variance of the capital variable is taken. It can be seen that the null hypothesis for the export variable can be rejected at 1% significance level in both the LLC and IPS test results. The export variable is also stationary at 1% significance level.

**Table 4.** Results of Panel Unit Root Test.

| Variable   | LLC         | IPS         |
|------------|-------------|-------------|
| $y$        | 2.038       | 4.249       |
| $k$        | −2.216 **   | 5.531       |
| $l$        | 6.190       | 6.750       |
| $x$        | −5.012 ***  | −3.833 ***  |
| $\Delta y$ | −90.646 *** | −81.646 *** |
| $\Delta k$ | −10.036 *** | −14.412 *** |
| $\Delta l$ | −16.187 *** | −28.798 *** |

Note:  $\Delta$  represents difference operator. Estimates include a constant. LLC Maximum lag length is set to 4 with respect to SIC. \*\*\* and \*\* represent levels of significance at 1% and 5%, respectively.

#### 4.2. Regression Analysis: Panel Data Approach

To tackle the aggregation bias problem in panel data econometrics, parameter estimation should be done using heterogeneous panel time series estimators. One of the biggest advantages of heterogeneous panel time series estimators is that it is not important whether the variables in the model be integrated at I (0) or I (1), and therefore it is not necessary to investigate whether the variables are cointegrated (see, for example: Chudik Alexander and Tosetti 2011; Kapetanios et al. 2011; Pesaran and Tosetti 2011; Sadorsky 2014). In the panel data econometrics, mean group estimators are used in the recently developed heterogeneous coefficient time series approach. These estimators are: Mean Group (MG) estimator developed by Pesaran and Smith (1995), Estimator of Common Correlated Effects Mean Group (CCEMG) developed by Pesaran (2006) and Augmented Mean Group (AMG) estimators developed by (Eberhardt and Bond 2009; Eberhardt and Teal 2010; Bond and Eberhardt 2013). Eberhardt (2012), however, suggests that CCEMG and AMG predictors are more suitable for macro panels. Since our study is a micro panel, we estimate the parameters in Equation (2) with the MG estimator developed by Pesaran and Smith (1995). The relation presented in Equation (2) is a static panel data model. In this study, Equation (5), which is the dynamic version of Equation (2), will be estimated. The reason that dynamic models are more useful than static models is that the coefficients obtained from dynamic models are used to calculate short and long run elasticities and these elasticities provide useful information in policy implication.

$$y_{i,t} = \beta_{1i}y_{it-1} + \beta_{2i}k_{it} + \beta_{3i}l_{it} + \beta_{4i}x_{it} + v_i + e_{it} \quad (5)$$

Table 5 shows the MG estimator results for both the pooled panel and the sectors. In the pooled panel, the lagged growth coefficient was estimated at 0.270 and is significant at 1% level. In the pooled panel, coefficients for capital, labor and export variables are found respectively 0.409, 0.607 and 0.041. Also, they are significant at 1% level. In the agriculture and forestry sector, all of the lagged growth, capital, labor and export coefficient are significant at 1% significance level and their coefficient have respectively 0.450, 0.385, 0.430 and 0.084 values. For the fishery sector, lagged growth, capital, labor and export variables are estimated respectively as 0.263; 0.427; 0.689 and 0.022. Also, all the coefficients are significant at the 1% level. Similarly, all variables in the manufacturing industry are significant at the 1% significance level. In this sector the lagged growth rate, capital, labor and export coefficients are respectively calculated as 0.291, 0.366, 0.516 and 0.072. The coefficients for lagged growth, capital, labor and export variables which are significant at 1% level in electricity, gas and water sector are estimated as 0.217, 0.433, 0.799 and 0.018, respectively. The lagged growth, capital and labor coefficients, which are significant at the 1% significance level for the wholesale and retail trade sectors, are calculated as 0.237, 0.420 and 0.648, respectively. The export coefficient in this sector is estimated at 0.035, which are significant at the level of 10%. The lagged growth, capital and labor coefficients for real estate, renting and business activities sector are estimated at 0.220, 0.462 and 0.738, respectively which are significant at the 1% significance level. Export coefficient is estimated at 0.004 and insignificant even at the 10% level. In other community, social and personal service activities sector, the lagged growth, capital, labor coefficients are estimated 0.200, 0.471 and 0.691, respectively which are significant at the level of 1%. The coefficient for the export variable is 0.008, which is insignificant at the 10% level.

Short and long-term elasticities can be calculated using the findings obtained from the MG estimator. Accordingly, the coefficients obtained from the MG estimator in Table 5 can be interpreted as direct short-term elasticities. Long run elasticities can also be calculated from the data in the table. Table 6 reflects the short and long-term growth elasticities. Capital elasticity in the short term varies between 0.308 and 0.471. In the pooled panel, the short run capital elasticity is 0.409. This finding reveals that as long as the capital ratio increases, growth will also increase consistent with the Neoclassical production function, Learning by Doing Model by Arrow (1962), Human Capital Model by Lucas (1988) and R & D Growth Model by Rivera-Batiz and Romer (1991). Moreover, while the sector with the greatest capital elasticity in the short term is the other community, social and personal

service activities sector, the mining and the quarrying sector has the lowest. Long-run capital elasticity varies between 0.427 and 0.700. In the pooled panel, the long-run capital elasticity is calculated as 0.560. This finding, in line with the theoretical and empirical literature, implies that increases in capital inputs will increase growth in the long run. In addition, while the sector with the greatest capital elasticity in the long run is the agriculture and forestry sector, the sector with the lowest elasticity is mining and quarrying. According to these results, mining and quarrying is the sector with the lowest capital elasticity in both the short and long term. The main reason for this situation is that the production in this sector is largely dependent to nature resources rather than inputs such as labor and capital. An increase in capital in the personal and social services sector, which is highly sensitive to capital, increases the growth in the short term more than in other sectors. In the long run, an increase in capital in the agriculture and forestry sector contributes to the growth more.

