

# An Examination of the Natural Resource Curse after the 1990s

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## *Abstract*

*After remarkable changes in the global economy in the last two decades, does the natural resource curse still exist? To answer this question, this paper examines the relationship between economic growth and natural resource abundance with World Bank data over the period 1970–2009. The results suggest that the natural resource curse still exists after the 1990s; however, it is weaker compared with the findings of Sachs and Warner (1997) over the period 1970–1990. Our results are robust even when we include post-Soviet countries in the sample and introduce new institutional quality indicators into the model.*

**Keywords:** Economic growth, natural resources, institutions (JEL O43, O47, Q33)

## 1. Introduction

A country with abundant natural resources tends to have better opportunities for economic growth. However, when economists examined carefully the relationship between economic growth and natural resource abundance, they found the opposite: countries with abundant natural resources tend to grow more slowly than those with limited natural resources. The negative interaction between economic growth and natural resource abundance, which is called the “natural resource curse”, is roughly illustrated by Figure 1. Resource rich countries like Honduras, Gambia, Gabon, Ghana, Zambia, Guyana, Malawi, and Venezuela obviously have a serious problem with the “natural resource curse”.

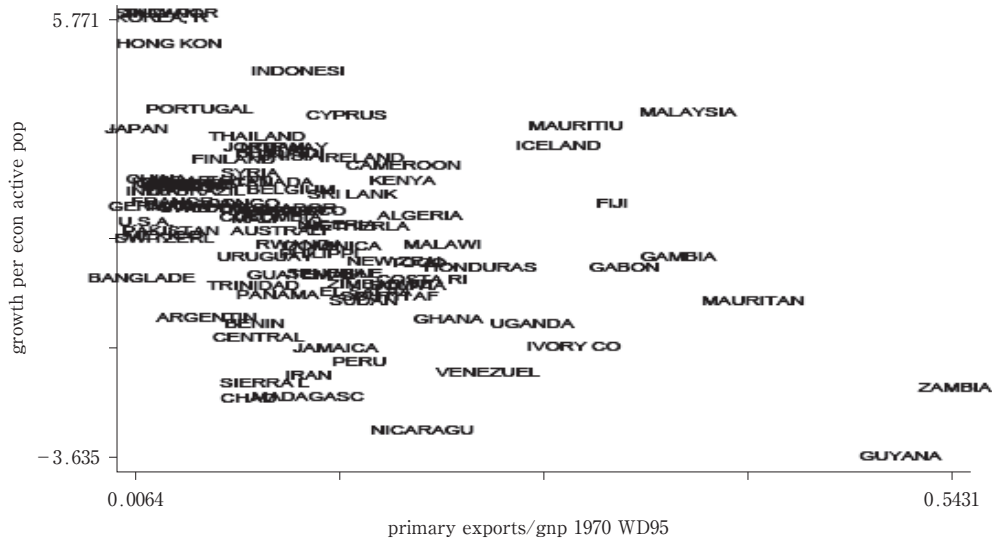
The seminal and influential study by Sachs and Warner (1997) with data from 95 countries during the period 1970–1990 illustrates a significant negative correlation between natural resource abundance, measured by the share of exports of primary products in

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Figure 1. Economic growth and natural resource abundance during the period 1970–1990



Source: Sachs and Warner (1997)

gross national product (further — SXP) in 1970 and economic growth, measured by average gross domestic product (GDP) growth rate divided by the economically active population (GEA) in the period 1970–1990. This phenomenon is confirmed by Lederman and Maloney (2002), Mehlum, Moene and Torvik (2006b), Davis (2011) and many other researchers.

Later, Sachs and Warner (2001) examined the natural resource curse by using geographical and climate variables and again found a strong negative correlation. Therefore, the geography variables generally do not eliminate the evidence for the existence of the natural resource curse. Wright and Czelusta (2003) reject the existence of the natural resource curse and argue that resource-based development depends on investment in exploration and extraction processes. Therefore, appropriate investment in technological progress should be a reasonable factor in fostering the economic development in resource rich economies. To extend the studies on the resource curse Mehlum, Moene and Torvik (2006a) used the same data and method as Sachs and Warner (1997), but focused on the effect of institutional quality. They derived and tested an equation for the institutional threshold and found that the resource curse is weaker in countries where the institutional quality is higher. This result implied that the quality of institutions is a key factor that determines whether a country can avoid the resource curse or not.

Nevertheless, even if the natural resource abundance is narrowly defined as a curse for economic growth, it may still lead to improvements in other aspects of economic development, such as, the decline of human poverty, reduction of population that are undernourished, and a decrease in underweight children and life expectancy at birth. Bulte, Deacon and Damania (2004) examined the impact of natural resources on undernourishment, poverty, and other human development indicators, and found the same significant negative

correlation between natural resources and economic development through the channels of institutional quality.

This paper conducts an examination of the natural resource curse with World Bank data that includes 157 countries and covers the period 1970–2009.

First, we try to answer the following question: *does the natural resource curse still exist after the 1990s?* In the last two decades, the world economy has experienced dramatic changes such as a revolution in IT technology, growing importance of emerging markets, rising prices of oil and other natural resources. Hence, a re-examination of the natural resource curse with data in recent years is required. In this paper, we test the Sachs and Warner model (1997) with World Bank data and show that the correlation between natural resources and economic growth after the 1990s is still negative, but weaker.

Second, we carry out an empirical test that includes post-Soviet collapse countries in the sample. By using the same model of Sachs and Warner (1997) and the World Bank data, we show that there is a significant negative relationship between natural resources and economic growth even after 1995.

Third, we make a further examination of the effect of institutional quality on the natural resource curse. Poor institutional quality usually means government ineffectiveness, corruption, rent-seeking, conflicts, unstable financial system among other factors. Sachs and Warner (1997) and Mehlum, Moene and Torvik (2006a) used the rule of law index as an indicator of institutional quality and found that it had a significant effect on the natural resource curse. In this paper, we use two additional variables related to institutional quality, government effectiveness index and the index of voice and accountability. Data from all the three variables were taken from the Worldwide Governance Indicators. The results show that after controlling for the effect of institutional quality, there is still a significant negative correlation between natural resources and economic growth.

