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The relationship between Greek exports and foreign income

Konstantinos Chisiridis and Theodore Panagiotidis

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Department of Economics, University of Macedonia, 156 Egnatia str, 540 06 Thessaloniki, Greece, Fax: + 30 (0) 2310 891292
The Relationship Between Greek Exports and Foreign Income

Konstantinos Chisiridis
Department of Economics, University of Macedonia, email: k.chisiridis@gmail.com

Theodore Panagiotidis
Department of Economics, University of Macedonia, email: tpanag@uom.gr

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Abstract

This paper assesses the effect of foreign economic activity on Greek exports. We employ data from 1995:I to 2016:IV and quantify the long-run foreign income elasticity of Greek exports. We establish a cointegration relationship and employ Dynamic OLS estimations. We find that the aggregate foreign income elasticity of Greek exports is positive and significant. When foreign income is decomposed to the main trading partners, we reveal that economic growth in Turkey and in emerging markets such as the Balkans, North Africa and the Middle East have the greatest impact on Greek exports. The impact of the traditional European trading partners of Greece (Germany and Italy) are found to be positive but insignificant. Finally, the dynamic analysis shows a positive interaction between real income growth in Turkey and Greek export growth at the short-run horizon.
1 Introduction

The cumulative deficits of the Greek current account have been cited as one of the factors that contributed to the recent debt crisis (see [Gros, 2011] for instance). After joining the Euro zone, the Greek economy could not anymore use currency devaluation as a tool of consolidation of the current account deficits. Despite the sluggish adjustment, the Greek current account recorded surplus during the third quarter of 2012 for the first time in 18 years. A critical question is whether exports or imports of goods and services were the driving force behind this adjustment. A report of the National Bank of Greece in July 2013, argues that this adjustment in current account stems from imports that contracted (the period 2009-2012) by 33% in value terms. Exports have increased by 20%.

It has been argued that trade openness and export expansion can act as a catalyst to stimulate growth recovery ([Riedel, 1984] among others). Promotion of exports is linked with increased productivity and positive externalities, the so-called Export-Led-Growth-Hypothesis (ELGH; [Emery, 1967], [Balassa, 1978], [Sharma & Panagiotidis, 2005]). Also, an export-oriented economy can benefit from economies of scale ([Helpman & Krugman, 1985]). Increased aggregate demand and better allocation of total investment. Export growth ensures a strong balance of payments which provides support to imports of intermediate and capital goods.

Another strand of the literature focuses on the impact of trade openness and imports on economic growth. [Grossman & Helpman, 1991] point out that the adoption of trade expansion policies can strengthen knowledge and innovation spillovers in a small open economy framework. [McNab & Moore, 1998] reiterate the latter for developing countries as they relate strongly outward oriented policies with a 1.5% annual increase in GDP growth. In this context, imports of intermediate goods exhibit growth inducing effects as well, known as the import-led-growth hypothesis (ILGH). The studies of [Awokuse, 2007], [Thangavelu & Rajaguru, 2004] provide evidence for the importance of imports in the growth process. [Chortareas et al., 2013] show that openness is more important for developing countries.

Empirical modeling of the mechanisms that define international trade relations among countries helps to understand the evolution of trade deficits ([Crane et al., 2007]). Economic theory points to three factors that can determine the foreign demand for domestic goods and services: (i) foreign income, (ii) prices of domestic export goods and services and (iii) prices of goods and services that compete with the domestic ones in the global markets. It is important though, to grasp how changes in foreign demand can affect export growth. For this purpose, part of the literature focuses on the computation of the foreign income and price elasticity of exports for developed and developing countries ([Marquez & McNeilly, 1988], [Marquez, 1990], [Senhadji & Montenegro, 1999]). These foreign income elasticities...
of exports, quantify the simultaneous relationship between foreign economic growth and domestic exports. Higher GDP growth in the trade partners of Greece may lead to higher demand for Greek exports of goods and services. Thus, economic prosperity in foreign regions can be associated with higher Greek export growth.