**Table 5.** Results of Mean Group (MG) Estimator.

| Cross Section   | $y(-1)$   | $k$       | $l$       | $x$       |
|---|-----------|-----------|-----------|-----------|
| Pooled Panel  | 0.270 *** | 0.409 *** | 0.607 *** | 0.041 *** |
| Agriculture and Forestry                                | 0.450 *** | 0.385 *** | 0.430 *** | 0.084 *** |
| Fishery   | 0.263 *** | 0.427 *** | 0.689 *** | 0.022 *** |
| Mining and Quarrying                                    | 0.279 *** | 0.308 *** | 0.348 *** | 0.084 *** |
| Manufacturing   | 0.291 *** | 0.366 *** | 0.516 *** | 0.072 *** |
| Electricity, Gas and Water Supply                       | 0.217 *** | 0.433 *** | 0.799 *** | 0.018 *** |
| Wholesale and Retail Trade                              | 0.237 *** | 0.420 *** | 0.648 *** | 0.035 *   |
| Real Estate, Renting and Business Activities            | 0.220 *** | 0.462 *** | 0.738 *** | 0.004     |
| Other Community, Social and Personal Service Activities | 0.200 *** | 0.471 *** | 0.691 *** | 0.008     |

Note: Estimates consist constant term. \*\*\* and \* represent levels of significance at 1% and 10%, respectively.

**Table 6.** Growth Elasticities.

| Cross Section   | Short Term |       |       | Long Term |       |       |
|---|------------|-------|-------|-----------|-------|-------|
|   | $k$        | $l$   | $x$   | $k$       | $l$   | $x$   |
| Pooled Panel  | 0.409      | 0.607 | 0.041 | 0.560     | 0.831 | 0.056 |
| Agriculture and Forestry                                | 0.385      | 0.430 | 0.084 | 0.700     | 0.781 | 0.152 |
| Fishery   | 0.427      | 0.689 | 0.022 | 0.579     | 0.934 | 0.029 |
| Mining and Quarrying                                    | 0.308      | 0.348 | 0.084 | 0.427     | 0.482 | 0.116 |
| Manufacturing   | 0.366      | 0.516 | 0.072 | 0.516     | 0.727 | 0.101 |
| Electricity, Gas and Water Supply                       | 0.433      | 0.799 | 0.018 | 0.553     | 1.020 | 0.022 |
| Wholesale and Retail Trade                              | 0.420      | 0.648 | 0.035 | 0.550     | 0.849 | 0.045 |
| Real Estate, Renting and Business Activities            | 0.462      | 0.738 | 0.004 | 0.592     | 0.946 | 0.005 |
| Other Community, Social and Personal Service Activities | 0.471      | 0.691 | 0.008 | 0.588     | 0.863 | 0.010 |

According to Table 6, the short-run elasticity of labor varies between 0.348 and 0.799. In the pooled panel the short-term capital elasticity is 0.607. This finding is consistent with Neoclassical production function. This finding reveals that as long as the labor ratio increases, growth will also increase. This finding is consistent with Learning by Doing Model by Arrow (1962), Human Capital Model by Lucas (1988), R & D Growth Model by Rivera-Batiz and Romer (1991), Neoclassical production function. Moreover, while the sector with the greatest labor elasticity in the short-term growth is the electricity, gas and water sector, the mining and the quarrying sector has been the least. Long-run labor elasticity varies between 0.482 and 1.020. In pooled panel, long run labor elasticity is calculated as 0.831. This finding, in line with the theory and the empirical literature, indicates that in the long run the increases in labor input will increase growth. Moreover, the sector with the greatest amount of labor elasticity in the long run is the electricity, gas and water supply sector; the mining and quarrying sector has been the least. The increase in the labor force in the electricity, gas and water supply sector is the biggest contributor to growth. In the case of capital, the sector with the least capital elasticity in both the short and long term has been mining and quarrying.

The empirical evidence that exports positively affect economic growth in Turkey is provided by the MG estimator for the pooled panel. This finding suggests that export led growth hypothesis is valid in the Turkish economy at the macro level. Accordingly, the export elasticity of growth in Turkey in the short term was calculated as 0.041, which indicates that the 1% increase in exports will increase the growth by 0.041%. The sectoral export elasticity of growth in the short-term is calculated as 0.084 in the agriculture and forestry sector, 0.022 in the fishery sector, 0.084 in mining and quarrying, 0.072 in the manufacturing industry, 0.018 in electricity gas and water supply, and 0.035 in wholesale and retail trade. Even though export elasticity of growth in the real estate, rental and business sectors as well as other community, social and personal service activity sectors is positive, the estimated coefficients of the export variable are not statistically significant at 10% significance level in these sectors. Therefore, it can be interpreted that the growth in these two sectors is not sensitive to exports in the short term.