The rest of the paper is organized as follows. Section 2 examines the existence of the natural resource curse after the 1990s with World Bank data. Section 3 tests the model with post-Soviet countries included. Section 4 focuses on the effect of institutional quality on the natural resource curse. And Section 5 concludes the findings.

## 2. An examination of the Natural resource curse with World Bank Data

### 2.1. Model and Data

The influential studies by Sachs and Warner (1997, 2001) examined the existence of the natural resource curse with a cross-country dataset over the period of 1970–1990 and found a significant negative correlation between the natural resource abundance and economic growth. The objective of this paper is to extend their studies and examine the existence of the resource curse post-1990s. During the last two decades the global economy experienced many remarkable changes and many economists characterized this period as a transitional period leading to new technologies, free market competition, trade openness, and economic

reforms.

In this paper we use the Sachs and Warner model (1997), which is presented below:

$$GEA7090 = a_0 + a_1 * LGDPEA70 + a_2 * SXP70 + a_3 * SOPEN + a_4 * LINV7089 + a_5 * RL82 + a_6 * DTT7090 + e \quad (1)$$

where,

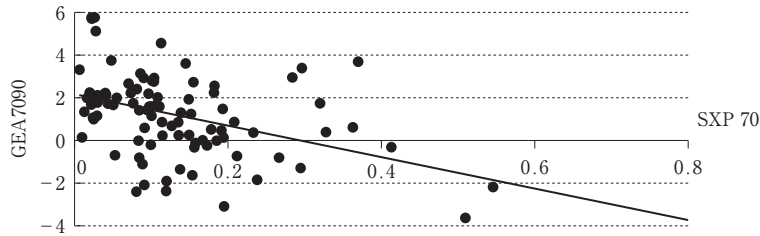
GEA7090	average annual growth in real GDP divided by the economically active population during the years 1970–1990;
LGDPEA70	natural log of real GDP divided by the economically active population in 1970;
SXP70	share of exports of primary products in GNP in 1970;
SOPEN	the fraction of years during the period 1970–1990 in which the country is rated as an open economy;
LINV7089	natural log of the ratio of real gross domestic investment (public + private) to real GDP, average over the period 1970–1989;
RL82	rule of law index that “reflects the degree to which the citizens of a country are willing to accept the established institutions to make and implement laws and adjudicate disputes”;
DTT7090	average annual growth rate in the log of the external terms of trade between 1970–1990.

The dependent variable is the growth rate of GDP per economically-active population; and among the explanatory variables SXP is denoted as an indicator of natural resource abundance.<sup>2)</sup> Another important independent variable is RL, the rule of law index, which is defined as the indicator of institutional quality of the country.

In this study, we, first, test the Sachs and Warner model (1997) for the last two decades. This test uses the same sample as Sachs and Warner (1997), whose dataset is currently available in the database for the Centre for International Development of Harvard University.<sup>3)</sup> The first column in Table 1 shows the initial Sachs and Warner results (1997) over the period of 1970–1990. The results report that there is strong negative correlation between the natural resource abundance and economic growth. This negative relationship between growth pace and natural resource abundance is well illustrated in the following Figure 2. The second column — Regression 1 — presents results for the next two decades and indicates a weaker negative relationship between natural resources and economic growth.

Sachs and Warner (1997) use different sources of data, such as the World Bank database (CD-ROM, 1995, World Bank) and Penn World Tables of the Center for International Comparisons of the University of Pennsylvania, International Country Risk Guide of the Political Risk Services. To test the robustness of the natural resource curse phenomenon and to equalize all data sources, we use the World Bank data (CD-ROM, 2010, World Bank), the same sample of countries and the same period as Sachs and Warner (1997). Macroecono-

Figure 2. The natural resources and economic growth over the period 1970–1990



economic data for all variables is available in the World Bank database. The results are shown in Table 2.

Regression 4 and Regression 5 in Table 3 were conducted to examine the existence of the natural resource curse after the 1990s. We obtain the variable of trade openness in this test as being the sum of exports and imports divided by GDP. This is in contrast to Sachs and Warner (1995) who defined this variable as a dummy variable equal to 1 for open economy, and equal to 0 otherwise. Sachs and Warner (1997) used cross-country dataset of 95 developing countries during the 1970–1990, except 8 slow-growing oil-exporting economies such as Bahrain, Iraq, Libya, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates, because of lack of complete data. In this test we expanded the number of countries from 95 to 119 countries, which corresponds to the 1990. Hence, Regression 4 in Table 3 corresponds to the 95 countries in the sample of Sachs and Warner (1997), while Regression 5 conducts an examination for the whole of the World Bank countries, which are related to the 119 number of countries.

The Regressions in Table 5 focus on the countries post-Soviet collapse after 1995. This is because after the Collapse of the Soviet Union in 1991, the world map was re-organized and new countries added. These countries started to build up their states based on the abundance of national wealth and resources. In this test we again use World Bank data. Therefore, in Table 5 in Section 3 empirical results of the examination of the natural resource curse after the Collapse of Soviet Union are presented. The Regression 6 in Table 5 illustrates the sample of countries which are related to 1995. The Regression 7 presents results for the 95 countries published in Sachs and Warner (1997) and the Regression 8 presents the results of the 119 countries, which refer to 1990.

Finally, we examine the impact of institutional quality on the natural resource curse. Sachs and Warner (1997) used the rule of law index as a proxy for the institutional quality. This indicator was constructed by the Center for Institutional Reform and the Informal Sector and was available from the International Country Risk Guide. Scores range from approximately 0 (lowest) to 6 (highest) in value. To investigate the reliability of the impact of the institutions on the natural resource curse, in this test we use two new additional factors of institutional quality the government effectiveness index and voice and accountability index from “The Worldwide Governance Indicators” of World Bank data source. The score of these indices vary from -2.5 (weak) to 2.5 (strong). Table 6 in Section 4 presents the empirical results of the Sachs and Warner model (1997) with new fac-

tors of institutional quality. Regression 9 in the first column of Table 6 reexamines Regression 5 to compare the results for the same sample of 119 countries. Regression 10 examines the impact of the institutions, based on the same sample of countries as Regression 8, but after 1995. Finally, Regression 11, which is similar to Regression 6, tests the model for 157 countries after 1995 (*See Appendix A for the complete list of all countries*).

