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Energy exports, globalization and economic growth: The case of South Caucasus

Chun-Ping Chang [a], Aziz N. Berdiev [b], Chien-Chiang Lee [c,*]

[a] Department of Marketing Management, Shih Chien University, Kaohsiung, Taiwan
[b] Department of Economics, Bryant University, Smithfield, RI 02917, USA
[c] Department of Finance, National Sun Yat-sen University, Kaohsiung, Taiwan

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ABSTRACT

We examine the effect of energy exports and globalization on economic growth using the bias-corrected least square dummy variable model in a panel of five South Caucasus countries (Azerbaijan, Armenia, Georgia, Russia and Turkey) over the period of 1990–2009. We provide evidence that higher energy exports and globalization expand economic growth. Also, we find that higher economic, political and social integrations are associated with higher growth rates. Furthermore, we find that greater energy exports contribute to higher growth rates in the course of globalization. In particular, higher energy exports lead to higher growth rates in the period of increasing economic and political integration. We therefore emphasize that energy exports, global integration, and their interaction effects are important determinants of economic growth in the South Caucasus region.

1. Introduction

The South Caucasus is valuable due to its location at the crossroad between Europe and Asia, and, more importantly, it possesses important supply of energy (de Haas et al., 2006). Thus, the global integration of the South Caucasus region into the world market is significant for economic growth in these countries (Wittich and Maas, 2009). In this context, Azerbaijan, Georgia and Turkey have constructed the energy transportation routes in the South Caucasus. In particular, the development of Baku–Tbilisi–Ceyhan oil pipeline, the Baku–Tbilisi–Erzurum gas pipeline and the Baku–Tbilisi–Kars railroad links Azerbaijan, Georgia and Turkey to Europe and Asia (Petersen, 2007).

Hence, these energy transport routes have shaped the energy supply security in the South Caucasus.[1] Elkind (2005: 39), for example, notes that the energy transit corridor has contributed to a "critical infrastructure link between once-distant Caspian energy deposits and global markets, but also as a source of greater supply diversity, a symbol of independence, a proof of cooperation among neighbors, a standard for the performance of a global industry, and a tool for economic development."[2] Furthermore, Blatchford (2005: 131) suggests that the energy transport routes have developed a sustainable investment program, namely, "the community investment program, the environmental investment program, and the regional sustainable development program" in the host countries.

Nevertheless, the development of the energy transit routes has circumvented Armenia and Russia. More specifically, the construction of these energy transportation corridors has created alternative energy supply to the Russian energy transit routes (Kalicki, 2001), and, also, excluded Armenia from foremost local development projects in the South Caucasus region (Cornell et al., 2005). These events have shaped the economic, social and political integration in the South Caucasus. According to Correljé and van der Linde (2006: 535), the disintegration of the former Soviet Union has contributed to more transport countries, and, also, increased the "political and commercial risk of projects" in the region.

The supply of energy and global integration has important implications for long-term economic growth in the South Caucasus. As such, the purpose of this paper is to investigate the impact of energy

* Corresponding author. Tel.: +886 7 5252000x4825; fax: +886 7 5254899.
E-mail address: cclee@cm.nsysu.edu.tw (C.-C. Lee).

[1] The Asia Pacific Energy Research Centre (2007: 6) describes energy supply security as the "ability of an economy to guarantee the availability of energy resource supply in a sustainable and timely manner with the energy price being at a level that will not adversely affect the economic performance of the economy."

[2] Moreover, Cornell and Ismailzade (2005: 64) indicate that the energy transport corridor has advanced "sustainable economic and social development in the country with projects in the fields mainly of health awareness, social infrastructure and agricultural development, and to promote income generation opportunities."

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exports and globalization on economic growth employing annual data over the 1990–2009 period covering five South Caucasus countries: Azerbaijan, Armenia, Georgia, Russia and Turkey. Moreover, we examine the interaction effects of energy exports and global integration as these two forces may possibly interact in influencing economic growth across countries. More specifically, higher energy exports may potentially lead to higher growth rates particularly in the period of increasing global integration in the South Caucasus region.

We develop two models in the empirical analysis: a panel 5-country model (Azerbaijan, Georgia, Turkey, Armenia and Russia) and a panel 3-country model (Azerbaijan, Georgia and Turkey). We group the countries into two models in order to provide greater understanding on the relationship between energy exports, global integration and economic growth in the South Caucasus. It is especially imperative to investigate a panel 3-country model given that the energy transportation routes have circumvented Armenia and Russia in the South Caucasus region. We attempt to discover differences, if any, on the effect of energy exports and globalization on economic growth in a panel 3-country model and a panel 5-country model.

We use the bias-corrected least square dummy variable (LSDVC) model developed by Kiviet (1995, 1999), Judson and Owen (1999), Bun and Kiviet (2003), and, more recently, Bruno (2005), who proposed a methodology to approximate the small sample bias of the LSDV estimator, constructed this estimator and demonstrated that the LSDVC estimator is more efficient and robust compared to numerous instrumental variable estimators in dynamic panel data models, including LSDV, first differenced and system generalized method of moments (GMM) estimators. A useful feature of the LSDVC model is that it is especially appropriate for small samples (Bruno, 2005).

To anticipate our results, we find that higher energy exports and globalization expand economic growth. We also provide evidence that higher economic, political and social integrations are associated with higher growth rates. Furthermore, we find that greater energy exports contribute to higher growth rates in the course of globalization. More specifically, higher energy exports lead to higher growth rates in the period of increasing economic and political integration. Overall, our findings are consistent in the 3-country and 5-country models. We conduct a number of robustness tests. The results from the robustness tests continue to support our earlier findings. We therefore emphasize that energy exports, global integration, and their interaction effects are important determinants of economic growth in the South Caucasus region.

The rest of the paper is structured as follows. In Section 2, we provide a general background based on the literature. Section 3 explains the econometric methodology used in the empirical analysis, while Section 4 describes the data. Section 5 presents the empirical results for the 3-country and 5-country models, and conducts a number of robustness tests. The final section summarizes the major findings.

2. General background

The energy transit corridor is considerably important in the South Caucasus region. Therefore, Azerbaijan, Georgia and Turkey have started the development of the East-West energy transit routes in the early 1990s. The East-West energy transportation corridor is a system of infrastructure that unites Azerbaijan, Georgia and Turkey to Europe and Asia (Petersen, 2007). More specifically, the energy transportation routes include the Baku–Tbilisi–Ceyhan (BTC) oil pipeline, the Baku–Tbilisi–Erzurum (BTE) gas pipeline and the recently established Baku–Tbilisi–Kars (BTK) railroad (see Fig. 1).

The BTC pipeline transports oil from Baku in Azerbaijan to Tbilisi in Georgia and to Ceyhan in Turkey. The construction of the BTC pipeline began in 1998, and was completed in 2005 (Bacik, 2006). The BTE pipeline carries natural gas from Baku in Azerbaijan to Tbilisi in Georgia and to Erzurum in Turkey. The construction of BTE gas pipeline started in 2004, and was finished in 2007 (Petersen, 2007). The BTK railroad is anticipated to transport goods and passengers from Baku in Azerbaijan to Tbilisi in Georgia and to Kars in Turkey. The construction of BTK railroad began in 2007 (Lussac, 2008) and is listed for completion in 2013.

These energy transportation routes have significantly shaped energy supply security in the South Caucasus. İpek (2006: 2) emphasizes that "long-distance, cross-border pipelines are important to expand energy security and make an alternative to the many vulnerable chokepoints along the sea transportation routes." It is important to note however that the construction of the energy transportation routes has circumvented Armenia and Russia, which, in turn, has shaped the economic, social and political integration in the South Caucasus region (Cornell and Ismailzade, 2005).

As such, considerable amount of literature has been devoted into understanding the nature and significance of the South Caucasus region. According to Polyakov (2001), the trade capacity for Azerbaijan and Armenia has been restrained because of interrupted transport routes. This is the case as the dispute over the Nagorno-Karabakh area between Azerbaijan and Armenia stays unsolved (Wittich and Maas, 2009). The energy transit routes have therefore circumvented Armenia, which, in turn, have excluded Armenia from foremost local development projects in the South Caucasus (Cornell et al., 2005).

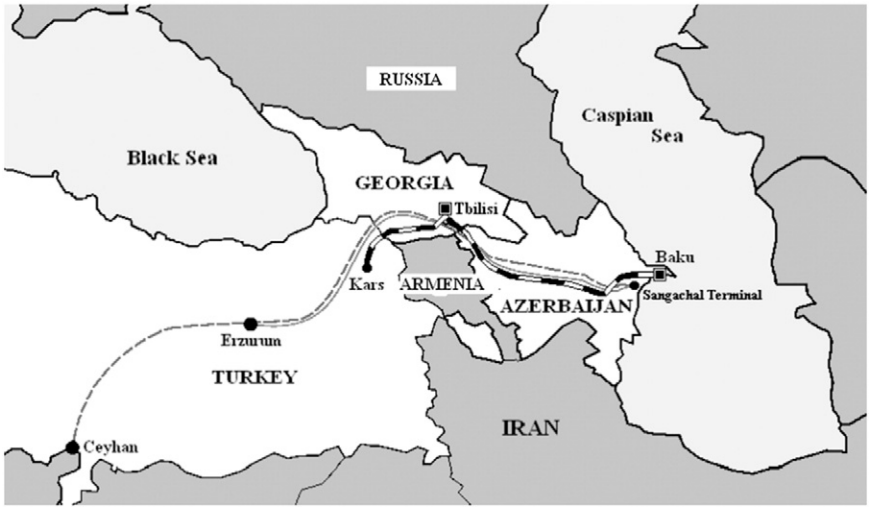

Fig. 1. BTC pipeline BTE pipeline BTK railroad.