#### 4.3. Cointegration

In panel data econometrics Pedroni (1999) cointegration test is the commonly used one. The procedure consists of seven statistics for the test of the null of no cointegration against the alternative of cointegration. Four out of seven statistics (panel v, panel rho, panel PP and panel ADF) pertain to the within dimension test; the remainder of the statistics (group rho, group PP and group ADF) pertain to the between dimension test.

Table 7 presents the results of the cointegration test. Both the results of within group and between group cointegration tests reveal the rejection of the null hypothesis indicating no cointegration. Therefore, we can conclude that the variables are cointegrated.

**Table 7.** Pedroni's Cointegration Results.

| Dimension                         | Test      | Result             |
|-----------------------------------|-----------|--------------------|
| Within group cointegration tests  | Panel-v   | 2.498 [0.00] ***   |
|                                   | Panel-rho | −14.741 [0.00] *** |
|                                   | Panel-pp  | −14.540 [0.00] *** |
|                                   | Panel-ADF | −2.402 [0.00] ***  |
| Between group cointegration tests | Grup-rho  | −15.017 [0.00] *** |
|                                   | Grup-pp   | −17.335 [0.00] *** |
|                                   | Grup-ADF  | −2.089 [0.01] **   |

The tests are carried out with 4 lags. Figures in the brackets are  $p$ -values. \*\*\* and \*\* represent levels of significance at 1% and 5%, respectively.

#### 4.4. Causality

Standard causality tests do not provide cross sectional results in heterogeneous panel data models. Thus, Dumitrescu and Hurlin (2012) propose a simple non-causality test for testing Granger (1969) causality in heterogeneous panel data models, which is shown as follows:

$$y_{it} = \alpha_i + \sum_{k=1}^K \gamma_i^{(k)} y_{i,t-k} + \sum_{k=1}^K \beta_i^{(k)} x_{i,t-k} + \varepsilon_{i,t} \quad (6)$$

where  $y$  and  $x$  represent growth and exports, respectively. The approach uses an average Wald and tests the null of homogeneous non-causality from exports to growth against the alternative of causality from exports to growth for at least one cross-section. Compared to traditional causality tests, this test has a great number of advantages, including, for example: (i) the test fits well even with smaller size in terms of time and cross-section dimension; (ii) the test depends on cross section average of Wald statistics without estimating any particular panel regression; (iii) the test fits well for unbalanced panels as well as for the panels with different lag order for each cross section.



Table 8 demonstrates the causality results of the Dumitrescu and Hurlin test<sup>4</sup>. Test results indicate unidirectional causality from export to economic growth for (i) agriculture and forestry; (ii) fishery; (iii) electricity, gas and water supply sectors and (iv) other community, social and personal service activities whereas unidirectional causality from growth to export is found in the case of mining and quarrying. In addition, causality findings show bidirectional in (i) manufacturing; (ii) wholesale and retail trade; and (iii) real estate, renting and business activities sectors.

**Table 8.** Causality Results.

| Sectors   | $x \rightarrow y$ | $y \rightarrow x$ |
|---|-------------------|-------------------|
| Agriculture and Forestry                                | 63.276 [0.00] *** | 0.825 [0.36]      |
| Fishery   | 20.908 [0.00] *** | 1.760 [0.18]      |
| Mining and Quarrying                                    | 1.474 [0.22]      | 12.454 [0.00] *** |
| Manufacturing   | 4.285 [0.03] **   | 20.142 [0.00] *** |
| Electricity, Gas and Water Supply                       | 3.970 [0.04] **   | 0.343 [0.55]      |
| Wholesale and Retail Trade                              | 12.467 [0.00] *** | 3.560 [0.05] *    |
| Real Estate, Renting and Business Activities            | 8.901 [0.00] ***  | 3.031 [0.08] *    |
| Other Community, Social and Personal Service Activities | 5.903 [0.01] **   | 0.845 [0.35]      |

Figures are reported using Wald statistics. Figures in the brackets are  $p$ -values. \*\*\*, \*\* and \* represent levels of significance at 1%, 5% and 10%, respectively.

## 5. Concluding Remarks

In this study, export-led growth hypothesis is analyzed at the micro-scale in Turkey. Two hypotheses have been proposed in this framework. The first is “exports will affect growth in the micro-base as well as in the macro-base”. As these effects may change with respect to the export and production potential of the relevant sector, the second hypothesis is “sectors that increase export volume more will contribute to economic growth more”. To test these hypotheses, the impact of eight different sectors’ export volumes on economic growth is analyzed using quarterly data covering the period 2000–2015 by employing the MG estimator.