This paper estimates the long-run aggregate foreign income elasticity of Greek exports of goods and the long-run disaggregated income elasticity of Greek exports of goods per trading partner along with the price elasticity. The adopted approach allows us to quantify the impact of a change in the foreign real income on Greek exports separately for each trading partner. [Nie & Taylor, 2013] follow the same procedure to study the region-specific income effects for the U.S. exports. We employ a Vector Autoregressive (VAR) model to gauge the dynamic inter-linkages between Greek exports, regional foreign growth and the real effective exchange rate of Greece. The main questions that we address are:

1. What was the evolution of shares and destinations of Greek export goods per region over the last twenty years (1996-2016)?

2. How changes in real GDP per region affect Greek exports?

3. Which is the dynamic response of Greek exports in positive shocks on foreign disaggregated income and the exchange rate in the short-run and long-run?

The model includes real income activity in the main trading partners of Greece over the last five years; Germany, Italy, Turkey and the rest of Europe. These regions account, on average, for the 75% of the Greek export goods. We employ quarterly data from 1995:I - 2016:IV. To investigate the long-run relationship among our variables, we conduct a cointegration test (we refer to this as the static analysis). The estimations of the foreign real income and price elasticities of Greek exports are based on Dynamic OLS (DOLS) procedure as proposed by [Saikkonen, 1992] and [Stock & Watson, 1993]. We reveal that economic growth in Turkey and emerging markets such as the Balkans and the Middle East and North Africa account for the majority of the growth of Greek exports. The price elasticity of Greek exports is found to be negative (in line with expectations) but insignificant.

In the dynamic analysis (VAR), we examine the effect of a positive shock in the foreign real income growth on Greek export growth. We employ both generalized impulse response functions and local projections. The results indicate again the importance of the Turkish market for Greek exports. Also, a real depreciation of the Greek economy can boost export growth in the short-run (for 4 quarters).

The outline of the paper is structured as follows: Part 2 provides an overview of the trade partners of Greece for the last twenty years and part 3 discusses the methodology. The empirical evidence provided in part 4 and the last one concludes.
2 The Composition of Greek Export Goods per Region

An open economy benefits from trade with both developed and fast-growing economies (Arora & Vamvakidis, 2005). The Greek economy is influenced by economic conditions abroad with global shocks transmitted into the domestic economy through the trading partners channel. An investigation of the recent evolution of the Greek trade partners can offer useful insights for economic policy analysis. The Greek economy is one of the more closed economies in the EU in terms of trade openness. Böwer et al., 2014 attribute the latter to weak institutional quality. Internal demand (rather than exports) and the housing market (rather than manufacturing) are more influential in the Greek case (Panagiotidis & Printzis, 2016).

Over the last twenty years, 75% of the Greek exports was absorbed by European markets. The Middle East and North Africa (MENA) hold, an average, 8% of the Greek export goods followed by the USA with 5% and East Asia with 4%. Growth in these regions affects the growth rate of Greek exports of goods and services. Figure 1 presents the region and country destination of Greek export goods from 1996:02 till 2016:02. The most important trade partners for Greece were (i) Germany with 11% of Greek export goods and (ii) Italy with 10%; UK, Turkey, Bulgaria and the USA follow.

For the period 2012-2016 Germany, Italy and Turkey emerge the most important markets for Greece. These countries absorbed, on average, 26% of Greek export goods.

Figure 1: Greek Export Goods Share per Region

![Graph showing the share of Greek exports per region from 1996:02 to 2016:02.](image)

Notes: Rest of Europe includes Austria, Belarus, Belgium, Czech Republic, Denmark, Estonia, Finland, Hungary, Iceland, Ireland, Latvia, Lithuania, Malta, Netherlands, Norway, Poland, Portugal, Russia, Slovak Republic, Spain, Sweden, Switzerland, Ukraine. Balkans includes Albania, Cyprus, FYROM, Romania, Serbia, Slovenia. MENA includes Algeria, Kingdom of Bahrain, Egypt, Islamic Republic of Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Libya, Morocco, Saudi Arabia, Tunisia, United Arab Emirates. East Asia includes China, Hong Kong, Indonesia, Japan, Korea, Singapore. Rest of the World includes Argentina, Australia, Brazil, Canada, Colombia, Mexico, South Africa.

