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The Impacts of Exogenous Oil Supply Shocks on Mediterranean Economies

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Summary

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JEL Classification: C22, E32, Q43, Q41

The first author gratefully acknowledges financial support from the Italian Ministry of Education, Universities and Research (MIUR) research program titled "Climate change in the Mediterranean area: scenarios, economic impacts, mitigation policies and technological innovation" (PRIN 2010-2011, prot. n. 2010S2LHSE-001).

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1 Introduction

Three continents - Europe, Asia and Africa - and twenty one sovereign countries border the Mediterranean Sea.[1] As of 2014 the total population living in Mediterranean countries represents 6.7% of world total (The World Bank - World Development Indicators) and, taken together, economies in this area account for 11.9% of world Gross Value Added, GVA (United Nations Statistics Division - National Accounts Main Aggregates database).

Countries with coastlines on the Mediterranean Sea are very heterogeneous and have distinct cultural and historical backgrounds. Moreover, a divide exists within the area between countries on the north and south shore of the Mediterranean basin.

According to the World Bank's classification, these countries range from lower-middle-income (with per capita Gross National Income, GNI, between $1046 and $4125 in 2014) to high income (with per capita GNI of more than $12736 in 2014). High income countries are concentrated on the northern region of the basin, while the Middle East and North Africa region hosts the majority of lower- and upper-middle income economies.[2]

The north and south shores of the Mediterranean sea differ also in terms of their degree of energy dependence. The World Bank's World Development Indicators show that in 2011, with the exception of Algeria, Egypt, Libya and Syria that were net energy exporters, the remaining Mediterranean countries were heavily dependent on imported energy. For these countries net energy imports - estimated as primary energy before transformation to other end-use fuels, less production - were in the range 22% (for Tunisia) to 100% (for Malta) of energy use in 2011.

[1]These are: Albania, Algeria, Bosnia-Herzegovina, Croatia, Cyprus, Egypt, France, Greece, Israel, Italy, Lebanon, Libya, Malta, Montenegro, Morocco, the Principality of Monaco, Slovenia, Spain, Syria, Tunisia and Turkey. Moreover, other entities with a coastline on the Mediterranean sea include: the British overseas territory of Gibraltar, the Spanish autonomous cities of Ceuta and Melilla, the State of Palestine and the self-declared Turkish Republic of Northern Cyprus.

[2]Lower-middle-income economies are: Egypt, Morocco and Syria. Upper-middle-income countries, with per capita GNI in the range $4126 - $12736 in 2014, are: Albania, Algeria, Bosnia and Herzegovina, Lebanon, Libya, Montenegro, Tunisia, Turkey. Croatia, Cyprus, France, Greece, Israel, Italy, Malta, Slovenia, Spain and the Principality of Monaco are classified as high income countries.

These differences explain why energy integration is high in the policy agenda of Mediterranean countries. In particular, the relationship between the European Union (EU) and countries in the Middle East and North Africa region are strategically important for providing a secure supply of energy to EU member states, whose economies are highly dependent on imported crude oil and natural gas.

In March 2011 the European Commission announced its commitment to establishing an "EU-South Mediterranean Energy Community" aimed at "*promoting a real and reliable convergence of South Mediterranean partners' energy policies and EU policy*" (the European Commission, 2011, p. 10). Tholens (2014) thoroughly discusses the EU-South Mediterranean Energy Community.

Since the security of energy supply is a key geopolitical factor in the relationship between the EU and South Mediterranean neighborhood countries, we study the response of eight economies, representative of the heterogeneity that characterizes the Mediterranean area, to exogenous oil supply shocks for the period 1973-2013. We focus on the effects on economic activity - as proxied by real Gross Value Added - for the whole economy, as well as for selected industries.

Exogenous oil supply shocks are estimated with the method due to Kilian (2008b). To measure shocks to the supply of crude oil Kilian (2008b) considers the difference between the observed and a counterfactual level of crude oil production to proxy the shortfall associated with strifes in Organization of Petroleum Exporting Countries (OPEC) member states.

Results in Kilian (2008b,a) highlight that for the U.S. and most G7 economies exogenous shocks to the production of crude oil cause a temporary reduction in real Gross Domestic Product. Our findings are in line with those of Kilian (2008b,a): we show that most net energy importers experience a temporary reduction in the growth rate of GVA. Moreover, we illustrate that there are some patterns characterizing the response of different economies to an unexpected reduction in global oil production. The main determinants underlying these patterns are the degree of energy intensity and energy dependence of the country, as well as the composition of its GVA.

There are other measures of exogenous shocks to the supply of crude oil available in the literature. Notably, Hamilton (1996) introduced a proxy known as net oil price increase. The idea underlying Hamilton's proposal is that since some of the major price increases in the 1970's were driven by exogenous political events in OPEC countries, the net price increase relative to the recent past can capture the price changes during those episodes. There are two problems with this and other price-based measures of exogenous oil supply disruptions. First, now the consensus view among academics and practitioners is that since the early 1970's the price of crude oil has been endogenous to global macroeconomic conditions; second, there are episodes when the net oil price increase measure fails to capture exogenous oil supply shocks and other instances when, on the contrary, the proxy suggests an increase that is not the result of a production shortfall, but is due to demand side pressures. For more details see Kilian (2008b,a) and references therein.