Findings provide some useful information in terms of policy implications. Export incentive policies will contribute positively to economic growth. Although the largest share in the sectoral composition of exports belongs to the manufacturing industry, increases in export level in the agriculture and forestry, and mining and quarrying sectors enhance economic growth more than the manufacturing industry. Therefore, export promotion policies in the agriculture and mining sectors will have a larger effect on the growth than the effect created by the manufacturing industry. This finding is consistent with [Khalafalla and Webb \(2001\)](#), which has resulted in the primary export of goods having a greater impact on growth than manufacturing industry exports in Malaysia, which is a developing country like Turkey. This can be explained by the fact that the agriculture and mining sectors are the two main sectors that provide raw materials to the manufacturing industry. Therefore, the increase in production in these two sectors will contribute to the manufacturing industry, whose production is largely based on imported raw materials, due to the inadequacy of domestic resources. Import of energy is in the first place among imported raw materials. In particular, the incentives to evaluate the current potential of the mining and quarrying sector will increase mining production, especially energy production. Therefore, imports of intermediate goods in manufacturing industry will decrease.

Except for exports, the coefficients of the estimated control variables also provide some important data. For all sectors, the estimated coefficient on the labor variable is greater than that of capital

<sup>4</sup> Table 8 reports the causality results only for the first lag. Testing the robustness of the results to different lag lengths, however, is very crucial especially with the quarterly data. Even though they are not reported herein, causality results with respect to four lags can be found in the Appendix.

variable. This finding reveals that the increases in labor input increase economic growth more than the increases in capital input. This finding is also confirmed for all sectors. This result is quite consistent with Alam (2003) and Cuernasma and Wörz (2005), in which the validity of Neo-classical origin-export led growth hypothesis is analyzed in Mexico and 45 developed and developing countries, respectively. Although the impact of labor on growth in Turkey is greater than the effect of capital on growth, technology (capital) intensive policies should be implemented rather than labor intensive policies. In this context, technology-intensive production with a higher added value will lead to a higher growth rate. In addition, findings from the MG estimator show that growth elasticity of labor is elastic in the electricity, gas and water supply sector. Further increases in the input of labor lead to an additional increase in the production level of this sector. This finding can be explained by the need for a large infrastructure in terms of distribution and storage activities of the electricity, gas and water sector. Infrastructure necessity of the sector is directly related to the construction sector which is labor intensive.

The findings indicate that growth contribution of the exports in real estate, renting and business activities sector and other community, social and personal service activities sector is very low. In fact, the impact of exports on growth in these sectors is generally statistically insignificant. The relative insignificance of both sectors in the sectoral export composition is likely to explain the finding.

Micro findings are consistent with Abu-Quarn and Abu-Bader (2004), Kurt and Terzi (2007), and Yaprakli (2007) who conclude that the export-led growth hypothesis is found to be valid in the manufacturing sector of Turkey. Moreover, in the manufacturing industry findings are consistent with Parida and Sahoo (2007), Ghatak et al. (1997), Herzer et al. (2006), Cuernasma and Wörz (2005), Cipamba (2012), Shakouri and Yazdi (2012), and Shafiullah et al. (2017) in the case of countries other than Turkey. In the case of the fishery sector, findings of this study have results consistent with those by Duc and Tram (2011) in Vietnam. In the case of the agriculture sector, findings are consistent with Hennebery and Khan (2000), who report validity of export led growth hypothesis in Pakistan, Uddin (2015), who confirm the export led growth hypothesis in Bangladesh, and Shafiullah et al. (2017), who examine Australia. In the case of the mining sector, results match Ciftcioglu and Nekhili (2005) who support validity export led growth hypothesis in Turkey, Cipamba (2012). who investigates South Africa, Shakouri and Yazdi (2012), who confirms validity of export led growth hypothesis in Iran, and Shafiullah et al. (2017), who validate validity of export led growth hypothesis in Australia.

Finally, empirical findings can be evaluated in terms of the aforementioned hypotheses. The findings verify the hypothesis that “exports will affect growth in micro-base as well as macro-base”. The hypothesis that “sectors that increase export volume more will contribute to economic growth more” is also confirmed to be in line with the empirical results.

In this study, Dumitrescu and Hurlin’s causality test is also employed. Test results indicate the validity of the export-led growth hypothesis for (i) agriculture and forestry; (ii) fishery; (iii) electricity, gas and water supply sectors and (iv) other community, social and personal service activities whereas growth-led export hypothesis is valid in the case of mining and quarrying. In addition, causality findings support the feedback hypothesis in (i) manufacturing; (ii) wholesale and retail trade; and (iii) real estate, renting and business activities sectors. The results based on different lag lengths show that causal hypotheses are sensitive to the lag specifications. Given these findings, this study underlines the importance of lag specification in determining the causality between exports and growth.

In the case of Turkey, the findings of the causality test are consistent with Akbulut and Terzi (2013) and Onder and Hatirli (2014) who confirm a bidirectional relationship between export and growth in the manufacturing industry.

Although the main motivation of the study depends on the estimation of the slope coefficients through the panel regression approach, we also employ causality for robustness purpose. Once the results obtained from two procedures are compared, the majority of the sectors produce consistent results. In the case of some sectors, however, this study reveals that findings might be volatile across the empirical approach.

It is possible to make some suggestions for the researchers who will work on similar issues in the future. First, this study analyzes the effects of sectoral exports on growth using a Neoclassical production function. Upcoming studies could analyze the effect of exports on growth by using internal growth models. Second, the analysis period can be divided into two sub-periods in order to see the impact of the 2008 financial crisis.

**Acknowledgments:** This paper is derived from a dissertation entitled “A New Approach to Export-Led Growth Hypothesis: A Sectoral Evidence from Turkish Economy” written by Ebru Topcu under the supervision of Professor Alper Aslan.

