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Theoretical and empirical applications of petroleum production function framework for analysis of the Phenomenon of Plenty

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The current study examines how analysis of the Phenomenon of Plenty, paradox of economic underperformance of resource-rich nations, could benefit from theoretical and empirical application of suggested petroleum production function framework, basing on sample oil-abundant countries of the Commonwealth of Independent States, in particular Russia, Azerbaijan, and Kazakhstan. Proposed approach displays capacity of oil-economy production function to shed light on larger scope of theoretical issues. Empirical testing of suggested theoretical framework exhibited ability of proxied components of devised production function, capturing main metrics of the Phenomenon of Plenty and additionally factoring in corruption, to exert a strong impact on the majority of twelve principal macroeconomic indicators monitored by CIS supra-national institutions: with most pronounced influence on gross domestic product, industrial production, capital investments, and export to CIS countries.

JEL Classifications: C18, L71, O50, Q32, Q38

Keywords: Oil economy, Phenomenon of Plenty, petroleum production function framework, capital openness, CIS.

Introduction

Petroleum abundant economies suffering from negative repercussions of the Phenomenon of Plenty, more commonly referred to as the Dutch Disease, require elaboration of refined theoretical and empirical analysis techniques. Currently widespread and applied all-over-the place 'per effects' approach relies on essential components of the Phenomenon of Plenty represented by effects resulting in deindustrialisation and deservisation of national economies. However, economic analysis could also benefit by application of the toolset of consideration of oil economies via production function's settings, accounting for petroleum as a principal feature differentiating oil-rich nations, and capital as core issue of our sample countries undergoing financial liberalisation. Validity of the theoretical framework of the Petroleum Production Function for examination of hydrocarbon-intensive states is most appropriately tested by applying this framework for empirical study in countries exposed to the Phenomenon of Plenty across Eurasia, i.e. nations of the Commonwealth of Independent States, in particular Russia, Azerbaijan, and Kazakhstan.

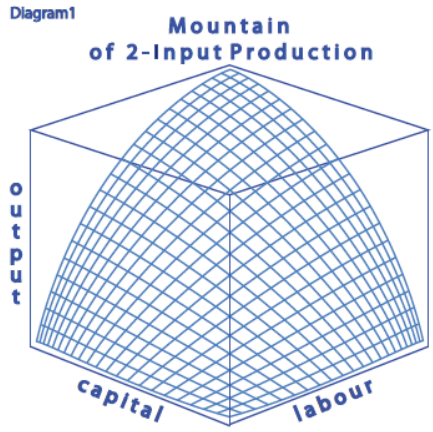
Section A : Theoretical capacities of petroleum production function framework

Literature background

Doctrine economics experienced paramount developments and underwent remarkable overall transition from utility function of early-classical XVIII century economics

founding on Adam Smith's 'An Inquiry into the Nature and Causes of the Wealth of Nations' 1776 with already grouped set of production factors and classical beginning XIX century David Ricardo's landowners' production function to contemporary widely used C-D form of utility function. Turning time took place at the edge of XIX and XX centuries due to a profuse flow of pioneering scientific findings on composition of production function, coming predominantly from path-breaking works of Swedish economist Knut Wicksell in 1893, British classics' scientist Philip Wicksteed in 1894, and notably US researchers - mathematician Charles Cobb and economist Paul Douglas in 1928.

FIGURE 1. MOUNTAIN OF 2-INPUT PRODUCTION



Source: Author.

Dramatic evolution of classical economics' agricultural production function of variable labour (L) and fixed land (T) in form $Y = f(L, T_0)$ was to successful mathematical testing of three factor economy model $Y = f(L, K, T)$ with labour (L), capital (K), and land/terrain (T) by Wicksteed who demonstrated factor shares' adding-up to/ exhausting total output, so corroborating John Clark's 1889,91 tentative findings on *Marginal Productivity Theory of Distribution (MPTD),* under condition that production function is *linearly homogeneous* making all factors be rewarded with marginal products and consequently leading sum of income shares to be equal to aggregate output $Y = f_L L + f_K K + f_T T$. Land-marking investigations of Wicksell also shed more light on production function via his research on theory of marginal productivity and working-out of a clear-cut mode of exhibiting, as being asserted by many to be first in doing so, of a principle 'payments to production factors correspond to their marginal productivity' and modelling mechanics applying a stationary state framework - 'wine production function' with removal of time (t) from his original equation $Y = f(L, K, t)$; along with this, normative implications of MPTD on social fairness of economic rents distribution have been acknowledged by him (asserting that previous unjust states of affaires can determine the future) vs. pure positive economics content. Formula for production function was already formulated in Wicksell's works, however Douglas and Cobb in their 1928 paper "A Theory of Production" (Cobb and Douglas, 1928) attained greater depth of understanding it and application for practical purposes of economic analysis fore-laying a

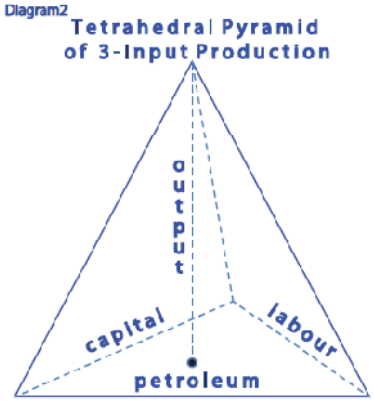
path for its use in further researches leading to naming this function after them, whereas production function was expressed as follows:

$$Y = AK^{\alpha}L^{1-\alpha}$$

Mainstream economics' paradigm of aggregate C-D production function has been continuously distinguished for about a century for its capacity to embrace numerous variations and maintain its scientific validity. Inclusion of multiple inputs allowed in C-D space through $Y = Ax_1x_{2...}x_n$ formula renders it convenient for modelling with necessary number of variable production factors, treating remaining ones as fixed. Applicability of C-D settings for petro-nations symbolizes today overcoming of political economics' hurdles since an inclusion of oil into the production function highlights rents/taxes paid by proprietors for oil fields' use and draws public attention to appropriateness of a structure for 'transferring of black gold into populace gold', hence focusing on social-economic policy's implications along with rigid financial macroeconomic study. Granularity of analysis of mechanics of a relationship governing a process of transformation of petroleum, labour and capital into output enabled by this framework assumes perfect technical efficiency within these factors themselves and goes up to a level of allocative efficiency of this mechanism enquiring into right balance of factors' use in order to pursue high-level pattern review.

Our approach - petroleum production function framework

FIGURE 2. TETRAHEDRAL PYRAMID OF 3-INPUT PRODUCTION



Source: Author.