The rest of the paper is organized as follows. Section 2 describes the dataset and the econometric methods used in the empirical analysis, Section 3 discusses key statistics for Mediterranean countries; results are illustrated in Section 4, while Section 5 concludes.

2 Data and methods

2.1 Measuring exogenous oil supply shocks

We measure exogenous shocks to the supply of crude oil in OPEC member countries using the approach of Kilian (2008b). The author has developed a proxy of supply shocks based on the difference between the observed and a counterfactual crude oil production level in countries where a geo-political event - such as a war - has led to a production shortfall.

The counterfactual path is defined as the level of production that would have been observed in the absence of the exogenous event responsible for the crude oil production shortfall. It is obtained by extrapolating the pre-event production level based on the average growth rate of production in countries not hit by the geo-political event. Exogenous crude oil production shortfalls are then aggregated over countries, expressed as a percent of world crude oil production and first differenced.

Since the series developed by Kilian (2008b) ends in September 2004, we rely on its updated version due to Bastianin and Manera (*forthcoming*) that spans January 1973 until

December 2013 and hence includes the crude oil production shortfall due to the Libyan Civil War of 2011. The counterfactual for Libya starts in February 2011 and is based on the average growth rate of production in Algeria, Angola, Ecuador, Nigeria, Qatar, United Arab Emirates[3]. During 2011 the shortfall due to the Libyan Civil War was over 1.5 millions barrels per day.

The Kilian's measure of exogenous oil supply shocks is based on monthly production data available from the Energy Information Administration's Monthly Energy Review and its construction follows the details in Kilian (2008b,a). The variable, suitably aggregated at annual sampling frequency, is shown in Figure 1. As it can been seen the production shortfall associated with the Libyan Civil War represents a trough corresponding to -1.6% of world crude oil production. Compared to previous episodes, the magnitude of this shortfall is small: for instance, in 2002 civil unrest in Venezuela have led to a shortfall equivalent to -3% of world oil production.

[Fig. 1 about here]

2.2 Macroeconomic aggregates

There are twenty one countries with coastlines on the Mediterranean sea, however data starting in the 1970's are available only for a subset of these economies. Having this decade in our sample is important because some of the most severe oil price shocks are associated with turmoils in OPEC member countries during this time period (see e.g. Hamilton (2003)).

Thus due to lack of data the Principality of Monaco and four countries of the former Yugoslavia have been dropped from the dataset. Moreover, we have also excluded countries such as Albania, Cyprus, Lebanon, Malta and Tunisia, Syria where conflicts and political

[3]As of August 2015 OPEC members include: Algeria, Angola, Ecuador, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, United Arab Emirates and Venezuela. This list is different from that in Kilian (2008b,a): Angola joined OPEC in 2007, while Ecuador suspended its membership from December 1992 until October 2007. Notwithstanding small numerical discrepancies, Alquist and Coibion (2014) show that the correlation between the original Kilian (2008b) measure and the updated series of Bastianin and Manera (*forthcoming*) is very close to one.

turmoils have generated structural breaks and outliers in the series. Algeria and Libya have been dropped because being members of OPEC, the supply shocks measure is not exogenous to their economies. This leave us with a total of eight economies: Egypt, France, Greece, Israel, Italy, Morocco, Spain, Turkey.

Gross Value Added (GVA) for these eight countries has been sourced from the National Accounts Main Aggregates database, maintained by the Economic Statistics Branch of the United Nations (UN) Statistics Division. This database consists of annual time series of national accounts aggregates of all UN Members States from 1970 onward. Variables are based on the official data reported to the UN Statistics Division through an annual questionnaire.

The same database also provides Value Added (VA) by kind of economic activity. In particular we analyze the impact of exogenous oil supply shocks on the VA for the following industries: Agriculture, hunting, forestry, fishing (ISIC A-B), Mining, Manufacturing, Utilities (ISIC C-E), Construction (ISIC F) Wholesale, retail trade, restaurants and hotels (ISIC G-H) and Transport, storage and communication (ISIC I)[4].

All variables expressed in US dollars at constant 2005 prices and cover the period 1970-2013.

2.3 Econometric specification

Let Y_t be either GVA or one of series measuring VA by kind of economic activity for a given Mediterranean country and let $y_t \equiv \log(Y_t)$. Then we define its percentage growth rate as $\Delta y_t = 100 \times (y_t - y_{t-1})$. To study the effects of exogenous oil supply shocks, x_t, on growth we use the following model:

$$\Delta y_t = \alpha + \sum_{j=0}^{5} \beta_j x_{t-j} + \varepsilon_t \tag{1}$$

where the error term ε_t might be serially correlated. The model is estimated with

[4] A sixth category - Other Activities (ISIC J-P) - is also available, but we decided not to consider it in the empirical analysis in that it includes highly heterogeneous industries with a low degree of energy intensity, such as: information and communication, financial and insurance activities, real estate activities, professional, scientific and technical activities, administrative and support service activities, public administration and defense and education.

the Ordinary Least Squares (OLS) estimator, while inference is based upon standard errors computed with block-bootstrap methods, so as to deal with the possibility of serial correlation in the error term[5].