## 2.2. A test of the Sachs and Warner Model in 1970-2009

As mentioned above, Sachs and Warner (1997) discovered the phenomenon of the natural resource curse over the period 1970-1990. Post-1990 the world has experienced significant structural changes and reforms which have drastically altered economic and political regimes in many countries. Therefore, the goal of this Section is to extend the examination of the existence of the natural resource curse from post-1990 — until 2009. In doing so, first, we use the Sachs and Warner model (1997) with the sample including the exact same 95 countries as Sachs and Warner.

The first column in Table 1 below replicates the Sachs and Warner results (1997), while the second column examines model the period 1970-2009. The model of Regression 1 is specified as below:

$$GEA7009 = a_0 + a_1 * LGDPEA70 + a_2 * SXP70 + a_3 * SOPEN + a_4 * LINV7008 + a_5 * RL82 + a_6 * DTT7009 + e \quad (2)$$

Table 1. The test of Sachs and Warner model of 1970-1990 and 1970-2009

	Regression SW 1970-1990	Regression 1 1970-2009
Dependent variable	GEA 7090	GEA7009
Independent variables:		
LGDPEA 70 (Initial income level)	-1.79** (-8.82)	-0.48* (-2.09)
SXP 70 (Natural Resources)	-10.26** (-6.89)	-3.90* (-2.24)
SOPEN (Openness)	1.34** (3.44)	0.69 (1.19)
LINV (Investment)	0.81* (2.63)	1.33** (2.79)
RL 82 (Rule of law index)	0.40** (3.94)	0.26 (1.70)
DTT (Growth in terms of Trade)	0.09 (1.85)	0.15 (1.52)
Adjusted R <sup>2</sup>	0.73	0.32
Standard error	0.92	1.38
Total number of countries	95	95
Number of adjusted countries	71	71

Notes: T-stat in brackets; \*significant at the 10% level, \*\*significant at the 5% level.

In this test, we investigated variables of economic growth, investment and growth rate in external terms of trade for the period 1970-2009. SXP was taken as 1970, the same as Sachs and Warner (1997). RL82 is the rule of law index in 1982. SOPEN is constructed by

Sachs and Warner (1995). Other variables were calculated by using the same estimation as Sachs and Warner (1997) for the extended period.

The result of Regression 1 indicates that the interaction term between SXP 70 and GEA 7009 is still negative, but it is weaker. SOPEN and RL82 are insignificant in results of Regression 1 and show contrast to the results of Sachs and Warner (1997). LINV is still positive and significant over the time.

### 2.3. An examination of the Sachs and Warner model with World Bank Data

In order to verify the Sachs and Warner (1997) model with the World Bank data, we assumed that the results would not have a strong divergence from the choice of another data source. Sachs and Warner (1997) used the Penn World Tables and the World Bank database as a major data source. The World Bank data are commonly used by researchers and various economic studies, because of their availability and reliability. Therefore, an examination of the existence of the natural resource curse in this paper covers more countries than Sachs and Warner (1997).

Table 2 overleaf reports the results of the Sachs and Warner (1997) model with World Bank data. Among the variables, in Regression 2 and Regression 3 we use the same SOPEN and SXP, and the same DTT in Regression 2, as Sachs and Warner (1997). This is because SXP is taken for 1970, SOPEN is constructed by Sachs and Warner (1995), and DTT is taken for the same period of 1970–1990 with World Bank data. LINV is a gross capital formation (percentage share of GDP). RL is a Government Indicator Index of rule of law in 2000.

Regression 2 in Table 2 focuses on the same sample of countries and same period as Sachs and Warner (1997), but this examination uses World Bank data. The results of our examination confirm Sachs and Warner's (1997) conclusion of the existence of the natural resource curse.

However, Regression 3 in the second column of Table 2 uses the data of 89 countries in the estimation, the same adjusted sample of countries as in Regression 2. The results of Regression 3 show a significantly negative linkage between resource abundance and economic growth. Yet, only LINV in this test was found to have had a positive and significant impact on economic growth. The coefficient of LINV in Regression 2 and Regression 3 was larger than of the results of the Regressions in Table 1.

Our examination with the World Bank data had shown the negative and significant effect of natural resources on economic growth over time. That is, even when we extended the period of examination until 2009, the natural resource curse still existed. As shown in previous results in Table 1, both Regressions in Table 2 demonstrated significant and positive effects of LINV, while LGDPEA70 did not show any significant link with economic growth.

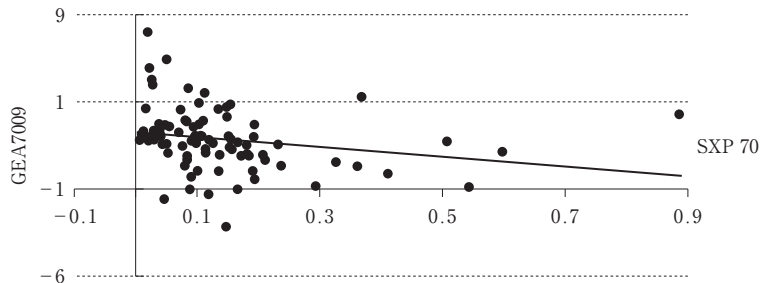
Figure 3 below also illustrates the existence of the natural resource curse during the period 1970–2009 with World Bank data.