Moreover, Kalicki (2001) explains that Russia increases tariffs and restrains exports, or pressures these measures to gain economic and political collaborations from the bordering countries. These particular actions indicate the necessity for alternative energy supply and transportation routes in the South Caucasus region. The energy transit corridors (e.g., BTC oil pipeline) provide (1) "a more secure investment environment", (2) "potentially lower tariff", (3) "direct linkage to large carriers in the Mediterranean", and (4) "access to the substantial Turkish and western European energy markets (Kalicki, 2001: 124)."

Certainly, the supply of energy and global integration has important implications for long-term economic growth. The construction of the system of infrastructure has increasingly contributed to greater energy exports in the South Caucasus region. For example, we plot the mean energy exports for the five South Caucasus countries over the period of 1990 and 2009 in Fig. 2. As can be seen, energy exports have substantially increased in this period, especially following the construction of the energy transportation routes.

A review of the literature suggests that energy is a significant component in aggregate production (Beaudreau, 2005; Lee and Lee, 2010; Stern, 1993). Wei and Rose (2009) explain that energy efficiency enhancements contribute to energy saving, a decline in environmental emissions and improves the supply of energy. Recently, the notion of energy security has focused on the physical distribution of energy supply, i.e., networks for energy pipeline transportation (Jamasb and Pollitt, 2008).[3] As such, Lesbirel (2004: 1) suggests that energy supply security acts as an "insurance mechanism against disruptions to energy import markets." Energy supply is therefore significant for the effective operation of many industries (Kruyt et al., 2009).

In particular, energy supply security, which represents assurance in its continuing capacity to access a dependable energy supply at affordable prices (Dorian et al., 2006), impacts the cost of production in the local economy (International Chamber of Commerce, 2007). Moreover, energy supply plays a critically important function in determining the relationships among many countries in the world (Von Hippel et al., 2011). As a result, supply of energy security and economic growth are interconnected in the global economy (International Chamber of Commerce, 2007). Thus, energy exports play an important role in global energy supply and long-run economic growth in the South Caucasus.

The process of global integration represents the "widening and deepening of the international flows of trade, capital, technology and information within a single integrated market (Petras and Veltmeyer, 2001:11)." Gaston and Nelson (2004) argue that globalization is transformative, where it reconstitutes and restructures the economic and political configuration of the world. Norris (2000: 155) indicates that globalization erodes "national boundaries, integrating national economies, cultures, technologies, and governance, producing complex relations of mutual interdependence."

In this context, the process of globalization, which integrates the world economy into a single system, may possibly influence energy exports. Azerbaijan, Georgia, and Turkey have attempted to facilitate greater global integration via the energy transit routes in the South Caucasus region. These movements are potentially promoting the stability and growth in their economies by generating greater efficiency in coordination and reducing the costs of transactions and transportation (Berdiev et al., 2012). It is therefore possible that higher energy exports may contribute to long-run economic growth particularly in the period of increasing global integration.

In this line, the economic, political and social integration may impact the economic growth in the South Caucasus region. The literature documents that trade openness significantly influences economic growth

[3] The International Chamber of Commerce (2007: 2) indicates that "energy security may mean different things in different countries, in different industrial sectors and with regard to different energy sources." Löschel et al. (2010: 1665) thus emphasize that the definition of energy security "seems to be rather blurred." It is therefore not surprising that the literature provides many indicators for energy supply security (Kruyt et al., 2009).

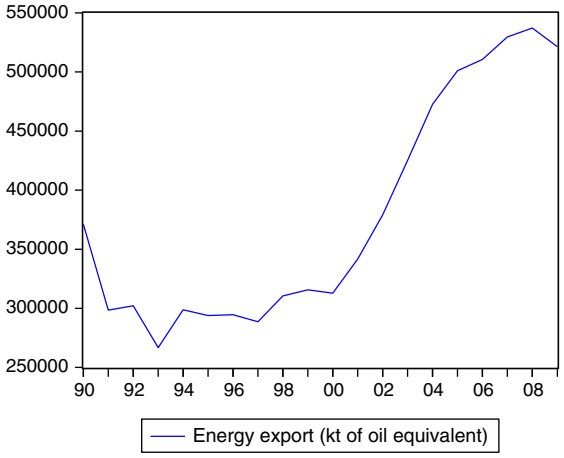

Fig. 2. Mean energy exports for five South Caucasus countries.

(Lee, 2011; Shen et al., 2010; Yanikkaya, 2003). According to Stiglitz (2004), economies that effectively manage the process of global integration experience higher economic growth. In addition, market structures are considerably transformed in the route of globalization (Potrafke, 2009). It is therefore significant to understand the relationship between energy export, globalization and economic growth in the South Caucasus region.

3. Model

We estimate the impact of energy exports and globalization on economic growth using the bias-corrected least square dummy variable (LSDVC) model developed by Kiviet (1995, 1999), Judson and Owen (1999), Bun and Kiviet (2003), and, more recently, Bruno (2005). As such, following these important studies, consider the following dynamic panel data model, which improves and corrects many of the shortcomings resulting from the cross-sectional and static panel data methodology:

$$y_{it} = \alpha y_{i,t-1} + \beta x_{it} + \mu_i + \eta_t + \varepsilon_{it} \quad i = 1, \ldots, N \quad t = 1, \ldots, T \tag{1}$$

where $\mathbf{y_{it}}$ is the dependent variable that represents the growth rate of gross domestic product (GDP) per capita, x_{it} corresponds to a set of independent variables, μ_i is the unobserved country-specific effect, η_t is the time-specific effects, ε_{it} is the disturbance term, and i and t represent country and time period, respectively.

The lagged value of the dependent variable is positively correlated with the omitted fixed effects when the ordinary least square (OLS) model is employed in the estimation. The LSDV methodology utilizes the within-group operator to remove the omitted variable bias formed by the unobserved country-specific effect (Huang, 2010). Hence, consider the following panel data approach:

$$y = D\varphi + M\gamma + \varepsilon \tag{2}$$

where y is the dependent variable, D is the matrix of individual dummy variables, M is the matrix of independent variables, including the lagged dependent variable, and γ is the vector of coefficients. φ and ε represent the vector of individual specific effects and error disturbances, respectively. Thus, the estimated coefficient of LSDV produces the following:

$$\gamma_{LSDV} = \left(M'AM\right)^{-1} M'Ay \tag{3}$$

where A represents the within transformation that eliminates the individual specific effects. The lagged value of the dependent variable is still correlated with the error disturbance, which suggests that LSDV

estimator is biased for small T, even when N gets larger (Nickell, 1981). Therefore, Kiviet (1999) derives the following approximation formula for the bias of LSDV estimator:

$$E(\gamma_{LSDV}-\gamma) = d_1\left(T^{-1}\right) + d_2\left(N^{-1}T^{-1}\right) + d_3\left(N^{-1}T^{-2}\right) + O\left(N^{-2}T^{-2}\right) \quad (4)$$

Bun and Kiviet (2003) further examine the following three approximation of LSDV bias and compare them with the true bias obtained from the Monte Carlo simulation:

$$B_1 = d_1\left(T^{-1}\right),\ B_2 = B_1 + d_2\left(N^{-1}T^{-1}\right),\ B_3 = B_2 + d_3\left(N^{-1}T^{-2}\right) \quad (5)$$

The Monte Carlo evidence from Bun and Kiviet (2003) suggests that the approximations of B_3 is almost close to the true bias. This implies that the bias-corrected LSDV (LSDVC) estimator corresponds to the following:

$$LSDVC = LSDV - B_3 \quad (6)$$

We estimate LSDVC (AB) and LSDVC (BB), which represents the bias corrected estimates initialized by Arellano and Bond (1991), and Blundell and Bond (1998), respectively. The bootstrapped standard errors are generated using Monte Carlo simulations. To ensure robustness of our results, we report the results of the generalized method of moments (GMM) estimator. We first difference Eq. (1) to eliminate the country-specific effects to generate the first difference GMM (Arellano and Bond, 1991) model as follows:

$$\Delta y_{it} = \alpha\Delta y_{i,t-1} + \beta\Delta x_{i,t-1} + (\eta_t - \eta_{t-1}) + \Delta\varepsilon_{it} \quad (7)$$

where Δ denotes first differences. To ensure maximum efficiency, we use all available lagged values of independent variables as instruments (as in Beck et al., 2001). As a way to minimize the number of instruments in the regressions, we collapse the matrix of instruments as suggested in Roodman (2009).