In the Distributed Lag (DL) model in equation (1) the OLS estimate of β_h corresponds to the impulse response estimate at horizon h and the lag order of the model, set to five years, represents the the maximum horizon of the impulse response function. While $\hat{\beta}_h$ is the estimated response of real GVA (or VA) growth to a unit change in x_t at horizon h, the level response for GVA (or VA) can be obtained by cumulating the OLS estimates of β_h. Therefore, the estimated level response of GVA (or VA) to a unit change in x_t at horizon h is $\sum_{j=0}^{h} \hat{\beta}_j$

Model (1) rests on the assumption that x_t is pre-determined with respect to macroeconomic conditions in a given country. Pre-determinedness of x_t implies that there is no instantaneous feedback from the level of economic activity in Mediterranean countries to crude oil production in OPEC countries. This working hypothesis has been extensively used in the literature and is also empirically supported by the results in Kilian and Vega (2011).

An AutoRegressive DL (ARDL) model represents the main alternative to model (1). While both the DL and the ARDL specifications are based on the assumption that x_t is pre-determined, the ARDL model is more restrictive in that it requires our measure of oil supply shocks to be strictly exogenous. Moreover, the use of an ARDL model rests on the additional assumption that data are well approximated by a linear Vector Autoregressive model, while equation (1) relaxes this constraint (see Kilian, 2008a).

3 Growth and energy in Mediterranean countries

Per capita real GVA in 2011 for the Mediterranean countries in our panel is shown in the last column of Table 1. As it can be seen, the north-south divide discussed in the Introduction is apparent also for the economies in our sample: Egypt and Morocco have the lowest per

[5]The bootstrap procedure is based on blocks of two consecutive observations and has been implemented with the routines attached to Kilian (2009).

capita GVA, while EU countries have the highest levels of per capita GVA. Columns headed (a-e) in Table 1 illustrate how GVA is distributed across industries. We can notice that North African countries have the highest share of GVA produced in the agriculture, hunting, forestry and fishing branch of economic activity. Moreover, we see that for Egypt - that, according to Figure 2, in 2011 was the only net energy exporter in the sample - the highest share of GVA is associated to the mining, manufacturing and utility branch, that includes the petroleum industry.

[Table 1 about here]

The degree of energy dependency, namely the extent to which an economy relies upon imports in order to meet its energy needs, is an important factor in explaining how different countries experience oil supply shocks. Energy dependency in 2011 is shown in Figure 2 and is given by net energy imports as a percentage of energy use. Net energy imports are estimated as energy use less production and are both measured in oil equivalents. A negative value, such as -14% for Egypt, indicates that the country is a net exporter. It is apparent that Morocco and France are respectively the most and the least energy dependent countries among net importers. Italy follows Morocco with 81% of energy derived from imports.

[Fig. 2 about here]

How an oil supply shock impacts on a country's economy is influenced not only by its reliance on imported energy, but also depends on the the quantity of energy required per unit output. Energy intensity in 2011 and its difference in the 1981-2011 period are shown in Figure 3. Egypt, Morocco and Turkey are the countries with the highest degree of energy intensity. However, while the economy of Morocco now requires less energy per unit output than in 1981, both in Egypt and Turkey the production of goods and services has become more energy intense. With the exception of Greece, the remaining countries have experienced a reduction in energy intensity, with France leading the group of virtuous economies.[6]

[6] The impact of oil supply shocks in different industries is also expected to depend on the level of energy intensity, however we were not able to find energy intensity data at this level of disaggregation.

[Fig. 3 about here]

4 Results

4.1 Model selection

Model (1) allows for a contemporaneous feedback from the Kilian's measure of oil supply shocks, x_t, to the growth rate of GVA or VA by kind of economic activity, Δy_t.

Each cell of table 2 shows the p-value of the test of the null hypothesis $H_0 : \beta_0 = 0$; that is, the test for the exclusion of the contemporaneous effect of the exogenous oil supply shock from model (1).

When the dependent variable of equation (1) is real GVA growth, p-values lie above 74% for all countries but Israel, thus suggesting that in seven cases, out of eight, the contemporaneous value of the Kilian's measure of oil shocks can be excluded from the model.

When Δy_t corresponds to real VA growth for a given branch of economic activity in one of the Mediterranean countries in our panel, p-values range from 9.1% to 99.8%.

All in all, tests for the exclusion of the contemporaneous value of the Kilian's measure of exogenous oil supply shock shown in Table 2 lead to the conclusion that x_t can be safely dropped from the regression equation in all cases.

[Table 2 about here]

4.2 The impacts of oil supply shocks on real GVA

The response of real GVA growth to a permanent 1% reduction in global crude oil production is presented in Figure 4. The second and third columns in the top panel of Table 3 show the date and the magnitude of the trough of the response of real GVA growth. The date of the trough is the number of years that it takes to the estimated impulse response function to reach its minimum, after an oil supply shock has hit the economy of a given country. The corresponding information for the level of real GVA is shown in the bottom panel of Table 3 and in Figure 5.