Table 2. An examination of Sachs and Warner Model with World Bank Data

	Regression 2 1970-1990	Regression 3 1970-2009
Dependent variable	GEA 7090	GEA7009
Independent variables:		
LGDPEA 70 (Initial income level)	0.003 (0.06)	-0.008 (-0.19)
SXP 70 (Natural Resources)	-4.70** (-3.74)	-3.05** (-2.98)
SOPEN (Openness)	2.19** (3.12)	0.66 (1.06)
LINV (Investment)	4.23** (5.94)	4.78** (6.54)
RL 96 (Rule of law index)	-0.20 (-0.66)	0.06 (0.19)
DTT (Growth in terms of Trade)	-0.04 (-0.65)	-0.02 (-0.21)
Adjusted R <sup>2</sup>	0.54	0.51
Standard error	1.59	1.29
Total number of countries	95	89
Number of adjusted countries	89	81

Notes: T-stat in brackets; \*significant at the 10% level, \*\*significant at the 5% level.

Figure 3. The natural resources and economic growth over the period 1970-2009



#### 2.4. Does the Sachs and Warner results withstand for the next two decades ?

After the 1990s the process of globalization hastened its steps; however, its effect is complex. In the 1970s, there were 31 countries with 11.1 percent of the world having zero or minus growth in per capita income. In the 1990s the number of such countries had risen to 48 and their combined population up to 22.5 percent of the world. Concurrently, the proportion of the population in countries, where per capita income growth exceeded 4 percent per year, went up from 12.3 percent in the 1970s to 28.7 percent in the 1990s. In the developing world, a small group of countries has increased their share of exports from 26.3 percent in 1970 to 66.7 percent in 2000. This group of countries has attracted the vast majority of foreign investments, and then they benefited more from globalization.

Due to the great changes in the global economy, whether the natural resource curse still exists cannot be definitively argued.



Regression 4 and Regression 5 examine the natural resource curse during the period 1990–2009. The model of this examination is as below:

$$GEA9009 = a_0 + a_1 * LGDPEA90 + a_2 * SXP90 + a_3 * SOPEN + a_4 * LINV9008 + a_5 * RL00 + a_6 * DTT9009 + e \quad (3)$$

LGDPEA and SXP in previous tests were calculated for 1970, in 1990 LGDPEA and SXP have different values although insignificant in amount.<sup>5)</sup> Other variables were calculated over the period 1990–2009, except that RL is taken for 2000 — the year in the middle of this period. In contrast to the Sachs and Warner (1997) definition, we define SOPEN as the sum of exports and imports over GDP. DTT is the ratio between export and import value indices over the period 1990–2009. The results of Regression 4 and Regression 5 are shown in Table 3 below.

Table 3. An examination of the Sachs and Warner model for the period 1990–2009

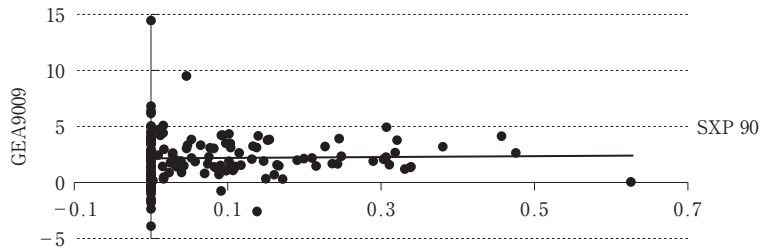
Dependent variable	Regression 4 1990–2009	Regression 5 1990–2009
Independent variables:	GEA 9009	
LGDPEA 90 (Initial income level)	0.008 (0.19)	0.02 (0.33)
SXP 90 (Natural Resources)	1.38 (0.88)	−0.48 (−0.37)
SOPEN (Openness)	−0.47 (−1.40)	−0.02 (−0.06)
LINV (Investment)	4.49** (6.48)	5.32** (8.74)
RL 00 (Rule of law index)	−0.04 (−0.21)	−0.34* (−2.05)
DTT (Growth in terms of Trade)	0.11 (1.36)	0.06 (1.26)
Adjusted R <sup>2</sup>	0.42	0.45
Standard error	1.44	1.65
Total number of countries	95	119
Number of adjusted countries	81	119

Notes: T-stat in brackets; \*significant at the 10% level, \*\*significant at the 5% level.

Regression 4 examines the 95 countries which are in the sample of Sachs and Warner (1997). The correlation between SXP 90 and GEA 9009 is positive, but insignificant (1.38), which is totally different from the results of Sachs and Warner (1997). In this test only LINV has a positive and significant coefficient (4.49). The outcome of this regression indicates that the natural resource curse disappears after the 1990s in 95 countries of Sachs and Warner (1997).

In Regression 5 we tested the model with a greater number of countries. The correlation between SXP 90 and GEA 9009 is negative, but insignificant (−0.48). Figure 4 below demonstrates this weak natural resource curse after the 1990s. The effect of LINV on economic growth is still strong and positive (5.32). RL is negative and significant (−0.34).

Figure 4. The natural resources and economic growth over the period 1990–2009



The results of Regression 4 and Regression 5 suggest that the natural resource curse generally does not exist in the period 1990–2009. However, the selection of sample countries may have an important effect on the results. Therefore, in the next Section we include the post-Soviet collapse countries to extend the sample number.

### 3. The Natural Resource Curse after the Collapse of Soviet Union

Many post-Soviet collapse countries have abundant natural resources and have received more attention in recent years. During 1991–1995 the post-Soviet countries became independent, built their own state, received international recognition, joined of international organizations, established a contractual relationship with each other, and established financial, economic, fiscal, tax, customs and border authorities.

Table 4 below reports the initial date of stabilization of post-Soviet and nearby European states, and their leaders, who conducted these efforts.