We provide the results of Sargan and Arellano–Bond tests at the bottom of each table. The Sargan test of over-identification restrictions tests the validity of the instruments (amounting to a test for the exogeneity of the covariates). As can be seen, the Sargan test cannot reject the null hypothesis (p-value > 0.10) in all equations, suggesting that the instrumental variables are valid in the estimation. Next, the Arellano–Bond test of second-order autocorrelation tests that the estimated residuals does not produce second-order serial correlation. While autocorrelation of first-order prevails by definition, second-order autocorrelation must be absent in order for the estimator to be consistent. The Arellano–Bond test cannot reject the null hypothesis (p-value > 0.10) in all equations, indicating that the estimated residuals do not produce second-order serial correlation, and, thus, the estimators are consistent in all equations.

4. Data

We examine the relationship between energy exports, globalization and economic growth in a panel of five South Caucasus countries (Azerbaijan, Georgia, Turkey, Armenia and Russia) using annual data over the 1990–2009 period. The sample countries are grouped into two models in the empirical analysis: a panel 3-country model (Azerbaijan, Georgia and Turkey) and a panel 5-country model (Azerbaijan, Georgia, Turkey, Armenia and Russia). The data are obtained from 2011 KOF Index of Globalization (Dreher, 2006; Dreher et al., 2008) and the World Bank (2011) World Development Indicators. The dependent variable is (log) GDP per capita (constant 2000 US $). To proxy for energy exports, we use energy production less energy use (*Energy*), obtained from the World Bank (2011) World Development Indicators.[4]

We utilize the globalization index (2011), originally developed by Dreher (2006) and further summarized in Dreher et al. (2008), who construct an index of globalization covering three main dimensions: economic, social and political integration. Economic globalization (*Economic*) refers to "long distance flows of goods, capital and services as well as information and perceptions that accompany market exchanges." Political globalization (*political*) represents "diffusion of government policies." Social globalization (*social*) epitomizes the "spread of ideas, information, images, and people." These sub-indexes are, in turn, aggregated into one single index of overall globalization (*globalization*). All globalization indexes range between 0 and 100 (higher values denote greater globalization), and are transformed in logarithms.[5]

We plot the economic, social, political and overall globalization indexes for the five South Caucasus countries in our sample for the period between 1990 and 2009 in Fig. 3. To start, we observe that all of the countries exhibit higher economic, social, political and overall globalization in 2009 relative to their 1990s levels. More specifically, we notice that all of the countries in our sample have experienced an increase in their economic, social, political and overall globalization for the period between 1990 and 2009. Overall, it appears that the political integration is the highest in Russia and Turkey, whereas the economic integration is the highest in Armenia, Azerbaijan and Georgia. Furthermore, the overall globalization is the highest in Russia and Turkey.

To obtain efficient estimation results, we follow the economic growth literature (see, for example, Barro, 1991, 1996; Levine and Renelt, 1992) and incorporate additional explanatory variables that are generally utilized in growth regressions: general government final consumption expenditure as a percentage of GDP (*government*), money and quasi money (M2) as a percentage of GDP (*money*), (log) inflation rate as measured by the consumer price index (*inflation*), gross capital formation as a percentage of GDP (*capital*), (log) life expectancy at birth (*life*), and fertility rate (*fertility*). To further ensure the robustness of our findings, we conduct a number of sensitivity tests using a variety of control variables in the empirical analysis. The definitions, data sources and summary statistics for all the variables are presented in Table A1 (in Appendix A).

5. Results

We provide the LSDVC (AB) and LSDVC (BB) regression estimates for the panel 3-country model (Azerbaijan, Georgia, Turkey) in Table 1. To ensure the robustness of our findings, we also report the GMM regression estimates in Table 1. As can be seen, most of the explanatory variables are estimated consistently across different models. Nevertheless, we use the LSDVC (AB) and LSDVC (BB) regression estimates to discuss the empirical results since the LSDVC estimator is considered as the favored model based on the discussion in Section 3. We also compute the long-run effects for the variable *energy* on the growth rate of GDP per capita.[6] The long-run estimates for the variable *energy* and their corresponding t-statistic are displayed at the bottom of Table 1.

To start, consider the impact of energy exports on the growth rate of GDP per capita in Table 1. The variable *energy* is positive and statistically significant at the 5% level in almost all equations, suggesting that higher energy exports expand economic growth. The long-run

[4] The World Bank (2011) World Development Indicators defines energy use as the "use of primary energy before transformation to other end-use fuels, which is equal to indigenous production plus imports and stock changes, minus exports and fuels supplied to ships and aircraft engaged in international transport."

[5] For a detailed analysis of the globalization indexes, including their construction and methodology, see Dreher (2006) and Dreher et al. (2008).

[6] We follow Chang and Berdiev (2011), who estimate the long-run effect of government ideology on the growth rate of regulation indicators in the gas and electricity sectors in a panel of 23 OECD countries over the 1975–2007 period.

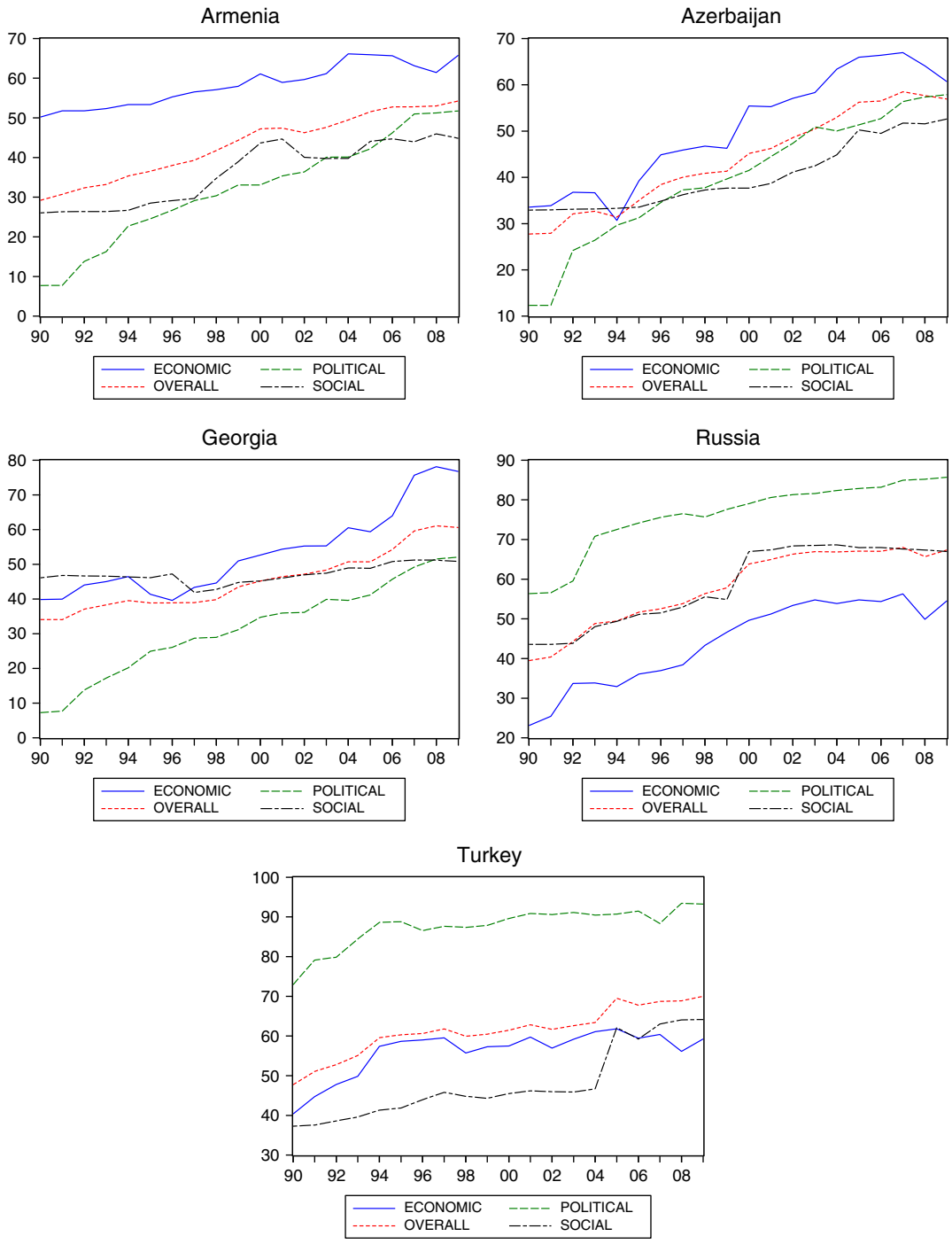

Fig. 3. Economic, political, social and overall globalization in five South Caucasus countries.

estimate of this variable is also positive and statistically significant at conventional levels in most specifications, thereby implying that this effect is sustained into the long run. These results are anticipated given that Azerbaijan, Georgia and Turkey have constructed the energy transportation corridor in the South Caucasus region. The energy transit routes have contributed to higher energy exports, which, in turn, significantly lead to higher economic growth in the region.