**Author Contributions:** Both authors contributed equally to the paper.

**Conflicts of Interest:** The authors declare no conflict of interest.

## Appendix A

| Lag Length  | Sectors                                      | $x \rightarrow y$ | $y \rightarrow x$ |
|---|--|-------------------|-------------------|
| $k = 1$   | Agriculture and Forestry                     | 63.276 [0.00] *** | 0.825 [0.36]      |
|   | Fishery                                      | 20.908 [0.00] *** | 1.760 [0.18]      |
|   | Mining and Quarrying                         | 1.474 [0.22]      | 12.454 [0.00] *** |
|   | Manufacturing                                | 4.285 [0.03] **   | 20.142 [0.00] *** |
|   | Electricity, Gas and Water Supply            | 3.970 [0.04] **   | 0.343 [0.55]      |
|   | Wholesale and Retail Trade                   | 12.467 [0.00] *** | 3.560 [0.05] *    |
|   | Real Estate, Renting and Business Activities | 8.901 [0.00] ***  | 3.031 [0.08] *    |
| Other Community, Social and Personal Service Activities | 5.903 [0.01] **                              | 0.845 [0.35]      |                   |
| $k = 2$   | Agriculture and Forestry                     | 59.793 [0.00] *** | 61.795 [0.00] *** |
|   | Fishery                                      | 23.561 [0.00] *** | 30.171 [0.00] *** |
|   | Mining and Quarrying                         | 0.743 [0.68]      | 16.398 [0.00] *** |
|   | Manufacturing                                | 3.534 [0.17]      | 36.582 [0.00] *** |
|   | Electricity, Gas and Water Supply            | 3.654 [0.16]      | 2.527 [0.28]      |
|   | Wholesale and Retail Trade                   | 14.240 [0.00] *** | 7.422 [0.02] **   |
|   | Real Estate, Renting and Business Activities | 9.896 [0.00] ***  | 3.033 [0.21]      |
| Other Community, Social and Personal Service Activities | 6.637 [0.03] **                              | 0.844 [0.65]      |                   |
| $k = 3$   | Agriculture and Forestry                     | 37.357 [0.00] *** | 13.350 [0.00] *** |
|   | Fishery                                      | 14.788 [0.00] *** | 5.708 [0.12]      |
|   | Mining and Quarrying                         | 10.855 [0.01] **  | 2.908 [0.40]      |
|   | Manufacturing                                | 4.352 [0.22]      | 1.732 [0.62]      |
|   | Electricity, Gas and Water Supply            | 8.807 [0.03] **   | 1.188 [0.75]      |
|   | Wholesale and Retail Trade                   | 12.398 [0.00] *** | 0.749 [0.86]      |
|   | Real Estate, Renting and Business Activities | 11.971 [0.00] *** | 0.329 [0.95]      |
| Other Community, Social and Personal Service Activities | 8.450 [0.03] **                              | 1.161 [0.76]      |                   |
| $k = 4$   | Agriculture and Forestry                     | 1.071 [0.89]      | 10.886 [0.02] **  |
|   | Fishery                                      | 12.733 [0.01] **  | 4.795 [0.30]      |
|   | Mining and Quarrying                         | 8.350 [0.07] *    | 1.598 [0.80]      |
|   | Manufacturing                                | 6.641 [0.15]      | 1.535 [0.82]      |
|   | Electricity, Gas and Water Supply            | 5.212 [0.26]      | 1.522 [0.82]      |
|   | Wholesale and Retail Trade                   | 11.653 [0.02] **  | 0.617 [0.96]      |
|   | Real Estate, Renting and Business Activities | 12.502 [0.01] **  | 0.275 [0.99]      |
| Other Community, Social and Personal Service Activities | 7.749 [0.10]                                 | 1.312 [0.85]      |                   |

Figures are reported using Wald statistics. Figures in the brackets are  $p$ -values. \*\*\*, \*\* and \* represents levels of significance at %1, %5 and %10, respectively.

## References

- Abu-Quarn, Aamer S., and Suleiman Abu-Bader. 2004. The validity of the ELG hypothesis in the MENA region: Cointegration and error correction model analysis. *Applied Economics (Taylor & Francis Journals)* 36: 1685–95.
- Akbulut, Seval, and Harun Terzi. 2013. Analysis based on export growth by sectors in Turkey (Türkiye’de ihracata dayalı büyümenin sektörler itibarıyla analizi). *Karadeniz Teknik Üniversitesi Sosyal Bilimler Dergisi* 3: 43–58.
- Alam, M. Imam. 2003. Manufactured exports, capital good imports, and economic growth: Experience of Mexico and Brazil. *International Economic Journal* 17: 85–105. [[CrossRef](#)]

