



The positive impact of trade openness on consumption of energy: Fresh evidence from Andean community countries

Matheus Koengkan

Department of Economics, Federal Fluminense University, Campus do Gragoatá, Bloco F, São Domingos, Niterói, Rio de Janeiro, 24210-350, Brazil



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ABSTRACT

The impact of trade openness on consumption of energy was investigated for a panel of four Andean community countries, over a period of forty-three years (from 1971 to 2014). The Arellano-Bond dynamic GMM model was used as method to realization of this investigation. The results demonstrate that the economic growth and trade openness have a positive effect on energy consumption, while the financial openness exerts a negative effect. These findings suggest that more energy conservations policies should be devised to reduce the consumption of energy by households and industries. Moreover, it is necessary more liberalization and deregulation policies that incentive the trade and economy liberalization with the intention of bring more investments in energy efficiency technologies, and access to products with high energy efficiency that reduces the consumption of energy from fossil fuels and the environmental degradation.

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1. Introduction

The consumption of energy in Latin American and Caribbean (LAC) countries has increased in tandem with the economy. Thus, between 1971 and 2013 the LAC's Gross Domestic Product (GDP) had an average annual growth rate of approximately 3.0%, while the consumption of energy was 5.4% approximately [3]. The consumption of energy in Latin America has more than tripled over the past forty years, wherein 1971 was consumed 248 million tonnes of oil equivalent (MTOE) and in 2013 was 848 MTOE an increase of 8% in the global electricity demand over the period [3]. This energy consumption comes from the fossil origin (e.g., oil, coal, and gas), which accounted for 68.9% of all energy demand in 1971 and increased to 74.4% in 2013 [3]. It is projected for the region an expand by more than 80% through 2040, with an average annual rate of 2.2%, reaching over 1.538 MTOE by the end of the outlook period [3]. In the Andean community between 2000 and 2007, the consumption of energy grew 37%, and it is projected that the consumption of energy increases more rapidly in the next years by reason of the rapid economic growth and higher income *per capita* [7]. The trade openness in Latin America was one of the reforms that swept the region in the 1980s and the early 1990s and

aftermath of the debt crisis in the context of broad structural adjustment measures. These structural adjustment measures had a combination liberalization and deregulation policies, as well as, stabilization policies. In some countries of the region, the trade reforms began in the mid-1980s and most other countries carried out trade liberalization during 1980–1993 [30]. In the Andean community countries, trade liberalization between the countries starting in 1991, where the community replaced and expanded on the group, which had been in force since 1969, by widening its institutional framework and strengthening the moves towards consolidation of the internal market. Moreover, the community adopted its “open skies” policy and called for the elimination of tariffs within the group by 1993 [12]. The nexus between consumption of energy and trade is an important area and that needs to be studied, due to the existence of few investigations. Indeed, understanding this relationship is crucial to understanding the energy policies and develop new policies more efficient. According to Sadorsky [30], the relationship between trade and consumption of energy is an important topic to investigate due to several reasons, such as (a) the reduction of consumption of energy by introduction of any energy conservation policies will reduce the trade and economic activity; (b) the energy conservation policies that reduce the energy consumption will counterbalance the trade liberalization policies developed to promotes the economic activity. These policies that reduce the consumption of energy at odds with

E-mail address: matheuskoen@hotmail.com.br.

trade liberalization policies; (c) in the existence of a unidirectional relationship between trade to consumption of energy or no causal relationship is found, the conservation policies will not affect the liberalization policies developed to increase economic activity. The central question of this article is: What is the impact of trade openness on consumption of energy in the Andean community countries? The main aim of this study is to investigate the impact of trade openness on consumption of energy in four Andean countries, over a period from 1971 to 2014. The Arellano-Bond dynamic GMM model was used as methodology. New empirical results of the relationship between consumption of energy, economic growth, trade openness, and financial openness were produced. This article will help policymakers develop appropriate energy policies and economic policies for Andean countries. This article is organized as follows: Section 2 presents a summary of the literature; Section 3 the material and method; Section 4 the results; Section 5 the discussion of results, and finally, section 6 presents the conclusions and policy implications.