3-factor Cobb-Douglas context

Analysis of oil abundant nations using formulated below production function sheds light on optimal pathways for current and future economic development of transition

petroleum economies of Eurasia. Inquiry into comportment patterns of incorporated petroleum production factor and insights into sectoral distribution of labour, capital, and energy enabling separation of on-going processes in oil sector from performance in other counterparts distinguish our current investigation.

$$Y = f(A, L^{\alpha}, K^{\beta}, E^{\gamma}), \text{ where } \alpha, \beta, \gamma > 0 \text{ and } \alpha + \beta + \gamma = 1$$

Decomposition of three-factor model into sectoral parts corresponding to booming (only part of tradable experiencing upsurge), tradable (rest part) and non-tradable spheres of production engender in-detail function:

$$Y = f(A, L_B^{\alpha}, L_T^{\alpha}, L_N^{\alpha}, K_B^{\beta}, K_T^{\beta}, K_N^{\beta}, E_B^{\gamma}, E_T^{\gamma}, E_N^{\gamma})$$

Composite structure of production factors:

$$L = L_0 + L_1 + L_2 + ... + L_n \qquad K = K_0 + K_1 + K_2 + ... + K_n$$
$$E = E_0 + E_1 + E_2 + ... + E_n$$

Essential elements overview

Laid out just above *3-input Phenomenon of Plenty C-D type aggregate macroeconomic production function* is comprised by the variables and constants as follows: (Y) is monetary value of aggregate output, i.e. produced goods and rendered services, of a national economy, (L) is amount of labour force input in man-hours/number of FTE staff contributed/worked within a year, (K) is monetary value of a volume of capital stock (plant, machinery, equipment and vehicles) input in local/foreign currency, (E) is a size of utilized *energy minerals* (i.e. petrochemicals) / natural resource input, (A) is a total-factor productivity (TFP) embracing output change determinants not included in 3 main inputs; TFP is narrowed down here to the *index of technological efficiency* - which is a level of technology or state of the art of production in economy (Hicks neutral). Domain of this C-D function is determined in a positive 3-dimensional space by a set of numbers which lie to the right from zero point $\{(L, K, E) : L \geq 0, K \geq 0, E \geq 0\}$, since labour, capital, and energy minerals cannot have negative values.
Applied superscripts mean output elasticity: (α) - Alpha from change in labour, (β) - Beta from change in capital, and (γ) - Gamma from change in energy. Subscripts: (B) booming sector, (T) tradable sector, (N) non-tradable sector.

$$Y = Af(L^{\alpha}, K^{\beta}, E^{\gamma})$$

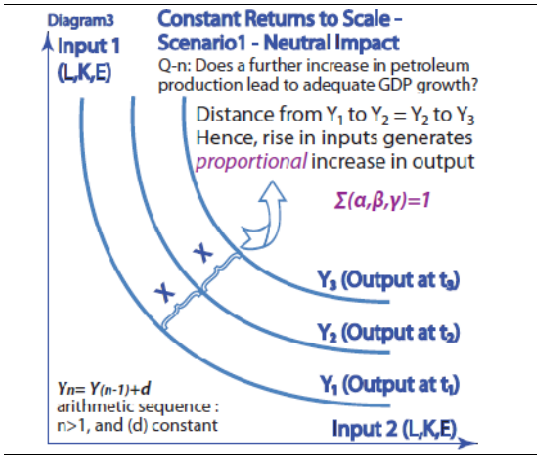
Existing *technological innovation* is considered as *neutral in a sense of John Hicks's* 1932 "The Theory of Wages" (Hicks 1963), therefore congruently in its presence while a fixed capital to labour ratio is maintained the respective ratio to each other of marginal products (MP)

for both of these production factors remain unchanged, in contrast to Roy Harrod's neutral (A) leading $\mathrm{MP}(L)\uparrow$ and Robert Solow's neutral (A) leading $\mathrm{MP}(K)\uparrow$. Extension is also stipulated here for a third production factor (E) standing for natural resource determinant of aggregate national output. Hence, all 3 factors of production under condition of their constant proportion keep the same ratios of their marginal products, whereas technology (A) is the sole determinant of output which is changed under Hicks neutrality settings.

Attribution of elasticity value to production factors

Exponents α, β, γ are positive numbers representing *output elasticity* to changes of production factors and hence displaying responsiveness of national output (Y) to increase/decrease of labour, capital, or resources variables, as a $\%\Delta(Y)$ due to respective $\%\Delta(L)$, $\%\Delta(K)$, or $\%\Delta(E)$. Portions of output due to labour, capital, and natural resources are discernible in competitive markets' settings as respective shares of α, β, γ in 1. Elasticity is essential for channelling of energy policy decision making of CIS authorities into optimal exploitation of petroleum endowments and finding proper balance of all utilized production factors in maximization of national wealth. In addition to oil level trade-offs there is capital level choice - massive accumulation of capital from sterilized oil proceeds to national wealth funds broadens input adjustment options for authorities.

FIGURE 3. CONSTANT RETURNS TO SCALE - SCENARIO1 - NEUTRAL IMPACT



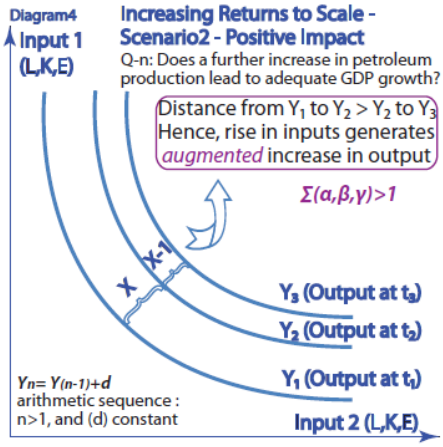
Source: Author.

Scenarios of returns to scale for CIS oil nations

Endowment with a property of additivity to 1 of these exponents $\sum \alpha, \beta, \gamma = 1$ is envisaged with the purpose to have *constant returns to scale (CRS)*, which alternatively could be *increasing (IRS)* given $\sum \alpha, \beta, \gamma > 1$ (output grows more than a proportional increase) or *decreasing (DRS)* provided that $\sum \alpha, \beta, \gamma < 1$ (output grows less than a proportional increase). Equal/proportional increase of all 3 production factors (L, K, E) by (N) is

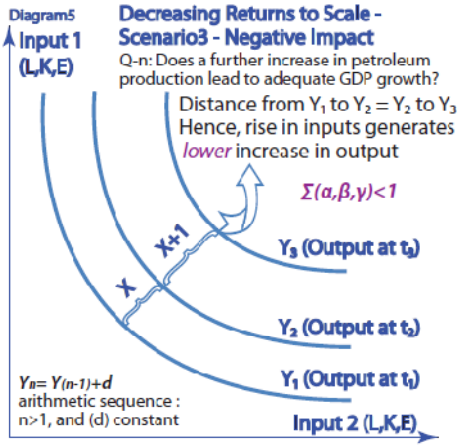
assumed to result in ensuing augmentation of national output (Y) by the same coefficient (N).

FIGURE 4. INCREASING RETURNS TO SCALE – SCENARIO 2 - POSITIVE IMPACT



Source: Author.

FIGURE 5. DECREASING RETURNS TO SCALE - SCENARIO3 - NEGATIVE IMPACT



Source: Author.

Structural evolution of a production process can change over time composition and portion in total inputs of labour which is getting more qualified, as well as characteristics of capital including various machinery/equipment for different products and natural resources, which grow/shrink basing on technological capacities and profitability of

exploring particular types of minerals - therefore, α, β, γ are expected to undergo some transformation. Serving for a time being as a basis for modelling CRS condition could be relaxed later on in this work to figure out return implications of various combinations of production factors getting for example abundant capital and moderate/scarce labour, or abundant resources and labour but limited capital due to closed capital account of the country. Thus, different factor endowments of considered countries of the CIS, namely Russia, Azerbaijan and Kazakhstan are supposed to be potentially revealed to exhibit various patterns of national returns.