Source: IMF Direction of Trade Statistics and authors’ calculations.
The ranking of Greece’s trade partners has changed during the last seven years of economic crisis. Important destinations such as Europe and the Balkans lost part of their share and more distant areas such as the USA and East Asia have emerged. Moreover, we note a notable rise of the share of the region of the Middle East and North Africa that nearly doubled its share to 14% in the period 2012-2016. Figure 2 summarizes the evolution of the geographical destination of Greek export goods.

Figure 2: Time-Varying Share of Greek Export Goods per Region 1996:II-2016:II

This geographical reorientation of the Greek exports can be attributed to the weak economic growth of the western and the southeastern Europe during the last six years. From 2008 to 2016, the Euro area had an anemic GDP growth rate of 0.6% as a result of the global financial crisis. Southeastern Europe failed to recover to the pre-crisis level. This has direct implications for the structure of Greek exports of goods. The weak demand from these countries forced Greek exporters to find other markets. Turkey showed a GDP growth rate of 3.4%, the USA grew on average 1.5% and East Asia recorded a high GDP growth rate of 8%. Trade with Italy and Germany has been traditionally the most important for Greece and this has been remained unchanged although, exports to the German market did not increase.
3 Methodology

This section discusses the methodology employed in order to uncover the link between economic growth in foreign economies and Greek exports. We provide a framework to gauge both the short run and long-run relationship between foreign real GDP and real Greek exports (see Goldstein & Khan, 1985 for a detailed description on specification issues of trade equations).

The first model examines the contemporaneous, long-run relationship between the real Greek exports, real foreign income, and real effective exchange rate. Assuming that domestic and foreign tradable goods are imperfect substitutes, this specification is close to the standard export demand function and can be written as:

\[
\log(ex_t) = a_0 + \alpha_1 t + \beta \log(y_t) + \gamma \log(reer_t) + a_2 d_t + u_t
\]  

(1)

where \(ex_t\) is real merchandise exports of Greece; \(y_t\) is the real foreign income variable approximated by the difference between real GDP and real exports of goods and services of the main Greek trading partners; \(reer_t\) is the real effective exchange rate of Greece and represents the relative price between exported Greek goods and those that compete with them in the global markets. Parameter \(\beta\) can be interpreted as the foreign income elasticity of Greek exports and \(\gamma\) is a proxy of competitiveness of the Greek economy. Senhadji & Montenegro, 1999, employ the same specification with \(y_t\) to account for proxying for trading partners’ income. Also, we incorporate in equation (1) a dummy variable \(d_t\) to capture shifts in the constant term due to structural breaks. Previous studies have employed cointegration analysis for equation (1) (see for instance Caporale & Chui, 1999, Hooper et al., 2000).

The linkage between foreign income and Greek exports through the aggregate income elasticity is of importance. Nevertheless, it would also be interesting to examine how Greek exports react to income changes in specific regions. Therefore, we estimate the region disaggregated foreign income elasticities for the Greek exports. We include in our analysis the three most important trade partners of Greece over the last five years as defined in section 2; Germany, Italy, and Turkey. We quantify income in the remaining trading partners of Greece through the variable \(y_{RoW}^t\). Thus, the augmented model can be written as:

\[
\log(ex_t) = a_0 + \alpha_1 t + \beta_1 \log(y_{i,t}) + \beta_{1RoW} y_{RoW}^t + \gamma \log(reer_t) + a_1 d_t + u_t
\]  

(2)

where \(i = 1, 2, 3\) for the case of the real income activity (real GDP minus real exports) in Germany, Italy, and Turkey respectively. Parameters \(\beta_{1i}\) represent the region-specific real income elasticities of the Greek exports while \(\beta_1\) is the elasticity of the Greek exports with respect to income in the rest of the world. This approach gauges the effect of a change in the foreign income on Greek goods separately for each region. If all variables of equation (1) and equation (2) are I(1) and there is a cointegration relationship among them, estimation
can be conducted using Dynamic OLS (DOLS) with the fixed specification of leads and lags (leads = 1, lags = 1 given that the dataset is limited). Table 2 summarizes the estimation results of equation (1) and equation (2) based on the underlying method.