2. Literature review

In the literature, the relationship between trade openness and consumption of energy has been poorly explored [34]. These studies have been used by one hand variables, such as GDP, labor, capital stock, urbanization, renewable, fossil, primary energy consumption, total energy consumption, and national energy use. On the other hand, other investigations have used variables, such as trade openness, trade liberalization, and imports, exports, as a proxy of trade openness. Although several authors have used different variables representing trade openness the question still remains: What conclusions have been reached regarding the impact of trade openness on consumption of energy in the economic and energy economics literature in the last years? In the literature, two lines of thought have emerged about the impact of trade openness on consumption of energy. The first argues that trade openness increase the consumption of energy. For instance, Nasreen and Anwar [23] explored the relationship between economic growth, trade openness, and consumption of energy in 15 Asian countries over the period of 1980–2011. The authors used the panel cointegration and causality approaches as methodology. Indeed, the results indicated that there is a positive bidirectional relationship between trade openness and consumption of energy. Sebri and Ben-Salha [32] investigated the nexus between consumption of renewable, economic growth, trade openness, and CO₂ emissions in the BRICS countries (e.g., Brazil, China, India, and South Africa) over the period of 1971–2010. The authors selected to use the Autoregressive Distributed Lag (ARDL) and Vector Error Correction Model (VECM) as method. The empirical results indicated that the trade openness promoting the renewable energy consumption in the long-run. According to the authors, this increase is due to the capacity of trade openness in incentive the investments in green technologies. Sadorsky [29] used the Fully Modified OLS (FMOLS) to examine the impact of trade openness on energy consumption in a sample of 8 Middle Eastern countries covering the period 1980 to 2007. The results indicated that the trade openness increases the consumption of energy in short-and long-run. This increase, according to the author is due to the positive effect of imports and exports on economic activity and consequently increases the consumption of energy. Houssain [13] examined the relationship between CO₂ emissions, consumption of energy, GDP, trade openness, and urbanization index for the panel of newly industrialized countries (NIC) using the time series data for the period of 1971–2007. Moreover, the Granger Causality test was used as methodology. The outcomes indicated the existence of a positive unidirectional relationship between the trade openness

and consumption of energy. Furthermore, the author justified this result by the simple fact that the trade openness incentive the economic activity and consequently the energy consumption. Sadorsky [30] studied the relationship between consumption of energy, trade, and economic growth in 7 South American countries (e.g., Argentina, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, and Uruguay), over the period of 1980–2007. The author used the FMOLS and dynamic OLS (DOLS) as methodology. The empirical results pointed to the existence of a positive bi-directional relationship between all variables in the model. Narayan and Smyth [24] used the Granger Causality test as method to examine the nexus between electricity consumption, exports, and GDP for a panel of Middle Eastern countries, over the period of 1974–2002. The authors found the existence of a positive relationship between all variables of the model. Jena and Grote [15] investigated the link between GDP, trade liberalization, and environmental degradation in India over the time period 1991–2003, using the panel regression technique. The results indicated that trade openness increases the economic activity and consumption of energy, consequently the environmental degradation. Cole [6] studied the impact of trade liberalization on national energy use in 32 developed and developing countries for the period 1975–1995. The Fixed Effect (FE) model was used as method. The author found that trade openness exerts a positive effect on energy consumption. However, the second suggests that trade openness decreases it. For example, Ghani [10] examined the effect of trade liberalization on consumption of energy in 27 countries over the period of 1970–1999. The author used an unusual method that account countries' heterogeneity in studying the effect of liberalization on economic growth and consumption of energy. Besides that, the author discovered that the trade openness does not increase the consumption of energy in the developing countries. This effect is due to the technological transfer of energy-saving technologies, products and/or processes brought about by trade liberalization. Al-Mulali and Ozturk [2] investigated the impact of consumption of energy, urbanization, trade openness, industrial output, and political stability on environmental degradation in the Middle East and North African (MENA) countries, over the period of 1996–2012. The authors used as methodology, the FMOLS model. The empirical results indicated that there is a negative relationship between trade openness and consumption of energy. Sbia et al. [31] used the ARDL and VECM as method to investigate the nexus between renewable energy, trade openness, GDP, and CO₂ emissions in the United Arab Emirates (UEA) country covering the period of 1975Q1–2011Q4. The results showed that the trade openness reduces the consumption of energy, where the trade lead to energy use efficiency as the energy market is bigger and the access to reduced energy-intensity products is easier. Shahbaz et al. [34] examined in Indonesia the link between GDP, consumption of energy, CO₂ emissions, and trade openness over the period of 1975Q1–2011Q4. The ARDL bounds test and VECM as methodology. The results indicated that the trade openness reduces the environmental degradation, because the market liberalization incentives the introduction of new technologies that reduces the energy demand. Managi et al. [19] investigated the impact of trade openness on environmental degradation in Organization for Economic Co-operation and Development (OECD) countries in a period of 1971–1996 using Arellano-Bond dynamic GMM model. The empirical evidences pointed that the trade openness benefit the environment in OECD countries, because reduces the consumption of energy from fossil fuels. Even though the literature has used different variables, countries, regions, and methodologies to explain the impact of trade openness or liberalization on consumption of energy, there are some gaps that were identified, and that need to be filled. Among them is the impact of financial openness on consumption of energy on Andean

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