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Energy conservation policies, growth and trade performance: Evidence of feedback hypothesis in Pakistan

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HIGHLIGHTS

- This study investigates the energy–growth–trade nexus in Pakistan.
- Results indicate a long-run link between energy consumption (EC) and trade.
- EC is positively affected by GDP, exports, and imports.
- We find significant bilateral causal linkages among the studied variables.
- Energy conservation policies thus lead to reduce the trade performance and growth.

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ABSTRACT

This study investigates the energy–growth–trade nexus in Pakistan by using the annual time series data for the period of 1973–2013. Our main results show: (i) the presence of long-run link between energy consumption and trade performance; (ii) positive impact of gross domestic product, exports, and imports on energy consumption; (iii) bidirectional causal relationship between exports and energy consumption, and also between imports and energy demand; and (iv) bidirectional causality between gross domestic product and energy consumption points to the presence of feedback hypothesis in Pakistan. We therefore note that energy conservation policies will reduce the trade performance which in turn leads to decline in economic growth in Pakistan. The present study may guide policymakers in formulating a conclusive energy and trade policies for sustainable growth for long span of time.

1. Introduction

Over the last four decades, many developing economies have experienced the rapid increase in exports, imports, income per capita and energy consumption to promote economic growth. It has widely been recognized that trade policy plays an important role in economic growth, with trade openness and terms of trade being considered as the main determinants of economic growth (e.g., Bhagwati, 1978; Romer, 1990; Hwang, 1998). In general, the studies on the export-growth nexus argue that exports provide the proper channel to liberalization of trade and positively affect domestic production, which then leads to economic growth. Exports also constitute the main source of foreign exchange earnings and provide domestic companies with the greater access to international markets.

On the other hand, the importance of relationship between energy consumption and economic growth has been widely discussed in energy economics literature. Energy consumption is directly affected by individual consumption and industrial production. Under the growth hypothesis, energy consumption is a crucial input for growth activities and harmonizes capital and labor directly or indirectly as an input in the process of production. To the extent that energy is a critical input for industrial production and economic activity, many studies have, since the oil shocks of

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the 1970s, investigated the relationship between energy consumption and economic growth (e.g. Ramcharran, 1990; Ebohon, 1996; Yang, 2000; Lee and Chang, 2005; Altinay and Karagol, 2005; Lee, 2006; Chen et al., 2007; Apergis and Payne, 2009; Wolde-Rufael, 2009; Ozturk, 2010; Shahbaz and Lean, 2012). There is also a separate and comparative literature available on the relationship between trade and economic growth (e.g. Culem, 1988; Pain and Wakelin, 1998; Wong, 2010). However, very few studies have addressed the interactive relationship between energy consumption and trade openness.

The energy consumption-trade nexus is an important issue in an open economy. If the causal relationship runs from energy consumption to trade or there is feedback relationship exists between them, then energy conservation policies will reduce the trade performance which would lower economic growth. Differently, if the causality goes from trade to energy or does not exist at all in either direction, energy conservation policies can be implemented without harmful effects on trade. Some studies have recently tackled this issue by using cross-country data (e.g. Narayan and Smyth, 2009; Sadorsky, 2011; Dedeoğlu and Kaya 2013). While the use of panel data is suitable for providing insights about the energy-trade nexus across the whole sample countries, it fails to explain the causal effect at individual country level, which thus limits the policy implication for a specific country in terms of domestic economic, trade, and energy policies.