Egypt experiences a temporary reduction in real GVA growth the first year after the oil supply shock. However, Table 3 shows that the -0.2% variation in real GVA is statistically indistinguishable from zero. A joint inspection of Figures 4-5 highlights that neither the growth rate, nor the level of real GVA in Egypt react, in a statistically significant manner, to a permanent 1% reduction in global oil production. Egypt has two peculiarities: it is the only net energy exporter and it has the most energy intense economy in our panel of Mediterranean countries. Our results, seem therefore to suggest that for this country the benefits of not depending on imported crude oil are greater than the costs of having a very energy intense economy. The balance of these two effects is to render the impact of oil supply shocks on the economy negligible.

[Fig. 4 and 5 about here]

Results for Morocco, the only other North African country, look completely different from those for Egypt. As of 2011 Morocco was importing 96% of the energy used in the country and in that year it was second only to Egypt in terms of energy intensity, notwithstanding a decreasing trend from 1981 to 2011. These two factors can probably explain the long-lasting reduction in real GVA growth observed in Figure 4. The variation of real GVA reaches its minimum, -0.67%, a year after the economy was hit by the oil supply shock and remains statistically significant for three years, using the one-standard error bands. The bottom panel of Table 3 and Figure 5 show that there is a reduction also in the level of real GVA. The response of real GVA gets to a minimum, -2%, five years after the exogenous oil supply disruption and is statistically significant using the one-standard error bands.

For all EU member countries - France, Greece, Italy, Spain - an unexpected reduction in global oil production leads to a temporary reduction in real GVA growth two years after the shock that, in all cases, is also statistically significant, using the one-standard error bands. This suggests that there are similarities among these countries possibly due to factors, such as the influence of a common monetary policy, that tie them together.

France, that has the lowest degree of energy intensity (about 5000 Btu per 2005 U.S. dollars) and is the least energy dependent country among net energy importers (it imports 46% of its energy), experiences the smallest reduction in growth, -0.16%. Italy and Spain are similar in terms of energy dependence, in 2011 both imported over 75% of the energy they used, and respond to an oil supply shock with a reduction in real GVA growth close to -0.4% in the second year. This negative effect on growth is in both cases statistically significant using the two-standard error bands. The effect of a production disruption on the real GVA growth of Greece, that imports 64% of its energy, is -0.27%.

As we have seen, EU member countries experience oil supply shocks in a similar fashion: they all record a negative and statistically significant effect on real GVA growth two years after the shock. Interestingly, the negative impact on growth increases with the degree of energy dependency of the economy.

As it can been seen in Figure 4 and 5, the responses of Turkey and Israel are never statistically distinguishable from zero. However, we can observe that Turkey, like EU countries, experiences the maximum reduction of real GVA growth two years after the oil supply shock.

[Table 3 about here]

4.3 The impacts of oil supply shocks on real VA for selected industries

Studying the impacts of a disruption in global oil production on the level and the growth rate of real VA in a different of branches of economic activity might help disentangling how Mediterranean countries experience oil supply shocks.[7]

The top panel of Table 3 shows that in Egypt the only industries that exhibit a temporary and statistically significant (using the one-standard error bands) reduction of real VA growth are the mining, manufacturing and utilities (MMU, henceforth) industries and the branch that includes touristic activities, retail and wholesale trade (TRW henceforth), see columns (b) and (d). In the first case the trough, -1.15%, is reached two years after the shock, while in the second case it takes only one year to reach the minimum. However, looking at column (b) in the bottom panel of Table 3, we see that the response of the level of real VA in the

[7] To conserve space impulse responses are shown in the Appendix.

MMU industries is never statistically distinguishable from zero.

In Morocco, where agriculture accounts for 15% of real GVA, there is a disproportionate response of the real VA growth in this branch of economic activity, that records a statistically significant trough of -3% one year after the shock. The MMU industries experience a -0.3% reduction in the real VA growth two years after the crude oil production disruption, while the TRW industries feature a -0.4% growth decline one year after the shock. In both cases the response is statistically significant using the one-standard error bands.

There are patterns that characterize the responses of real VA growth in the MMU industries: with the exception of Greece, the trough is always recorded two years after the shock. Moreover, using the one-standard error bands, the negative effect of an oil supply shock on the growth rate of real VA in this branch of economic activity is statistically significant for all EU countries, except Greece. Lastly, we notice that in the case of France, Spain and Italy the response of the level of VA in the MMU industries is negative and statistically significant (using the one-standard error bands) up to five years after the oil supply shock.

Column (d) in panel *a* of Table 3 illustrates that oil supply shocks have negative and often statistically significant effects on the TRW industries in most Mediterranean countries.

Lastly, we see from column (e) that the transportation sector is negatively affected by a shock to the supply of crude oil. The magnitude of the (statistically significant) responses range from -0.3% for Spain up to -0.6% for France.

5 Conclusions

The relationship between the EU and countries in the South Africa and Middle East region of the Mediterranean sea are strategically important for energy firms operating in the area as well as for the energy security of net energy importers.