- Arrow, Kenneth J. 1962. The economic implications of learning by doing. *The Review of Economic* 29: 155–73. [CrossRef]
- Awokuse, Titus O. 2005. Export-led growth and the Japanese economy: Evidence from VAR and directed acyclic graphs. *Applied Economics Letters* 12: 849–58. [CrossRef]
- Awokuse, Titus O. 2008. Trade openness and economic growth: Is growth export-led or import-led? *Applied Economics* 40: 161–63. [CrossRef]
- Awokuse, Titus O., and Dimitris K. Christopoulos. 2009. Nonlinear dynamics and the exports–output growth nexus. *Economic Modelling* 26: 184–90. [CrossRef]
- Balassa, Bela. 1978. Exports and economic growth: Further evidence. *Journal of Development Economics* 5: 181–89. [CrossRef]
- Balassa, Bela. 1981. *The Newly Industrializing Countries in the World Economy*. New York: Pergamon Press.
- Balassa, Bela. 1982. *Development Strategies in Semi-Industrialized Economies*. New York: Oxford University Press.
- Balassa, Bela. 1985. Exports, policy choices and economic growth in developing countries after the 1973 oil shock. *Journal of Development Economics* 18: 23–25. [CrossRef]
- Baldwin, Richard E. 1992. Measurable dynamic gains from trade. *Journal of Political Economy* 100: 162–74. [CrossRef]
- Ben-David, Dan, and Michael B. Loewy. 2003. Trade and the neoclassical growth model. *Journal of Economic Integration* 18: 1–16. [CrossRef]
- Bhagwati, Jagdish N. 1988. Export-promoting trade strategy: Issues and evidence. *World Bank Research Observer* 3: 27–57. [CrossRef]
- Biswal, Bagala, and Urvashi Dhawan. 1998. Export-led growth hypothesis: Cointegration and causality analysis for Taiwan. *Applied Economics Letters* 5: 699–701. [CrossRef]
- Bond, Steve R., and Markus Eberhardt. 2013. Accounting for Unobserved Heterogeneity in Panel Time Series Models. Nuffield College, University of Oxford. Unpublished mimeo.
- Chow, Peter C. Y. 1987. Causality between export growth and industrial development: Empirical evidence from newly industrialized countries. *Journal of Development Economics* 28: 265–76. [CrossRef]
- Chudik Alexander, M. Hashem Pesaran, and Elisa Tosetti. 2011. Weak and strong cross-section dependence and estimation of large panels. *The Econometrics Journal* 14: 45–90. [CrossRef]
- Ciftcioglu, Serhan, and Ramzi Nekhili. 2005. New evidence for exports-led growth, tradables-led-growth, and manufacturing-led growth: Causality test results for Turkey. *Latin American Journal of Economic Development* 5: 135–42.
- Cipamba, Paul Cipamba WA. 2012. *A Cointegration Analysis of Sectoral Export Performance and Economic Growth in South Africa*. Cape Town: University of the Western Cape.
- Cuerasma, Jesús Crespo, and Julia Wörz. 2005. On export composition and growth. *Review of World Economics* 141: 33–49.
- Darrat, Ali F. 1986. Trade and development: The Asian experience. *Cato Journal* 6: 695–99.
- Dhawan, Urvashi, and Bagala Biswal. 1999. Re-examining export-led growth hypothesis: A multivariate cointegration analysis for India. *Applied Economics* 31: 525–30. [CrossRef]
- Duc, Nguyen Minh, and Nguyen Anh Tram. 2011. Relationship between sectoral exports and economic growth—a time series econometric analysis for Vietnamese fishery sector 1997–2008. Available online: [http://www2.hcmuaf.edu.vn/data/nmduc/VN%20fish%20export%20contribute%20to%20GDP%20submitted\(1\).pdf](http://www2.hcmuaf.edu.vn/data/nmduc/VN%20fish%20export%20contribute%20to%20GDP%20submitted(1).pdf) (accessed on 28 November 2016).
- Dumitrescu, Elena-Ivona, and Christophe Hurlin. 2012. Testing for Granger non-causality in heterogeneous panels. *Economic Modelling* 29: 1450–60. [CrossRef]
- Eberhardt, Markus. 2012. Estimating panel time-series models with heterogeneous slopes. *Stata Journal* 12: 61–71.
- Eberhardt, Markus, and Stephen Bond. 2009. Cross-Section dependence in Nonstationary Panel Models: A Novelestimator. Munich Personal RePEc Archive Working paper No. 17870. Munich Personal RePEc Archive, Munich, Germany.
- Eberhardt, Markus, and Francis Teal. 2010. Productivity Analysis in Global Manufacturing Production. Economics Series Working papers 515. Oxford: Department of Economics, University of Oxford.
- Ee, Chia Yee. 2016. Export-led growth hypothesis: Empirical evidence from selected Sub-Saharan African countries. *Procedia Economics and Finance* 35: 232–40. [CrossRef]
- Fajana, Olufemi. 1979. Trade and growth: The Nigerian experience. *World Development* 7: 73–78. [CrossRef]

