THE RESOURCE CURSE IN PERU

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ABSTRACT

We often hear that many developing countries suffer from the "resource curse". This paper examines the case of Peru during the period 1960-2007. At first sight, Peru does not seem affected by the curse yet despite its vast mineral endowment. Since the nineties, Peru has lived from its mineral boom, and its economy is primarily based on the raw material exports. However, Peru shows many signs of the "Dutch disease": high mineral prices, abundance of liquidity, and currency appreciation.
This research introduces the index of revealed comparative advantages to the main economic sectors which confirm the diagnosis of Dutch disease. Next, we develop an econometric model showing a huge dependence of the Peruvian growth on natural resources. Finally, we conclude that a change of policies is absolutely necessary to avoid the resource curse. We need to rethink totally the management of the mineral rents.

Keywords: resource curse, Dutch disease, mineral capital, mineral policies, Peru.

INTRODUCTION

During the last decade, Peru was benefited by the recuperation of the mining investment in Latin America, a region benefited by a wave of investments due to the favourable conditions offered to the transnationals by the governments. Mining received US$2882 million of direct investment between 1990 and 2006; that is to say 18.66% of the total foreign investment in Peru. The entry of new capital has meant the modernization of the large mining industry. On the one hand, ores already exploited have been expanded and their equipment has been replaced by other with greater capacity and with cleaner technology. On the other hand, the tendency of the international quotations to rise has permitted well-established ores to start operating

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again and contribute to the raise of the mining production. Projects like Yanacocha have contributed to converting gold into the principal export product. However, the high prices of the minerals, the abundance of liquidity and the appreciation of the currency have led us to analyse a context of the Dutch disease in Peru.

It is important to emphasize that the Dutch disease and the natural resource curse are two different subjects, which are frequently wrongly used as synonyms by stating that the curse is a serious Dutch disease. The article describes this difference, focusing on the natural resource curse in Peru. The relationship between an abundance of natural resources and growth is now valid after the experience of the OPEC countries, which are now undergoing negative growth rates despite their oil endowment. Sachs and Warner (1995) were the first to present empirical evidence of this paradox.

This paper tries to determine the effect of the natural resource abundance on the growth in Peru. We will demonstrate that the natural resource curse does not exist in Peru, but the dependence on natural resources does exist, and such dependence on the extraction activities (mining and hydrocarbons) affects the growth negatively. The majority of studies on the relationship between growth and natural resource abundance were executed using cross-sectional data for a group of countries. This work represents a first approach of a model of temporal series for a specific case as is the Peruvian experience. We start by a causal analysis among the abundance of natural resources, the dependence on natural resources and the growth. It is necessary to mention that these results are framed as a theoretical exercise, which, however, will help to understand the role of the natural resources in the Peruvian economy.

This article presents a revision of the literature on the natural resource curse and the Dutch disease, indicating the differences. A diagnosis of the Dutch disease for Peru is made according to the revealed comparative advantages indicator. Then for an analysis of the natural resource curse, we start from the causal relationships among the natural resource abundance, dependence and growth to determine a growth model that incorporates the role of the natural resources for the period of 1960-2007. Finally, the results and the conclusions are presented.