In this paper we have shown that the degree of energy intensity and energy dependence influence how Mediterranean economies react to an unexpected reduction in global crude oil production. The response of real GVA growth is negative and often statistically significant for net energy importers, while for net energy exporters (i.e. Egypt) it is not distinguishable from zero. This result holds for the economy as a whole, as well as for selected industries.

In the case of EU countries, there are many similarities: the effect of an oil supply shock increases with the degree of energy dependency and countries experiences shocks with same timing.

These results suggest that initiatives aimed at strengthening the collaboration between the EU and other Mediterranean countries, net energy exporters in particular, might be crucial for improving the energy security of the region. Beyond the energy security target, integration efforts such as the development of the "EU-South Mediterranean Energy Community" might help countries in the area to reach other goals such as the design common environmental policy.

From a methodological point of view, we believe that the use of regression techniques that allow to combine data at different sampling frequencies, such as annual data for real VA and monthly data for the Kilian's measure, might prove useful to exactly pin down the timing with which oil supply and price shocks hit the economy. Extension of the present analysis using the Mixed Data Sampling regression approach of Ghysels et al. (2007) is left for future work.

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Tables and Figures

Table 1: Per-capita real Gross Value Added and its components in 2011.

	VA by kind of economic activity as % of GVA					
Country	(a)	(b)	(c)	(d)	(e)	per capita GVA
Egypt	12.60	32.33	5.97	14.79	13.54	1512
France	1.94	14.77	4.87	16.09	8.43	32336
Greece	4.24	10.31	4.77	18.94	7.82	18317
Israel	1.51	18.45	5.29	9.74	15.40	21296
Italy	2.29	18.92	4.93	17.16	8.50	27234
Morocco	15.83	18.35	6.91	12.50	7.91	2362
Spain	3.22	17.18	7.71	18.21	9.20	23599
Turkey	9.00	23.33	4.89	16.08	15.35	7060

Notes: columns (a-e) show real Value Added (VA) by kind of econmic activity as a percentage of Gross Value Added (GVA), while the last column displays per-capita real GVA in 2011 (in 2005 US dollars). VA is available for the following industries: (a) Agriculture, hunting, forestry, fishing, (b) Mining, Manufacturing, Utilities, (c) Construction, (d) Wholesale, retail trade, restaurants and hotels, (e) Transport, storage and communication. The row sum of percentages in columns (a-e) is not equal to 100 in that the contribution of "Other activities" to GVA is not shown. Source: United Nations, Statistics Division - National Accounts Main Aggregates.

Table 2: Test for the exclusion of the contemporaneous exogenous oil supply measure.

	VA by kind of economic activity					
Country	(a)	(b)	(c)	(d)	(e)	GVA
Egypt	0.4583	0.9841	0.1920	0.4932	0.5688	0.8789
France	0.2297	0.9614	0.3340	0.6143	0.7407	0.7476
Greece	0.8839	0.7390	0.0910	0.8870	0.9204	0.8592
Israel	0.8090	0.1532	0.1115	0.5837	0.2206	0.0844
Italy	0.4224	0.9293	0.3842	0.5341	0.9980	0.9213
Morocco	0.6575	0.6773	0.0952	0.6421	0.9702	0.9125
Spain	0.2946	0.5772	0.8990	0.7317	0.2469	0.8025
Turkey	0.6139	0.3936	0.6646	0.6720	0.6730	0.8308

Notes: the table shows p-values of the tests for the exclusion of the contemporaneous exogenous oil supply measure from equation 1. This corresponds to testing $H_0 : \beta_0 = 0$ in $\Delta y_t = \alpha + \sum_{j=0}^{5} \beta_j x_{t-j} + \varepsilon_t$. In columns 2-6 the dependent variable is the percentage growth rate of real VA in the following industries: (a) Agriculture, hunting, forestry, fishing, (b) Mining, Manufacturing, Utilities, (c) Construction, (d) Wholesale, retail trade, restaurants and hotels, (e) Transport, storage and communication. The last column shows p-values when the dependent variable is the percentage growth rate of real GVA. Standard errors have been computed using 20000 block bootstrap samples (with a block size of 2 years), so as to account for possible serial correlation in the error term.

Table 3: Magnitude and dates of troughs of real GVA (VA) growth and real GVA (VA) response to a 1% exogenous oil supply shock.