- Feder, Gershon. 1982. On exports and economic growth. *Journal of Development Economics* 12: 59–73. [[CrossRef](#)]
- Ghatak, Subrata, Chris Milner, and Utku Utkulu. 1997. Exports, export composition and growth: Cointegration and causality evidence for Malaysia. *Applied Economics* 29: 213–23. [[CrossRef](#)]
- Granger, Clive. 1969. Investigating causal relations by econometric models and cross spectral methods. *Econometrica* 37: 424–38. [[CrossRef](#)]
- Granger, Clive, and Newbold Paul. 1974. Spurious regressions in econometrics. *Journal of Econometrics* 2: 111–20. [[CrossRef](#)]
- Gundlach, Erich. 2007. The Solow model in the empirics of growth and trade. *Oxford Review of Economic Policy* 23: 25–44. [[CrossRef](#)]
- Hatemi-J, Abdunnasser. 2002. Export performance and economic growth nexus in Japan: A bootstrap approach. *Japan and the World Economy* 14: 25–33. [[CrossRef](#)]
- Hatemi-J, Abdunnasser, and Irandoust Manuchehr. 2000. Time-series evidence for Balassa's export-led growth hypothesis. *The Journal of International Trade & Economic Development* 9: 355–65.
- Heller, Peter S., and Richard C. Porter. 1978. Exports and growth: An empirical re-investigation. *Journal of Development Economics* 5: 191–93. [[CrossRef](#)]
- Hennebery, Shida R., and Muhammed E. Khan. 2000. An analysis of the linkage between agricultural exports and economic growth in Pakistan. *Journal of International Food & Agribusiness Marketing* 10: 13–29.
- Herzer, Dierk, Felicitas Nowak-Lehmann, and Boriss Siliverstovs. 2006. Export-led growth in Chile: Assessing the role of export composition in productivity growth. *The Developing Economies* 43: 306–28. [[CrossRef](#)]
- Hossain, Mohammad, and Neil D. Karunaratne. 2004. Exports and economic growth in Bangladesh: Has manufacturing exports become a new engine of export-led growth? *The International Trade Journal* 18: 303–34. [[CrossRef](#)]
- Hsiao, Mei-chu W. 1987. Tests of causality and exogeneity between exports and economic growth: The case of Asian NICs. *Journal of Economic Development* 12: 143–59.
- Im, Kyung So, M. Hashem Pesaran, and Yongcheol Shin. 2003. Testing for unit roots in heterogeneous panels. *Journal of Econometrics* 115: 53–74. [[CrossRef](#)]
- Jung, Woo S., and Peyton J. Marshall. 1985. Export growth and causality in developing countries. *Journal of Development Economics* 18: 1–12. [[CrossRef](#)]
- Kapetanios, George, Hashem M. Pesaran, and Takashi Yamagata. 2011. Panels with non-stationary multi factor error structures. *Journal of Econometrics* 160: 326–48. [[CrossRef](#)]
- Kavoussi, Rostam M. 1984. Export expansion and economic growth: Further empirical evidence. *Journal of Development Economics* 14: 241–50. [[CrossRef](#)]
- Khalafalla, Khalid Yousif, and Alan J. Webb. 2001. Export-led growth and structural change: Evidence from Malaysia. *Applied Economics* 33: 1703–15. [[CrossRef](#)]
- Kónya, Laszlo. 2004. Export-led growth, growth-driven export, both or none? Granger causality analysis on OECD countries. *Applied Econometrics and International Development* 4: 73–94.
- Kravis, Irving B. 1970. Trade as a handmaiden of growth: Similarities between the nineteenth and twentieth centuries. *The Economic Journal* 80: 850–72. [[CrossRef](#)]
- Kristjanpoller, R. Werner, and Josephine E. Olson. 2014. Economic Growth in Latin American Countries: Is It Based on Export-Led or Import-Led Growth? *Emerging Markets Finance and Trade* 50: 6–20.
- Krueger, Anne O. 1978. Foreign Trade Regimes and Economic Development: Liberalization Attempts and Consequences (Cambridge Balinger). *Weltwirtschaftliches Archiv* 114: 834–36.
- Kurt, Serdar, and Harun Terzi. 2007. The relationship among foreign trade of manufacturing industry, productivity and economic growth (İmalat sanayi dış ticareti, verimlilik ve ekonomik büyüme ilişkisi). *Atatürk Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi* 21: 25–46.
- Levin, Andrew, Chien-Fu Lin, and Chia-Shang James Chu. 2002. Unit root tests in panel data: Asymptotic and finite sample properties. *Journal of Econometrics* 108: 1–24. [[CrossRef](#)]
- Lucas, Robert E. 1988. On the mechanics of the economic developments. *Journal of Monetary Economics* 22: 3–42. [[CrossRef](#)]
- Michaely, Michael. 1977. Exports and growth: An empirical investigation. *Journal of Development Economics* 4: 49–53. [[CrossRef](#)]

