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Price modelling of natural gas for the EU-12 countries: Evidence from panel cointegration

Vedat Yorucu*, Pejman Bahramian

Department of Economics, Eastern Mediterranean University, Gazimagusa, Via Mersin 10, North Cyprus, 99628, Turkey

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ABSTRACT

This study explores the relationship between the prices of natural gas, crude oil and taxation among selected EU-12 countries over the period of 2001–2012 on a quarterly basis. According to Ouedraogo (2013a), "panel unit root, heterogeneous panel cointegration, panel fully modified and panel dynamic regression procedures are commonly employed empirical techniques for panel estimations". A significant long-run relationship between the prices of natural gas, crude oil and taxation was detected, which validates the hypothesis that there is a long-run equilibrium relationship between among them. The empirical results from both fully modified and dynamic panel regression tests also support the hypothesis that crude oil prices and taxation have significant impacts on natural gas prices within the EU-12 countries, which indirectly affects industrial production growth, electricity transformation, heating, cooling and the overall cost of living in the Eurozone. The findings of a common coefficient for panel causality deliver robust evidence of uni-directional relationships from crude oil prices and taxation toward natural gas prices. The results of individual coefficient for panel causality analysis reveal that there are bi-directional causalities among natural gas prices and taxation, crude oil prices and taxation and crude oil prices and natural gas prices with the EU-12.

1. Introduction

After the Russian invasion of Crimea, EU–Russia relations were betrayed. As global energy dynamics continue to evolve, the European Union has to find alternative energy sources through different means. Because of its large dependency on Russian gas supplies, EU countries face future uncertainties in their energy needs and future economic prospects. Over the last decade, the large dependency on Russian gas delivery has increased energy prices in Europe and made it impossible to stimulate growth, especially after the 2008 global financial crisis.

Following the global economic crisis, the EU has begun promoting alternative energy sources to meet internal demand while also building up supply to support of its increasingly ambitious renewable policy. Since 2009, the EU has continuously been enacting Energy directives (Directive 98/30/EC, 1998; Directive 2003/55/EC, 2003 and Directive 2009/73/EC, 2009), such as unbundling gas transmission networks and promoting alternatives such as solar, wind and biofuel energy. In addition, in 2010, another EU regulation (2010) was enacted by the European Parliament and the Council with regard to security of gas supplies.

As emphasized by Hilbert (2010), the new roadmap for 2050 must be considered, with a clearer and shared understanding of possible development paths of the EU energy system and the related policy context, both globally and within the EU. The main scope is to achieve a low-carbon, high efficiency energy system, which will probably have a near zero net emissions power generation system, large increases in energy efficiency and possibly near zero emissions in passenger road transport.

The EU is highly dependent on natural gas for energy production, heating and industry. As also noted by Dispenza (2010), recently produced natural gas accounts for almost 25% of Europe's primary energy consumption. Enough conventional and unconventional gas resources exist in the world to serve the future generations for many years to come. Comparing conventional gas produced by Algeria, Qatar, Russia, UK, Netherlands and Norway, accessing the unconventional gas produced in the US and Mozambique is the new challenge for the European market.

* Corresponding author.
E-mail addresses: vyorucu@hotmail.com, vedat.yorucu@emu.edu.tr (V. Yorucu), bahrami1983@ymail.com (P. Bahramian).

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Considering the future gas supply potential for Europe, the new Southern Gas Corridor has become important, especially after the Arab Spring and the recent offshore gas discoveries in Egypt, Israel and Cyprus (for details see Glachant et al. (2012)). The new eastern Mediterranean offshore gas will reshape the equilibrium of the eastern Mediterranean political future. North Cyprus will be a critical territory in such a Turkish-Israel link. There are, however, disputes and conflict in all the neighbouring countries. In addition to Greek-Turkish dispute in these troubled waters, there are further boundary disputes in the area of the ocean among Cyprus, Israel, Syria, Lebanon and Egypt. Israel is eager to monetize this asset and has now become a stakeholder in the outcome of the Cyprus settlement. Civil war in Syria, spilling into Lebanon and the Arab Middle East have meant that the most practical option for monetizing Israeli natural gas is through an undersea pipeline, via Cyprus, linking to the Turkish pipelines. Current exploration activities in the region highlights future gas potentials in offshore Lebanon, Gaza, Iskenderun and Kas (Mugla). As emphasized by Hafner and Tagliapietra (2013), new challenges as well as opportunities now exist for different nations resulting from new geopolitics in the eastern Mediterranean.