Some economists examined the natural resource curse among these countries. Kronenberg (2004) show that the natural resource curse still exist in transitional countries, which are have also high corruption levels and alow degree of education. Franke, Gawrich and Alakbarov (2009) examine two post-Soviet countries with strong political regimes, Kazakhstan and Azerbaijan, which have an abundance of oil and gas resources, howeverhave poor economic performances. They conclude that the natural resource curse in these states was induced by autocratic presidential regimes. Pomfret (2012) focuses on the resource management of seven resource-rich Asian transition economies: Uzbekistan, Turkmenistan, Tajikistan, Azerbaijan, Kazakhstan, Kyrgyzstan and Mongolia. Pomfret points out that resource-rich transition economies have to eliminate barriers to benefit from resource abundance through promptly exploiting resource endowments with better state management. Egert (2012) examines the effect of Dutch disease in the post-Soviet countries and show that a clear sign of Dutch disease is obvious in resource rich post-Soviet economies: high exchange rate and large revenues from the natural resources.

In this Section we include post-Soviet collapse countries in the sample and re-examine the natural resource curse in the period 1990–2009 based on the following model:

**Table 4.** The politics of stabilization of post-Soviet and nearby European states

Country	Most serious stabilization effort	Executive who conducted it
Albania	8/92	Meksi
Armenia	12/94	Ter-Petrosian
Azerbaijan	1/95	Aliiev
Belarus	11/94	Lukashenko
Bulgaria	2/91	Popov
Croatia	11/93	Tudjman
Czech Republic	1/91	Klaus
Estonia	6/92	Vahi
FYR Makedonia	1/94	Crvenkovski
Georgia	9/94	Shevardnadze
Hungary	3/90	Nemeth
Kazakhstan	1/94	Nazarbaev
Kyrgyz Republic	5/93	Akaev
Latvia	6/92	Godmanis
Lithuania	6/92	Abisala
Moldova	9/93	Snegur
Poland	1/90	Mazowiecki
Romania	9/93	Vacariou
Russia	1/95	Yeltsin
Slovak Republic	1/91	Klaus
Slovenia	2/92	Peterle
Tajikistan	2/95	Rkhmonov
Ukraine	11/94	Kuchma
Uzbekistan	11/94	Karimov

Source: European Bank for Reconstruction and Development (1999).

$$GEA9509 = a_0 + a_1 * LGDPEA95 + a_2 * SXP95 + a_3 * SOPEN + a_4 * LINV9508 + a_5 * RL09 + a_6 * DTT9509 + e \quad (4)$$

The coefficients of LGDPEA 95 and SXP 95 were calculated for 1995. RL was taken for 2009. Other variables were calculated for the period 1995–2009. The definition of SOPEN and DTT is the same as in Table 3. The results of the test are shown in Table 5 below.

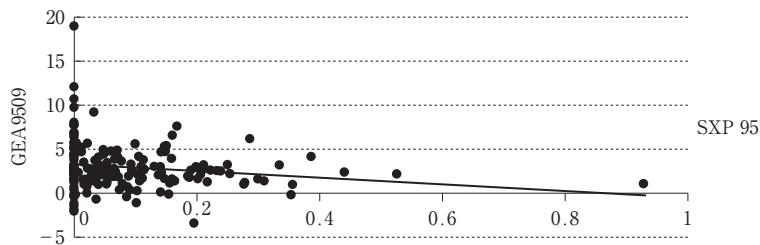
In Regression 6 the correlation between SXP 95 and GEA 9509 is negative and significant ( $-3.73$ ). Hence, with post-Soviet countries included in the sample; the evidence of the natural resource curse is strong. Figure 5 below illustrates the relationship between SXP 95 and GEA 9509. The impact of LINV on GEA 9509 (5.92) is still robust and the coefficient of LINV (5.92) is higher than those in previous tests. However, RL 09 shows negative and significant correlation with GEA 9509, which indicates that poor institutional quality has negative effects on economic growth.

Regression 7 examines the 95 countries in the sample of Sachs and Warner countries

**Table 5.** An examination of the Sachs and Warner model after the collapse of Soviet Union

	Reg. 6 1995-2009	Reg. 7 1995-2009	Reg. 8 1995-2009
Dependent variable	GEA 9509		
Independent variables:			
LGDPEA 95 (Initial income level)	-0.06 (-1.06)	-0.03 (-0.63)	-0.03 (-0.51)
SXP 95 (Natural Resources)	-3.73** (-2.69)	-1.22 (-1.01)	-2.52 (-1.86)
SOPEN (Openness)	0.37 (0.97)	-0.45 (-1.44)	0.08 (0.22)
LINV (Investment)	5.92** (8.67)	4.04** (6.00)	5.71** (8.38)
RL 09 (Rule of law index)	-0.59** (-3.29)	-0.07 (-0.39)	-0.46* (-2.46)
DTT (Growth in terms of Trade)	0.10* (2.14)	0.07 (1.18)	0.04 (0.67)
Adjusted R <sup>2</sup>	0.42	0.33	0.43
Standard error	2.08	1.42	1.89
Total number of countries	157	95	119
Number of adjusted countries	157	85	119

Notes: T-stat in brackets; \*significant at the 10% level, \*\*significant at the 5%

**Figure 5.** The natural resources and economic growth over the period 1995-2009

(1997). The coefficient of SXP 95 is negative, but insignificant (-1.22).

Regression 8 examines the 119 countries that are included in the sample of countries of Regression 5. The results show that the natural resource curse exists, but it is weaker.

In summary, when post-Soviet countries are included in the sample, the natural resource curse still exists and it is robust in the period 1995-2009. This result is consistent with many existing studies of post-Soviet collapse countries.

#### 4. The Natural Resource Curse and Institutional Quality

The effect of the quality of institutions on economic growth has been discussed by many papers. For example, Mehlum, Moene and Torvik (2006b) investigate the relationship between the natural resource curse and institutional quality, based on the model of Sachs

and Warner (1997). Ploeg (2011) examines a variety of hypothesis related to the resource curse. Mehlum, Moene and Torvik (2006b) and Ploeg (2011) conclude that institutional quality is crucial for countries to avoid the natural resource curse. Sachs and Warner (1997), Mehlum, Moene and Torvik (2006a), Bulte, Deacon and Damania (2004) also attained similar results; they pointed out that countries with good institutional quality have effective management of economic growth, trade openness, good environment and investment. In contrast, countries with low institutional quality tend to suffer from rent-seeking, corruption, weak legislative framework, shady dealings, crime, civil wars, among other instances.