3.1 The Vector Autoregressive Model

A VAR model can capture linear interdependencies between real Greek export goods growth, Greek trade partners real income activity growth and exchange rate growth. To quantify short-run dynamics, we utilize a reduced form VAR($p$) model represented by:

$$x_t = v + A_1x_{t-1} + \ldots + A_px_{t-p} + u_t, \quad t = 1, 2, \ldots, T$$

where $x_t = (x_{1t}, \ldots, x_{kt})'$ is a ($k \times 1$) vector of the variables, $A_i$ is a $k \times k$ coefficient matrices for $i = (1, \ldots, p)$, $v = (v_1, \ldots, v_k)'$ is an intercept term vector and $u_t = (u_{1t}, \ldots, u_{kt})$ is a $k$-dimensional zero-mean white noise process with covariance matrix $E(u_tu_t') = \Sigma_u$. The underlying model consists of six endogenous variables with $x_t$ being a $6 \times 1$ vector, defined as:

$$x_t = \begin{bmatrix}
\text{Greek export goods growth}_t \\
\text{German real income growth}_t \\
\text{Italian real income growth}_t \\
\text{Turkish real income growth}_t \\
\text{RoW real income growth}_t \\
\text{reer growth}_t
\end{bmatrix}$$

We will investigate the dynamic properties of the VAR($p$) model using the Generalized Impulse Response Functions (GIRFs) developed by [Pesaran & Shin, 1998]. GIRFs are invariant of the ordering of the variables. This will allow us to trace the total effect on Greek exports from a one-standard-deviation positive shock to foreign real GDP. The Local Projections (LPs) (different to the GIRFs) were proposed by [Jordà, 2005, Jordà, 2009] and are also produced. The main advantage of this procedure is that LPs rely on their own IRF regression instead of previous iterations of the model leading them to be less vulnerable to misspecification. Also, LPs benefit from the simplicity of their estimation (they rely on OLS with robust standard errors\footnote{A cautioning note should be raised here as the two approaches are not alternative; GIRFs calculate the response of a typical shock whereas the central idea of LPs consists of estimating local projections at each period of interest instead of extrapolation into increasing horizons (VAR)}}.

2
4 Empirical Results

4.1 Data and Unit Root Tests

We employ quarterly seasonally adjusted data for the period 1995:I-2016:IV (88 observations). The variable \( y_t \) is created by the weighted average of the thirty major trading partners of Greece during the last twenty years. Also, real income activity for Germany, Italy, and Turkey and the rest of the world (RoW) was created using data for real GDP and real exports of goods and services. Region RoW consists of the remaining trading partners of Greece; exceptions include Germany, Italy, and Turkey whose growth impact is already incorporated into the analysis. Greek merchandise exports were deflated using the unit value of Greek export goods.

The Augmented Dickey-Fuller (ADF) test and the modified DF test proposed by Elliott et al., 1992 (DF-GLS test) are used for all the variables of equation (1) and equation (2). The unit root tests were conducted both in the levels and first differences of the variables and the lag length of the test was chosen based on AIC. The results indicate that all variables in the analysis are I(1). Table 3 in the Appendix summarizes the results.

4.2 Cointegration Analysis

To investigate whether there is a cointegrating relationship between the variables in equation (1) and equation (2), we adopt the single-equation cointegration test proposed by Phillips & Ouliaris, 1990. This procedure implies a test for the presence of a unit root in the residuals of the cointegrating equation. To account for a structural break of unknown time in the cointegrating relation of the equation (1) and equation (2) we employ the residual based cointegration test of Gregory & Hansen, 1996a, Gregory & Hansen, 1996b. A cointegration relationship suggests that there is a long-run equilibrium among real Greek exports \( (ex_t) \), real foreign income (total \( y_t \) and region disaggregated \( y_{i,t}, y_{RoW}^t \)) and the proxy of the relative price of Greek exports \( (reer_t) \). Table 1 summarizes the cointegration tests statistics for equation (1) and equation (2).

The results from both tests indicate the presence of a cointegrating relationship among the variables of equation (1) and equation (2) as the null hypothesis of no cointegration is rejected in all cases at the 5% level of significance. Hence, the long-run foreign income elasticities of the Greek exports can be quantified using DOLS.

