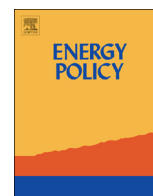




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# Natural gas consumption and economic growth: Are we ready to natural gas price liberalization in Iran?



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## HIGHLIGHTS

- Iran has been considered as a major natural gas producer in the world.
- This paper examines the relationship between gas consumption and growth in Iran.
- Positive impact of gas consumption on growth has been obtained.
- The paper finds that gas consumption and income reinforce each other in Iran.
- Natural gas price has also negative and significant impact on natural gas consumption in Iran.

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## ABSTRACT

This paper examines the relationship between natural gas consumption and economic growth in Iran within a multivariate production model. We also investigate the effects of natural gas price on its consumption and economic growth using a demand side model. The paper employs bounds test approach to level relationship over the period of 1972–007. We find evidence of bidirectional positive relationship between natural gas consumption and economic growth in short-run and long-run, based on the production model. The findings also suggest that real GDP growth and natural gas have positive and negative impacts on gross fixed capital formation, respectively. Employment, however, was found to have negative but insignificant impact on gross fixed capital formation. Moreover, the estimation results of demand side model suggest that natural gas price has negative and significant impact on natural gas consumption only in the long-run, though there is insignificant impact on economic growth. These results imply that the Iranian government's decision for natural gas price liberalization has the adverse effects on economic growth and policy makers should be cautious in doing this policy.

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## 1. Introduction

The debate on the relationship between energy consumption and real income growth led to the emergence of divergent views. Neo-classical economists pointed out that energy is an intermediate good rather than a primary input for production (see, e.g., Stiglitz, 1974; Ockwell, 2008; among others). On the opposite view, ecological economists criticize the neo-classical views due to the account for two laws of thermodynamics: mass-balance principal and entropy law (see Ockwell, 2008). Based on these two laws, for ecological economists, energy is a fundamental factor in the

production. From this perspective, the possibility of decoupling energy use from economic growth seems more limited.

With the current trend of energy consumption in the world, nations have faced two great threats of environmental pollution: Climate change phenomenon and accelerated growth of the consumption of nonrenewable energy sources (Energy Balance, 2008). The *Executive Plan Johannesburg* noted to discuss the energy in the context of sustainable development. The main objectives behind this plan are the following: (1) Improving access to adequate energy services. (2) Identifying the positive effects of the energy services on reducing poverty and improving living standards. (3) Diversifying energy supplies by developing advanced technologies, clean, efficient and better prices (Energy Balance, 2004). Therefore in recent years, the use of the natural gas with the qualifications such as its relative fuel efficiency, low emissions, quick construction timelines, and capital costs has been a growing trend especially for industrial and electricity generation

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sectors, and it has been predicted that this trend continues until 2035 (EIA, 2010).

With regards to this trend investigating the empirical relationship between natural gas consumption and economic growth has important implications for policy makers. If there is a unidirectional causality running from natural gas consumption to economic growth, natural gas conservation policies are likely to have adverse effects on economic growth. In contrast, if there is a unidirectional causality running from economic growth to natural gas consumption, Natural gas conservation policies can be implemented (that will have little or no adverse effects on economic growth). On the other hand, if there is no-causality running in any direction the natural gas conservation policies have no effect on economic growth. In contrast, if there is bidirectional causality between natural gas consumption and economic growth, natural gas consumption and economic growth are jointly determined and affected at the same time. But, the results of empirical studies on the causal relationship between natural gas consumption and economic growth have been mixed and conflicting (see, e.g., Yang, 2000; Aqeel and Butt, 2001; Lee and Chang, 2005; Sari et al, 2008; and Aspergis and Payne, 2010). This is a vacuum of research as theoretical and empirical studies results are mixed, at best.

