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The dynamics of natural gas consumption and GDP in Bangladesh

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ABSTRACT

Reserves of natural gas in Bangladesh are very large and total demand has increased secularly in recent years. This paper examines the causal relationship between the consumption of natural gas and GDP in Bangladesh over the period 1980 to 2010. We find that there is a positive unidirectional causality running from GDP to natural gas consumption: movements in GDP affect the consumption of natural gas but not vice-versa. While our results rest on several statistical assumptions, they support the pursuit of policies that are in line with energy conservation. Implementing these policies will be of particular significance in light of the fact that Bangladesh's current reserves of natural gas will not meet its current level of consumption demand beyond the next two decades.

Contents

1. Introduction

The literature on the relationship between energy consumption and economic growth emerged during the oil shocks of the 1970s [37]. Since the seminal paper by Kraft and Kraft [26], this relationship has been extensively studied by researchers. Their results reveal four main findings on the causal relationship between energy (measured in a variety of ways) consumption and economic growth: (1) unidirectional causality running from energy consumption to economic growth [2,49,48,42], (2) unidirectional causality running from economic growth to energy consumption [26,8,16,9,37], (3) bidirectional causality between energy consumption and economic growth [21,17,20,15,34], and (4) no causality [50,13,35,46].

These findings show that there is no unique policy recommendation that can be applied across all countries when the goal is to advance economic growth through energy policy. For example, energy conservation policy will have minimal to no impact on economic growth when there is no causality between these two variables (*neutrality hypothesis*). However, if unidirectional causality runs from energy consumption to growth then the so-called *growth hypothesis* holds. In such a situation, any reduction in energy consumption may have a deleterious impact on country's economic growth prospects. On the other hand, if causality runs only from GDP growth to energy consumption, then energy conservation policy may be pursued without negatively impacting GDP growth (*conservation hypothesis*). Finally, if there is bidirectional causality, interdependent relationship between energy consumption and growth (*feedback hypothesis*) must be taken into account in the process of formulating policies.

While a plethora of literature examines the association between energy and economic growth, it is necessary to identify

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this relationship at the disaggregated level since different types of energy may have different effects on economic growth [27]. Hence, a new set of literature has recently emerged to study the link between electricity consumption, coal consumption, natural gas consumption, gasoline consumption, and other types of energy consumption and economic growth separately.[1]

Vast reserves of natural gas have been discovered at the Bay of Bengal since the mid-1990s, onshore and offshore. Proven reserves of approximately 15 trillion cubic feet have been found in 22 discovered gas fields (Reuters, 2012). Following from the discovery of these reserves, there has been rising demand for it by the manufacturing and household sectors[2]: consumption of dry natural gas has risen from 50 billion cubic feet in 1980 to approximately 711 billion cubic feet in 2010 [45].

In a published report in 2000, Jaccard et al. [23] argued that proven reserves of natural gas would last for 45 years at the then current rate of natural gas consumption. Additionally, the authors also cautiously mentioned that these reserves would last only about 17 years if the 2000 rate of natural gas use in Bangladesh were to increase only by 10 percent per year. As a matter of fact, the consumption of natural gas has increased by more than 10 percent per year since 2000.[3] Hence, although the total proven reserves have reached 15 trillion cubic feet in recent years, experts calculated that it would take 19 years or so before the recoverable gas reserves are fully exhausted unless new fields are found and explored (Reuters, 2012).

Concomitant with the sharp rise in the consumption of natural gas, Bangladesh has achieved a remarkable average GDP growth rate of 5 percent per year from 1981 to 2010. In fact, since 2004, GDP growth rates have always been at least 6 percent per year [47]. Surprisingly, the literature on the link between economic growth and natural gas consumption in Bangladesh is conspicuously absent. The aim of this paper is to fill this gap by addressing these questions: (1) Does the use of natural gas have any significant impact on the GDP of Bangladesh? (2) What is the causality between natural gas consumption and economic growth in this country? (3) Should policies related to conservation of natural gas be implemented in Bangladesh?

We use data on real GDP and natural gas consumption for Bangladesh from 1980 to 2010. We find that both series are cointegrated in the long run. Additionally, Granger causality results suggest the existence of a unidirectional causality from GDP to natural gas consumption in Bangladesh. The rest of the paper is organized as follows. Section 2 presents the review of relevant literature on natural gas consumption and economic growth. Section 3 discusses the data and econometric method that will be used. Section 4 presents our findings. Section 5 underscores the policy implications and recommendations emerging from our results and Section 6 concludes.