Sachs and Warner (1997) use the rule of law index from the International Country Risk Guide, published by the Political Risk Service of the Center for Institutional Reform and the Informal Sector. The score ranges from 0 (lowest) to 6 (highest). Bulte, Deacon and Damania (2004) use three variables to determine institutional quality—the rule of law index, the voice and accountability index and the index of government effectiveness, which were taken from the data of Kaufmann, Aart and Mastruzzi (2003).

In this Section, except for the index of rule of law, we also include two variables as a proxy variable of institutional quality—the voice and accountability index and the index of government effectiveness. In contrast to the Sachs and Warner test (1997), we take these indices from “The Worldwide Governance Indicators” of the World Bank database, which range from approximately -2.5 (weak) to 2.5 (strong) in value.

Regression 9 and Regression 10 do not include the post-Soviet collapse countries. These Regressions examine the sample of the same 119 countries as in Regression 5 and Regression 8, respectively. Regression 11 includes the post-Soviet collapse countries and, hence, tests the 157 countries, which are in the sample of Regression 6.

Thus, Regression 9 examines the period 1990–2009 by the following model:

$$GEA9009 = a_0 + a_1 * LGDPEA90 + a_2 * SXP90 + a_3 * SOPEN + a_4 * LINV9008 + a_5 * RL00 + a_6 * GE00 + a_7 * VA00 + a_8 * DTT9009 + e \quad (5)$$

Regression 10 and Regression 11 focus on period 1995–2009 based on the model presented below:

$$GEA9509 = a_0 + a_1 * LGDPEA95 + a_2 * SXP95 + a_3 * SOPEN + a_4 * LINV9508 + a_5 * RL09 + a_6 * GE09 + a_7 * VA09 + a_8 * DTT9509 + e \quad (6)$$

Table 6 presents the results of these regressions.

In Regression 9 the coefficient of SXP 90 is negative, but statistically insignificant. This result is similar to SXP 90 in Regression 5. The coefficients of RL 09, GE 09 and VA 09 are also negative, but insignificant.

In Regression 10 the coefficient of SXP 95 is negative and significant. The coefficient of RL 09 is positive, but insignificant. The coefficients of GE 09 and VA 09 are negative, but insignificant. These results are different from the results of Regression 8, where the SXP is insignificant, but the RL is statistically significant.

**Table 6.** An examination of the Sachs and Warner Model with new factors of institutional quality

	Reg. 9 1990-2009 ( <i>same as Reg. 5</i> )	Reg. 10 1995-2009 ( <i>same as Reg. 8</i> )	Reg. 11 1995-2009 ( <i>same as Reg. 6</i> )
Dependent variable	GEA 9009		GEA 9509
Independent variables:			
LGDP EA (Initial income level)	-0.02 (0.35)	-0.02 (-0.47)	-0.05 (-0.89)
SXP (Natural Resources)	-0.53 (-0.41)	-2.73* (-2.02)	-3.93** (-2.85)
SOPEN (Openness)	-0.03 (-0.09)	0.08 (0.19)	0.31 (0.81)
LINV (Investment)	5.26** (8.45)	5.66** (8.29)	5.84** (8.58)
RL 09 (Rule of law index)	-0.16 (-0.34)	0.41 (0.72)	0.36 (0.78)
GE 09 (Government effectiveness)	-0.04 (-0.09)	-0.69 (-1.19)	-0.76 (-1.59)
VA 09 (Voice and Accountability)	-0.17 (-0.58)	-0.30 (-1.02)	-0.33 (-1.17)
DTT (Growth in terms of Trade)	0.06 (1.19)	0.04 (0.69)	0.12* (2.42)
Adjusted R <sup>2</sup>	0.44	0.44	0.43
Standard error	1.66	1.88	2.06
Total number of countries	119	119	157
Number of adjusted countries	119	119	157

Notes: T-stat in brackets; \*significant at the 10% level, \*\*significant at the 5%

Finally, in Regression 11 the coefficient of SXP 95 is negative and strongly significant. All three coefficients of institutional quality, RL 09, GE 09 and VA 09, demonstrate insignificant impact on GEA 9509. However, in Regression 6 the coefficient of RL 09 is strongly significant.

In general, adding the indices of GE 09 and VA 09 into the model have little effect on the results. The evidence for the existence of the natural resource curse after the 1990s still remains strong. The quality of institutions is generally important for the abundance of natural resources to be a curse or a blessing. However, how to explicitly illustrate the relationship between the natural resource curse and institutional quality remains a question and will be the topic for future research.

## 5. Conclusion

This paper examines the relationship between economic growth and the natural resource abundance with World Bank data over the period 1970-2009. The results suggest that the natural resource curse still exists after the 1990s; however, it is weaker compared with the findings of Sachs and Warner (1997) over the period 1970-1990. Our results are robust even when we include post-Soviet countries in the sample and introduce new institutional

quality indicators into the model.

#### Notes

- 1) Lederman and Maloney (2002) examine the Sachs and Warner model (1997) in period of 1820–1989, Mehlum, Moene and Torvik (2006b) test the Sachs and Warner model (1997) with the derived threshold level of institutional quality. Davis (2011) statistically attempted to replicate the Sachs and Warner model (1997) to confirm the robustness of the natural resource curse.
- 2) This measure implies the indicator of density of the primary explored resources of the country, since they are controversial to determine resource wealth among countries based on the availability of knowledge of the presence of natural resource endowments.
- 3) <http://www.cid.harvard.edu/ciddata/ciddata.html>
- 4) Bulte, Deacon and Damania (2004) defines the government effectiveness index as a measure of the quality of the civil service and bureaucratic efficiency, and voice and accountability index as index, which is constructed from various indicators that capture the extent to which citizens participate in the selection of government and the freedom of the press.
- 5) See Appendix A.
- 6) See Appendix A.