In addition to eastern Mediterranean gas, Iran, Azerbaijan and the Kurdistan Regional Government have vast reserves that can reduce dependency on Russian gas. However, the political disputes in the eastern Mediterranean between Israel and Libya, Turkey and Greek Cypriot Administration of Southern Cyprus, Iraq and the Kurdistan Regional Government have made it difficult to deliver eastern Mediterranean gas to Europe. The new Trans Anatolian Pipeline (TANAP) pipeline project has changed the whole scenario, and starting in 2019, Shah Deniz Phase II natural gas is expected to be delivered to Europe via TANAP. As a candidate for the European Union, Turkey has now become a key player in the region with the potential to become a new energy hub in the Southern Energy Corridor. Increasing tensions between Russia and the EU after the occupation of Crimea makes Turkey a leader in the evolving eastern Mediterranean gas market. Hafner and Tagliapietra (2013) also stated that the high-level political commitment between Turkey and the EU may create a new outlook for the future energy cooperation between the EU and Turkey.

All in all, Levoyannis and Labreche (2013) noted that the extraction of gas and oil in the North Sea has been declining which may increase energy dependency of Europe in the near future. Following current anti-nuclear campaigns in Europe, the EU has directed its interest towards alternative energy mix. The most recent findings of Yorucu and Katircioglu (2014) also validate anti-nuclear arguments. Considering proven gas reserves in the eastern Mediterranean, natural gas may substitute all other energy options in Europe's energy portfolio.

An earlier study undertaken by Stern (2012) highlights that gas is a relatively new fuel with extremely high investment and infrastructure costs. Markets for gas needed to be developed with prices that were low enough, relative to alternatives, to stimulate demand, but high enough to justify the often considerable infrastructure expenditure. Stern (2012) emphasized that much internationally traded gas is still sold on the basis of long-term contracts. However, as infrastructure develops, the contractual issues and the appropriate market structure also change. The ways in which gas prices are formed appear to be endogenous to the way the overall market develops, and as markets develop one might expect price formation mechanisms to evolve in response. According to the IEA/OECD (1992), the European gas industry has traditionally been based on long-term contracts (up to 25 years) that involve a large amount of 'take-or-pay' (TOP). Take-or-pay contracts guarantee that the buyer will take a specific minimum volume each year or pay for it anyway with the flexibility for the buyers to take delivery of the balance later in the contract period. Gas prices are now mainly determined on a regional basis, with different tax rates. In the US, the UK and several parts of Europe, gas prices are determined at hubs, usually at spot markets while in Asia, LNG contracts are indexed to crude oil prices. Much of continental European gas has traditionally been transacted on the basis of the long-term contracts indexed to crude oil product prices.

Honore (2010) stated that the oil indexation mechanism in the determination of internationally traded gas prices is based on gas contracts developed with a linkage with oil products, usually of heavy fuel oil and gas oil. There are several reasons why natural gas prices are indexed to crude oil prices. First, gas prices cannot deviate too much from competing energies such as household fuel for heating, fuel oil, alternative industrial fuel for heating and steam, which offer a possible replacement for gas. Second, the oil market had been a liquid commodity market for several decades when netback market pricing with oil product indexation was created in the 1960s. This caused three consequences: (a) producers accepting the price risk related to changes in gas prices aligned with movements of oil prices; (b) banks seemed to be comfortable with the idea of lending money based on revenues linked to oil products; and (c) oil indexation prevented the few gas suppliers to Europe from influencing prices.

Dilaver et al. (2014) also stated that volatility in natural gas prices or supply can have devastating effects on European economies and therefore identification of future gas needs is a vital and urgent issue for policymakers in OECD Europe. Considering the future uncertainties in oil and gas prices, stakeholders and banks must take this critical issue into account to meet consumption requirements.

Along the lines of Soemardan et al. (2014) the gas price can be calculated from the average cost by adding the risk factor during exploration, return on costs and government take. The government take is calculated by composing the contractor's share and the government's share which is determined through the production sharing contract subject to the law of oil and gas. Profit is highly dependent on the gas price and increase in the gas price increases the optimum gas rate and maximum profit.

Both government's and stakeholder's profit is also affected by taxation imposed on gas prices. Consistent with Xia et al. (2015) taxes are added as one of the determinants in calculating the prices of natural gas. According to their study, the tax categories are composed of construction tax, education surtax, resource tax and corporate income taxes. On top of the total taxes, acquisition costs, exploration costs, development costs and operating costs are summed up as an initial cost. VAT is also added on the final price of natural gas which is controlled by the government. The statistical data gathered from IEA/OECD (2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012) includes the price of natural gas, crude oil and taxation in the OECD countries. Some of the nations of OECD Europe, such as Belgium, Italy and Norway do not publish actual data as a matter of confidentiality. Data on energy indices prices are published as a substitute. Transport costs, lack of infrastructure or government policy may sometimes be conceived as barriers in determining the gas prices resulting in significant inter-regional price differentials.

A similar study by Yorucu (2014) on a single country case has recently been undertaken by conducting autoregressive distributed lag modelling (ARDL). The results reveal the crude oil prices did not show any significant impact on natural gas prices. Yet, on a more global picture, it is not known if a group of countries, in particular the EU-12 with considerable size in gas consumption will demonstrate different results.

Therefore, this study investigates the dynamic relationship between natural gas prices, crude oil prices and taxation among