Payments to factors of production and their output contribution

Intrinsically active in nature capital and labour production factors interact with passive one - oil reserves to produce petroleum output of a certain exchange value. Process of creating hydrocarbon consumable goods underpins *rental costs of use of particular factors of production* (L, K, E) which determine profitability/prosperity of a petro-economy. Estimation of current economic system of production expediency is relaying on proper evaluation of cost variables: (w) - expensed wage per unit of output, (r) - rate at which capital is rented in economy, (t) - cost of exploitation of natural resources. Corresponding *factor payments* include remuneration of labour - (wL), compensation for use of capital - (rK), and payment for utilization of natural resources - (tE), whereas respective *portions of distributed profit from national output* are as follows: $\frac{wL}{Y}, \frac{rK}{Y}, \frac{tE}{Y}$.

To highlight values of *shares of factors of production* in petroleum goods of CIS oil countries**:**

Labour input portion: $\alpha = \frac{wL}{Y}$; Capital input portion: $\beta = \frac{rK}{Y}$; Energy input portion: $\gamma = \frac{tE}{Y}$.

Productivity analysis of Eurasian petroleum economies

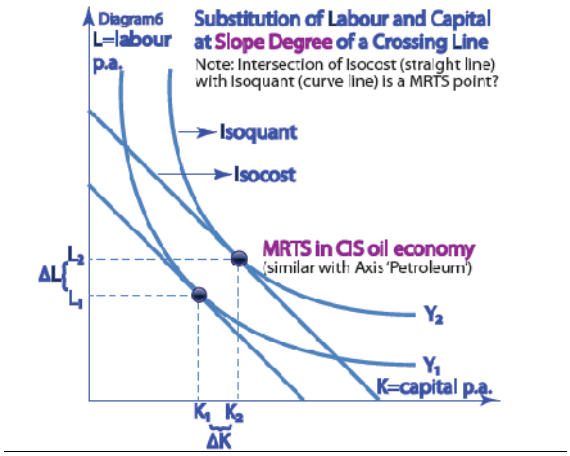
Prism of *multifactor productivity analysis* focuses concurrently on all factors exerting impact on output level and included in C-D type production function. Numerically, such all-factor inclusive *Total Factor Productivity (TFP)* defined by (A) equals to: $A = \frac{Total\ Output}{Total\ Input} = \frac{Y}{L^{\alpha}, K^{\beta}, E^{\gamma}}$

Advantageous for multifaceted review the inclusion of all production factors regularly poses troubles of accurate measurement of everything necessary, thereby undermining simplicity of application of aforementioned expression for economic analysis.

Abbreviated measurement of output per unit of input, so-called *Partial Productivity Analysis (PPA)*, is a solution dealing with estimation complexities. Essence of this method is in employment of a single input variable for productivity evaluation, in particular determining *human productivity* by $A_L = Y/L$, *capital productivity* by $A_K = Y/K$, and *energy productivity* by $A_E = Y/E$. Upward/downward trend in relationship between one particular factor and output demonstrates direction of such interaction movement, so enabling consistency in follow-on policy-makers' response line. Benchmarking levels obtained in partial productivity exploration are valuable for comparisons across various industries. As a diagnostic tool partial productivity technique performs well, however has a

major drawback stemming from not accounting for trade-offs among all factors which jointly influence C-D production function. Therefore, disperse relations are obtained which are still useful out of holistic approach in particular context, though the whole pattern from 360 review is likely to be somewhat remote away.

FIGURE 6. SUBSTITUTION OF LABOUR AND CAPITAL AT SLOPE DEGREE OF A CROSSING LINE



Source: Author.

Marginal rate of technical substitution (MRTS)

In the light of undergoing transformation of a content of production function there is a method allowing quantitative representation - Marginal Rate of Technical Substitution (MRTS). Quintessence of marginal technical substitution technique is in depicting mechanics of shifting to using more of one production input than another to achieve same output level - which is constant while going over the isoquant (line of this constant output with replacing inputs). In this context, labour (L) vs. capital (K) is being substituted. Value of MRTS is a slope of a straight line that is tangent to this particular point on the isoquant.

Magnanimous investment into petroleum sector of the 'oil league nations' of the Commonwealth of Independent States, i.e. Russia, Azerbaijan and Kazakhstan, by interior and exterior financiers, so as other entities, underpins capital side of production function. However, presence of extensive capital controls in the region does not permit to go too far in this direction - up on capital value line; therefore there is a substantial excessive regulation-born chunk of labour-supply in the oil sector, which would not exist in a state with a liberalized capital account. Bountiful supply of some resources and scarcity of others, could lead to growing insufficiency of the latter for expanding number of new projects, as well as likely to generate macroeconomic imbalances throughout national economy and entail judiciousness of considerations on possibility of factor per factor replacement, instead of leaving this role to the market mechanisms.

Marginal productivity theory of distribution

Inception in nineteenth century of the Marginal Productivity Theory of Distribution (MPTD) has set forward a principle applied in C-D function that the *marginal productivity of*

any factor of production is proportionate to output per unit of such input. To that end it propounds that: 1) marginal productivity of labour corresponds to the ratio of output to labour input quantity; 2) marginal productivity of capital corresponds to the ratio of output to capital input quantity; whereas, extension of this principle for 3-factor production function puts forward that - 3) marginal productivity of energy corresponds to the ratio of output to energy input quantity. Stylized representation of these relations is outlined below:

Uneven alteration of input amounts of production factors will affect their marginal productivities, in this vein keeping remaining factors constant there are the following relations:

$L \uparrow \Rightarrow$ Marginal productivity of labour (MPL) $\downarrow$(negatively sloping MPL curve)

$K \uparrow \Rightarrow$ Marginal productivity of capital (MPK) $\downarrow$((negatively sloping MPK curve)

$E \uparrow \Rightarrow$ Marginal productivity of energy (MPE) $\downarrow$((negatively sloping MPE curve)

According to established relationship of marginal factor productivity with quantity of supplied input of particular production factor in relation to other factors the observations over respective ratios, such as $L/K, K/E, L/E$ give grounds to judge where marginal productivity goes (e.g. adding more capital $\Rrightarrow K/L \uparrow \Rrightarrow MPK \downarrow and\ MPL \uparrow$) and does it make sense to add this particular factor or industrial/macroeconomic policy adjustments are required. Policy responses are to be individually tailored since shares of factors of production vary across different countries of the sample and change over time as well.

MPK move driver - K input significantly goes ↑ (not to optimum): Implications of opening capital account for the nations of the Commonwealth of Independent States get paramount importance here, because capital restrictions can be used to effectuate quantitative correction of inflow of this particular factor consequently affecting balance of factors' productivities. Giving up in part or in full of this instrument is supposed to impact national economy - this could be illustrated in empirical section, where data on presence of capital controls in CIS within last two decades is analyzed. Massive investments flowing to the CIS due to higher capital rewarding projects are changing capital volume available for production.

MPL move driver - L input remains almost steady (K-replacer): Population number dynamics and creation of the workforce in the country is under little if any significant control of the government, therefore a control of this production factor is not a very potent measure, in particular for a short-haul horizon. Outcome of the policies targeting an augmentation of amount of labour force and its qualification could be observable only in a long-haul perspective. Nevertheless, a vibrant economic environment of the emerging world invalidates any possibility for this factor to be untouched while nation's withering to the new economic order and experiencing major economic transformations.

