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The transition between energy efficient and energy inefficient states in Cameroon

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ABSTRACT

I use a two-state (energy efficient/inefficient) Markov-switching dynamic model to study energy efficiency in Cameroon in a novel manner, employing yearly data covering 1971 to 2012. I find that the duration of an energy inefficient state is about twice as long as an energy efficient state, mainly due to fuel subsidies, low income, high corruption, regulatory inefficiencies, poorly developed infrastructure and undeveloped markets. To escape from an energy inefficient state a broad policy overhaul is needed. Trade liberalization and related growth policies together with the removal of fuel subsidies are useful, but insufficient policy measures; the results suggest that they should be combined with structural policies, aiming at institutional structure and investment in infrastructure.

1. Introduction

An economy is in an energy efficient (inefficient) state, if in that state, it is able to deliver more (less) services or output with less (more) energy input. Alternatively, in an energy efficient (inefficient) state, the economy with the same energy input is able to deliver more (less) services or output. In intertemporal sense, this means that the growth rate in energy intensity is negative (positive) in an energy efficient (inefficient) state (see Diagram 1).

The current literature on the drivers of energy efficiency has strong underpinning assumptions (see Fisher-Vanden et al., 2004; Hang and Tu, 2007; Hübler and Keller, 2010; Hubler, 2011; Yu, 2012; Sadorsky, 2013; Mulder et al., 2014; Lin and Moubarak, 2014; Adom and Kwakwa, 2014; Adom, 2015a, 2015b, 2015c inter alia). First, the current literature assumes that the process that is responsible for the observations in year t is known with certainty. For instance, it is assumed that energy inefficient state is responsible for observations in year t throughout the sample. In what state, an economy finds itself is a hidden and random process. I cannot infer beforehand what process might be responsible for observations in date t throughout the sample. Therefore, beginning with the assumption that energy inefficient (efficient) state is responsible for the observations in date t throughout the sample may be a wrong assumption to begin with. The best approach will be to form a probabilistic inference about these hidden states as to how likely they may have been responsible for the observations in date t in the sample. Second, the current literature assumes a smooth and complete transition process, for instance, from an energy inefficient state to an energy efficient state. By implication, it is assumed in these studies that removing fuel subsidies; instituting flexible trade scheme and foreign investment policies and investing in technology will successfully move the economy to the desired energy efficient state. What these studies ignore are the other important mechanisms that may obstruct the smooth transition from energy inefficient state to an energy efficient state. Especially from a developing country perspective, mechanisms such as high corruption, regulatory inefficiencies, and poor infrastructural development and institutions could impose great natural restrictions on the transition process, and this may slow the transition towards energy efficiency (i.e. increase the duration of energy inefficient state). Therefore, in my view, the policy implications of the current literature seem overly optimistic.

In this study, I apply a two-state (energy efficient/inefficient state) Markov-switching model, in a novel manner, to study the transition between energy efficient and energy inefficient states using Cameroon as a case study. Since energy intensity changes may mask some structural and

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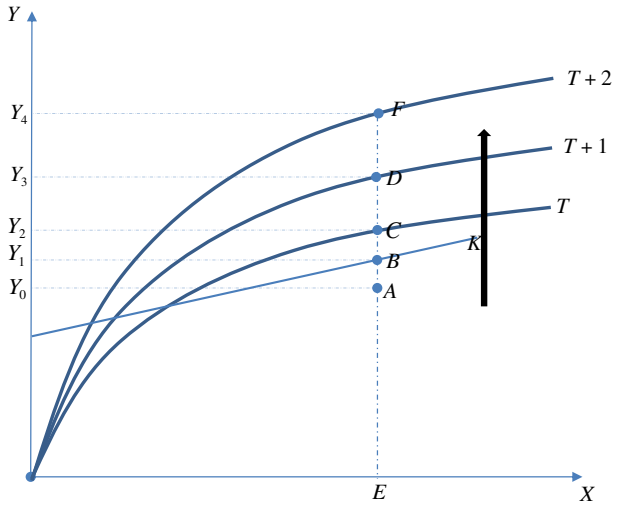

Diagram 1. Plot of output against energy input.

behavioral changes that do not necessarily imply improvements in energy efficiency, I control for the effects of price of energy, income and trade openness. The novelty here is that I determine in a probabilistic manner the processes that are responsible for the observations in date t in the sample and the transition between processes. Description of the data in this way has important implications for how the economy is likely to look if given say another 41 years. To the best of my knowledge, I do not know of any study that has addressed this concern, and this makes the contribution of the current paper very significant.