Our paper makes a unique contribution to the literature with reference to Pakistan, being a pioneering attempt to investigate the relationship between energy consumption and trade performance by using the long annual time series data from 1973 to 2013. This country is among the most populated countries of the world with 188 million of habitants and a population growth rate of 1.97% in 2013, and is expected to remain the 6th populated country in 2015 with population of 363 million (World Population Data Sheet 2013). Changes in population growth would have significant impacts on various aspects of an economy including particularly economic growth, energy consumption, trade, food security problem, environment problem and urban congestion. The energy sector in Pakistan has had substantial changes since 1995 in terms of energy sources and energy supply patterns. Fig. 1 illustrates the evolution of total energy supply in Pakistan as well as the share of different energy sources over the period 1995–2013. In 1995, the total energy supply of Pakistan was 28 million tones of oil equivalent (TOE), with a mix of 41.6% oil, 36.8% gas, 15.5% electricity, and 5.8% coal. In 2013, Pakistan's energy supply increased to 64 million TOE, with a shift to more gas consumption (48.2%) and less oil consumption (32.5%), particularly due to the sharp increase in oil prices. Regarding the trade activities, the Pakistan economic survey 2013–2014 reports that the five main categories of exports (cotton and cotton manufactures, leather, rice, and chemicals and pharmaceutical products, and sports goods) account in 2012–2013 for about 70% of total exports, with cotton manufactures being the most important sector (52%). On the other hand, Pakistan's major import items include crude oil and petroleum products (about 33%) and machinery group (13%). Pakistan's high degree of export concentration and oil dependence could thus induce the volatility of its export earnings and economic growth.

Another contribution of our study is the fact that we do not restrict it to any particular econometric technique at any stage to estimate the relationship between energy consumption and trade openness, which is the case in most past studies. Instead, different sensitivity analyses (estimations techniques) are used to check the robustness of initial estimated relationships between energy consumption and trade openness in Pakistan. They specifically involve the application of three different econometric techniques in each step of estimations of unit root tests, long-run cointegration and long-run elasticity.

The rest of the paper is organized as follows. Section 2 reviews the related theoretical and empirical literature, with a focus on the methodology. Section 3 reports the empirical findings. Section 4 discusses the results. Section 5 provides policy implications and concludes the paper.

2. Methods

2.1. Literature review

Following the oil shocks of 1970s, a number of studies have extensively analyzed the causal relationship between energy consumption and economic growth. For instance, studies such as Ramcharran (1990), Masih and Masih (1996), Morimoto and Hope (2004), Lee and Chang (2005), Altinay and Karagol (2005), Lee (2006), and Apergis and Payne (2009) document the unidirectional causality running from energy consumption to economic growth. On the other hand, studies such as Cheng and Lai (1997), Ghosh (2002), Soytas and Sari (2003), Yoo (2006), Halicioglu (2007) and Hu and Lin (2008) find evidence of the unidirectional causality running from economic growth to energy consumption. Finally, the evidence of bidirectional causality between energy consumption and economic growth has been found in, among others, Ebohon (1996), Yang (2000), Hondroyiannis et al. (2002), Yoo (2005), Zachariadis and Pashourtidou (2007), Squalli (2007), Chen et al. (2007), Akinlo (2008), Narayan and Smyth (2009), Wolde-Rufael (2009).

Fewer studies have found the long-run relationship between energy consumption and economic growth. Squalli and Wilson (2006) investigate the electricity consumption-income growth nexus by using time series data from 1980 to 2003 for six member countries of the Gulf Council Countries. Their results from the

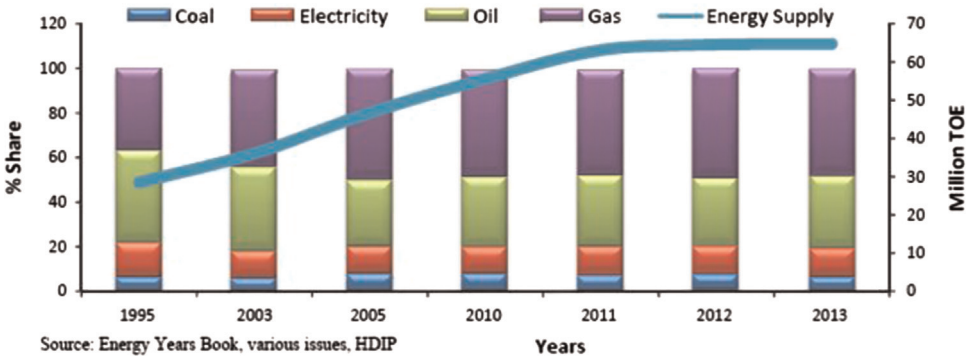

Fig. 1. Primary energy supply by source in Pakistan.