Panel a. Real GVA and real VA growth

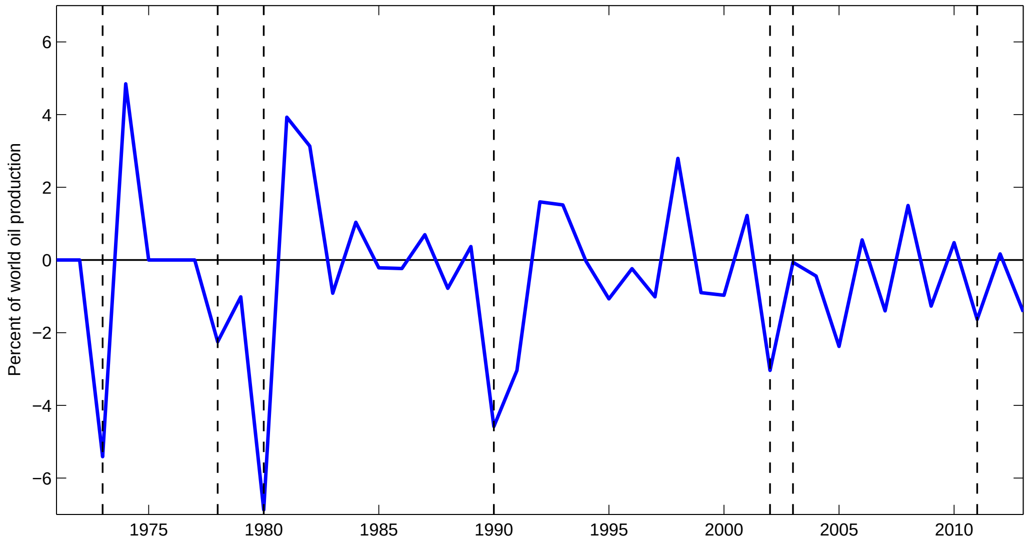
	GVA growth		VA growth (a)		(b)		(c)		(d)		(e)	
Country	t	%	t	%	t	%	t	%	t	%	t	%
Egypt	1	-0.20	5	-0.22*	2	-1.15*	1	-0.35	1	-0.56*	2	-0.61
France	2	-0.16*	3	-0.99**	2	-0.45**	3	-0.42*	2	-0.42**	4	-0.61**
Greece	2	-0.27*	4	-0.37	4	-0.26	2	-1.46*	4	-0.78*	1	-0.28
Israel	4	-0.13	3	-1.05*	2	-0.04	5	-1.44*	3	-0.12	4	-0.56*
Italy	2	-0.41**	5	-0.13	2	-0.94**	4	-0.33*	2	-0.34*	4	-0.44*
Morocco	1	-0.67*	1	-3.07*	2	-0.33*	5	-0.26	1	-0.42*	3	-0.02
Spain	2	-0.37**	1	-0.80*	2	-0.63**	2	-0.77*	2	-0.23*	2	-0.31*
Turkey	2	-0.10	4	-0.41*	2	-0.21	2	-0.86*	2	-0.06	2	-0.06

Panel b. Real GVA and real VA

	GVA		VA (a)		(b)		(c)		(d)		(e)	
Country	t	%	t	%	t	%	t	%	t	%	t	%
Egypt	2	-0.25	5	-0.22	2	-1.12	1	-0.35	1	-0.56*	3	-1.15
France	5	-0.56*	1	-0.83*	5	-1.05*	5	-1.15*	5	-1.33**	5	-1.39**
Greece	4	-0.53	4	-0.12	4	-0.38	5	-2.89	5	-2.06*	5	-0.82
Israel	5	-0.21	3	-0.82	2	0.76	1	4.08**	1	0.04	4	-1.19*
Italy	5	-0.86**	5	0.10	5	-1.56*	5	-0.10	5	-0.55*	5	-1.23*
Morocco	5	-2.14*	5	-9.33*	4	-0.79*	1	0.29	5	-1.12*	1	0.14
Spain	5	-1.29**	5	-2.42*	5	-1.80**	5	-3.06**	5	-0.52*	5	-0.73*
Turkey	4	0.05	5	-0.77	2	0.24	5	-0.86	2	0.28	2	0.12

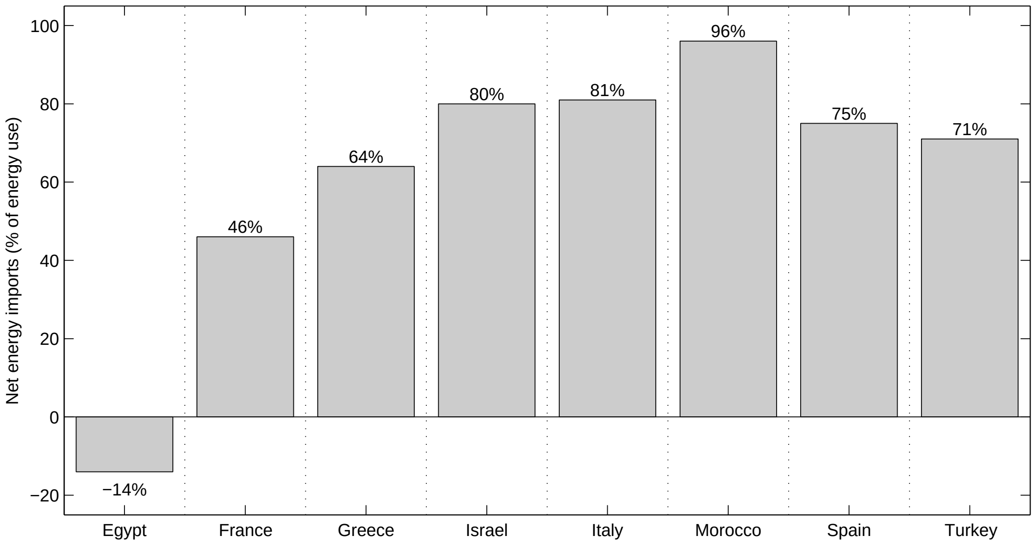
Notes: Columns headed with a "t" ("%") denote the date (magnitude) of the trough of the response of real GVA growth (Panel a) and real GVA (Panel b) to a 1% permanent reduction in world oil production. Columns headed (a-e) denote the following industries: (a) Agriculture, hunting, forestry, fishing, (b) Mining, Manufacturing, Utilities, (c) Construction, (d) Wholesale, retail trade, restaurants and hotels, (e) Transport, storage and communication. "*" ("**") denotes that the response is statistically significant using the one- (two-) standard error bands.