- Onder, Kubra, and Selim Adem Hatirli. 2014. Economic analysis of the relationship between manufacturing industry export and economic growth in Turkey (Türkiye’de imalat sanayi ihracatı ve büyüme ilişkisinin iktisadi analizi). *Journal of Yasar University* 9: 5851–69. [CrossRef]
- Parida, Puena C., and Pravakar Sahoo. 2007. Export-led growth in South Asia: A panel cointegration analysis. *International Economic Journal* 21: 155–75. [CrossRef]
- Pedroni, Peter. 1999. Critical values for cointegration tests in heterogeneous panels with multiple regressors. *Oxford Bulletin of Economics and Statistics* 61: 653–70. [CrossRef]
- Pesaran, M. Hashem. 2006. Estimation and inference in large heterogeneous panels with a multifactor error structure. *Econometrica* 74: 967–1012. [CrossRef]
- Pesaran, M. Hashem, and Ron Smith. 1995. Estimating long-run relationships from dynamic heterogeneous panels. *Journal of Econometrics* 68: 79–113. [CrossRef]
- Pesaran, M. Hashem, and Elisa Tosetti. 2011. Large panels with common factors and spatial correlation. *Journal of Econometrics* 161: 182–202. [CrossRef]
- Ram, Rati. 1985. Exports and economic growth: Some additional evidence. *Economic Development and Cultural Change* 33: 415–25. [CrossRef]
- Ram, Rati. 1987. Exports and economic growth in developing countries: Evidence from timeseries and cross-section data. *Economic Development and Cultural Change* 36: 51–72. [CrossRef]
- Rivera-Batiz, Luis A., and Paul M. Romer. 1991. *International Trade with Endogenous Technological Change*. NBER Working Papers Series. Working paper No. 3594. National Bureau of Economic Research, Cambridge, MA, USA.
- Sadorsky, Perry. 2014. The effect of urbanization on CO<sub>2</sub> emissions in emerging economies. *Energy Economics* 41: 147–53. [CrossRef]
- Sahoo, Auro Kumar, Dukhabandhu Sahoo, and Naresh Chandra Sahu. 2014. Mining export, industrial production and economic growth: A cointegration and causality analysis for India. *Resources Policy* 42: 27–34. [CrossRef]
- Salvatore, Dominick. 1983. A simultaneous equations model of trade and development with dynamic policy simulations. *Kyklos* 36: 66–90.
- Sandalcilar, Ali Rıza. 2012. A causality analysis of relationship among agricultural export, non-agricultural export and economic growth for Turkey (Türkiye’de tarımsal ihracat, tarım dışı ihracat ve ekonomik büyüme arasındaki ilişkinin nedensellik analizi). *Finans Politik ve Ekonomik Yorumlar Dergisi* C49: 65–76.
- Sentsho, Joel. 2000. *Export Revenue as a Determinant of Economic Growth: Evidence from Botswana*. Department of Economics Research paper. Gaborone: University of Botswana, pp. 1–16.
- Shafiullah, Muhammad, Saroja Selvanathan, and Athula Naranpanawa. 2017. The role of export composition in export-led growth in Australia and its regions. *Economic Analysis and Policy* 53: 62–76. [CrossRef]
- Shakouri, Bahram, and Soheila Khoshnevis Yazdi. 2012. Granger causality relationship between mining exports and GDP growth in Iran. *Australian Journal of Basic and Applied Sciences* 6: 429–35.
- Shan, Jordan, and Fiona Sun. 1998. On the export-led growth hypothesis: The econometric evidence from China. *Applied Economics* 30: 1055–65. [CrossRef]
- Shan, Jordan, and Fiona Sun. 1999. Export-led growth and the US economy: Some further testing. *Applied Economics Letters* 6: 169–72. [CrossRef]
- Sharma, Subhash C., Mary Norris, and Daniel Wai-wah Cheung. 1991. Exports and economic growth in industrialized countries. *Applied Economics* 23: 697–708. [CrossRef]
- Sjarif, Indra Nurcahyo, Koji Kotani, and Ching-Yang Lin. 2011. Exports and economic growth in Indonesia’s fishery sub-sector: Cointegration and error-correction models. *Economics & Management Series* 16: 1–13.
- Tang, Chor Foon, Yew Wah Lai, and Ilhan Ozturk. 2015. How stable is the export-led growth hypothesis? Evidence from Asia’s Four Little Dragons. *Economic Modelling* 44: 229–35. [CrossRef]
- Turkish Exporters Assembly (TEA). 2016. Economy and Foreign Trade Report. Available online: [http://www.tim.org.tr/files/downloads/Raporlar/Tim\\_Ekonomi\\_Raporu\\_2016.pdf](http://www.tim.org.tr/files/downloads/Raporlar/Tim_Ekonomi_Raporu_2016.pdf) (accessed on 15 September 2016).
- Thornton, John. 1996. Cointegration, causality and export-led growth in Mexico. *Economic Letters* 50: 413–16. [CrossRef]
- Toyin, Megbowon Ebenezer. 2016. Causality relationship between agricultural exports and economic growth: Evidence from South Africa. *Journal of Social Sciences* 48: 129–36. [CrossRef]
- Tyler, William G. 1981. Growth and export expansion in developing countries. *Journal of Development Economics* 9: 121–30. [CrossRef]

- Uddin, Mirza Md. Moyen. 2015. Causal relationship between agriculture, industry and services sector for GDP growth in Bangladesh: An econometric investigation. *Journal of Poverty, Investment and Development* 8: 124–29.
- Williamson, Robert B. 1978. The role of exports and foreign capital in Latin American economic growth. *Southern Economic Journal* 45: 410–20. [[CrossRef](#)]
- Yaprakli, Sevda. 2007. Causality between exports and economic growth: An econometric analysis on Turkey (İhracat ile ekonomik büyüme arasındaki nedensellik: Türkiye üzerine ekonometrik bir analiz). *ODTÜ Gelişme Dergisi* 34: 97–112.



© 2018 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<http://creativecommons.org/licenses/by/4.0/>).

© 2018. This work is licensed under <http://creativecommons.org/licenses/by/4.0/> (the “License”). Notwithstanding the ProQuest Terms and Conditions, you may use this content in accordance with the terms of the License.