MPE move driver - E input dramatically advances ↑: In contrast, availability of mineral resources as a production factor can vary dramatically due to unforeseen discoveries of new deposits, which by definition being new - hence cannot be known in advance, therefore potential of this factor change is extraordinarily high. Commencing from 1990-s proved total oil reserves of Russia increased from 48 to approximately 80 bln. barrels, Azerbaijan's surveyed crude estimates have grown from 1 to 7 bln. barrels, whereas absolutely incredible numbers were exhibited in case of Kazakhstan were oil reserves have increased fabulously going from 5 to about 40 bln. barrels. Actual participation of discovered petroleum in national production has expeditiously followed these discoveries creating settings for oil boom and related structural domestic economic reforms.

TABLE 1. RELATION OF CAPITAL CONTROLS WITH MP OF 'K','L', AND 'E'

Presence of Capital Controls	Direction of MPK Movement	Direction of MPL Movement	Direction of MPE Movement
present	increase	decrease	to be defined
absent	decrease	increase	to be defined

Source: Author.

MPK & Capital Liberalization: Outlaid table exhibits that capital controls are very lucrative instruments for statesmen who have capital invested in petroleum projects throughout the country since removal of such restrictions is supposed to reduce MPK and remuneration for capital use in terms of interest accordingly. Therefore, it is reasonable to believe that as long as a share of CIS governments' related entities remains significant there will be a strong resistance to capital account liberalization regardless of possible upsides for national economy in general, since personal vested interests prevail. Change of political elites across oil league nations of the Commonwealth of Independent States, namely Russia, Azerbaijan and Kazakhstan, for new groups belonging to other spheres of business could correct such internal imbalance harmful for economic development. Though, such event is quite unlikely in the near future due to concentration of most influential political and economic elite around best-performing asset of the region - petroleum.

MPL & K-Restrictions' Backing: Situation with labour is supportive for maintenance of existing state of affairs 'in situ' because MPL is low and a requirement for labour is elevated (simply due to non-availability of capital) driving wages in the sector up and triggering resource movement and spending effects (both are examined in the forthcoming sections) signalizing advent of Dutch Disease to the region. Risk of unemployment in the oil-fields' area treacherous with potential social unrests as it was documented in the very early history of industrialization of Europe couple of centuries ago (when workers were destroying plant equipment because labour force was made redundant) is another argument for incumbent governments to keep situation as it is now. Hence, labourers of oil endowed regions enjoy higher wages at the expense of their counterparts in other parts of respective countries, which otherwise would benefit from higher national proceeds coming from petroleum business. There is an absolute lack of understanding and awareness of this mechanism on people's level, so creating in the aftermath hollowness instead of a necessary active social pressure on the domestic politicians from the majority of country inhabitants.

MPE & Capital Inflows: MPE is not essential in on-going interaction in the production process simply as a consequence of the fact that, as it was already previously mentioned, energy is a passive production factor. Productivity of petroleum oilfields will only slightly improve due to technological enhancements coming from higher level of participation of capital. Nevertheless, such amelioration should not be disregarded and creation of favourable conditions for capital participation in the sector should be fostered. Discontent of local population with a practice of giving property rights to some renown multinationals which are negatively perceived inside the country due to their infamous activities in the past (especially in relation to huge natural disasters coming from petroleum spills, oil rigs' explosions and other highly detrimental occurrences) could be changed to better alignment of local population and foreign business interests- there is a

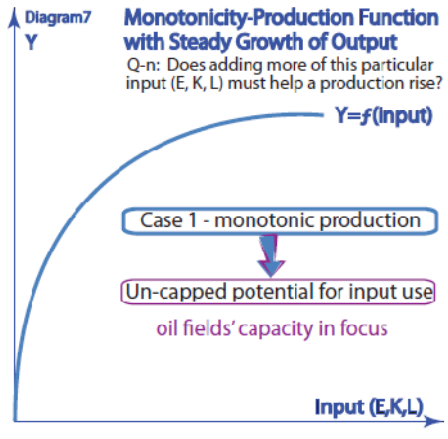
need to transform the ways of providing opportunities for foreign players for participation in oil projects allowing only a very small part of equity and making arrangements conducive for more debt, so capital structure of the main oil projects should be streamlined by state authorities from up-to-bottom in a proper manner to ensure that when permissions for work in these petroleum projects are granted organizational structure is appropriate.

Therefore, as it is observed, Dutch Disease Symptoms are largely stimulated by existing internal political conjuncture stemming mainly from the interests of high officials holding significant stakes in domestic petroleum exploration and development. Scarcity of capital, high wages in oil and 'enlarged wage scissor's space' with other parts of the country - are all artificial and have to be removed within future reforms. There are two layers of maintenance of this situation: 1. De-jure: Legal way - directly outlawing many financial activities and impeding new-comers to oil exploration projects; 2. De-facto: Local interest groups - oppose using their power in different state and business organizations to new entrants from outside. Openness to capital and expertise are key needed improvements.

Patterns of output variations - monotonicity and 3-stages production

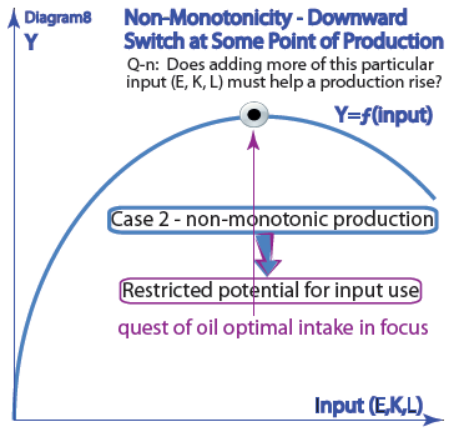
Monotonicity: Sustainability of operating economic production is dependent on temporal sequence of output generations with the same or increasing input with no relative drops over Y-side. Reliance on a stable long-term growth by simply increasing used inputs, of course, is not realistic and there is an expected time-point when Y-reaction will halt to accommodate in its growth more input and then simply terminate doing so, followed by a decline of output under condition of further increasing of inputs use. *Implication for CIS nations* is a need to determine such point in the time-line of exploitation of their petroleum reserves in order to find optimum production level and transfer getting unreasonably used factors of production to better use once block-point is reached.

FIGURE 7. MONOTONICITY - PRODUCTION FUNCTION WITH STEADY GROWTH OF OUTPUT



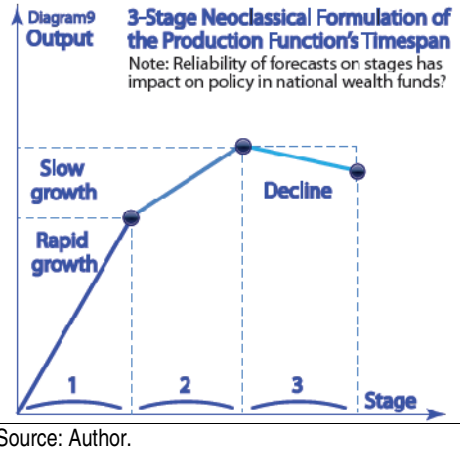
Source: Author.

FIGURE 8. NON-MONOTONICITY - DOWNWARD SWITCH AT SOME POINT OF PRODUCTION



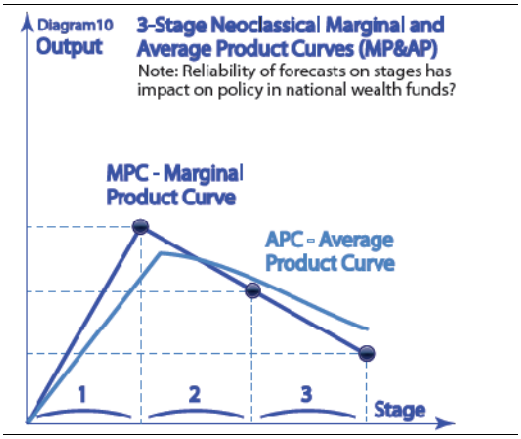
Source: Author.