2. Review of the literature

Empirical results on the causal relationship between natural gas consumption and economic growth can be divided into four groups: unidirectional causality from natural gas consumption to GDP, unidirectional causality from GDP to natural gas consumption, bidirectional causality and no causality.

The seminal paper by Yu and Choi [49] is among the first to identify the causal relationship between natural gas consumption and GNP. Applying Sims and Granger causality technique on UK time series data for the post-war period from 1950 to 1976, they find evidence of unidirectional causality running from natural gas consumption to economic growth. Hence, the growth hypothesis seems to be true for the UK. More recently, Yang [48] uses Granger technique on Taiwan's time series data from 1954 to 1997 to identify causal relationships between GDP and the consumption of aggregate as well as different types of energy including coal, oil, natural gas and electricity. Yang's results suggest bidirectional causality between total energy consumption and GDP, but a unidirectional causality from natural gas consumption to GDP. Lee and Chang [28] however argue that Taiwan has experienced a number of changes in the economic structure from 1960 to 1980 including adopting export promotion and financial liberalization policies. Hence, it is important to take structural breaks into consideration. However, even after including the structural break, Lee and Chang find a unidirectional causality running from natural gas consumption to economic growth from 1954 to 2003. These results, therefore, reinforce the findings of Yang [48].

Kum et al. [27] apply the bootstrap-corrected causality test on G-7 countries for the 1970–2008 period for Canada, Germany, Italy, Japan, United Kingdom and United States and 1960–2008 period for France. For Italy, they find that the Granger causality runs from natural gas consumption of GDP growth. Pirlogea and Cicea [38] use a smaller dataset from 1990 to 2010 and find that natural gas consumption causes economic growth in Spain. Within a multivariate framework, Muhammad et al. [32] examine the long run relationship between natural gas and GDP growth in Pakistan from 1972 to 2010. Their results from the ARDL procedure support the natural gas consumption-led-growth hypothesis.

Sari et al. [41] estimate the effects of natural gas consumption on industrial production (as a proxy of economic activity) in the US. Using monthly dataset from 2001 to 2005, they find unidirectional causality from industrial production and employment to natural gas consumption. Payne [36] uses the US data for the 1949 to 2006 period and applies Toda-Yamamoto long run causality test to investigate the natural gas consumption-real GDP nexus. Payne's results support the findings of Sari et al. [41]. A similar result is found by Kum et al. [27] for the UK.

Another strand of the literature finds no causality between natural gas consumption and economic growth. Yu and Choi [49] do not find the evidence of any causal relationship between natural gas consumption and GDP in the United States. Aqeel and Butt [4] examine the causal relationship between gas consumption and GDP for the period of 1955–56 to 1995–96. The novelty of their work is the application of the Hsiao's Granger test. Their results do not suggest any causal relationship between natural gas consumption and GDP in Pakistan. Fatai et al. [12] do not find any evidence of causal link while studying the growth-gas consumption nexus in Australia and New Zealand. The insignificant impact of natural gas consumption on economic growth is also evident in Canada and Japan during 1970–2008 [27] and Romania from 1990 to 2010 [38]. Therefore, implementation of the conservation policy may not have any negative impact on economic activities of these countries where either *conservation hypothesis* or *neutrality hypothesis* holds.

The so-called feedback hypothesis has been found in recent papers by several authors. Zamani [51] uses a vector error-correction model to identify the causal relationship between gas consumption and GDP, industrial and agricultural value added in Iran from 1967 to 2003. The results suggest bidirectional causality between GDP and gas, but a unidirectional causality running from agricultural value added to gas consumption and a unidirectional causality from gas consumption to industrial value added. Therefore, it can be argued that the conversation of natural gas may have no effect on the agricultural output but detrimental effect on the industrial output in Iran. Using quarterly data from 1991 to

[1] See for example, [31,5–7,19,10,14].

[2] In Bangladesh, natural gas is mainly used for thermal power generations, and other commercial and household consumption ([22,30]).

[3] Total consumption of natural gas went up from 342.56 billion cubic feet in 2000 to 710.89 billion cubic feet in 2010. Hence, the rate of increase of total gas consumption per year was approximately 10.75 percent.