Moreover, note the impact of global integration on economic growth in Table 1. The overall globalization index is positive and statistically significant at the 5% level in all equations, indicating that increases in globalization is associated with higher growth rates. According to Dreher (2006), Dreher and Gaston (2007), and Dreher et al. (2008), it is imperative to separate the dimensions of globalization in the empirical analysis. As such, consider the effect of sub-dimensions of globalization on economic growth. Overall, we find that higher economic, political and social integrations promote economic growth, statistically significant at conventional levels. These findings are in line with Dreher (2006), and, more recently, Chang and Lee (2010) and Lee and Chang (2012) who find that increases in globalization contribute to higher growth rates.

Furthermore, we examine the influence of the control variables on the growth rate of GDP per capita. The variables *government*, *money* and *inflation* appear to be statistically insignificant at conventional levels in most specifications. In addition, the variables *life* and *fertility*

Table 1
LSDVC and GMM regression estimates: 3-country model.

Models	GMM	LSDVC	LSDVC	GMM	LSDVC	LSDVC	GMM	LSDVC	LSDVC	GMM	LSDVC	LSDVC	GMM	LSDVC	LSDVC
Independent variable	(AB)	(AB)	(BB)	(AB)	(AB)	(BB)	(AB)	(AB)	(BB)	(AB)	(AB)	(BB)	(AB)	(AB)	(BB)
Lagged dep. var.	0.724**	0.785**	0.802**	0.710**	0.782**	0.784**	0.755**	0.818**	0.841**	0.837**	0.984**	0.929**	0.725**	0.796**	0.811**
	(10.932)	(10.528)	(11.367)	(10.146)	(8.778)	(15.202)	(11.846)	(14.929)	(16.563)	(12.540)	(604.272)	(89.909)	(10.475)	(13.083)	(13.278)
Energy	0.029*	0.022**	0.022*	0.047**	0.038**	0.040**	0.003**	0.007	0.001	0.043**	0.041**	0.041**	0.021**	0.007**	0.008**
	(1.861)	(12.357)	(1.848)	(2.926)	(2.316)	(2.423)	(2.188)	(0.393)	(0.050)	(2.631)	(3.797)	(3.890)	(3.967)	(3.180)	(2.161)
Globalization	0.534**	0.581**	0.549**												
	(5.566)	(5.411)	(6.149)												
Economic				0.334**	0.374**	0.360**							0.160**	0.132	0.130*
				(4.969)	(5.896)	(4.987)							(2.389)	(1.352)	(1.905)
Political							0.373**	0.414**	0.374**				0.215*	0.275**	0.256
							(5.459)	(4.202)	(3.114)				(1.715)	(3.190)	(1.041)
Social										0.226**	0.273**	0.264**	0.113	0.124*	0.127**
										(2.051)	(2.160)	(2.583)	(1.036)	(1.718)	(2.059)
Capital	0.054**	0.043**	0.042**	0.072**	0.057**	0.056**	0.038*	0.026**	0.025**	0.096**	0.077**	0.077**	0.045*	0.032**	0.031**
	(2.624)	(4.360)	(4.099)	(3.633)	(5.173)	(5.867)	(1.739)	(5.219)	(3.022)	(4.821)	(9.258)	(10.874)	(1.941)	(11.216)	(8.676)
Government	0.000	−0.034	−0.032	0.031	−0.020	−0.022	−0.014	−0.052	−0.047	0.101**	0.004	0.006	−0.006	−0.043	−0.039
	(−0.003)	(−0.374)	(−0.303)	(0.638)	(−0.195)	(−0.186)	(−0.289)	(−0.687)	(−0.453)	(2.124)	(0.024)	(0.040)	(−0.125)	(−0.551)	(−0.440)
Money	−0.047	−0.061	−0.068	−0.058	−0.066	−0.065	−0.068*	−0.082	−0.091	−0.115**	−0.132	−0.116	−0.053	−0.071	−0.078
	(−1.214)	(−0.608)	(−0.623)	(−1.475)	(−0.578)	(−0.564)	(−1.832)	(−0.725)	(−0.661)	(−2.966)	(−1.316)	(−1.107)	(−1.347)	(−0.543)	(−0.547)
Inflation	−0.007	−0.007	−0.006	−0.006	−0.006	−0.007	−0.010	−0.011	−0.009	−0.001	−0.005	−0.007*	−0.008	−0.009	−0.008
	(−0.897)	(−0.827)	(−0.793)	(−0.792)	(−0.710)	(−0.909)	(−1.300)	(−1.282)	(−1.179)	(−0.132)	(−1.205)	(−1.694)	(−1.034)	(−1.190)	(−1.060)
Life	1.526**	1.246**	1.211**	2.257**	1.945**	1.859**	2.502**	2.322**	2.186**	1.065	0.487*	0.670**	1.893**	1.669	1.587
	(3.465)	(2.027)	(2.241)	(5.084)	(3.075)	(4.235)	(5.835)	(7.532)	(5.280)	(1.571)	(1.924)	(4.517)	(2.758)	(1.188)	(1.004)
Fertility	0.580**	0.536**	0.506**	0.604**	0.562**	0.551**	0.776**	0.764**	0.702**	0.220	0.117	0.142	0.678**	0.658*	0.614
	(3.925)	(2.036)	(2.018)	(3.877)	(2.181)	(2.728)	(4.790)	(8.670)	(5.061)	(1.431)	(0.556)	(1.178)	(3.743)	(1.945)	(1.636)
Long-run effect	0.106**	0.101**	0.110**	0.161**	0.176**	0.183**	0.013**	0.039	0.009	0.265**	2.596**	0.579**	0.075**	0.036*	0.042**
(energy)	(2.223)	(2.043)	(2.115)	(3.710)	(1.912)	(2.062)	(3.192)	(0.445)	(0.050)	(3.071)	(2.737)	(2.788)	(2.083)	(1.717)	(2.153)
Sargan test	48.570			49.870			52.140			65.910			28.458		
(p-value)	(0.994)			(0.981)			(0.994)			(0.991)			(0.985)		
Arellano–Bond test	0.510			0.080			0.940			0.670			0.814		
(p-value)	(0.884)			(0.938)			(0.346)			(0.503)			(0.771)		

Notes: The t-statistics are in parentheses. ** and * indicate the statistical significance at the 5% and 10% levels, respectively.

Table 2
LSDVC and GMM regression estimates: 5-country model.

Models	GMM	LSDVC	LSDVC	GMM	LSDVC	LSDVC	GMM	LSDVC	LSDVC	GMM	LSDVC	LSDVC	GMM	LSDVC	LSDVC
Independent variable	(AB)	(AB)	(BB)	(AB)	(AB)	(BB)	(AB)	(AB)	(BB)	(AB)	(AB)	(BB)	(AB)	(AB)	(BB)
Lagged dep. var.	0.752**	0.036**	0.835**	0.811**	0.913**	0.923**	0.689**	0.777**	0.805**	0.783**	0.885**	0.896**	0.768**	0.838**	0.850**
	(18.336)	(7.388)	(7.527)	(19.295)	(7.754)	(10.368)	(14.968)	(5.258)	(5.220)	(18.435)	(8.573)	(12.969)	(15.668)	(8.554)	(8.598)
Energy	0.037**	0.067	0.025**	0.048**	0.030**	0.029**	0.052**	0.036	0.036**	0.060**	0.061**	0.055**	0.039**	0.028**	0.028**
	(2.747)	(0.193)	(2.176)	(3.492)	(3.208)	(3.172)	(3.732)	(0.398)	(4.294)	(4.407)	(3.662)	(2.441)	(2.796)	(2.174)	(2.152)
Globalization	0.596**	0.027**	0.569**												
	(8.523)	(3.580)	(3.371)												
Economic				0.343**	0.321**	0.316**							0.242**	0.240**	0.241**
				(7.635)	(2.883)	(2.690)							(4.169)	(2.954)	(2.692)
Political							0.337**	0.339**	0.317**				0.096	0.113**	0.101*
							(5.417)	(2.989)	(2.116)				(1.262)	92.060)	(1.859)
Social										0.397**	0.321**	0.313**	0.224**	0.206**	0.202**
										(5.803)	(9.923)	(6.798)	(3.053)	(14.874)	(13.178)
Capital	0.036**	0.028**	0.025**	0.051**	0.036**	0.033**	0.033	0.004	−0.003	0.084**	0.069**	0.055**	0.044**	0.034**	0.032**
	(2.041)	(6.509)	(7.212)	(2.881)	(10.786)	(20.214)	(1.328)	(0.169)	(−0.107)	(4.846)	(5.946)	(9.351)	(2.203)	(4.545)	(4.372)
Government	−0.067*	−0.095**	−0.093**	−0.059*	−0.1128**	−0.116**	−0.116**	−0.130**	−0.123**	−0.001	−0.066**	−0.071**	−0.045	−0.081**	−0.081**
	(−1.954)	(−4.252)	(−5.252)	(−1.673)	(−5.238)	(−7.670)	(−2.530)	(−2.496)	(−2.225)	(−0.023)	(−86.947)	(−8.503)	(−1.206)	(−2.619)	(−2.951)
Money	−0.027	−0.041	−0.046	−0.046	−0.053	−0.056	−0.056	0.010	−0.004	−0.028	−0.049	−0.054	−0.043	−0.058	−0.062
	(−0.963)	(−0.417)	(−0.445)	(−1.571)	(−0.493)	(−0.564)	(0.824)	(0.111)	(−0.039)	(−0.952)	(−0.629)	(−0.737)	(−1.440)	(−0.622)	(−0.620)
Inflation	0.000	0.001	0.001	−0.002	0.000	0.000	0.000	−0.008**	−0.009**	−0.001	−0.002	−0.003	0.001	0.003**	0.003**
	(−0.012)	(0.517)	(0.477)	(−0.430)	(−0.048)	(−0.286)	(−1.485)	(−10.988)	(−18.153)	(−0.304)	(−1.033)	(−0.861)	(0.300)	(5.909)	(9.117)
Life	0.660**	0.465**	0.431	1.025**	0.684**	0.618	0.618**	1.121**	1.084**	0.108	0.134	0.153	0.583	0.471	0.401
	(2.066)	(2.220)	(1.548)	(3.146)	(2.250)	(1.604)	(4.364)	(3.173)	(92.176)	(0.291)	(0.396)	(0.380)	(1.552)	(1.538)	(1.263)
Fertility	0.318**	0.267	0.257	0.245**	0.163	0.154	0.154**	0.375	0.380	0.110	0.051	0.074	0.293**	0.257	0.240
	(3.273)	(1.298)	(1.140)	(2.478)	(0.725)	(0.622)	(3.623)	(1.532)	(1.222)	(1.124)	(0.291)	(0.407)	(2.621)	(1.058)	(0.967)
Long-run effect	0.150**	0.147	0.152**	0.253**	0.349**	0.380**	0.166**	0.162	0.184**	0.276**	0.535**	0.527**	0.168**	0.175**	0.188**
(energy)	(3.134)	(0.221)	(3.200)	(4.066)	(3.290)	(4.215)	(3.840)	(0.540)	(3.383)	(4.891)	(3.637)	(2.625)	(2.846)	(3.195)	(3.168)
Sargan test	88.790			92.940			126.340			114.570			84.900		
(p-value)	(0.999)			(0.999)			(0.999)			(0.999)			(0.998)		
Arellano–Bond test	0.060			0.140			0.070			0.030			0.020		
(p-value)	(0.953)			(0.886)			(0.948)			(0.978)			(0.982)		