FIGURE 9. 3-STAGE NEOCLASSICAL FORMULATION OF THE PRODUCTION FUNCTION'S TIMESPAN



Source: Author.

FIGURE 10. 3-STAGE NEOCLASSICAL MARGINAL AND AVERAGE PRODUCT CURVES (MP&AP)



Source: Author.

3-Stages Production: Oil-based economies viewed from a neoclassical perspective are supposed to encounter three stages in a production process. First stage following discovery and commencement of exploitation of massive petroleum reserves - oil shock, results in expeditious growth of output, while displaying high level of both marginal and average product. Attaining maturity phase at stage 2 displays a moderate increase of output per applied input, so Y still augments but already at a slower pace, whereas there is an onset of a shift to downward trend of MP and AP. Getting to decline phase at stage 3 exhibits that any further use of inputs generates a drop in output level, as well as continuation of both MP and AP fall. *CIS Economic Policy Focus:* Sterilization of oil proceeds by national wealth funds of the CIS region usually pursues inflation/deflation targeting objectives in respect to monetary policy, whereas once maturity phase is reached or simply forecasted with a significant confidence degree accumulated funds should be reconsidered from monetary instrument needed for oil economy generating main profits from this petroleum business to building of a new industrialized type of national economy. Adopting such approach beforehand could ensure long-term strategic benefits of early transition which is anyway inevitable in a long-haul horizon.

SECTION B: Empirical inquiry into the phenomenon of plenty in Russia, Azerbaijan and Kazakhstan

Extensive empirical analysis enquires into the actual impact of the Phenomenon of Plenty on the nations of the Commonwealth of Independent States, i.e. Russia, Azerbaijan, and Kazakhstan. Terms of 3-factor oil-economy production function are re-formulated from straightforward notional petroleum, capital, and labour factors into composite variables-indices best reflecting their respective dimensions. Additional variable capturing corruption level is also tested due to paramount importance of this parameter for performance of petroleum abundant economies.

Essential work for structure of our empirical testing of the Phenomenon of Plenty is Papyrakis and Gerlagh (2004) laying down very straightforward and fruitful approach.

Structure of applied econometric analysis contains two phases - firstly, there is an evaluation of an impact on macroeconomic outcomes of core processes of our research -

petrolization via 'petrostate' index and capital opening via 'finopen' index; secondly, there is an assessment of a role for macroeconomic outcomes of all parameters of 3-factor oil-economy production function expressed though 'petrostate', 'finopen', and 'humancap' reflecting labour dynamics, as well as including 4-th parameter 'corrupt' gauging corruption practices across sample countries.

Configuration of Independent Variables for effectuating our econometric study is appropriately arranged by creating a set of variables efficiently capturing all elements of three-factor oil production function and reflecting high corruption in researched nations:

PETROSTATE - core index exhibiting importance of petroleum in national economy for a particular period of a country, which reflects data on: oil crude world price, oil output, barrel from ton conversion, value in US Dollars of annual oil output, population number, oil dollar proceeds per capita, crude oil proved reserves, barrel reserves per capita, and oil endowment coefficient.

FINOPEN - principal index reflecting a trajectory of changing a degree of capital openness while transition of a nation from closed command economy to liberal market economic order, which contains information as below: share in GDP of total in/outward flows of direct investment abroad, direct investment in representative economy, portfolio investment assets, portfolio investment liabilities, other investment assets, other investment liabilities.

HUMANCAP - essential variable accounting for dynamics of the labour-force measured in a percent change per annum, which is displaying the following data: proxies of labour-force are the overall number of population in oil-producing regions and aggregate number in the country; they are applied to make sufficiently long data-series from deficient datasets and to incorporate intake by the region of work and skills of entirety of households.

CORRUPT - crucial index of corruption measuring quality of business law-and-order environment, which contains information as follows: measurements from Corruption Perception Index reports of Transparency International gauging perception of corruption practices in the country, so introducing such important for our research dimension as "how oil proceeds detriment quality of state institutions and standards of government decisions".

Elaborated and applied in our research indices / variables, PETROSTATE, FINOPEN, HUMANCAP, and CORRUPT, represent potent instruments for econometric evaluation of the parameters of the Phenomenon of Plenty on sample economies due to the fact that all three countries - Russia, Azerbaijan, and Kazakhstan are 1) prominent petro-nations of the Commonwealth of Independent States, 2) concurrently experiencing application of policies targeting capital account liberalization, 3) along with this having intense dynamics of labour-force reallocations, 4) as well as suffering from high corruption levels.

Composition of Dependent Variables: There is a set of dependent variables selected according to inter-CIS agreement for monitoring foremost influential indicators for national economic development - these 12 variables are in a primary monitoring and reporting focus of the Interstate Statistical Committee of the Commonwealth of Independent States. Latitude of a range of the macroeconomic indicators supposed to be influenced spans over key economic and financial performance metrics: GDP - Gross domestic product, IPROD - Industrial production, APROD - Agricultural production, CAPIN - Capital investments, FRECA - Freight carried, TRADE - Retail trade turnover, IPPI - Industrial producers' price index, CPI - Consumer price index, EXCIS - Export to CIS countries, EXW - Export to other countries, IMCIS - Import from CIS countries, and IMW - Import from other countries.

Methodological foundation: Technically, econometric tests are performed applying Econometric Views (EViews) software and using the Method of Panel Least Squares facilitating an exploration of a dataset for 1990-2010 years, with main focus on 1995-2010

timespan for sample countries of the Commonwealth of Independent States, i.e. Russia, Azerbaijan, and Kazakhstan to investigate the relationship of set above 4 independent and 12 dependent variables.

Phase 1 of Econometric Analysis - Impact of "petrostate" and "finopen" on macroeconomic outcomes. Primary focus of the empirical section is in exploration of type and strength of association of ongoing petrolization concurrently accompanied by capital opening in sample oil-nations with principal macroeconomic parameters. Core nature of petroleum-led development and capital openness reforms for the Phenomenon of Plenty determines principal attention for their respective investigation. Mechanics of testing employs "petrostate" index to capture petrolization and "finopen" index to capture capital opening, while studying their separate and combined impact. Form of Tested Equations:

$$\Delta INDICATOR_i = \alpha + \beta_1 PETROSTATE_i + \beta_2 FINOPEN_i + \varepsilon,$$

where, Δ is change, α is intercept, β is coefficient

Phase 2 of Econometric Analysis - Impact of all parameters of 3-factor oil-economy production function - "petrostate", "finopen", and "humancap" as well as 4-th parameter "corrupt" on macroeconomic outcomes. Full-scale econometric analysis extends to testing of relationship of included proxies for all 3 factors of petroleum-economy production function - "petrostate", "finopen", and "humancap" and incorporated 4-th parameter "corrupt" with main macroeconomic indicators. Entirety of components of petro-economy production enables to explore the whole picture in greater detail, whereas inclusion of additional corruption independent variable is capable to exhibit how non-economic, in particular corruptive behaviour, affects bottom-line of oil-abundant nation.

