Applied Energy 136 (2014) 312–324

Contents lists available at ScienceDirect

Applied Energy

journal homepage: www.elsevier.com/locate/apenergy

No more gas from Egypt? Modeling offshore discoveries and import uncertainty of natural gas in Israel

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HIGHLIGHTS

- Gas supply from Egypt to Israel has been erratic since its initiation and became more so after the Egyptian 2011 revolution.
- Recent gas discoveries in Israel exceed domestic demand and will turn Israel into a net energy exporter.
- CGE simulations show that an increasing import price for gas from Egypt causes the Israeli economy to retract by only 0.2%.
- Exploiting new gas fields in Israel leads to economic growth and higher household welfare, with the poor benefitting most.

ARTICLE INFO

Article history:
Received 16 January 2014
Received in revised form 8 August 2014
Accepted 7 September 2014

Keywords:
Natural gas
Energy policy
Egypt
Israel
MyGTAP

ABSTRACT

Israel depends on natural gas imports from Egypt for about 40% of its domestic needs, with the remaining met from domestic production. Gas supplies from Egypt have been erratic since their initiation: disruptions have increased after the 2011 revolution in Egypt and have been further ignited by public discontent. Despite these developments, Israeli policy makers have viewed the Egyptian gas deal as a positive factor in preserving peace with Egypt and have had no better alternatives than relying upon it. This has changed, however, after recent discoveries of three major offshore fields that are expected to satisfy domestic demand for an indefinite period and to provide gas for exports. We use an extended global CGE modeling framework that incorporates multiple households and factor ownership to investigate the effects of reduced gas imports from Egypt and the evolvement of domestic gas production as an alternative. In case of reduced gas imports from Egypt, the Israeli economy would slightly retract mainly due to lower production in energy intensive sectors. Poor households would be the most negatively affected, due to the strongest relative decline in income and the strongest increase of their consumer price index. In the case of increasing domestic gas production, Israeli GDP and domestic absorption would rise by about 0.2% and 0.4%, respectively. Poor households would be more positively affected than rich ones due to their composition of factor income and their higher expenditure shares for energy intensive commodities.

1. Introduction

In 2009, major offshore natural gas deposits were discovered in Israel. Historically, Israel is an energy-poor state relying on imported fossil fuels to meet its energy needs, as well as an energy island disconnected from energy infrastructure in the region, with the exception of gas from Egypt [1]. Since 2008, Egypt has supplied Israel with 40% of its domestically consumed natural gas. The gas is delivered through a pipeline that branches off from the Arab gas pipeline connecting Egypt, Jordan, Lebanon, and Syria in Egypt.

Natural gas entered Israel's energy mix for the first time in 2004, with a domestic field (Yam Tethys) supplying its production to the market. Natural gas consumption expanded in 2008 when the Eastern Mediterranean Gas and Oil (EMG) Company began importing natural gas from Egypt to Israel. The EMG supplied 2.5 Billion Cubic Meters (BCM) of natural gas to consumers in Israel in 2010, or nearly 50% of the 5.3 BCM consumed in Israel, with the rest supplied by domestic fields [1].

There is no detailed information available on the level of the preferential price Israel paid and the difference from non-preferential global gas prices. However, according to Khadduri [2] the initially agreed upon price was US$ 3 to US$ 3.5 per million British

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http://dx.doi.org/10.1016/j.apenergy.2014.09.019
0306-2619/

thermal units (Btu). Khadduri [2] also reports that in August 2009, the Israel Electric Corporation (the primary consumer of gas exports from Egypt) approved an adjusted price of US$ 4 to US$ 4.5 per million Btu. In comparison, a calculated average price of natural gas worldwide[2] is between US$ 5.2 and US$ 9.8 per million Btu through the period between 2008 and 2013 [5,6].

Significant natural gas resources were discovered in 2009 and 2010 close to Israel's Mediterranean coastline in three fields: Tamar, Dalit, and Leviathan. The estimated total reserves are 700 BCM, of which 246 BCM come from Tamar, between 7 and 14 BCM from Dalit and the rest from Leviathan [7,8]. According to Israel Strategist [9], the Tamar field was the largest natural gas discovery in 2009 in the world and is expected to meet Israel's gas needs for up to 30 years. The Leviathan field was discovered in December 2010 and represents the largest natural gas discovery in the world since 2000. This field is predicted to satisfy Israel's domestic gas needs indefinitely and could be used for export. The production of natural gas from Dalit and Leviathan fields is expected in 2016 and 2017, respectively, while the production at Tamar has already started in March 2013 [10–14]. These gas discoveries have fueled debate in Israel on the appropriate strategy to enhance long-term energy security [15,16].

