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Financial development and energy consumption in Central and Eastern European frontier economies

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ABSTRACT

This study examines the impact of financial development on energy consumption in a sample of 9 Central and Eastern European frontier economies. Several different measures of financial development are examined including bank related variables and stock market variables. The empirical results, obtained from dynamic panel demand models, show a positive and statistically significant relationship between financial development and energy consumption when financial development is measured using banking variables like deposit money bank assets to GDP, financial system deposits to GDP, or liquid liabilities to GDP. Of the three stock market variables investigated, only one, stock market turnover, has a positive and statistically significant impact on energy consumption. Both short-run and long-run elasticities are presented. The implications of these results for energy policy are discussed.

1. Introduction

While there is a fairly large literature investigating the link between economic growth and financial development (see, for example, Levine, 1997; Fung, 2009), the impact that financial development has on the demand for energy is a topic that has, however, received very little attention. Financial development, which broadly defined, refers to a country's decision to allow and promote financial activities like increased foreign direct investment (FDI), increases in banking activity, and increases in stock market activity. Financial development is important because it can increase the economic efficiency of a country's financial system and this can affect economic activity and the demand for energy. If financial development is found to affect the demand for energy then this relationship can affect energy policy and carbon emissions strategies.

To date, there has been surprising little research looking into the relationship between financial development and energy consumption. Mielnik and Goldemberg (2002) find a relationship between foreign direct investment and energy intensity in a sample of 20 developing countries while Tamazian et al. (2009) find that financial development lessens CO_2 emissions in the BRIC countries. Tamazian and Rao (2010), in a study of 24 transition economies, find that financial liberalization may be harmful for environmental quality if it is not accomplished in a strong institutional framework. Sadorsky (2010) studies the relationship between financial development and energy demand in a sample of 22 emerging economies. Sadorsky (2010) finds that increases in financial development, measured using stock market variables, like stock market capitalization to GDP, stock market value traded to GDP, and stock market turnover, increases the demand for energy in emerging economies. Outside of these papers, however, there appears to be little published research on the link between financial development and energy demand. The purpose of this paper is to investigate the impact of financial development on energy demand for a panel of 9 frontier economies located in Eastern and Central Europe. This is a topic for which very little is known about. The empirical approach taken in this paper follows that of Sadorsky (2010) in his study of the impact of financial development on emerging economies.[1] Empirical energy demand models are estimated using panel generalized method of moments (GMM) regression techniques that are specifically designed to handle endogeneity issues.

The collapse of the Soviet Union, in 1991, created new economic opportunities for not just countries that once belonged to the Soviet Union, but also Central and Eastern European countries that were located behind the "iron curtain".[2] According to the Morgan Stanley Capital International, Central and Eastern Europe consists of 9 frontier market economies. The Morgan Stanley Capital International (MSCI) identifies frontier market economies as economies that are investable but have lower per capita income,

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[1] The approach taken in this present paper is in the spirit of Karanfil (2009) who suggests that it is time to start including other variables beyond just income into the energy demand equation.

[2] The iron curtain refers to the boundary running from the Baltic Sea to the Adriatic Sea that separated East Germany, the Czech Republic, Slovakia, Hungary, and Slovenia from Western Europe (http://www.yourchildlearns.com/online-atlas/continent/cold-war-map.htm).

stock market size, and liquidity than emerging markets.[3] Frontier market economies have limited openness to foreign markets and ease of capital flows. Frontier market economies have modest levels of operational market efficiency and stability of the institutional framework. The frontier economies investigated in this paper are the Central and Eastern European and Commonwealth of Independent States (CIS) frontier economies of Bulgaria, Croatia, Estonia, Kazakhstan, Lithuania, Romania, Serbia, Slovenia, and the Ukraine. Estonia, Lithuania, and Slovenia became members of the European Union in 2004 and Bulgaria and Romania joined the European Union in 2007.[4] Estonia, Kazakhstan, and the Ukraine were members of the former Soviet Union.[5] Kazakhstan and the Ukraine are members of the CIS.[6,7] At present, Slovenia is the only country in the sample to adopt the Euro currency.[8] These countries are interesting to study because they are at a similar level of economic and financial development and except for Kazakhstan (which is separated from the Ukraine by Russia), are close neighbors to one another and Western Europe. Five of these countries are currently members of the European Union with the expectation that some of the others will follow. Studying the demand for energy in these economies is important not just at the country level but also at the regional level and in the context of energy demand in the European Union. These countries are also strategically located between large Western European energy consuming countries like France, Germany, and the United Kingdom and the vast oil and natural gas reserves located in Russia and the Middle East. The following sections of the paper set out the theoretical background material, empirical model, data, empirical results and discussion, policy analysis, and conclusions.