$$\Delta INDICATOR_i = \alpha + \beta_1 PETROSTATE_i + \beta_2 FINOPEN_i + \beta_3 HUMANCAP_i + \beta_4 CORRAPT_i + \varepsilon,$$

Assumptions Testing and Data Transformation for Phase 2 - Our investigation conducts testing for normality, independence of errors, and homoscedasticity; along with this there is an assumption of linearity of the relationship between dependent and independent variables. In order to ameliorate our dataset there were some transformations effectuated applying log, taking reciprocals, and using square root. Form of Tested Equations:

Specifications after data transformation:

Testing assumptions enabled to transform specification in the following way:

$1/GDP_i = a + \beta_1 Log\ (PETROSTATE_i) + \beta_2\ Log\ (FINOPEN_i) + \beta_3\ HUMANCAP_i + \beta_4 CORRUPT_i + \varepsilon$

$Log\ (IPROD_i) = a + \beta_1 Log\ (PETROSTATE_i) + \beta_2\ Log\ (FINOPEN_i) + \beta_3\ HUMANCAP_i + \beta_4 CORRUPT_i + \varepsilon$

$APROD_i = a + \beta_1 Log\ (PETROSTATE_i) + \beta_2\ Log\ (FINOPEN_i) + \beta_3\ HUMANCAP_i + \beta_4 CORRUPT_i + \varepsilon$

$Log\ (CAPIN_i) = a + \beta_1 Log\ (PETROSTATE_i) + \beta_2\ Log\ (FINOPEN_i) + \beta_3\ HUMANCAP_i + \beta_4 CORRUPT_i + \varepsilon$

$Log\ (FRECA_i) = a + \beta_1 Log\ (PETROSTATE_i) + \beta_2\ Log\ (FINOPEN_i) + \beta_3\ HUMANCAP_i + \beta_4 CORRUPT_i + \varepsilon$

$TRADE_i = a + \beta_1 Log\ (PETROSTATE_i) + \beta_2\ Log\ (FINOPEN_i) + \beta_3\ HUMANCAP_i + \beta_4 CORRUPT_i + \varepsilon$

$IPPI_i = a + \beta_1 Log\ (PETROSTATE_i) + \beta_2\ Log\ (FINOPEN_i) + \beta_3\ HUMANCAP_i + \beta_4 CORRUPT_i + \varepsilon$

$CPI_i = a + \beta_1 Log\ (PETROSTATE_i) + \beta_2\ Log\ (FINOPEN_i) + \beta_3\ HUMANCAP_i + \beta_4 CORRUPT_i + \varepsilon$

$EXCIS_i = a + \beta_1 Log\ (PETROSTATE_i) + \beta_2\ Log\ (FINOPEN_i) + \beta_3\ HUMANCAP_i + \beta_4 CORRUPT_i + \varepsilon$

$EXW_i = a + \beta_1 Log\ (PETROSTATE_i) + \beta_2\ Log\ (FINOPEN_i) + \beta_3\ HUMANCAP_i + \beta_4 CORRUPT_i + \varepsilon$

$IMCIS_i = a + \beta_1 Log\ (PETROSTATE_i) + \beta_2\ Log\ (FINOPEN_i) + \beta_3\ HUMANCAP_i + \beta_4 CORRUPT_i + \varepsilon$

$IMW_i = a + \beta_1 Log\ (PETROSTATE_i) + \beta_2\ Log\ (FINOPEN_i) + \beta_3\ HUMANCAP_i + \beta_4 CORRUPT_i + \varepsilon$

Results and discussion

Favorable influence on macroeconomic performance is displayed by "petrostate" having positive 5% significance effect on Export to CIS countries (EXCIS), and Export to other countries (EXW), 10% significance effect on Gross domestic product (GDP), Industrial production (IPROD), and negative for Capital investments (CAPIN). After transformation of data taking log "petrostate" and applying full 4-factor framework we document some similar findings with fluctuating significance levels (i.e. 1%: GDP, EXCIS, 10%: IPROD, EXW), whereas reporting supplementary positive impact on other variables, in particular Consumer price index (CPI) at 5% significance level, and Industrial producers' price index (IPPI) at 10% significance level.

Beneficial impact is exhibited by "finopen" having positive 1% significance effect on Gross domestic product (GDP), Capital investments (CAPIN), and Export to CIS countries (EXCIS), 5% significance effect on Import from CIS countries (IMCIS), and Import from other countries (IMW), 10% significance effect on Agricultural production (APROD), and Retail trade turnover (TRADE). Once, we estimate researched relationships after data transformation taking log "finopen" and deploying full 4-factor framework we mainly confirm findings for all listed above dependent variables with slightly varying significance (i.e. 1%: GDP and CAPIN, 5%: APROD, TRADE, EXCIS, 10%: IMCIS and IMW), along with this we report ameliorated impact on Freight carried (FRECA) exhibiting it at 5% significance level and negative statistically significant at 10% impact on Consumer price index (CPI).

Advantageous role is also exhibited by testing of a proxy for third component of petroleum production function "humancap" having positive 1% significance effect on Industrial production (IPROD), 5% significance effect on Gross domestic product (GDP), 10% significance effect on Freight carried (FRECA), and Retail trade turnover (TRADE); along with this, there is demonstrated statistically significant at 5% negative relationship of "humancap" with Agricultural production (APROD).

Detrimental impact is elicited by 'corrupt' having negative 10% significance effect on Export to other countries (EXW), whereas exerting adverse influence for numerous of explored economic parameters mainly at statistically insignificant degree, having though close to negative 10% significance negative effect on Agricultural production (APROD), and close to that level positive impact for inflation both at consumer and producer sides - Industrial producers' price index (IPPI), and Consumer price index (CPI).

Policy implications of theoretical and empirical study

Theoretical Part: Angle of analysis via formulated petroleum production function sheds light on multiple neglected aspects of finding optimal pathways for current and future economic development of transition petroleum economies of Eurasia - those of Russia, Azerbaijan, and Kazakhstan. Framework of opted production function enables covering the following issues overlooked in typical "per effect" review: i) Working-out output elasticity scenarios is instrumental for channeling energy policy into optimal exploitation of petroleum endowment with best proportion of production factors for profitability maximization; ii) Volume of petroleum activities can be adjusted by authorities basing on existing pattern of returns to scale - enlarging for increasing, cutting for decreasing, and holding fix for constant; iii) Proper alignment of factor remuneration fosters reinforcement of international competitiveness of country's output and strengthens financial bottom line of a nation, since lucrativeness of economic activities largely depends on rental costs of use of production factors; iv) Metrics of productivity available for oil nations are embedded in 3-factor production function framework in form of Multi-Factor - all facets influencing output 360 degree review, and more focused Single-Factor Productivity Analysis examining particular issue; v) Monotonicity estimation is a useful development planning tool displaying time-point when output does not grow any more with extra inputs; whereas 3-stage production process view displays when marginal and average product boost, slow down, and decline; both means are allowing adequate timing of economic activity. Essential extra matters of productivity agenda are elicited better in applied analytical context.