Notes: The t-statistics are in parentheses. ** and * indicate the statistical significance at the 5% and 10% levels, respectively.

Table 3
LSDVC and GMM regression estimates: 3-country model (interaction effects).

Models	GMM	LSDVC	LSDVC	GMM	LSDVC	LSDVC	GMM	LSDVC	LSDVC	GMM	LSDVC	LSDVC	GMM	LSDVC	LSDVC
Independent variable	(AB)	(AB)	(BB)	(AB)	(AB)	(BB)	(AB)	(AB)	(BB)	(AB)	(AB)	(BB)	(AB)	(AB)	(BB)
Lagged dep. var.	0.729**	0.786**	0.788**	0.715**	0.771**	0.788**	0.744**	0.819**	0.837**	0.839**	0.987**	0.935**	0.723**	0.784**	0.788**
	(10.832)	(7.507)	(7.687)	(10.296)	(8.108)	(18.045)	(11.741)	(17.513)	(56.374)	(12.256)	(39.067)	(29.378)	(10.647)	(25.033)	(35.309)
Energy	0.727**	1.328**	1.172	1.431**	1.685**	1.719**	0.678	0.331*	0.534**	1.227	0.967**	0.590**	0.525	0.107**	0.088**
	(2.844)	(2.657)	(0.608)	(2.615)	(3.426)	(2.622)	(1.290)	(1.742)	(2.677)	(1.358)	(2.337)	(2.258)	(0.464)	(3.029)	(3.025)
Globalization	0.584**	0.663**	0.636**												
	(5.198)	(2.487)	(2.542)												
Economic				0.425**	0.450**	0.440**							0.232*	0.229*	0.224
				(5.690)	(3.253)	(3.011)							(1.821)	(1.908)	(1.635)
Political							0.312**	0.386**	0.334**				0.117	0.216**	0.210**
							(3.815)	(4.796)	(9.611)				(0.641)	(2.892)	(2.856)
Social										0.429**	0.456	0.375	0.132	−0.067	−0.057
										(2.341)	(1.047)	(1.094)	(0.389)	(−0.120)	(−0.110)
Energy* globalization	0.186**	0.332**	0.294**												
	(2.878)	(2.638)	(2.592)												
Energy*economic				0.358**	0.419**	0.426**							0.356**	0.363	0.362
				(2.701)	(2.412)	(3.602)							(2.662)	(0.554)	(0.528)
Energy*political							0.164	0.083*	0.131**				0.238	0.099	0.112
							(1.285)	(1.855)	(2.655)				(0.961)	(0.178)	(0.192)
Energy*social										0.317	0.252**	0.158	0.015	−0.243	−0.235
										(1.406)	(3.332)	(0.260)	(0.037)	(−0.296)	(−0.304)
Capital	0.045**	0.036**	0.036**	0.061**	0.054**	0.052**	0.045**	0.027**	0.025**	0.070**	0.061**	0.067**	0.047*	0.047**	0.0468**
	(1.997)	(8.333)	(7.730)	(3.005)	(9.155)	(15.414)	(2.041)	(5.488)_	(2.030)	(2.532)	(5.052)	(6.556)	(1.717)	(4.738)	(4.667)
Government	0.001	−0.014	−0.014	0.059	0.050	0.046	−0.001	−0.052	−0.048	0.078	−0.009	−0.001	0.048	0.028	0.027
	(0.014)	(−0.138)	(−0.134)	(1.196)	(0.508)	(0.399)	(−0.012)	(−0.684)	(−0.482)	(1.510)	(−0.054)	(−0.009)	(0.885)	(0.264)	(0.255)
Money	−0.037	−0.052	−0.056	−0.034	−0.049	−0.057	−0.081**	−0.088	−0.095	−0.094**	−0.122	−0.114	−0.051	−0.069	−0.071
	(−0.902)	(−0.450)	(−0.467)	(−0.835)	(−0.492)	(−0.586)	(−2.136)	(−0.778)	(−0.765)	(−2.219)	(−0.874)	(−0.854)	(−1.262)	(−0.499)	(−0.516)
Inflation	−0.008	−0.009	−0.009	−0.009	−0.009	−0.010	−0.010	−0.010	−0.009	−0.002	−0.007	−0.008	−0.010	−0.009	−0.009
	(−0.995)	(−0.684)	(−0.719)	(−1.161)	(−0.752)	(−0.994)	(−1.271)	(−1.171)	(−1.639)	(−0.286)	(−0.962)	(−1.123)	(−1.314)	(−0.758)	(−0.764)
Life	1.242**	0.832*	0.907**	1.386**	1.057	0.998*	2.687**	2.401**	2.322**	0.252	−0.210	0.254	1.196	1.686**	1.619**
	(2.255)	(1.859)	(2.048)	(2.541)	(1.373)	(1.748)	(6.023)	(6.442)	(6.905)	(0.278)	(−0.294)	(0.913)	(0.851)	(30.330)	(37.570)
Fertility	0.457**	0.326	0.344	0.306	0.212	0.204	0.857**	0.808**	0.771**	0.008	−0.054	0.038	0.456	0.572**	0.551**
	(2.230)	(0.999)	(1.038)	(1.611)	(0.597)	(0.718)	(4.996)	(7.418)	(4.259)	(0.035)	(−0.153)	(0.151)	(1.218)	(6.663)	(4.427)
Long-run effect	2.686**	6.204**	5.532**	5.019**	7.373**	8.105**	2.648	1.828**	3.267**	7.646	4.766**	9.091**	1.894	0.494**	0.416**
(energy)	(3.809)	(4.497)	(4.470)	(2.164)	(3.895)	(3.216)	(1.287)	(5.202)	(4.638)	(1.154)	(3.203)	(3.229)	(0.453)	(3.029)	(3.025)
Long-run effect	0.686**	1.551**	1.385**												
(energy*globalization)	(3.841)	(3.486)	(2.460)												
Long-run effect				1.257**	1.832**	2.009**							1.284**	1.676	1.706
(energy*economic)				(2.231)	(4.889)	(3.205)							(2.215)	(0.513)	(0.500)
Long-run effect							0.640	0.456**	0.801**				0.860	−0.459	−0.526
(energy*political)							(1.276)	(4.255)	(5.618)				(0.909)	(−0.173)	(0.851)
Long-run effect										1.974	1.501**	2.431	0.055	−1.122	−1.104
(energy*social)										(1.191)	(5.201)	(0.231)	(0.037)	(−0.310)	(−0.314)
Sargan test	46.610			43.420			52.110			60.610			41.740		
(p-value)	(0.998)			(0.998)			(0.998)			(0.998)			(0.998)		
Arellano–Bond test	0.210			0.340			0.710			0.640			0.050		
(p-value)	(0.834)			(0.736)			(0.478)			(0.519)			(0.961)		

Notes: The t-statistics are in parentheses. ** and * indicate the statistical significance at the 5% and 10% levels, respectively.

Table 4
LSDVC and GMM regression estimates: 5-country model (interaction effects).