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## APPENDIX A. Dataset and list of countries for the years of 1970, 1990 and 1995

COUNTRY	Sachs and Warner		World Bank Data					
	1970		1970		1990		1995	
	LGDP	SXP	LGDP	SXP	LGDP	SXP	LGDP	SXP
Albania							10.94	0.00
Algeria	8.25	0.19	8.05	0.19	8.41	0.21	8.37	0.25
Angola					4.49	0.48	4.10	0.00
Argentina	9.09	0.05	8.32	0.05	8.09	0.06	8.36	0.05
Armenia							11.70	0.00
Australia	9.75	0.10	9.77	0.10	10.15	0.10	10.21	0.10
Austria	9.41	0.04	9.01	0.04				
Azerbaijan							5.59	0.00
Bahamas					9.44	0.00	9.36	0.05
Bangladesh	7.83	0.01	8.76	0.01	8.79	0.01	8.93	0.01
Barbados			7.36	0.17	7.86	0.07	7.83	0.05
Belarus							12.98	0.00
Belgium	9.49	0.11	9.07	0.11			9.68	0.00
Belize					7.85	0.32	8.01	0.24
Benin			10.89	0.08	10.85	0.00	10.91	0.20
Bhutan					9.34	0.00	9.59	0.00
Bolivia	8.04	0.18	7.19	0.18	7.16	0.19	7.24	0.14
Bosn. & Herz.							6.14	0.00
Botswana			6.43	0.05	8.24	0.00	8.36	0.00
Brazil	8.41	0.05	7.59	0.05	8.22	0.03	8.33	0.03



Brunei Darussalam					9.92	0.63	9.97	0.00
Bulgaria							7.78	0.00
Burkina Faso			10.89	0.04	11.00	0.00	11.07	0.11
Burundi			9.19	0.10	9.39	0.00	9.15	0.10
Cambodia							12.99	0.00
Cameroon	7.29	0.18	12.07	0.18	12.4	0.17	12.18	0.19
Canada	9.70	0.10	9.51	0.10	10.01	0.08	10.03	0.11
Cape Verde					9.52	0.00	9.66	0.00
Cent. Africa			11.85	0.09	11.56	0.00	11.49	0.09
Chad			11.20	0.08	10.92	0.00	10.86	0.00
Chile	8.77	0.15	13.53	0.15	14.01	0.25	14.34	0.20
China			6.35	0.02	7.67	0.05	8.19	0.03
Colombia	8.33	0.09	14.58	0.09	15.18	0.13	15.31	0.07
Comoros					11.28	0.00	11.24	0.04
Congo, Dem.			-16.61	0.15	-17.12	0.00	-17.70	0.00
Congo, Rep.			10.9	0.08	11.41	0.00	11.32	0.93
Costa Rica	8.65	0.19	11.58	0.19	12.01	0.13	12.18	0.21
Cote d'Ivoire			12.58	0.29	12.32	0.00	12.26	0.35
Croatia							10.00	0.05
Cyprus							9.02	0.07
Czech Republic							11.80	0.06
Denmark	9.62	0.10	11.47	0.10	11.90	0.10	12.00	0.09
Djibouti							10.99	0.00
Dominican	8.04	0.13	8.59	0.13	9.19	0.00	9.36	0.05
Ecuador	8.16	0.11	6.17	0.11	6.61	0.29	6.67	0.21
Egypt	7.67	0.07	6.40	0.07	7.16	0.05	7.27	0.03
El Salvador	8.18	0.16	6.28	0.16	6.18	0.08	6.44	0.11
Equatorial Guinea					12.34	0.00	12.44	0.00
Eritrea							6.19	0.00
Estonia							10.39	0.15
Ethiopia							6.17	0.05
Fiji					7.97	0.24	8.06	0.00
Finland	9.41	0.07	9.02	0.07			9.57	0.05
France	9.60	0.03	9.06	0.03				
Gabon			13.39	0.33	13.62	0.00	13.61	0.00
Gambia			6.88	0.36	6.85	0.00	6.80	0.03
Germany	9.60	0.02	9.06	0.02	9.65	0.02	9.71	0.02
Ghana	7.62	0.21	6.04	0.21	5.78	0.00	5.87	0.00
Greece	8.80	0.04	8.60	0.04			9.05	0.04
Grenada					8.76	0.10	8.78	0.07
Guatemala	8.28	0.11	8.49	0.11	8.62	0.12	8.71	0.11
Guinea					12.53	0.00	12.45	0.15
Guinea-Bissau					11.84	0.00	11.89	0.10
Guyana			11.82	0.51	11.84	0.00	12.18	0.00
Honduras	7.81	0.23	8.79	0.23	9.00	0.30	9.06	0.44
Hong Kong	8.94	0.03	10.12	0.03	11.49	0.05	11.68	0.05
Hungary							13.83	0.09
Iceland					14.31	0.24	14.27	0.23
India	7.27	0.02	8.79	0.02	9.23	0.02	9.41	0.02
Indonesia	7.18	0.11	13.86	0.11	14.91	0.15	15.25	0.11
Iran	9.16	0.12	14.69	0.12	14.54	0.00	14.68	0.00
Ireland	9.07	0.15	8.59	0.15	9.30	0.14	9.54	0.16