BACKGROUND

The effects of the Dutch disease

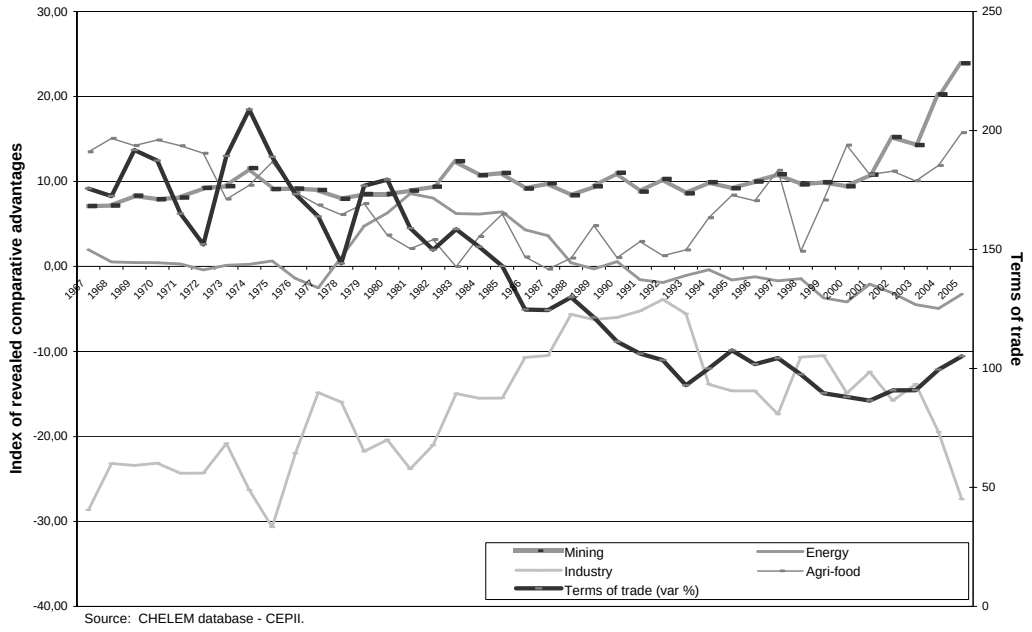
The Dutch disease is simply a description of the causes and effects on the sector of a boom in the exploitation of the natural resources. It is a context or “sickness” that affects the exporting country during a period of rising prices of its principal exportable product, or when the latter is discovered, or when a new ore is exploited. The entry of foreign currency leads to an appreciation of the exchange terms and a loss of the competitiveness of the other trade sectors of the economy, especially the manufacture and industry sector. As a result, the resources migrate to the benefited sector or boom sector, cutting back funds from sectors of greater aggregate value and of dynamic chaining effects.

In the core model, the mining sector is growing while the manufacture and agriculture is reducing. In the medium term, the Dutch disease causes the deindustrialisation of the economy. Corden (1984) affirms that if there is an essential problem of the Dutch disease, this will be the redistribution of resources and the burden or weight of this

adjustment, especially for the sector losing resources, generally the manufacture sector. The political pressure of the losing sector drives the governments to intervene (Roemer, 1985). According to Davis (1995), if the mining boom is indefinite or for a sufficiently long period, the Dutch disease simply describes the transformation of the economy from one equilibrium in the long run to another.

Examining the Peruvian economy for a vast period, 1967 to 2005, we come to the diagnosis of a Dutch disease. In our analysis we use the indicator of the revealed comparative advantages, which measures the specialization of a sector in terms of its commercial flow (see Appendix A). It is necessary to observe that the economical activities are not independent from the policies and the institutions that govern them. Besides, not only the scale of economical activities is determining for the political decisions in the sectors but also the comparative advantages of the sectors which are not intensive in the natural resources (Clarinda and Findlay, 1992).

Figure N°1. The Dutch disease in Peru 1967-2005



Source: CHELEM database - CEPII.

As principal evidence of the analysis, Peru maintains a mining specialization and a deteriorating tendency of the manufacturing production in the four last decades. The intention to reflourish the manufacture has always resulted in negative levels representing a comparative disadvantage compared with the other economical sectors. In an opening process, the little attraction of resources for the industry allows Peru neither to industrialize itself nor face a world competition.

The nineties are characterized by mining privatizations, the attraction of investment for mining and the start of an economy in crisis. This mining panorama is favorable for the present Peruvian mining boom, rewarded with the continuous rise in the quotizations of the metals. We can affirm that while the mining is growing, the industry and

manufacture is disappearing. Another notable consequence is the appreciation of the exchange terms which has intensified starting from the decade of the 80s.

The recovery of the agri-food sector starting from the nineties can be explained by the look of the agri-exporter towards infinity, explained by the programs “to export or to die”. Nevertheless, the non-traditional agri-export continues being little representative. For the period of 1990-2007, this means an average of 5.5% of the total exports.

There is evidence that several mining economies have experienced some form of the Dutch disease (Auty, 1993; Gelb, 1988). However, the Dutch disease is not an indicator of well-being, but a structural adjustment. Mikesell (1997) concludes that the Dutch disease provides only a partial explanation of the growth in mining countries and recommends examining other factors inherent to the mineral abundance.

The natural resource curse

The thesis of the natural resource curse is interpreted as a mining boom that generates net economical losses; that is to say, negative effects on the growth.