Models	GMM	LSDVC	LSDVC	GMM	LSDVC	LSDVC	GMM	LSDVC	LSDVC	GMM	LSDVC	LSDVC	GMM	LSDVC	LSDVC
Independent variable	(AB)	(AB)	(BB)	(AB)	(AB)	(BB)	(AB)	(AB)	(BB)	(AB)	(AB)	(BB)	(AB)	(AB)	(BB)
Lagged dep. var.	0.796**	0.865**	0.866**	0.841**	0.940**	0.941**	0.776**	0.859**	0.868**	0.853**	0.959**	0.947**	0.770**	0.844**	0.846**
	(16.876)	(7.110)	(7.578)	(20.016)	(7.882)	(10.281)	(14.631)	(4.793)	(4.813)	(18.930)	(5.910)	(7.471)	(14.791)	(7.825)	(8.282)
Energy	0.792*	0.644	0.662*	1.115**	0.999**	1.029**	1.156**	1.215	1.213	1.207**	1.027	1.020	0.740	0.713**	0.677**
	(1.768)	(1.476)	(1.646)	(3.112)	(7.761)	(17.705)	(3.472)	(1.606)	(1.590)	(3.773)	(1.094)	(1.213)	(1.454)	(2.488)	(3.584)
Globalization	0.556**	0.566**	0.558**												
	(7.673)	(3.319)	(3.274)												
Economic				0.330**	0.317**	0.315**							0.250**	0.264**	0.265**
				(7.502)	(2.837)	(2.778)							(3.061)	(23.239)	(18.343)
Political							0.424**	0.439**	0.424**				0.082	0.135**	0.117**
							(6.209)	(2.698)	(2.332)				(0.861)	(3.042)	(4.390)
Social										0.375**	0.345**	0.358**	0.159	0.098	0.104
										(5.597)	(6.129)	(5.870)	(1.484)	(1.016)	(0.905)
Energy*globalization	0.203*	0.164**	0.168**												
	(1.852)	(2.290)	(2.735)												
Energy*economic				0.280**	0.249**	0.256**							0.247**	0.277**	0.281**
				(3.248)	(38.725)	(9.590)							(2.142)	(4.304)	(3.400)
Energy*political							0.290**	0.302**	0.302**				0.109**	0.035	0.047
							(3.630)	(1.911)	(1.965)				(2.831)	(0.408)	(0.421)
Energy*social										0.313**	0.270	0.267	0.051	−0.066	−0.066
										(3.964)	(1.391)	(1.563)	(0.325)	(−0.355)	(−0.326)
Capital	0.039**	0.034**	0.032**	0.062**	0.053**	0.051**	0.017	0.006	0.000	0.069**	0.067**	0.056**	0.050**	0.042**	0.041**
	(2.238)	(3.311)	(5.047)	(3.527)	(9.932)	(8.265)	(0.801)	(0.373)	(−0.001)	(3.979)	(6.756)	(9.713)	(2.420)	(4.160)	(3.734)
Government	−0.040	−0.075**	−0.072**	0.006	−0.052**	−0.057**	−0.086**	−0.115**	−0.104**	0.015	−0.053**	−0.055**	0.003	−0.035	−0.032*
	(−1.072)	(−7.414)	(−10.293)	(0.147)	(−2.248)	(−2.557)	(−2.310)	(−2.937)	(−2.625)	(0.428)	(−4.629)	(−2.684)	(0.073)	(−1.625)	(−1.698)
Money	−0.044	−0.059	−0.062	−0.063**	−0.075	−0.074	−0.003	−0.023	−0.033	−0.067**	−0.095	−0.093	−0.052*	−0.061	−0.063
	(−1.523)	(−0.546)	(−0.577)	(−2.183)	(−0.707)	(−0.776)	(−0.100)	(−0.220)	(−0.297)	(−2.236)	(−0.712)	(−0.786)	(−1.693)	(−0.555)	(−0.558)
Inflation	0.000	0.003	0.002	−0.001	0.001	0.001	−0.005	−0.005**	−0.005**	0.000	0.001*	0.000	0.001	0.002**	0.002**
	(0.088)	(0.822)	(0.828)	(−0.193)	(0.972)	(1.394)	(−1.035)	(−2.041)	(−3.733)	(−0.068)	(1.779)	(−1.602)	(0.257)	(2.097)	(2.737)
Life	0.535*	0.382**	0.370	0.755**	0.513*	0.468	0.974**	0.759**	0.796**	0.219	0.173	0.138	0.700*	0.543	0.488
	(1.657)	(1.970)	(1.589)	(2.297)	(1.734)	(1.315)	(2.721)	(4.016)	(2.949)	(0.603)	(0.376)	(0.326)	(1.841)	(1.310)	(1.175)
Fertility	0.160	0.134	0.121	0.054	−0.011	−0.016	0.182	0.145	0.150	−0.072	−0.131	−0.108	0.200	0.180	0.159
	(1.242)	(0.844)	(0.697)	(0.477)	(−0.050)	(−0.067)	(1.418)	(1.426)	(1.124)	(−0.676)	(−1.551)	(−1.127_	(1.530)	(0.751)	(0.618)
Long-run effect	3.892*	4.757	4.931*	7.027**	16.649**	17.449**	5.164**	0.603	0.213	8.192**	0.928	0.386	3.216	4.579**	4.387**
(energy)	(1.799)	(0.635)	(1.685)	(2.157)	(5.636)	(5.622)	(2.221)	(0.529)	(0.500)	(2.084)	(0.206)	(0.309)	(1.270)	(5.914)	(4.064)
Long-run effect	0.996**	1.211**	1.255**												
(energy*globalization)	(2.453)	(4.749)	(3.821)												
Long-run effect				1.767**	4.146**	4.341**							1.075*	1.780**	1.821**
(energy*economic)				(2.228)	(3.510)	(3.691)							(1.895)	(2.172)	(2.724)
Long-run effect							1.297**	2.140**	2.293**				0.475**	0.225	0.304
(energy*political)							(2.286)	(4.558)	(3.532)				(2.863)	(0.318)	(0.329)
Long-run effect										2.126**	1.558	1.077	0.223	−0.423	−0.430
(energy*social)										(2.145)	(0.215)	(0.328)	(0.325)	(−0.470)	(−0.416)
Sargan test	87.450			87.240			106.590			104.460			81.370		
(p-value)	(0.998)			(0.997)			(0.999)			(0.999)			(0.997)		
Arellano–Bond test	0.280			0.590			0.440			0.260			0.160		
(p-value)	(0.777)			(0.522)			(0.658)			(0.794)			(0.874)		

Notes: The t-statistics are in parentheses. ** and * indicate the statistical significance at the 5% and 10% levels, respectively.

are positive and statistically significant at the 5% level in most equations, suggesting that higher life expectancy and fertility rate is associated with higher growth rates. We also find that greater gross capital formation contributes to higher economic growth, statistically significant at least at the 10% level in all equations. Finally, the lagged dependent variable is positive and statistically significant at the 5% level in all models, indicating that countries that experience high levels of GDP per capita growth in the past will continue to experience higher growth rates in the future.

Next, we turn to investigate the relationship between energy exports, globalization and economic growth for the panel 5-country model (Azerbaijan, Georgia, Turkey, Armenia and Russia). We present the LSDVC (AB) and LSDVC (BB) regression estimates in Table 2. We also provide the GMM regression estimates. As before, we find that higher energy exports and increases in globalization are associated with higher growth rates, statistically significant at the 5% level in most specifications. Similarly, greater economic, social and political integrations expand economic growth. Overall, the remaining results from the panel 5-country model are also consistent with the panel 3-country model, except for the variable *government*, which is now negative and statistically significant at conventional levels in most equations.

These findings are perhaps not surprising especially given that Russia maintains a critically important position in the prospect of energy supply in the global economy (Müller-Kraenner, 2007). Dorian et al. (2006), for example, suggests that Russia has intended to expand oil production from 8 million barrels per day to 10–14 million barrels per day by 2020. Moreover, Correljé and van der Linde (2006) emphasize that Russia plays a vital role in energy supply security in the global market as it is the lone energy producer that is capable to export oil and gas in sizeable capacity. Also, Müller-Kraenner (2007) explains that the European Union is expected to rely on energy imports from Russia in the coming years. Besides, the European Union anticipates greater economic integration with Russia (Correljé and van der Linde, 2006).

We also attempt to investigate whether energy exports influence economic growth in the process of global integration in the South Caucasus region. More specifically, we examine the interaction effects of energy exports and globalization on economic growth. We provide the LSDVC (AB) and LSDVC (BB) regression estimates for the panel 3-country model and panel 5-country model in Tables 3 and 4, respectively. As before, we also estimate the GMM regression model for all equations. As can be seen, the regression estimates are consistent across all models in Tables 3 and 4. In addition, we compute the

Table 5
LSDVC (BB) regression estimates.