Israel	9.21	0.04	10.14	0.04			10.75	0.02
Italy	9.37	0.02	8.93	0.02	9.56	0.02	9.61	0.02
Jamaica	8.63	0.14	11.4	0.14	11.53	0.09	11.71	0.07
Japan	9.27	0.01	14.01	0.01	14.67	0.00	14.73	0.00
Jordan	7.93	0.09			6.25	0.14	6.42	0.14
Kazakhstan							11.43	0.16
Kenya	7.11	0.18	9.28	0.18	9.73	0.09	9.70	0.16
Korea, Rep.	8.03	0.02	14.16	0.02	15.65	0.02	16.00	0.02
Kyrgyz Rep.							7.60	0.15
Lao PDR					11.26	0.00	11.43	0.00
Latvia							6.85	0.10
Lebanon					14.79	0.00	15.25	0.00
Lesotho					6.64	0.00	6.76	0.00
Lithuania							8.81	0.15
Macao, China					11.54	0.01	11.72	0.01
Macedonia							10.96	0.11
Madagascar			10.18	0.12	9.81	0.09	9.64	0.14
Malawi	6.76	0.21	6.26	0.21	6.35	0.22	6.46	0.28
Malaysia			7.72	0.37	8.67	0.32	9.02	0.21
Maldives							9.48	0.17
Mali			10.54	0.08	10.52	0.15	10.54	0.00
Malta							8.75	0.00
Mauritania			11.04	0.41	10.81	0.00	10.85	0.36
Mauritius					11.05	0.15	11.25	0.11
Mexico	8.99	0.02			10.48	0.09	10.51	0.06
Moldova							7.27	0.33
Mongolia							13.09	0.00
Morocco	7.93	0.11	8.30	0.11	8.86	0.08	8.85	0.11
Mozambique					7.53	0.00	7.59	0.07
Nepal					8.91	0.01	9.04	0.01
Netherlands	9.60	0.15	9.21	0.15	9.70	0.16	9.77	0.16
New Zealand	9.66	0.18			9.85	0.17	9.93	0.16
Nicaragua	8.47	0.19	8.40	0.19	7.78	0.31	7.79	0.13
Niger			11.21	0.05	10.73	0.00	10.60	0.15
Nigeria	7.32	0.14						
Norway	9.46	0.10	11.48	0.10	12.13	0.20	12.28	0.19
Oman			6.42	0.89	6.91	0.46	7.12	0.39
Pakistan	7.62	0.03	9.00	0.03	9.41	0.03	9.51	0.02
Panama					7.45	0.05	7.64	0.07
P. New Guinea					6.54	0.34	6.85	0.00
Paraguay	7.93	0.10	13.55	0.10	14.21	0.16	14.29	0.09
Peru	8.56	0.15	7.82	0.15	7.69	0.10	7.89	0.09
Philippines	7.90	0.13	9.83	0.13	10.1	0.06	10.12	0.05
Poland							9.32	0.05
Portugal	8.58	0.05	8.14	0.05	8.90	0.04	8.99	0.03
Puerto Rico							7.25	0.00
Romania							8.84	0.05
Russia							10.32	0.00
Rwanda			10.44	0.11	10.5	0.00	10.31	0.00
Saudi Arabia			9.49	0.60	9.70	0.33	9.74	0.31
Senegal	7.67	0.14	12.24	0.14	12.03	0.11	12.01	0.00
Sierra Leone			9.66	0.09				

Singapore	8.56	0.03	8.44	0.03	9.89	0.38	10.14	0.19
Slovak Republic							8.31	0.06
Slovenia							8.82	0.04
Solomon Islands					8.21	0.00	8.50	0.00
Somalia			8.98	0.09				
South Africa			9.72	0.17	9.79	0.00	9.77	0.05
Spain	9.15	0.03	8.65	0.03	9.22	0.03	9.30	0.03
Sri Lanka	7.73	0.15	9.83	0.15	10.45	0.10	10.70	0.00
St. Lucia					8.85	0.25	8.96	0.14
St. Vincent and the Grenadines					8.48	0.00	8.59	0.14
Sudan	7.34	0.16	5.10	0.16	5.11	0.00	5.25	0.04
Suriname					1.78	0.31	1.71	0.22
Swaziland					8.41	0.00	8.46	0.00
Sweden	9.71	0.05	11.58	0.05	11.91	0.04	11.90	0.04
Switzerland	9.89	0.02			10.59	0.02	10.54	0.02
Syria	8.5	0.08	9.50	0.08	10.03	0.23	10.33	0.25
Tajikistan							5.09	0.00
Tanzania					11.79	0.00	11.73	0.00
Taiwan	8.25	0.02						
Thailand	8.01	0.09	8.81	0.09	10.01	0.10	10.41	0.09
Togo	7.06	0.19	10.41	0.19	10.35	0.15	10.27	0.28
Tonga					7.32	0.07	7.48	0.08
Trin. & Tobago	9.45	0.08	9.65	0.08	9.83	0.31	9.91	0.29
Tunisia	7.97	0.10	5.90	0.10	6.63	0.09	6.77	0.07
Turkey	8.30	0.04	5.74	0.04	6.33	0.03	6.44	0.03
Turkmenistan							7.01	0.00
Uganda	7.16	0.27			11.91	0.00	12.08	0.08
Ukraine							8.01	0.00
U. A. Emirates					11.94	0.00	11.92	0.00
United Kingdom	9.52	0.03	8.72	0.03	9.19	0.03	9.25	0.04
United States	9.95	0.01	9.33	0.01	9.95	0.02	10.01	0.02
Uruguay	8.78	0.09	10.83	0.09	11.01	0.11	11.17	0.07
Uzbekistan							10.01	0.00
Vanuatu					11.61	0.10	11.65	0.00
Venezuela	9.62	0.24	7.04	0.24	6.89	0.34	6.98	0.22
Vietnam					13.94	0.00	14.28	0.00
Yemen					8.46	0.00	8.53	0.53
Zambia	7.68	0.54	12.33	0.54	11.94	0.00	11.75	0.30
Zimbabwe	7.72	0.17	5.98	0.17	6.07	0.14	6.05	0.20
TOTAL:	SW 1970		WB 1970		WB 1990		WB 1995	
	71 countries		89 countries		119 countries		157 countries	

Note: (a) The number of adjusted countries with LGDPEA and SXP values is 157, 119, 89 and 71 for the years of 1995, 1990, 1970 and Sachs and Warner year 1970, respectively. (b) The sample of countries for the 1970 uses same 95 Sachs and Warner countries, so after adjusting there are 89 countries, based on World Bank data and 71 countries, based on Sachs and Warner data sources. (c) The variables are: LGDPEA — the log of GDP per head of the economically active population in 1995 and SXP — the share of primary exports in GNP in 1995.