4.3 Income and Price Elasticities for Greek Exports

Estimation of equation (1) and equation (2) quantify the foreign income (aggregated and disaggregated) and the price elasticity of Greek exports. If the link between the growth of Greek exports and economic growth in its trade partners is significant, this will be depicted by a high level of foreign income elasticity. The expected relationship between foreign income and Greek exports is positive. Also, a real depreciation of the Greek economy can
enhance the domestic productivity leading to an increased market share of Greek export goods in the global market. Therefore, the literature suggests that the price elasticity of Greek exports should be negative (see [Stern, 1976] for a thorough analysis of price elasticities of exports).

The DOLS estimation results of equation (1) (Table 2, Column 1) indicate that the long-run aggregate foreign income elasticity of Greek exports is above unity (2.59) and statistically significant at the 1% level. This reveals that Greek exports are very sensitive to changes in foreign income conditions (Tourism could be one explanation. Another is the special role of oil in the Greek trade balance as we will explain later). A 1% increase in the real income of the Greek trading partners is associated with an approximately 2.5% simultaneous increase in the Greek exports. The long-run price elasticity of Greek exports is found positive (0.5) and statistically significant at the 1% level of significance.

A possible explanation for this stems from the special role of oil. The latter is a dominant commodity for both Greek imports and exports. In 2016, refined oil accounted for 21% of the Greek exports of goods while imports of goods were mainly consisted by crude oil (13%) and refined oil (5%)..

The disaggregated approach in equation (2) (Table 2, Column 2) highlights that different regions affect distinctly Greek exports. Economic growth in all four regions under consideration (rest of the world, Germany, Italy, and Turkey) impacts positively on Greek exports. The rest of the world has the greatest impact on Greek exports as a 1% increase in the region’s real income is associated with a 1% increase of real Greek exports which is also statistically significant. In addition, growth in the Turkish economy is accompanied with a positive (0.87) and statistically significant reaction of the Greek exports. Thus, the strong linkage of Greek exporting firms and the Turkish market of goods can be confirmed, especially during the years of the financial crisis.

4.4 Dynamic Analysis

We employ a VAR(4) model to study the dynamic relationship between Greek exports and real income growth in the trading partners. The number of lags structure was decided based on the AIC and the likelihood ratio test. Figure 3 and summarizes the GIRFs of a positive one standard deviation shock on regional real income and exchange rate to Greek export goods growth. The results indicate a positive response of Greek exports from real income shocks emanating from Turkey and the rest of the world. Evidence from the local projections of GIRFs (Figure 4) shows that Greek exports are affected positively by Turkish growth which is statistically significant only for one quarter after the shock. In addition, a depreciation of the Greek real exchange rate, corresponding to a positive shock on the real exchange rate, is associated with a decrease in Greek real exports.

3When the foreign income is decomposed the positive coefficient becomes negative and insignificant.

4Data source: UN COMTRADE
5 Conclusion

The relationship between foreign income and exports growth is well established in the literature. This paper examines the relation between Greek exports and the real income in the major trading partners of Greece. We quantify the static\long-run and dynamic relationships between Greek exports and the real income in various regions of interest. The evolution of the Greek trade partners as a share of the total Greek exports goods was examined.

Greek exports have shifted over the last seven years from the European markets to emerging markets such as the Balkans, Middle East, and East Asia. Regarding results from the region disaggregated foreign income elasticity of the Greek exports, we find that economic growth in these regions and Turkey affects the most demand for Greek export goods. This is depicted in the strong linkage between the demand for Greek goods in these regions and the growth of Greek exports during the years of financial crisis as Greek exports abandoned traditional markets such as Germany and Italy. These regions account for the bulk of the relationship between Greek real exports and foreign real income. Furthermore, results from a dynamic analysis tend to confirm the importance of economic growth in these regions for the Greek exports. Moreover, the high elasticity of the foreign real income of the Greek exports can signal that an export-led-growth policy can be beneficial for the recovery of the country.
Table 1: Cointegration Analysis of Greek Exports and Foreign Regional Income

<table>
<thead>
<tr>
<th>Phillips-Ouliaris Cointegration Test</th>
<th>tau-statistic</th>
<th>z-statistic</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equation 1</td>
<td>-4.96</td>
<td>-38.36</td>
<td>0.00</td>
</tr>
<tr>
<td>Equation 2</td>
<td>-7.43</td>
<td>-67.98</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Note: p-values from [MacKinnon, 1996].