Empirical Part: Elaborated Empirical Model could serve as a valuable tool for assessment of the impact of the Phenomenon of Plenty on petroleum-abundant economy. Designed setup enables policy-makers to test scenarios of influence of compositional modification of oil economy's production forces on major indicators of macroeconomic performance. Capturing fundamentals of 3-factor oil economy production function, i.e. petroleum, capital, and labour, through elaborated proxies "petrostate", "finopen", and "humancap" is efficaciously reflecting ongoing dynamics inside oil-intensive economy and its transmission channels to economic performance. Composite Indices "petrostate" and "finopen" could be built using proposed in our study components by economists of target region, and alternatively derived from them modifications could be of value as well. Incorporation of the variable accounting for corruption is advisable, since oil-rich emerging economies are prone to suffer from these damaging practices, which deteriorate their economic outcomes. Application of stipulated in our research 12 dependent variables track-recorded by CIS supranational bodies covers main macroeconomic matters and ensures homogeneity of comparable data in case sample nations' authorities are willing to benchmark their performance to the group with equivalent initial political, economic, geographical and other conditions. Findings on exertion of impact of the 4 independent variables on particular 12 dependent variables could be useful as a part of policy guidelines, prescribing which issues should be handled as prime importance.

Conclusion

Lens of three-dimensional production function of hydrocarbon-intensive economy render into disposition of scientists and statesmen a powerful gear-box for exploration of dynamics of economic processes. Outreaching exhaustiveness of scrupulous analysis via production function incorporates into spectrum of investigation of the Phenomenon of Plenty a whole palette of essential matters. Theoretical framework of petroleum production function also establishes appropriate structure for further empirical exploration of the leading oil producing nation of Eurasian Continent by capturing

essential dynamics of concentration of mobile and static production forces in oil economy.

Empirical Inquiry into Phenomenon of Plenty including Econometric Study basing on 3-factor petroleum model is fruitfully performed in two steps having at first analyzed two most essential for our work parameters "petrostate" and "finopen", while later on adding to them "humancap" to complement three-factor production function review and 'corrupt' to account for illegal practices in selected oil-producing countries. Optimal itinerary for development could rely on the efficient management of elicited economic relationships by oil-nations of the Commonwealth of Independent States, in particular Russia, Azerbaijan, and Kazakhstan striving to overcome Phenomenon of Plenty's adversities.

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Electronic Databases: CIS-STAT; IMF, World Bank, Datastream, Bloomberg, National Banks and Statistics Agencies of Russia, Azerbaijan, and Kazakhstan

Appendix

TABLE 2. MATRIX OF FINDINGS OVER IMPACT OF 4-COMPONENT MODEL OF THE PHENOMENON OF PLENTY WITH PETROSTATE, FINOPEN, HUMANCAP, AND CORRUPT ON 12 PRINCIPAL MACROECONOMIC INDICATORS OF SAMPLE COUNTRIES

SECTION 1 - EFFECT ON GDP

	1/GDP	1/GDP	1/GDP	1/GDP	1/GDP	1/GDP	1/GDP
LOG(PETROSTATE)	-0.0006				-0.0004	-0.0004	0.0000
	(-2.9826)***				(-2.1124)**	(-1.5768)	(-0.06)
LOG(FINOPEN)		-0.0010			-0.0008	-0.0008	-0.0007
		(-3.3074)***			(-2.5106)**	(-2.3127)**	(-1.7188)*
HUMANCAP			-0.0002			-0.0001	-0.0001
			(-2.3932)**			(-0.6777)	(-0.7042)
CORRUPT				0.0002			0.0001
				(0.8109)			(0.2890)
Constant	0.0112	0.0108	0.0284	0.0087	0.0117	0.0174	0.0163
	(18.3996)***	(26.1218)***	(3.5828)***	(12.4096)***	(19.1488)***	(2.0878)**	(1.9311)
R-squared	0.1621	0.1921	0.1107	0.0175	0.2650	0.2726	0.1637

SECTION 2 - EFFECT ON IPROD

	LOG(IPROD)	LOG(IPROD)	LOG(IPROD)	LOG(IPROD)	LOG(IPROD)	LOG(IPROD)	LOG(IPROD)
LOG(PETROSTATE)	0.0306				0.0302	0.0096	-0.0225
	(1.6051)				(1.5008)	(0.5468)	(-1.0408)
LOG(FINOPEN)		-0.0128			-0.0031	0.0033	0.0224
		(-0.3715)			(-0.0934)	(0.1223)	(0.8148)
HUMANCAP			0.0960			0.0893	0.0409
			(3.6631)***			(2.8868)**	(1.5512)
CORRUPT				0.0064			0.0112
				(0.4066)			(0.6682)
Constant	1.9192	2.0203	-7.6467	2.0023	1.9239	-7.0085	-2.0827
	(35.4079)***	(48.1007)***	(-2.9021)**	(54.0117)***	(25.3889)***	(-2.2646)**	(-0.7859)
R-squared	0.1554	0.0098	0.4894	0.0163	0.1560	0.5019	0.3781

SECTION 3 - EFFECT ON APROD

	APROD	APROD	APROD	APROD	APROD	APROD	APROD
LOG(PETROSTATE)	2.6494				0.9017	3.9181	-2.0727
	(0.8938)				(0.2917)	(1.1727)	(-0.5494)
LOG(FINOPEN)		8.2874			7.8237	9.6713	8.8153
		(1.8970)*			(1.6680)	(2.0898)**	(1.7781)*
HUMANCAP			-0.9587			-2.4541	-2.7114
			(-0.8887)			(-2.0237)**	(-2.5308)**
CORRUPT				-5.0290			-2.3303
				(-1.3080)			(-0.6025)
Constant	94.0852	91.0620	198.2682	115.3225	89.0669	325.2479	377.1865
	(10.9163)***	(15.8266)***	(1.8244)***	(12.7882)***	(9.9231)***	(2.7792)***	(3.6618)***
R-squared	0.0171	0.0726	0.0169	0.0442	0.0743	0.1531	0.2611

SECTION 4 - EFFECT ON CAPIN

	LOG(CAPIN)	LOG (CAPIN)	LOG (CAPIN)	LOG (CAPIN)	LOG (CAPIN)	LOG (CAPIN)	LOG (CAPIN)
LOG(PETROSTATE)	0.0045				-0.0358	-0.0289	-0.0504
	(0.1346)				(-1.1316)	(-0.8102)	(-1.4161)
LOG(FINOPEN)		0.1622			0.1806	0.1848	0.1621
		(3.5804)***			(3.7622)***	(3.7404)***	(3.4698)***
HUMANCAP			0.0038			-0.0056	-0.0096
			(0.3067)			(-0.4334)	(-0.9471)
CORRUPT				-0.0250			0.0238
				(-0.6704)			(0.6532)
Constant	2.0364	1.8413	1.6702	2.1146	1.9205	2.4606	2.9047
	(20.7473)***	(30.8604)***	(1.3508)	(24.2086)***	(20.9055)	(1.9691)*	(2.9919)***
R-squared	0.0004	0.2179	0.0020	0.0120	0.2396	0.2428	0.2768

SECTION 5 - EFFECT ON CAPIN

	LOG(FRECA)	LOG(FRECA)	LOG(FRECA)	LOG(FRECA)	LOG(FRECA)	LOG(FRECA)	LOG(FRECA)
LOG(PETROSTATE	0.0085				-0.0040	-0.0142	-0.0269
	(0.4960)				(-0.2276)	(-0.7247)	(-1.0331)
LOG(FINOPEN)		0.0541			0.0562	0.0499	0.0388
		(2.1706)**			(2.0981)**	(1.8350)*	(1.1350)
HUMANCAP			0.0097			0.0083	0.0052
			(1.5793)			(1.1661)	(0.7030)
CORRUPT				-0.0148			-0.0006
				(-0.6145)			(-0.0238)
Constant	1.9915	1.9466	1.0431	2.0554	1.9555	1.1553	1.5289
	(39.7978)***	(59.2712)***	(1.6930)*	(36.4507)***	(38.1543)***	(1.6789)	(2.1529)**
R-squared	0.0053	0.0929	0.0514	0.0101	0.0940	0.1211	0.0698