Figure 1: Measure of exogenous oil supply shocks: 1971-2013.



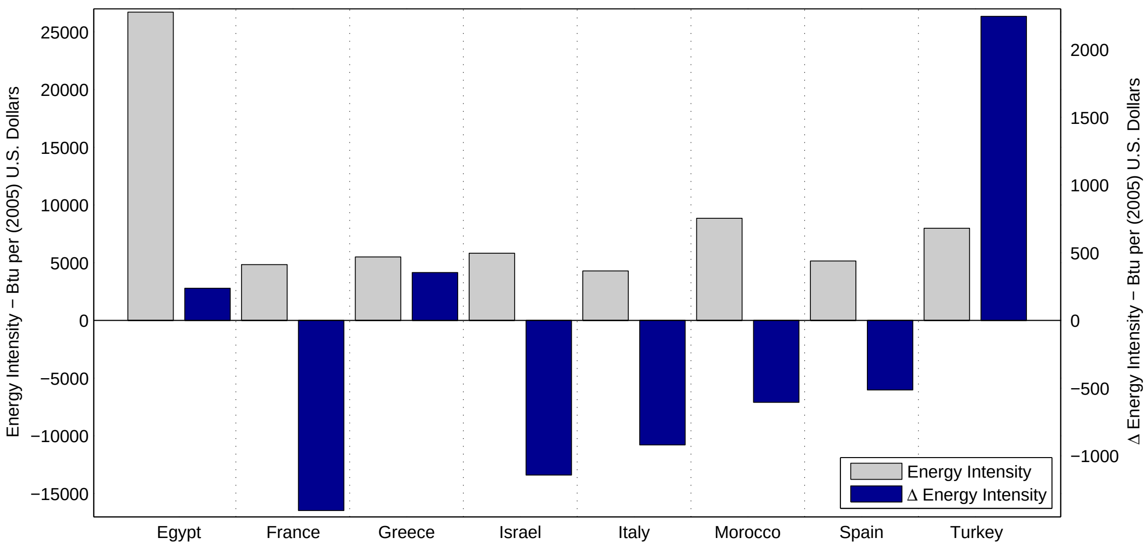
Notes: the figure shows the measure of exogenous oil supply shocks due to Kilian (2008b) and extended by Bastianin and Manera (*forthcoming*) to include the production shortfall associated to the Libyan Civil War of 2011. The first five vertical dashed lines identify key oil dates shown in Table 1 of Kilian (2008a), while the last line is drawn in correspondence of February 2011, when the Libyan Civil War begun. The remaining key oil dates are: October 1973 (Yom Kippur War and Arab oil embargo), October 1978 (Iranian revolution), September 1980 (Iran-Iraq War), August 1990 (Persian Gulf War), December 2002 (Civil unrest in Venezuela) and March 2003 (Iraq War).

Figure 2: Energy dependency in 2011: net energy imports (% of energy use).



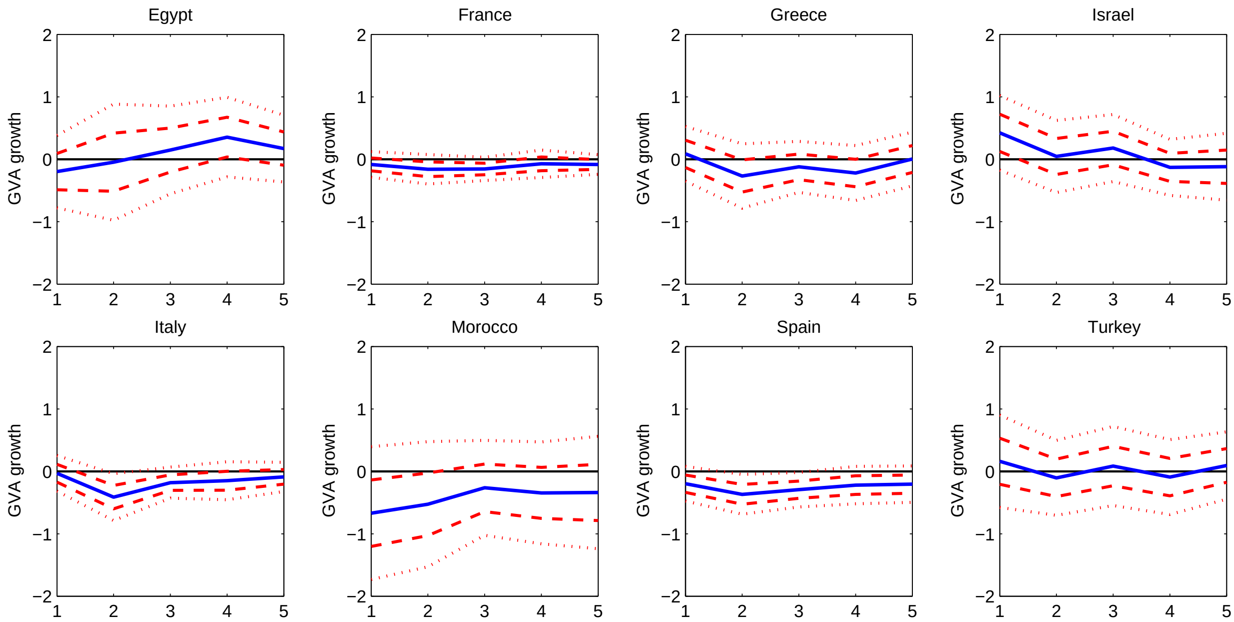
Notes: energy dependency is given by net energy imports as a percentage of energy use. Net energy imports are estimated as energy use less production and are both measured in oil equivalents. A negative value indicates that the country is a net exporter. Source: The World Bank - World Development Indicators (`http://wdi.worldbank.org/table/3.8`).