For the Iranian case, the country has been considered as the second most massive natural gas field and the fourth producer of natural gas in the world (EIA, 2010). These two factors along with other factors led to the replacement of oil products with natural gas consumption as a key policy of government in energy sector during the fourth development plan (2005–2009). Over 40% of total energy consumption in Iran is provided by natural gas, which indicates the importance role of its valuable energy factor in the process of economic growth and development plans (Energy Balance, 2008). Furthermore, for example, the natural gas consumption in Iran is 1.35 times of natural gas consumption in China (the most populated country in the world) in 2010, and also the equivalent of 25% and 4.5% of natural gas consumption in Europe and the world, respectively. Although Iran is the fourth largest producer of natural gas, its consumption has increased more rapidly than production. Therefore, this trend of production and consumption of natural gas in Iran leads to deficit that, except in 2010, always import of natural gas has been greater than exports<sup>2</sup>. The low growth rate of natural gas production in Iran has two main reasons: (1) Due to economic sanctions, Iran is not able to attract foreign investment. (2) Most of Iran's natural gas reserves are located in sea areas and gas exploitation in these areas is difficult and costly. For example, based on national energy balances, in 2009, the share of reserves in dry and sea regions are 35.05% and 61.95%, respectively. In the other hand, the increasing rate of natural gas consumption is due to the low price of domestic supply of natural gas that leads to economical justification of the use of wasting energy technologies, non-optimal allocation, inappropriate and abundant use of natural gas. So, unlike the pattern of natural gas consumption in industrialized countries, the highest share of its consumption in Iran is allocated to the household and commercial sectors (Energy Balance, 2008).

Until 2010, in order to encourage the production of goods and services and increasing the welfare of society, the government supply natural gas with low price by giving subsidies. But as mentioned above, the low price leads to inappropriate and abundant use of natural gas. Note that energy efficiency in Iran is not suitable. The energy intensity as an indicator to evaluation of

energy efficiency indicates that in Iran for one million dollars gross domestic production, the 863.93 t equivalent of crude oil should be used. This indicator for OECD countries and world are 109.23 and 189.75 t equivalent of crude oil, respectively<sup>3</sup>. Then, in order to change the situation, the government by liberalization of natural gas price in the late 2010 within the law of subsidies cut tries to avoid wasting its valuable energy factor and thus leads to optimal allocation. However, in order to support the low-income communities and economic justice, government pays subsidies cash to poor people.

Based on the above mentioned importance of the issue, the aim of this paper is to investigate the relationship between natural gas consumption and economic growth within a multivariate production framework as well as the effects of natural gas price on its consumption and economic growth applying a demand side model. To the best of our knowledge, a few studies investigated the relationship between natural gas consumption and economic growth in Iran. For example, Arman and Zare (2005) using Toda-Yamamoto and Vector Error Correction model (VECM) investigate the relationship between economic growth and consumption of different kinds of energy for the period 1967–2002. They find unidirectional causality from economic growth to natural gas consumption. Zamani (2007), investigates the relationship between overall GDP, industrial and agricultural value added, and disaggregated energy consumption measures using VECM technique for the period 1967–2003. He found bidirectional relationship between overall GDP and natural gas consumption as well as between industrial value added and natural gas consumption. Asgharpour et al. (2009) investigate the relationship between natural gas consumption and real GDP in the bivariate framework for the period 1971–2006. They found bidirectional relationship between the natural gas consumption and real GDP.

Considering that the government by liberalization of natural gas price in the late 2010 within the law of subsidies cut tries to avoid wasting its valuable energy factor, which leads to optimal allocation, the purpose of this paper is to re-examine the relationship between natural gas consumption and economic growth within a multivariate production side model in Iran. Moreover, we investigate the effects of natural gas price liberalization on its consumption and economic growth using demand side model. In this regard we take this dual approach to determine if natural gas consumption has a positive impact on economic and natural gas price has a negative impact on its consumption, then natural gas price liberalization has an adverse impact on economic growth. In fact, we evaluate the impact of natural gas price liberalization on economic growth. Our main results are in line with Asgharpour et al. (2009) for Iran with a bivariate model and Aspergis and Payne, 2010 for 67 countries within a panel framework.

This study has several advantages. First, this paper investigates the effect of natural gas price on its consumption and economic growth based on demand side model that has not been applied in the previous studies. Investigation of this relationship will help government and policy makers in Iran, to implement appropriate and precise policies during the next 4 years of executing the law of subsidies cut<sup>4</sup>. Second, we apply a multivariate framework in our investigation as the bivariate model's estimation results may be invalid due to omitted variables bias<sup>5</sup>. Moreover, since a multivariate model incorporates more information than a bivariate model, we can obtain more reliable and better results. Third, in

<sup>3</sup> The statistics reported are extracted from IEA, International Energy Agency Online Data Services, [www.iea.org](http://www.iea.org).

<sup>4</sup> Heidari and Saeedpour (2013) provide some recommendations for Iranian policy makers for oil products.

<sup>5</sup> The more recent study with Iranian data, Asgharpour et al. (2009), uses a bivariate framework.

<sup>2</sup> The statistics reported are extracted from EIA, <http://www.eia.gov/cfapps/ipdbproject/iedindex3.cfm?tid=93&pid=44&aid=33&cid=regions,&syid=2000&eyid=2011&unit=MM#>.

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