SECTION 6 - EFFECT ON TRADE

	TRADE	TRADE	TRADE	TRADE	TRADE	TRADE	TRADE
LOG(PETROSTATE	0.8087				-1.1043	-3.0041	1.6549
	(0.3218)				(-0.4302)	(-1.0621)	(0.5517)
LOG(FINOPEN)		7.9954			8.5633	7.3996	7.3192
		(2.2019)**			(2.1989)**	(1.8888)	(1.8567)*
HUMANCAP			1.5793			1.545675	0.427207
			(1.7835)*			(1.5056)	(0.5015)
CORRUPT				-1.3366			-0.030287
				(-0.4476)			(-0.0098)
Constant	107.6206	99.6846	-49.1489	112.2905	102.1280	-46.6244	51.6076
	(14.7261)***	(20.8434)***	(-0.5509)	(16.0316)***	(13.7040)***	(-0.4706)	(0.6301)
R-squared	0.0022	0.0953	0.0647	0.0054	0.0991	0.1432	0.1943

SECTION 7 - EFFECT ON IPPI

	IPPI	IPPI	IPPI	IPPI	IPPI	IPPI	IPPI
LOG(PETROSTATE)	-138.6029				-134.4920	-139.5654	1.3743
	(-1.7419)*				(-1.5732)	(-1.4450)	(0.1601)
LOG(FINOPEN)		-87.5682			-18.4020	-21.5096	-3.8177
		(-0.7063)			(-0.1419)	(-0.1608)	(-0.3383)
HUMANCAP			-23.4101			4.1277	-1.7311
			(-0.79)			(0.1177)	(-0.7100)
CORRUPT				8.7236			7.7018
				(1.1194)			(0.8750)
Constant	557.5011	271.7179	2517.5630	95.9071	569.3045	172.0664	273.7365
	(2.4096)**	(1.6641)	(0.8416)	(5.2466)	(2.2935)**	(0.0509)	(1.1677)
R-squared	0.0619	0.0107	0.0133	0.0328	0.0623	0.0626	0.0575

SECTION 8 - EFFECT ON CPI

	CPI	CPI	CPI	CPI	CPI	CPI	CPI
LOG(PETROSTATE)	-47.7256				-39.6756	-38.9178	-7.3536
	(-2.4025)**				(-1.8846)*	(-1.6360)	(-1.0345)
LOG(FINOPEN)		-56.4393			-36.0350	-35.5708	-11.5133
		(-1.8280)*			(-1.1281)	(-1.0796)	(-1.2326)
HUMANCAP			-10.6515			-0.6166	5.9951
			(-1.4190)			(-0.0714)	(0.8228)
CORRUPT				7.2080			1.1268
				(1.0685)			(0.5583)
Constant	263.8217	199.1462	1199.6970	95.5183	286.9353	346.2741	21.8793
	(4.5674)***	(4.8974)***	(1.5864)	(6.0367)***	(4.6940)***	(0.4156)	(0.1127)
R-squared	0.1115	0.0677	0.0419	0.0299	0.1359	0.1360	0.1354

SECTION 9 - EFFECT ON EXCIS

	EXCIS	EXCIS	EXCIS	EXCIS	EXCIS	EXCIS	EXCIS
LOG(PETROSTATE)	24.0815				19.0489	19.7279	13.5588
	(2.7613)***				(2.0917)**	(1.9175)*	(0.9709)
LOG(FINOPEN)		32.3243			22.5278	22.9438	32.6714
		(2.4000)**			(1.6303)	(1.6100)	(1.7804)*
HUMANCAP			4.9257			-0.5525	1.4454
			(1.4710)			(-0.1479)	(0.3645)
CORRUPT				-2.0085			2.5696
				(-0.1425)			(0.1795)
Constant	46.5242	74.2233	-380.4901	123.2422	32.0744	85.2412	-116.7188
	(1.8347)*	(4.1842)***	(-1.1279)	(3.7267)***	(1.2130)	(0.2365)	(-0.3061)
R-squared	0.1422	0.1113	0.0449	0.0005	0.1900	0.1904	0.2129

SECTION 10 - EFFECT ON EXW

	EXW	EXW	EXW	EXW	EXW	EXW	EXW
LOG(PETROSTATE)	63.8645				54.2194	62.7208	104.0076
	(1.6774)*				(1.3323)	(1.3666)	(1.5513)
LOG(FINOPEN)		71.0591			43.1753	48.3827	13.2906
		(1.2131)			(0.6992)	(0.7611)	(0.1509)
HUMANCAP			8.5431			-6.9168	-7.2638
			(0.6009)			(-0.4152)	(-0.3815)
CORRUPT				-102.5825			-120.6769
				(-1.6308)			(-1.7559)*
Constant	-44.0641	48.2120	-721.1973	383.0661	-71.7576	593.8993	827.6750
	(-0.3980)	(0.6249)	(-0.5036)	(2.5964)**	(-0.6073)	(0.3694)	(0.4522)
R-squared	0.0576	0.0310	0.0078	0.0671	0.0678	0.0714	0.1492

SECTION 11 - EFFECT ON IMCIS

	IMCIS	IMCIS	IMCIS	IMCIS	IMCIS	IMCIS	IMCIS
LOG(PETROSTATE)	12.4015				8.4991	6.8926	-3.1360
	(1.4326)				(0.9295)	(0.6680)	(-0.2298)
LOG(FINOPEN)		21.8397			17.4688	16.4848	27.7789
		(1.6758)*			(1.2592)	(1.1535)	(1.5494)
HUMANCAP			3.8957			1.3070	2.6159
			(1.2297)			(0.3490)	(0.6752)
CORRUPT				4.0076			10.8529
				(0.3093)			(0.7759)
Constant	77.7511	85.3519	-279.0556	105.9519	66.5462	-59.2409	-200.7394
	(3.0889)***	(4.9725)***	(-0.8744)	(3.4868)***	(2.5066)**	(-0.1639)	(-0.5389)
R-squared	0.0427	0.0575	0.0318		0.0753	0.0778	0.1119

SECTION 12 - EFFECT ON IMW

	IMW	IMW	IMW	IMW	IMW	IMW	IMW
LOG(PETROSTATE)	3.7906				-0.8805	-4.8302	0.5465
	(0.4749)				(-0.1057)	(-0.5186)	(0.0448)
LOG(FINOPEN)		20.4567			20.9095	18.4901	23.3808
		(1.7397)*			(1.6549)*	(1.4331)	(1.4595)
HUMANCAP			3.7928			3.2135	1.5156
			(1.3274)			(0.9505)	(0.4378)
CORRUPT				-6.5998			-1.4472
				(-0.5731)			(-0.1158)
Constant	107.7136	92.3536	-263.4668	133.2699	94.3018	-214.9618	-63.8249
	(4.6414)***	(5.9633)***	(-0.9153)	(4.9343)***	(3.9001)***	(-0.6588)	(-0.1918)
R-squared	0.0049	0.0617	0.0369	0.0088	0.0620	0.0808	0.1082

Source: Author's calculations.