Figure 3: Energy intensity in 2011 and change in energy intensity 1981-2011.



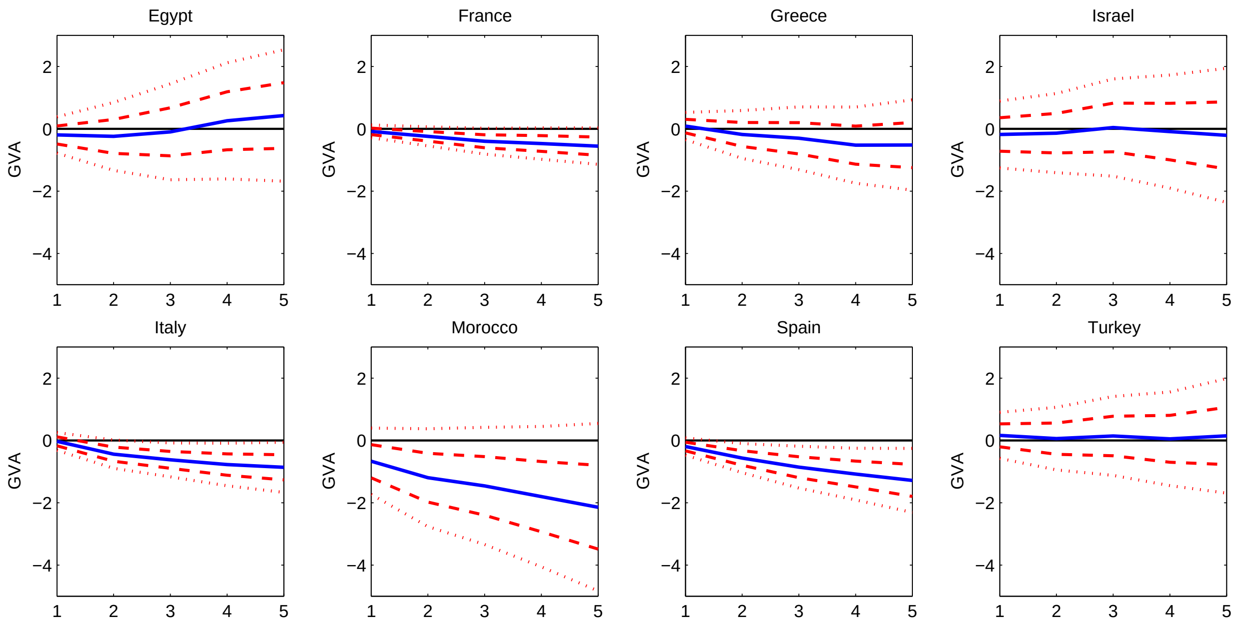
Notes: Energy intensity in 2011 (left axis) is given by total primary energy consumption per dollar of GDP and is expressed in BTU per (2005) U.S. Dollars. The difference in energy intensity between 1981 and 2011 (right axis) is denoted as Δ Energy Intensity. Source: EIA - International Energy Statistics.

Figure 4: Response of GVA growth to a 1% exogenous oil supply shock.



Notes: the continuous lines are the responses of GVA growth to a 1% permanent oil supply shock estimated from a distributed lag model of order 5. Dashed (dotted) lines are the one- (two-) standard error bands. These have been computed using 20000 block bootstrap samples (with a block size of 2 years), so as to account for possible serial correlation in the error term.

Figure 5: Response of GVA to a 1% exogenous oil supply shock.



Notes: the continuous lines are the responses of GVA to a 1% permanent oil supply shock estimated from equation (1). Dashed (dotted) lines are the one- (two-) standard error bands. These have been computed using 20000 block bootstrap samples (with a block size of 2 years), so as to account for possible serial correlation in the error term.

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