There exist 5 mechanisms that could explain such effects (David, 1995): firstly, the mechanism that supports that the implicit deindustrialisation of the Dutch disease inhibits growth. Assuming that the appropriate response should have been subsidizing the manufacture sector, and having as an effect a greater deindustrialisation because of the loss of competitiveness and the materialization of more mining economies. The second mechanism sustains that the Dutch disease weakens the economy. At a microeconomic level, the manufacture sector (executives and workers) can associate its loss of competitiveness with the mining boom that benefits from the economy as a whole. Concerning this, Krugman (1987) observes that the entrepreneurs are more alarming in their forecasts than the economists. As a third mechanism, Auty (1993) mentions that the mining economies with the depressed trade sectors will suffer to a greater degree the external shocks. Auty warns that the mining economies, optimistic as they are because of their mining rents, follow a tardy diversification impeding growth in the long run. As a fourth mechanism, Gelb (1985,1988) signals that a boom motivates the governments to be too optimistic about the future mining rents, acquiring debts based on boom forecasts which if they do not occur generate recession. Finally, as a fifth mechanism, the governments are used to retaining a big percentage of the mining rents, they get accustomed to the extraordinary rents in the boom periods, converting themselves in rent-seeking structures instead of providing social services, as well as reducing the transparency and deteriorating the governing. (Auty, 2001)

Besides the discussion of these mechanisms that inhibit growth, we find the evidence of various studies that relate natural resources and growth, emphasizing the natural resource curse. These studies have signalled the fact that in general the natural resource abundance has had an adverse effect on the growth.

In this discussion about the impact of the natural resources on the growth, it is important to distinguish among the natural resource abundance (stock in situ of the resources), the rent of the resources (boom or profit derived from the exploitation of the resources), and the dependence on natural resources (the level that a country has access to alternative incomes or not, other than those from the extraction of natural resources).These concepts are related to one another in countries in which big stocks

of resources generate extraordinary rents, and because of the arguments of “Dutch disease” end up specializing themselves in primary exports and depending on their natural resources.

It is since the work of Sachs and Warner (1995) that the resource curse has made its biggest contribution. The authors define the “resource curse” as the behaviour of economies with abundant natural resources which have tended to grow less rapidly compared to economies with scarce natural resources. They find a negative relationship between the natural resources abundance and the growth, based on cross sectional data of 69 countries.

However, the validity of this hypothesis is disputed by Brunnschweiler (2008), Wright and Czelusta (2003) and Davis (1995). Brunnschweiler sustains the deficiency of the resource abundance indicator of Sachs and Warner (percentage of primary exports of the PIB at the beginning of the observation period) for two reasons. First, a positive correlation is assumed between the percentage of primary exports and the abundance of natural resources. The percentage of primary exports of the PIB is a strong indicator of the specialization of an economy, and the low growth of countries with large percentages of primary exports could be for a big part related to the economical policies of dependence on natural resources, instead of on the natural resource curse. Second, the primary exports are highly changeable variables, so it is recommendable to use the average of the analysed period instead of the means at the beginning of the period (Lederman and Maloney, 2003).

Neumayer (2004) introduced a variation of the subject natural resource curse. He continues using Sachs and Warner’s indicator of exports and takes as an indicator of growth the real income (GDP minus the depreciation of the natural capital) that he considers a dependent variable and finds a negative relationship.

Empirical variations cast doubt on the hypothesis of the resource curse. These studies use different indicators for the abundance of natural resources. Lederman and Maloney suggest that the effect of the natural resources on the growth is subject to the time interval which is analysed. The authors find a positive relationship between growth and the percentage of primary exports over the total of exports. David (1995) uses the percentage of mining exports over the total of exports as an approximate of the natural resources and finds a positive relationship with the growth. Atkinson and Hamilton (2003) use a ratio of the rent of the resource over the GDP and obtain positive and negative results. Stijns (2006) suggests using data about the rent of the resource per capita. In like manner, he suggests that the natural resources affect the growth through positive and negative channels.