With these newly discovered fields of natural gas, Israel could get into a situation where domestic production displaces gas imports from Egypt. According to Ratner [10], this could generate benefits for both countries. From an Egyptian perspective, there is public discontent in Egypt against the sale of gas to Israel, particularly after the January revolution [10], because Israel pays below market prices for natural gas imports from Egypt. As a consequence, the gas pipelines used for transporting Egyptian gas to Israel have been attacked more than ten times since the Egyptian revolution of January 2011, causing Israel's gas supply to be temporarily cut off [17,18]. Sustaining natural gas exports to Israel seems doubtful in post-revolution Egypt. Therefore, ending Egyptian exports to Israel would have political advantages in Egypt and may lead to a more reliable supply of gas for Israel. Recent developments and population pressure in Egypt suggest that Egypt may even tend to import natural gas in the near to medium future, probably from Israel itself.

As an alternative to relying only on domestic natural gas, Israel may continue importing Egyptian gas and use additional domestic production for exports to destinations such as Europe or countries in the Middle East, such as Jordan. Under the condition of continued preferential prices offered by Egypt, this would generate economic benefits for Israel. Another possibility is changes to the agreement between Israel and Egypt such that there is an increase in the price paid by Israel for Egyptian gas. This could improve Egypt's trade balance [10] and would be supported by the argument that despite the negative factors associated with its continuation, the gas deal with Egypt is seen as a positive factor in preserving peace with Egypt by Israeli policy makers [11].

2. Objectives and research questions

This paper uses global applied general equilibrium models that link the Israeli economy with the rest of the world to investigate the economic implications for Israel of different scenarios related to the production and trade of natural gas. The following research questions are addressed with respect to their macroeconomic and welfare dimensions:

- What are the macroeconomic implications of increasing the price of Egyptian gas exports to Israel and equalizing it to the price of gas paid by other countries in the region, such as Jordan?
- The Tamar field of natural gas started production in March 2013 and the other recent discoveries of Dalit and Leviathan fields are expected to begin production in 2016 and 2017, respectively [10–14]. What are the implications for the Israeli economy at large and for the livelihoods of different household groups?
- How would the combination of domestic fields entering the market and the equalization of Egyptian export prices to those paid by other countries in the region affect the Israeli economy?

3. Methodology

To achieve the previously stated objectives we use two applied general equilibrium models that link the Israeli and Egyptian economies to world trade and production of natural gas. To benefit from the advantages of incorporating disaggregated household income, expenditure, transfers, and ownership of production factors, we apply the newly developed MyGTAP model [19]. Moreover, because we are also interested in analyzing welfare changes in Israel associated with the different policy experiments considered in this study, we apply the GTAP model [20].

3.1. Overview of the models

The GTAP CGE model relies on neoclassical theory and is based on the assumptions of constant returns to scale in production, perfect competition among firms, and product differentiation by the economy of origin (i.e., the Armington assumption). It has a single representative household for each region, called the 'regional household.' The regional household collects income from returns to production factors and tax revenues net of subsidies. This income is distributed to private household expenditure, government expenditure, and savings by applying a Cobb-Douglas per capita sub-utility function [20]. Private household utility maximization is modeled as a Constant Difference of Elasticity (CDE) demand system, while domestic and imported commodities are aggregated using a Constant Elasticity of Substitution (CES) function, and imports are sourced from different regions according to a CES function as well.

Production is based on an aggregation of value-added and intermediate inputs according to CES technology, with value-added being a CES composite of primary production factors and intermediate composite being a Leontief function of inputs. The model closes by assuming that savings drive the demand for investment in a particular region and that each region's savings contribute to a global pool of homogenous savings. The allocation of these savings among regions in response to investment demand is determined based on the relative rates of return to capital among regions.

The MyGTAP model is an extension of the GTAP model that modifies the original single regional household to allow for multiple households and an improved specification of government. It also includes inter-regional transfers, such as remittances and foreign capital income [19,21]. The government account of MyGTAP collects its income from taxes and foreign aid and spends this income on consumption expenditure, transfers to households, foreign aid (out), and subsidies. The difference between government income and expenditure is either a deficit or savings (Fig. 1).

Private households collect their income from returns to production factors, including foreign remittances and capital, transfers from the government, and transfers from other households.

[2] Four different prices of natural gas are used to constitute a global average price of natural gas, namely: (1) cif European Union, (2) UK Heren NBP Index, (3) US Henry Hub, and (4) Canada (Alberta) [3–5].