2. Financial development and energy demand

Financial development stimulates a number of changes within a country including, for example, a reduction in financial risk and borrowing costs, greater transparency between lenders and borrowers, access to greater financial capital and investment flows between borders, and access to the latest energy efficient products and cutting edge technology, all of which can affect the demand for energy by increasing consumption and business fixed investment.[9] Financial development can affect the demand for energy in several ways. One of the most direct ways that financial development can affect the demand for energy is by making it easier and cheaper for consumers to borrow money to buy big ticket (consumer durable) items like automobiles, houses, refrigerators, air conditioners, and washing machines. These big ticket consumer items typically consume a lot of energy, which can affect a country's overall demand for energy. Businesses also benefit from improved financial development because it makes it easier and less costly to gain access to financial capital that can be used to expand existing businesses (buying or building more plants, hiring more workers, and buying more machinery and equipment) or create new ones. Stock market development is particularly attractive to businesses because it allows them access to an additional source of funding, equity financing, that can be used to grow their business in addition to debt financing. Increased stock market activity can increase risk diversification for both consumers and businesses alike, which is an important component to generating wealth in an economy. Increased stock market activity also creates a wealth effect that in turn affects consumer and business confidence (Mankiw and Scarth, 2008). The stock market is often viewed as a leading economic indicator and increased stock market activity may be viewed as a sign of economic growth and prosperity, which in turn bolsters consumer and business confidence. Increased economic confidence increases economic activity and the demand for energy.

3. Empirical model

The empirical model is specified as a reduced form dynamic panel model of energy demand. Energy demand (e) depends upon income (y), price (p), and a measure of financial development (d):

$$e_{it} = \alpha e_{it-1} + \beta_1 y_{it} + \beta_2 p_{it} + \beta_3 d_{it} + v_i + \psi_t + \varepsilon_{it} \quad (1)$$

In Eq. (1), countries are denoted by the subscript i ($i=1,\ldots,9$) and the subscript t denotes the time period ($t=1996,\ldots,2006$). Eq. (1) is a fairly general specification, which allows for dynamic energy demand effects, individual fixed country effects (υ), fixed time effects (ψ), and a stochastic error term (ε). Eq. (1) is an example of an autoregressive distribute lag (ADL) model. The use of ADLs to model energy demand has a long history (see, for example, the discussion in Hsing (1994) and Liu (2004)).

Linear dynamic panel models, like Eq. (1), contain unobserved panel level effects that may be either fixed or random (Arellano and Bond, 1991). By construction, the unobserved panel level effects are correlated with the lag(s) of the dependent variable and this makes most standard estimation approaches inconsistent (Arellano and Bond, 1991). Arellano and Bond (1991) develop a generalized method of moments (GMM) estimator, which yields consistent parameter estimates for models of this type. In their approach the unobserved firm specific heterogeneity is eliminated using a first differencing transformation. The Arellano and Bond (1991) approach is specifically designed for situations where there are a large number of cross sections and a small number of time periods. In some instances the Arellano and Bond (1991) approach can perform poorly if the autoregressive parameters are too large or the ratio of the variance of the panel-level effect to the variance of the idiosyncratic error is too large. Blundell and Bond (1998), building on the work of Arellano and Bover (1995), develop a system GMM estimator that addresses these problems by expanding the instrument list to include instruments for the level equation. In this present paper, the system GMM approach is used to estimate models.

4. Data

This study uses annual data on energy demand, energy prices, and financial development for nine frontier market economies, as identified by the Morgan Stanley Capital International (MSCI), and located in Central and Eastern Europe and the Commonwealth of Independent States.[10] The countries studied in this paper include, Bulgaria, Croatia, Estonia, Kazakhstan, Lithuania, Romania, Serbia, Slovenia, and the Ukraine. Frontier market economies are investable but have lower per capita income, stock market size, and liquidity than emerging markets.[11] Frontier market economies also have limited openness to foreign markets and ease of capital flows. Frontier market economies have modest levels of operational market efficiency and

[3] http://www.mscibarra.com/products/indices/international_equity_indices/gimi/stdindex/MSCI_Market_Classification_Framework.pdf

[4] http://europa.eu/abc/european_countries/index_en.htm

[5] http://www.aneki.com/Former_Soviet.html

[6] http://www.cisstat.com/eng/cis.htm

[7] As Apergis and Payne (2009) and Reynolds and Kolodzieji (2008) indicate, there has been very little published research on modeling energy demand in the CIS countries.

[8] http://ec.europa.eu/economy_finance/euro/index_en.htm

[9] See Levine (1997), Xu (2000), and Fung (2009) for the main theory behind how and why financial development affects economic growth.

[10] http://www.mscibarra.com/products/indices/international_equity_indices/

[11] http://www.mscibarra.com/products/indices/international_equity_indices/gimi/stdindex/MSCI_Market_Classification_Framework.pdf