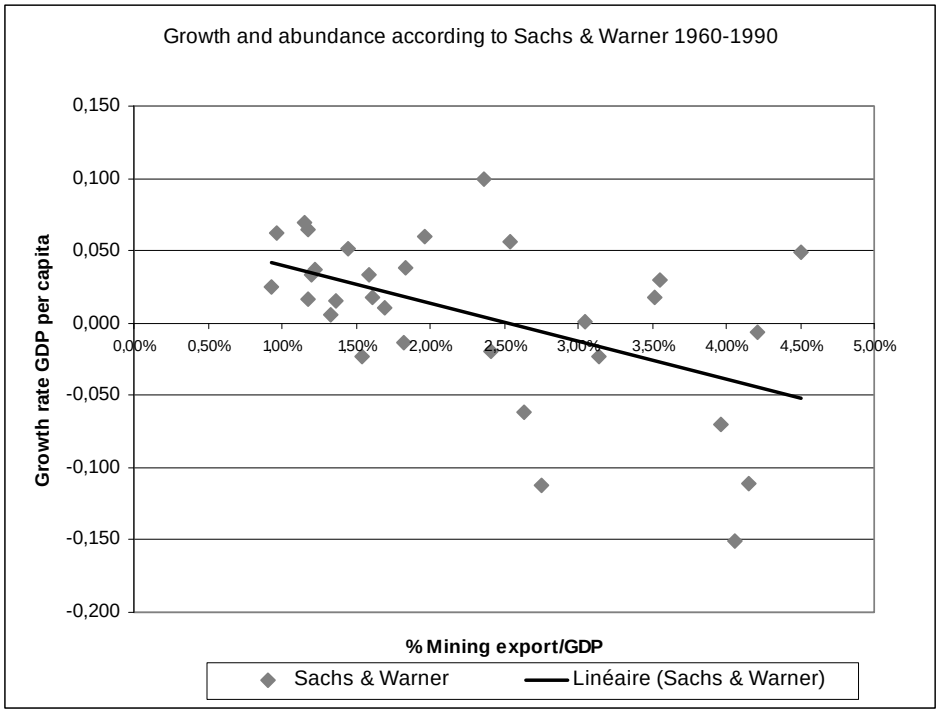
Brunnschweiler and Bulte (2006) have strongly criticized the paradox of the natural resource curse sustained by Sachs and Warner, considering that it concerns a false trail to deviate the attention of the real problems concerning development. The authors sustain that the used indicators to measure the abundance of natural resources are better interpreted as indicators of dependence on natural resources. Based on multiple estimates, they draw two important conclusions: firstly, that the abundance of resources and the institutions determine the dependence on resources and that such dependence does not affect the growth. Secondly, the abundance of natural resources affects the growth and the institutional quality positively. In addition, Gelb and Grasmann (2008) affirm that countries with high human capital and strong institutions will be capable of benefiting from their natural resources.