<table>
<thead>
<tr>
<th>Gregory-Hansen Cointegration Test</th>
<th>5% Critical Value</th>
<th>Break Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equation 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ADF t-stat.</td>
<td>-5.69</td>
<td>-4.92</td>
</tr>
<tr>
<td>Za-stat.</td>
<td>-47.69</td>
<td>-46.98</td>
</tr>
<tr>
<td>Zt-stat.</td>
<td>-5.72</td>
<td>-4.92</td>
</tr>
<tr>
<td>ADF t-stat.</td>
<td>-6.45</td>
<td>-5.29</td>
</tr>
<tr>
<td>Za-stat.</td>
<td>-57.51</td>
<td>-53.92</td>
</tr>
<tr>
<td>Zt-stat.</td>
<td>-6.49</td>
<td>-5.29</td>
</tr>
<tr>
<td>Equation 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ADF t-stat.</td>
<td>-6.94</td>
<td>-4.98*</td>
</tr>
<tr>
<td>Za-stat.</td>
<td>-67.73</td>
<td></td>
</tr>
<tr>
<td>Zt-stat.</td>
<td>-7.37</td>
<td></td>
</tr>
<tr>
<td>ADF t-stat.</td>
<td>-6.91</td>
<td>-5.23*</td>
</tr>
<tr>
<td>Za-stat.</td>
<td>-70.87</td>
<td></td>
</tr>
<tr>
<td>Zt-stat.</td>
<td>-7.70</td>
<td></td>
</tr>
</tbody>
</table>

Note: Critical values from [Gregory & Hansen, 1996b]. (*) denotes ADF t-statistic critical values based on [MacKinnon, 2010] due to the fact that, in the [Gregory & Hansen, 1996b] paper only critical values of up to 4 variables are available.
Table 2: The Long-Run Elasticities Between Greek Exports and Foreign Regional Real Income

<table>
<thead>
<tr>
<th>Dependent Variable: real</th>
<th>Equation (1)</th>
<th>Equation (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>merchandise Greek exports $e_{x_t}$</td>
<td>DOLS</td>
<td>DOLS</td>
</tr>
<tr>
<td>$y_t$</td>
<td>2.59***</td>
<td>0.50***</td>
</tr>
<tr>
<td></td>
<td>[5.09]</td>
<td>[2.76]</td>
</tr>
<tr>
<td>reer$_t$</td>
<td>-0.01</td>
<td>-30.68***</td>
</tr>
<tr>
<td></td>
<td>[-0.02]</td>
<td>[-4.14]</td>
</tr>
<tr>
<td>$C$</td>
<td>-0.01***</td>
<td>0.01***</td>
</tr>
<tr>
<td></td>
<td>[-0.74]</td>
<td>[3.03]</td>
</tr>
<tr>
<td>trend</td>
<td>0.01***</td>
<td>0.01***</td>
</tr>
<tr>
<td></td>
<td>[3.03]</td>
<td>[-0.74]</td>
</tr>
<tr>
<td>German real income$_t$</td>
<td>0.37</td>
<td>0.37</td>
</tr>
<tr>
<td></td>
<td>[0.37]</td>
<td>[1.57]</td>
</tr>
<tr>
<td>Italian real income$_t$</td>
<td>0.59</td>
<td>0.87***</td>
</tr>
<tr>
<td></td>
<td>[1.57]</td>
<td>[3.20]</td>
</tr>
<tr>
<td>Turkish real income$_t$</td>
<td>1.00**</td>
<td>0.10***</td>
</tr>
<tr>
<td></td>
<td>[2.22]</td>
<td>[2.22]</td>
</tr>
<tr>
<td>RoW real income$_t$</td>
<td>-0.18***</td>
<td>-0.14**</td>
</tr>
<tr>
<td></td>
<td>[-5.86]</td>
<td>[-2.31]</td>
</tr>
<tr>
<td>Observations:</td>
<td>88</td>
<td>88</td>
</tr>
<tr>
<td>R-squared:</td>
<td>0.94</td>
<td>0.96</td>
</tr>
</tbody>
</table>
Figure 3: Generalized Response of Greek Export Growth to a one s.d. Shock on Foreign Real Income Growth

(a) Generalized response of Greek exports to a one s.d. shock on German real income growth.