Models	3-country				5-country					
Independent variable										
Lagged dep. var.	0.847**	0.913**	0.947**	0.557**	0.887**	0.892**	0.933**	0.786**	0.985**	0.831**
	(4.125)	(4.665)	(4.125)	(6.471)	(8.254)	(7.105)	(9.640)	(5.330)	(16.563)	(25.382)
Energy	0.258**	1.287**	0.297	0.693**	0.125**	1.024**	0.380**	1.272	1.684**	0.443**
	(4.355)	(5.336)	(1.477)	(5.364)	(3.885)	(6.301)	(3.167)	(0.262)	(3.374)	(2.229)
Globalization	0.211**					0.100**				
	(3.133)					(3.23)				
Economic		0.455**			0.024**		0.080**			0.021**
		(7.234)			(2.369)		(3.223)			(5.259)
Political			0.187**		0.146			0.098**		0.031
			(5.214)		(0.657)			(6.218)		(0.034)
Social				0.447	0.554				0.236	0.340
				(0.879)	(1.587)				(0.439)	(1.161)
Energy*globalization	0.441**					0.136**				
	(3.698)					(4.209)				
Energy*economic		0.219**			0.874**		0.041**			0.489**
		(3.645)			(5.369)		(3.119)			(3.490)
Energy*political			0.277**		0.114			0.293**		0.618
			(6.558)		(0.874)			(6.272)		(0.705)
Energy*social				0.485	0.899				0.590	0.799
				(1.614)	(1.254)				(0.642)	(0.560)
Primary	0.015	0.001	−0.001	0.002	0.001	0.001	0.001	−0.001	0.002	0.001
	(0.011	(0.145)	(−0.227)	(0.157)	(0.338)	(0.001)	(0.011)	(−0.077)	(0.073)	(0.124)
Secondary	−0.014	−0.002	−0.002	−0.014	−0.002**	−0.003	−0.004	−0.001	−0.010	−0.008**
	(−0.857)	(−0.254)	(−0.125)	(−1.247)	(−3.247)	(−0.238)	(−0.292)	(−0.015)	(−0.953)	(−2.513)
Government	0.001	0.002	−0.002	0.001	−0.001	0.002	0.002	−0.002	0.003	−0.001
	(0.247)	(0.257)	(−0.984)	(0.336)	(−0.187)	(0.166)	(0.174)	(−0.069)	(0.230)	(−0.072)
Gdpdefdev	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	(0.655)	(0.335)	(0.254)	(0.157)	(0.352)	(0.029)	(0.032)	(0.024)	(0.022)	(0.008)
Revstart	0.975	1.277	−1.109	0.404	−1.310	1.975	1.277	−1.109	7.404	−1.310
	(0.457)	(0.412)	(−0.336)	(0.215)	(−0.368)	(0.207)	(0.434)	(−0.025)	(0.195)	(−0.436)
Physint	−0.013	−0.011	−0.146	−0.013	−0.221	−0.005	−0.007	−0.005	−0.010	−0.011
	(−0.215)	(−0.663)	(−0.213)	(−0.247)	(−0.347)	(−0.115)	(−0.153)	(−0.111)	(−0.197)	(−0.296)
Long-run effect (energy)	0.221**	0.614**	0.551	0.214**	0.258**	0.495**	0.664**	0.956	0.155**	1.426**
	(4.369)	(3.745)	(1.234)	(3.441)	(3.385)	(6.463)	(3.220)	(0.320)	(3.151)	(4.219)
Long-run effect (Energy*globalization)	1.222**					1.261**				
	(3.697)					(4.277)				
Long-run effect (Energy*economic)		0.215**			0.664**		0.609**			0.885**
		(2.669)			(3.697)		(2.102)			(2.157)
Long-run effect (Energy*political)			1.339**		0.165			1.371**		0.647
			(4.369)		(1.365)			(2.335)		(0.817)
Long-run effect (energy*social)				3.114	0.652				0.302	0.717
				(0.285)	(0.514)				(0.181)	(0.505)

Notes: The t-statistics are in parentheses. ** and * indicate the statistical significance at the 5% and 10% levels, respectively. The specifications include the basic control variables from Barro (1991).

long-run estimates for the interaction effects of energy and globalization, which are presented at the bottom of each table.

The interaction effect of energy exports and globalization is positive and statistically significant at conventional levels in Tables 3 and 4, suggesting that higher energy exports lead to higher growth rates in the course of globalization. The long-run effects are also positive and statistically significant at the 5% level, suggesting that these effects are sustained into the long run. These findings are consistent in the 3-country (Table 3) and 5-country (Table 4) models. Also, higher energy exports lead to higher growth rates particularly in the period of increasing economic and political integration. However, the interaction effects of energy exports and social integration have a limited impact on economic growth when it enters the model specification jointly in Tables 3 and 4. In general, the remaining results from Tables 3 and 4 are mostly in line with our earlier findings.

Finally, we conduct a number of sensitivity tests using a variety of control variables in the empirical analysis to further ensure the robustness of our results. More specifically, we include the basic control variables from Barro (1991) in Table 5, Levine and Renelt (1992) in Table 6, and Barro (1996) models in Table 7.[7] We provide the LSDVC (BB) regression estimates for the panel 3-country and panel 5-country models in Tables 5–7. As before, our findings continue to show that energy exports, globalization and their interaction effects are significant determinants of economic growth in the South Caucasus region. These findings are consistent across the panel 3-country and panel 5-country models.

6. Conclusion

We examine the relationship between energy exports, globalization and economic growth using the LSDVC approach over the 1990–2009 period in a panel of five South Caucasus countries: Azerbaijan, Georgia, Turkey, Armenia and Russia. We develop two models in the empirical analysis: a panel 3-country model (Azerbaijan, Georgia and Turkey) and a panel 5-country model (Azerbaijan, Georgia, Turkey, Armenia and Russia) to provide greater understanding on the relationship between energy exports, global integration and economic growth. Our results provide evidence that energy exports, globalization and their interaction effects are significant determinants of economic growth in the South Caucasus region.

In particular, we provide evidence that higher energy exports and globalization are associated with higher growth rates. We also find that greater economic, political, and social integrations expand

Table 6
LSDVC (BB) regression estimates.

Models	3-country model					5-country model				
Independent variable										
Lagged dep. var.	0.857**	1.147**	0.887**	0.947**	0.741*	0.985**	1.008**	0.940**	0.963**	0.907**
	(7.668)	(3.006)	(15.667)	(3.369)	(6.358)	(17.112)	(6.748)	(15.181)	(2.378)	(17.228)
Energy	0.113**	0.364**	0.399**	0.667**	0.557	0.623**	0.807**	0.357**	0.573**	0.186
	(4.325)	(3.117)	(2.457)	(5.365)	(1.325)	(3.258)	(3.242)	(2.135)	(4.083)	(0.220)
Globalization	0.852**					0.486**				
	(2.367)					(3.585)				
Economic		0.669**			0.208**		0.319**			0.110
		(2.369)			(3.621)		(4.975)			(0.957)
Political			0.757		0.114			0.299		0.003
			(1.611)		(0.339)			(0.608)		(0.023)
Social				0.242**	0.301				0.358**	0.301**
				(2.331)	(1.112)				(3.263)	(1.969)
Energy*globalization	0.133**					0.166**				
	(2.274)					(2.255)				
Energy*economic		0.355**			0.168**		0.207**			0.022**
		(4.214)			(3.557)		(2.227)			(3.104)
Energy*political			0.208**		0.157			0.104**		0.090
			(3.667)		(0.663)			(3.141)		(0.421)
Energy*social				0.224	0.204				0.168	0.186
				(0.997)	(1.117)				(0.092)	(0.658)
Investment	0.001	0.004	0.001	0.002	0.001	0.002	0.003	0.001	0.004	0.002
	(0.554)	(1.323)	(0.667)	(0.711)	(0.234)	(0.807)	(1.278)	(0.204)	(0.638)	(1.262)
Population	−0.176	−0.170**	−0.145	−0.156	−0.106**	−0.066	−0.053**	−0.055	−0.053	−0.046**
	(−1.323)	(−3.472)	(−0.668)	(−0.203)	(−3.055)	(−1.423)	(−5.182)	(−0.344)	(−0.100)	(−2.071)
Primary	0.014**	0.005**	0.002	0.004*	0.002**	0.005	0.005	0.006**	0.006**	0.005**
	(3.657)	(4.335)	(0.247)	(1.685)	(3.258)	(0.536)	(0.316)	(6.117)	(28.221)	(2.860)
Secondary	−0.002**	−0.013	−0.004	−0.001	−0.002	−0.003**	−0.003	−0.001	−0.002	−0.003
	(−2.557)	(−0.998)	(−0.338)	(−0.159)	(−1.475)	(−2.153)	(−0.908)	(−0.117)	(−0.992)	(−1.211)
Government	−0.002	−0.001	−0.013**	−0.002	−0.002	−0.001	−0.002	−0.003*	−0.001	−0.001
	(−0.135)	(−0.677)	(−2.885)	(−0.425)	(−0.553)	(−0.115)	(−0.649)	(−1.781)	(−0.252)	(−0.351)
Credit	−0.006**	−0.007	−0.015	−0.017**	−0.014**	−0.007	−0.006	−0.005	−0.007**	−0.006**
	(−3.218)	(−0.122)	(−1.139)	(−6.355)	(−3.657)	(−1.218)	(−0.509)	(−1.139)	(−7.216)	(−2.871)
Long-run effect	0.355**	1.301**	0.447**	1.335**	0.889	2.267**	3.961**	0.951**	1.464**	0.426
(energy)	(6.528)	(3.688)	(3.557)	(5.247)	(1.358)	(4.129)	(2.066)	(3.137)	(3.043)	(0.219)
Long-run effect	0.699**					1.265**				
(energy*globalization)	(3.587)					(2.128)				
Long-run effect		0.324**			0.647**		2.615**			1.885**
(energy*economic)		(3.875)			(2.335)		(3.067)			(4.157)
Long-run effect			2.655**		0.257			1.725**		0.647
(energy*political)			(4.685)		(1.158)			(3.143)		(0.817)
Long-run effect				0.369	0.367				4.525	4.717
(energy*social)				(1.447)	(0.741)				(0.046)	(0.505)

Notes: The t-statistics are in parentheses. ** and * indicate the statistical significance at the 5% and 10% levels, respectively. The specifications include the basic control variables from Levine and Renelt (1992).