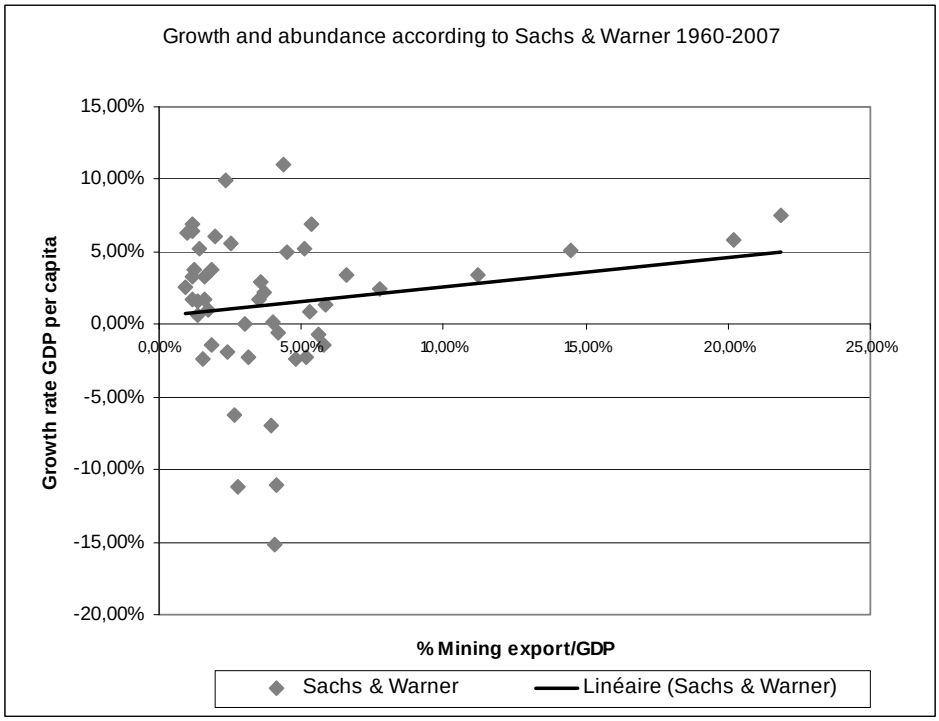
METHODOLOGY

Modelling of the "resource curse" in Peru

The goal of this article is to determine the possible effect of the abundance of natural resources on the growth of Peru. As a first step, we will seek to determine the indicator of abundance of natural resources starting from the work of Sachs and Warner. In the Peruvian case, if we take a sample of 1960-1990, the period analysed by the authors, we find a negative relationship between the percentage of mining exports over the GNP and the growth – indicator of abundance according to the work of Sachs and Warner. However, if we enlarge the sample to 2007, the relationship tends to be positive (see Figure N°2). The argument of Lederman and Maloney is proven in the Peruvian case. This change in time demonstrates that the hypothesis of the natural resource curse is momentary depending on the period analysed by the authors. If we add the present arguments of Brunnschweiler and Bulte (2006), the percentage of exports over the GNP would not be the best indicator for the abundance of resources.

Figure N°2. Growth and indicator of abundance of natural resources according to Sachs and Warner





Following the work of Davis (1995), it was decided to use the percentage of mining exports over the total of exports as an approximate of the abundance of resources (ARN_t). Considering that the internal consumption of minerals is hardly existent, and that the Peruvian mining extraction is destined for export, it is necessary to emphasize that the indicator ANR is the best available approximate of an indicator of stock of natural resources.

For the construction of the indicator of dependence on natural resources, it was decided to start from the index proposed by Davis (1995). The indicator of abundance of natural resources for the creation of the richness of the natural resources will be weighed, using the product of the ratio of the mining exports over the total of exports and the ratio of the mining production and hydrocarbon over the GNP. With this we are seeking to measure the contribution of the abundance or availability of natural resources in the Peruvian economy. At present there is no consensus about the definition of the indicator of mining dependence. For example, the OECD considers the ratio of exports over the GNP.

After having defined the variables of abundance of natural resources ARN_t and the dependence on natural resources $Mindepen_t$, it was decided to conserve the 2 indicators taking into account that both series have a slight correlation, and the test of causality of Granger demonstrates that there is no causality relationship between the two variables. Likewise, the Granger causality test demonstrates a causality relationship between the natural resources abundance and the growth, and the natural resources dependence and the growth.

Under these parameters the growth model with natural resources abundance in the case of Peru is defined according to the following equation

$$Log(GDP_t) = \alpha_{0t} + \alpha_{1t} ARN_t + \alpha_{2t} Mindepen_t + Z_t' \alpha_{3t} + \xi_t$$

In which $Log(GDP_t)$ stands for the growth per average capita for the year t, the term ARN_t, the abundance of natural resources indicator, $Mindepen_t$, the index of natural resources dependence, Z'_t, a vector of other explanatory variables of growth and ξ_t the residual error. Within the vector Z'_t, are the variables: exchange terms, economical opening, investment and education. Finally, α_{it} stands for the estimated coefficients.

RESULTS AND DISCUSSION

The resource curse in Peru

Following the proposed modelling, the period of 1960-2007 is analysed. After the test of stationary, the estimation is executed by an adjustment of first rank differences. To correct the autocorrelation the Durban-Watson indicator is used, which is incorporated in each variable. Using the corrected variable, the results are presented in the following table

Table N°1 Results of the estimation of the resource curse in Peru 1963-2007.