Cameroon faces huge energy shortage created by the twin problems of limited energy supply and increased energy demand. Between 2006 and 2009, for instance, while energy demand increased by 13.1%, net production increased marginally by 1.4% (Abanda, 2012). Energy demand is projected to reach 5000 MW in 2020 (Mas'ud et al., 2015). Albeit, government planned to add 2500 MW between 2012 and 2020, this has not been fully implemented (Ayompe and Duffy, 2014). This has decreased per capita electricity consumption below the average for Africa (Wandji, 2013). It is estimated that about 20% of the population in Cameroon do not have access to electricity (Wirba et al. 2015; Mas'ud et al., 2015). The energy situation in Cameroon poses a serious threat to the country's sustainable growth. For example, according to Kenfack et al. (2011), lack of access to electricity cost the economy about 2% of GDP growth. Also, according to Wandji (2013), the lack of energy is a major bottleneck to the development of the Cameroon economy. This has made the development of renewable energy and promotion of energy efficiency top priority in the country's sustainable growth agenda. However, how fast the economy can move towards an energy efficient state and the sustainability of this state depends on the country's ability to ensure a sustainable development of renewable energy resource and sustainability of energy efficiency programs.

Renewable energy development has huge capital outlay which makes it difficult for the country to self-finance these projects. The Nuru light project[3] and the 72-megawatt solar power plant are examples of major renewable energy projects that have benefited from donor and private sector support. However, in the event of donor fatigue, the abrogation of these projects would mean reverting to old energy inefficient resources. For example, in the 1970s and early part of the 1980s, green energy projects (biogas, cooking stoves, wind turbines and solar heaters), which were funded by development assistance agencies, failed due to poor maintenance, poor institutional consensus and insufficient stakeholder involvement (Martinot et al., 2002; Molteni and Masi, 2009). That led to consumers switching back to old inefficient energy resource such as wood fuel for cooking and heating. Recent solar street lightening project in Yaounde and Doula areas have also been impeded by poor maintenance and lack of government commitment (Mas'ud et al., 2015). Similarly institutional and administrative barriers in the renewable energy sector may impede further expansion of renewable projects. For example, Law No. 2011/022 of 2011, which governs the electricity sector, gives little attention to renewable energy. By implication, the duration of energy efficient state achieved through renewable energy development may be shortened.

The complex regulatory system[4] and the high corruption incidence[5] in Cameroon may have implications for the duration of energy efficient and energy inefficient states and the transition process as well. Regulatory inefficiencies and high corruption increase the cost of doing business for both existing firms and prospective investors. For existing firms, this may deter further investment in energy efficient technologies which may either imply a slow transition process towards energy efficient state or a fast transition process away from energy efficient state (depending on the state the economy finds itself).

The less integrated nature of economy may also have implications for the duration of energy states. For the past five years now, Cameroon has not registered any progress in opening markets. Recent estimate of trade freedom for the country is 59.6 compared to scores of 63.8 and 76.6 for Nigeria and South Africa, respectively (data source: Heritage Organization, 2015). Also, among the three countries, Cameroon obtained the lowest scores for investment freedom (i.e. 35) compared to 40 for Nigeria and 50 for South Africa. The consequence is the low flow of foreign investment into the country. Current net FDI stands at $572 million compared to $5.66 billion for Nigeria and $8.2 billion for South Africa (data source: Heritage Organization, 2015). Up-to-date, the Chad–Cameroon crude oil pipeline remains the largest foreign investment in Cameroon. This implies that, even if the country manages to achieve energy efficiency status, the duration is likely not to be infinite. This is because growth in population will put undue pressure on existing technologies which may reduce its energy efficiency level.

Last, the low per capita income status of the country and the heavily subsidized fuel prices may have implications for the duration of energy efficient state. In Cameroon, the low income status[6] prevents investment in new household appliances, transport, and equipment. Consequently, households and industries resort to the second best which is second hand goods. According to Tambi (2015), the wage cut between 1987 and 2003 in Cameroon culminated into high corruption among civil servants and the proliferation of second hand goods. Many of these second hand equipment and appliances either have short efficiency lifespan or exceeded their efficiency limit. The proliferation of these second hand goods may either imply short duration for energy efficient state or long duration for energy inefficient state. Since 2007, fuel prices have been heavily subsidized in the country, albeit it was cut down in 2014. Subsidies may prevent both households and private firms from embarking on further investment in energy efficient technologies. In that case, the duration of energy states is likely to be affected. The less economic freedom, regulatory inefficiencies, less open markets and high corruption means that energy efficient states are more likely to be less persistent compared to energy inefficient states in Cameroon

[3] This is a LED-based rechargeable light that is developed to provide off-grid light to rural markets. A pilot project has already been roll-out in Missole II near Douala which was mainly financed by grant from the Renewable Energy and Energy Efficiency Promotion in International Cooperation (REPIC). There are plans to extend this to the national level but this requires bigger samples distributed and operating in order to attract investors. Currently there have been difficulties to attract investors albeit some have shown some interest. Nonetheless, the problem of villagers paying the rechargeable fee during the pilot face could prove to be a major barrier to the expansion of the project to the national level.

[4] In 2015, Cameroon business freedom score is estimated as 41.6 compared to a score of 48.3 and 73 in Nigeria and South Africa, respectively (source: Heritage Organization, 2015).

[5] Cameroon and Nigeria obtained corruption free score of 25 which ranks them as the 144th most corrupt countries in the world out of 177 countries compared to a score of 42 for South Africa (source: Heritage Organization, 2015 and The Transparency international, 2013).

[6] Cameroon has a per capita income of $2423 compared to $2831 and $11,259 for Nigeria and South Africa, respectively (data source: Heritage Organization, 2015).