Table 7
LSDVC (BB) regression estimates.

Models	3-country				5-country					
Independent variable										
Lagged dep. var.	0.884**	0.443**	0.384**	0.112**	0.746**	0.786**	0.954**	0.695**	0.860**	0.780**
	(6.231)	(6.873)	(10.773)	(8.665)	(9.665)	(10.590)	(11.175)	(9.636)	(12.469)	(10.593)
Energy	0.332**	0.564**	0.616	0.773	0.155**	0.124**	0.491**	0.775	1.962**	0.821**
	(3.889)	(3.874)	(1.246)	(0.437)	(3.746)	(2.411)	(2.449)	(1.131)	(2.570)	(3.591)
Globalization	1.283**					0.622**				
	(3.309)					(3.029)				
Economic		0.455**			0.554**		0.375**			0.390**
		(7.747)			(3.776)		(2.061)			(2.166)
Political			0.186**		0.331			0.367*		−0.071
			(2.837)		(1.232)			(1.690)		(−0.252)
Social				0.119*	0.545**				0.322*	0.136*
				(1.767)	(2.767)				(1.885)	(1.886)
Energy*globalization	0.338**					0.526**				
	(3.365)					(2.455)				
Energy*economic		0.187**			0.114**		0.117			0.265
		(2.368)			(4.258)		(0.446)			(1.316)
Energy*political			0.325**		0.355**			0.185**		0.513**
			(6.368)		(3.558)			(2.140)		(2.633)
Energy*social				0.335	0.147				0.496**	0.053
				(1.523)	(0.667)				(2.602)	(0.221)
Male	−0.002	−0.002	−0.001	−0.001	−0.003	−0.004	−0.004	−0.002	−0.003	−0.003
	(−1.254)	(−1.334)	(−0.547)	(−1.224)	(−1.477)	(−1.577)	(−1.219)	(−0.85)	(−1.128)	(−1.202)
Female	0.012	−0.011	0.014	0.012	−0.011	0.002	−0.002	0.003	0.001	−0.001
	(0.774)	(−0.324)	(1.224)	(0.358)	(−1.324)	(0.694)	(−0.492)	(1.105)	(0.381)	(−0.062)
Life	0.039**	0.114	0.017**	0.177**	0.475**	0.040**	0.026	0.040**	0.042**	0.025*
	(2.475)	(1.355)	(3.668)	(2.998)	(1.996)	(2.618)	(1.421)	(3.135)	(2.618)	(1.704)
Fertility	0.2136*	0.002	0.336*	0.257	0.447	0.234*	0.106	0.217*	0.108	0.152
	(1.845)	(0.785)	(1.668)	(0.958)	(1.589)	(1.783)	(0.684)	(1.951)	(0.883)	(1.249)
Government	−0.012	−0.021	−0.024**	−0.011	−0.021	−0.002	−0.015	−0.021*	−0.001	−0.001
	(−0.335)	(−0.157)	(−2.665)	(−2.254)	(−0.255)	(−0.324)	(−0.588)	(−1.881)	(−0.352)	(−0.557)
Publicedu	0.012**	0.005*	0.0147	0.002	0.002	0.009**	0.010*	0.005	0.001	0.004
	(2.747)	(1.887)	(1.554)	(0.774)	(0.158)	(2.303)	(1.763)	(1.416)	(0.356)	(0.933)
Interest	−0.335*	−0.142	−0.225	−0.102**	−0.114	−0.026*	−0.009	−0.013	−0.045**	−0.004
	(−1.887)	(−0.669)	(−0.745)	(−3.336)	(−0.885)	(−1.661)	(−0.481)	(−0.856)	(−2.501)	(−0.241)
Law and order	0.003	0.002	−0.001	0.001	0.001	0.001	0.001	−0.001	0.001	0.001
	(0.165)	(0.447)	(−0.339)	(0.187)	(0.448)	(0.754)	(0.559)	(−0.105)	(0.096)	(0.585)
Trade	0.056	0.021	0.157**	0.214	0.047*	0.023	0.016	0.042*	0.019	0.039*
	(1.447)	(0.117)	(1.999)	(0.335)	(1.958)	(1.035)	(0.586)	(1.924)	(0.783)	(1.924)
Investment	0.001**	0.002	0.003	0.002**	0.001	0.001*	0.001	0.001	0.001**	0.001
	(2.369)	(0.442)	(0.552)	(2.668)	(0.116)	(1.863)	(0.045)	(0.362)	(2.831)	(0.772)
Democ	−0.001	−0.001	−0.001	−0.001	−0.001	−0.002	−0.001	−0.002	−0.001	−0.001
	(−1.502)	(−0.225)	(−1.002)	(−0.884)	(−0.114)	(−1.458)	(−0.153)	(−1.108)	(−0.604)	(−0.092)
Long-run effect (energy)	0.014**	0.011**	0.013	0.116	0.085**	0.008**	0.009**	0.003	0.017**	0.003**
	(5.336)	(4.258)	(0.885)	(1.312)	(4.687)	(3.695)	(3.663)	(0.324)	(2.399)	(4.273)
Long-run effect (energy*globalization)	0.258**					1.119**				
	(3.336)					(3.908)				
Long-run effect (energy*economic)		0.855**			0.857**		0.545			0.232
		(3.258)			(2.367)		(0.884)			(0.344)
Long-run effect (energy*political)			0.687**		0.545**			1.098**		0.998**
			(3.585)		(6.358)			(2.934)		(3.332)
Long-run effect (energy*social)				0.114	0.115				0.765**	0.626
				(0.258)	(0.335)				(2.338)	(0.778)

Notes: The t-statistics are in parentheses. ** and * indicate the statistical significance at the 5% and 10% levels, respectively. The specifications include the basic control variables from Barro (1996).

economic growth. Moreover, our findings suggest that higher energy exports contribute to higher growth rates in the period of rising global integration. More specifically, higher energy exports lead to higher growth rates in the period of increasing economic and political integration in the South Caucasus region. These findings are consistent in the panel 3-country and panel 5-country models. In addition, all these results are robust to the inclusion of variety of control variables in the empirical analysis.

The supply of energy and global integration has been a fundamental issue in the South Caucasus. This is because a break to energy exports may considerably impair the activities in the local economy. Lesbirel (2004: 7), for example, argues that the interruption to energy supply corresponds to a "major threat to nations that have few domestic resources and rely heavily on external supplies of energy sources." As such, Azerbaijan, Georgia and Turkey have constructed these energy transportation routes, which, in turn, have shaped energy supply security in the region. To sum, we emphasize that energy exports, global integration, and their interaction effects are important determinants of economic growth in the South Caucasus.

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Appendix A

Table A1
Data definitions, sources and descriptive statistics.

Variable	Definition	Source	Mean	Standard deviation	Min.	Max.
GDP	(log) Real GDP per capita (constant 2000 US$)	World Development Indicators (2011)	1730.024	1311.581	392.059	5104.11
Energy	Energy production less net energy use as a percentage of energy use	World Development Indicators (2011)	31.874	13.844	13.271	86.204
Globalization	(log) Overall globalization index	KOF Index of Globalization (2011)	50.335	11.055	28.460	69.160
Economic	(log) Economic integration index	KOF Index of Globalization (2011)	52.287	10.337	23.460	78.542
Political	(log) Political integration index	KOF Index of Globalization (2011)	53.014	26.528	7.714	93.680
Social	(log) Social integration index	KOF Index of Globalization (2011)	46.428	10.174	20.000	69.930
Capital	Gross capital formation (% of GDP)	World Development Indicators (2011)	24.206	9.658	−0.691	57.990
Government	General government final consumption expenditure (% of GDP)	World Development Indicators (2011)	13.157	4.887	5.861	31.458
Money	Money and quasi money (% of GDP)	World Development Indicators (2011)	19.381	9.198	5.844	43.727
Inflation	Consumer prices (annual %)	World Development Indicators (2011)	15.611	57.025	−8.525	4447.87
Life	(log) Life expectancy at birth	World Development Indicators (2011)	68.165	2.544	64.474	73.658
Fertility	Fertility rate (total births per woman)	World Development Indicators (2011)	1.944	0.471	1.125	3.087

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