Dependent Variable : LOGGDPC Method: Minimum Ordinary squares				
Sample (adjusted): 1963 2007 Observations: 45 after the adjustments				
Variable	Coefficient	Standard Error	t-statistic	Probability
C	-0.001638	0.004375	-0.374487	0.7101
ARNC	0.169957	0.073671	2.306972	0.0266
MINDEPENC	-6.580604	1.704103	-3.861623	0.0004
TERMSTRADEC	0.000110	0.000189	0.580017	0.5653
OPENNESSC	2.82E-06	1.91E-06	1.478950	0.1474
INVESTC	-0.040027	0.101635	-0.393834	0.6959
ILLITERACYC	-1.43E-07	1.64E-07	-0.872133	0.3886
R^2	0.457006	Average dependent variable		0.002209
R^2 adjusted	0.371270	S.D. dependent variable		0.020369
S.E. of regression	0.016151	Akaike info criterion		-5.271661
Sum. Square residual	0.009912	Schwarz criterion		-4.990625
Log likelihood	125.6124	F-statistic		5.330395
Durbin-Watson	1.648618	Prob(F-statistic)		0.000451

The model indicates a positive relationship between the abundance of mining resources in Peru and the growth, rejecting the hypothesis of a natural resource curse or "sentence". The results allow us to confirm that the abundance of mining resources represented by the percentage of mining exports over the total exports (ARN_t) has a positive influence on the Peruvian growth in the long run discarding the idea of an original sin due to the mining richness of the country.

However, in the long run we find a negative relationship between the dependence on natural resources ($Mindepen$) and the growth. Besides, we emphasize that, according to the parameters of the coefficients of ARN and $Mindepen$, a variation in the mining dependence would have a negative effect 38 times greater than the positive effect of the natural resource abundance. We infer that the dependence on the extracting activity would have a reverse effect on the growth. This indicates the necessity to diversify the production towards other economical sectors.

Gelb and Grasmann (2008) point out that the diversification of the economy requires a combination of three policies: a reasonable level of macro-economical stability, a policy of commercial opening, and an active use of the rents of the resources in the increase of the productivity of other exporting sectors via the reduction of production costs, construction of fundamental infraestructure, temporary subsidies, and other methods. They give the example of five countries that depend on natural resources – Malaysia, Thailand, Chile, Indonesia and Sri Lanka – and have achieved a successful diversification of natural resources.

We cannot demand the quantity of minerals that a country has to extract, but this makes the limitations clear: dependence on the extracting activity and its reverse impact on the growth in the long run. Likewise, we cannot control the rentability and the volatility of the minerals because these depend on the behavior of the market.

CONCLUSIONS

The results demonstrate that the abundance of natural resources would have a stimulating effect on the growth. That is to say, it is possible to benefit from the natural resources; the Peruvian case is evidence of a country which has grown taking advantage of the abundance of its mineral endowment. However, the dependence on extracting activities tends to influence the growth negatively and to a higher degree than the abundance of natural resources. Taking into account that Peru is experiencing a Dutch disease that promotes the mining extraction without creating a climate of development towards other activities or other sources of capital, this positive effect of the abundance could or better would not be lasting.

Furthermore, according to the law of Hartwick (1977), the rents of non-renewable natural resources will be sustainable if such rents correspond with the depreciation of the natural capital of the resource and are reinvested in other forms of capital. The studies of Cantuarias, Orihuela and Point (2008) show us that the mining rents do not cover the depreciation of the natural capital and that such rents are not reinvested at present. This indicates a situation that marks again the unsustainability of the mining activity in Peru.

Due to lack of data this study does not analyse the impact of institutional variables, variables which are considered promotional of a climate of development under natural resources abundance; likewise, it is recommended to include governing indicators. It is important to point out, as is mentioned by Brunnschweiler and Bulte (2008), that the impact of the institutions as growth promoters in countries with natural resource abundance has an endogenous nature.

In this discussion about the natural resource abundance and growth, a unique formula for success does not exist, but certain approximates show us some recipes. An opportunity is the creation of funds for development[2], anticipating rents with the idea of a transfer of funds of the extracting sector to other economical sectors. These funds can increase the transparency and strengthen the institutes which promote economical diversification. The present article does not seek to present proposals of economical policy. It focuses on the understanding of the causal relationship between natural resource abundance and growth for Peru.

[2] Davis, Ossowski y Fedelino, 2003.

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APPENDIX A: Calculation of the revealed comparative advantages

The indicator of revealed comparative advantages shows the degree of specialization of one sector in an economy according to the commercial flow (national export and import versus the world flow).The positive values indicate a specialization or comparative advantage and the negative values a comparative disadvantage.

The formulas are then described, designating V_{ijk} the commercial flow derived from the exporting country i, destined for the importing country j for the sector k. The indexes are defined as follows:

$X_{ik} = V_{i.k}$ stands for the exports of country i in sector k.