(b) Generalized response of Greek exports to a one s.d. shock on Italian real income growth.

(c) Generalized response of Greek exports to a one s.d. shock on Turkish real income growth.

(d) Generalized response of Greek exports to a one s.d. shock on the RoE real income growth.

(e) Generalized response of Greek exports to a one s.d. shock on reer growth.

Note: Shaded areas represent the ±2 s.e. confidence bands.
Figure 4: Local Projections of the Generalized Response of Greek Export Growth to a one s.d. Shock on Foreign Real Income Growth

(a) LP of the generalized response of Greek exports to a one s.d. shock on German real income growth.

(b) LP of the generalized response of Greek exports to a one s.d. shock on Italian real income growth.

(c) LP of the generalized response of Greek exports to a one s.d. shock on Turkish real income growth.

(d) LP of the generalized response of Greek exports to a one s.d. shock on the RoE real income growth.

(e) LP of the generalized response of Greek exports to a one s.d. shock on reer growth.

Note: Shaded areas represent the 95% confidence bands.
References


### Table 3: Unit Root Tests

#### ADF test statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>level</th>
<th>first difference</th>
<th>level</th>
<th>first difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>ex</td>
<td>0.00</td>
<td>-7.09</td>
<td>-2.38</td>
<td>-7.11</td>
</tr>
<tr>
<td>y</td>
<td>-0.04</td>
<td>-9.24</td>
<td>-2.84</td>
<td>-9.25</td>
</tr>
<tr>
<td>reer</td>
<td>-1.43</td>
<td>-7.21</td>
<td>-1.08</td>
<td>-7.28</td>
</tr>
<tr>
<td>Germany</td>
<td>-0.80</td>
<td>-11.07</td>
<td>-2.13</td>
<td>-11.02</td>
</tr>
<tr>
<td>Italy</td>
<td>-0.45</td>
<td>-3.56</td>
<td>-1.03</td>
<td>-4.21</td>
</tr>
<tr>
<td>Turkey</td>
<td>0.49</td>
<td>-8.76</td>
<td>-1.70</td>
<td>-8.82</td>
</tr>
<tr>
<td>RoW</td>
<td>-0.46</td>
<td>-9.11</td>
<td>-2.21</td>
<td>-9.06</td>
</tr>
</tbody>
</table>

**Notes:** Variable ex refers to real Greek merchandise exports. Variable y refers to the weighted foreign real income of the Greek trading partners. Variables Germany, Italy, Turkey and RoW refer to the real income in the respective regions and variable reer is the real effective exchange rate of Greece. All the above variables are in logarithms of the level values. The lag length of the test was based on AIC. Values in bold indicate rejection of the null hypothesis. Critical values based on [MacKinnon, 1996].

#### DF-GLS test statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>level</th>
<th>first difference</th>
<th>level</th>
<th>first difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>ex</td>
<td>1.30</td>
<td>-3.82</td>
<td>-2.36</td>
<td>-6.85</td>
</tr>
<tr>
<td>y</td>
<td>1.25</td>
<td>-9.02</td>
<td>-2.57</td>
<td>-9.18</td>
</tr>
<tr>
<td>reer</td>
<td>-1.26</td>
<td>-3.22</td>
<td>-1.29</td>
<td>-7.08</td>
</tr>
<tr>
<td>Germany</td>
<td>0.61</td>
<td>-1.73</td>
<td>-1.57</td>
<td>-3.96</td>
</tr>
<tr>
<td>Italy</td>
<td>-0.74</td>
<td>-2.48</td>
<td>-0.56</td>
<td>-3.14</td>
</tr>
<tr>
<td>Turkey</td>
<td>2.63</td>
<td>-8.09</td>
<td>-1.59</td>
<td>-8.53</td>
</tr>
</tbody>
</table>

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