$X_{i.} = V_{i..}$ stands for the exports of country i for all the sectors.

$M_{jk} = V_{.jk}$ stands for the imports of country j in sector k.

$M_{j.} = V_{.j.}$ stands for the imports of country j for all the sectors.

$W. = V...$ stands for the world commerce for all the sectors.

These indexes are harmonized by the CEPII (Centre of studies and research on international economy) using the data base of international commerce CHELEM. The indicator of comparative advantages F_{ik} considers the size of the country, using the GNP (Y_i) in thousands of US$ at constant prices. For our calculation 1994 was taken as the base year being that year a census year.

$$F_{ik} = 1000 * \frac{W_k}{Y_i} * \left[\frac{X_{ik} - M_{ik}}{W_k} - \frac{X_{i.} - M_{i.}}{W_.} \right]$$

Among the advantages of this indicator we find: the pondering of the national commerce compared to the world commerce and the incorporation of the size of the country (Y_i), which permits us to measure the degree of specialization of the country for each sector.

APPENDIX B: Variables and sources of the resource curse in Peru

Variable	Definition	Source
LOGGDP	Logarithm of the GPI per capita US4 1994	INEI and BCR Peru
ANR	Abundance of natural resources: ratio of Mining exports over total exports	BCR, SUNAT and enterprises
MINDEPEN	Dependence on natural resources: product of the ratio of the mining exports over the total exports and the ratio of the mining and hydrocarbon production over the GDP.	INEI and BCR Peru
TERMSTRADE	Exchange terms: relationship between the prices of the exports and imports	BCRP, SUNAT, Zofratacna, Banco de la Nacion and enterprises
OPENNESS	Economical opening: Value FOB of the Exports and imports in millions of US$.	BCR, SUNAT and enterprises
INVEST	Investment as a percentage of the GDP.	BCR
ILLITERACY	Illiterate population in number of inhabitants.	INEI
C	Indicates that the variable has been adjusted by the statistics of Durbin-Watson for the correction of the autocorrelation.	

APPENDIX C: Descriptive statistics of the principal variables

Sample: 1960 2007	LOGGDP	TERMSTRADE	OPENNESS	INVEST	ILLITERACY	ARN	MINDEPEN
Average	3.333772	139.7644	8540.098	0.215223	3246195.	0.468982	0.020089
Median	3.336759	144.5346	5715.427	0.213902	3171800.	0.463026	0.019253
Maximum Value	3.449086	208.7887	47554.73	0.332388	4086784.	0.619854	0.038347
Minimum Value	3.208834	86.50975	785.3370	0.160959	2064819.	0.340392	0.011120
Standard Deviation	0.052844	34.86491	9585.854	0.038562	620832.1	0.058425	0.007181
Curtosis	2.787745	1.777279	8.816152	4.451985	1.819194	3.580245	3.455650
Sum	160.0211	6708.692	409924.7	10.33071	1.56E+08	22.51115	0.964289
Sum Standard Deviation	0.131248	57131.42	4.32E+09	0.069890	1.81E+13	0.160431	0.002424
Observations	48	48	48	48	48	48	48

APPENDIX D: Causality Test of Granger for the principal explanatory variables.

- The Causality Test for the variables: abundance of natural resources and growth.

Causality Test Granger
Sample: 1960 2007
Period of rezago: 3

Null Hypothesis:	Obs.	F-statistic	Probability
ARN no Granger Cause LOGGDP	45	3.61399	0.02169
LOGGDP no Granger Cause ARN		1.30878	0.28567

- Causality Test for the variables: dependence on natural resources and growth.

Causality Test Granger
Sample: 1960 2007
Period of rezago: 2

Null Hypothesis:	Obs.	F-statistic	Probability
MINDEPEN no Granger Cause LOGGDP	46	4.99025	0.01149
LOGGDP no Granger Cause MINDEPEN		1.58031	0.21820

- Causality Test for the variables: abundance of natural resources and dependence on natural resources.

Causality Test Granger
|Sample: 1960 2007
Period of rezago: 2

Null Hypothesis:	Obs.	F-statistic	Probability
MINDEPEN no Granger Cause ARN	46	1.76256	0.18436
ARN no Granger Cause MINDEPEN		1.52903	0.22885