

**"Does Natural Capital matter for
productivity?"**

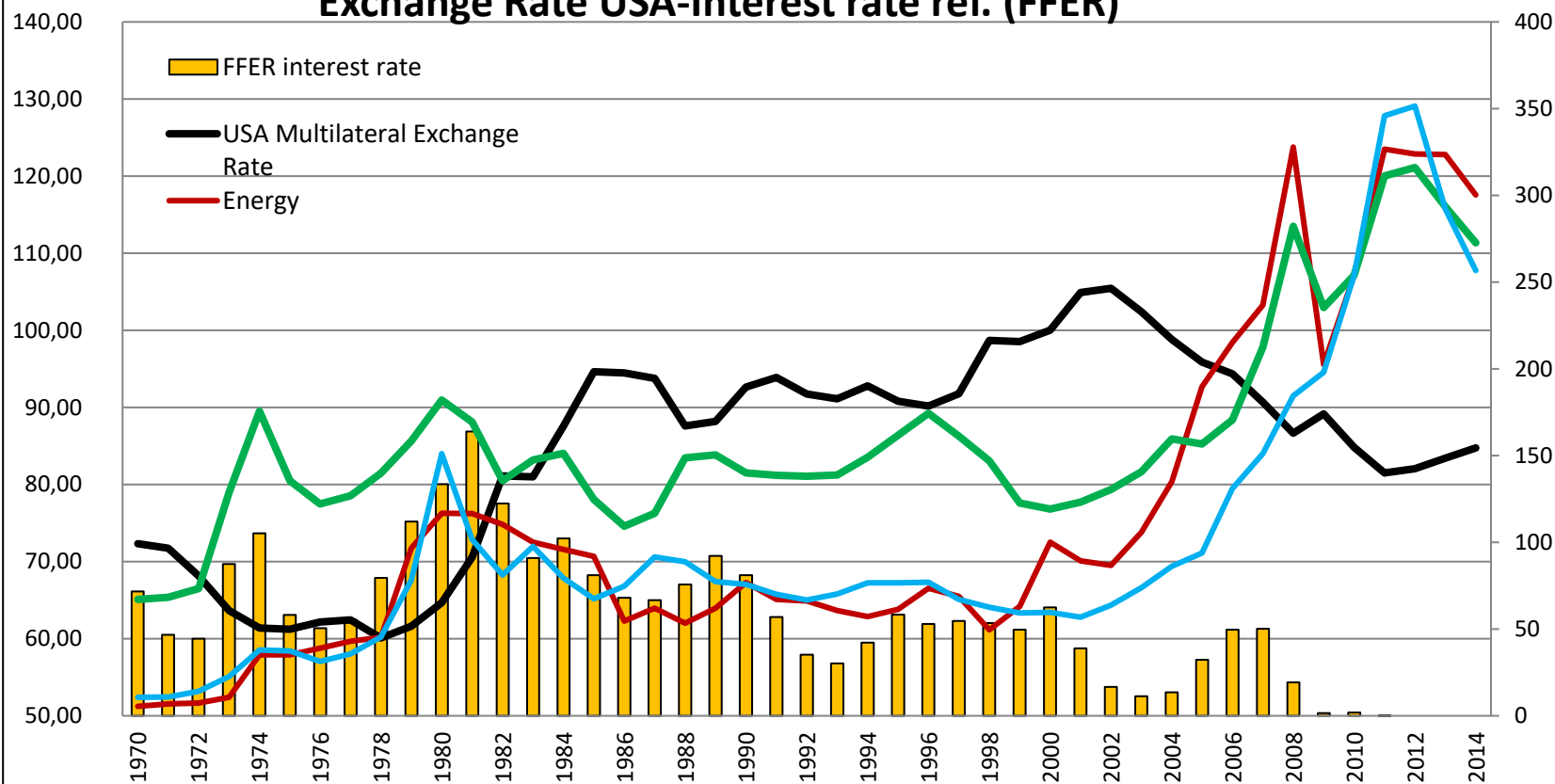
**Testing Resource Curse of Natural
Resource Rich Economies-
KLEMS+N aproach
*Special focus on Oil and Gas Latin-
American countries***

Ariel Coremberg
ARKLEMS+LAND

Centre of Studies of Productivity
University of Buenos Aires

Commodity prices boom during the first decade of 21st century impact on Natural Resource Dependent Economies by a significant consumption and GDP growth.

Agricultural, Energy and Metals Commodities Prices-Multilateral Exchange Rate USA-Interest rate ref. (FFER)



Source: ARKLEMS, FR, WorldBank

- However, present terms of trade reversion cast several doubts on the sustainability of their prosperity.
- Domestic Savings, human capital formation, productivity and management of natural resource abundance during the boom are key variables to sustain future economic growth in case of terms of trade reversion.

- Growth Accounting and Balance Sheet Vulnerability analysis does not usually include Natural Capital contribution to growth.
- The economic literature in terms of Dutch Disease and Resource Curse was not based on common metrics.
- Moreover, Standard Growth Accounting does not include Natural Capital as Input.

OBJECTIVES

- Discuss a new Asset Frontier based on Conditions under which Human and Non-Economic Natural Capital could be included in the SNA
- Common and Consistent Metrics of Different Types of Capital as Wealth, Input and Income Side (KLEMS+N approach)
- Testing the Methodology for Oil and Gas Dependent Economies

- SNA strict based on ownership rights principle:
economic assets: “those used in economic activity from which the owners can perceive profits by holding or using them in any economic activity”.
- Symmetry Analogy as Hulten, Corrado and Sichel did with intangibles: investment: all expenses in postponed consumption
- New Scope: Intangibles+ non SNA assets as +Durables + Enviromental and Non Enviromental Capital (vrg: TRR)+Human Capital

WELFARE AND SUSTAINABILITY GROWTH ASSET BOUNDARY (KLEMS+N approach)

NON FINANCIAL ASSETS

PRODUCED ASSETS

Fixed Assets

Inventories

Valuable objects

NON PRODUCED ASSETS

Natural Capital

Intangibles

Intangibles

Tangibles

Raw Materials and supplies

Precious stones and metals

Economic Resources

Non-Economic Resources

Leases and other transferable contracts

Mining and Oil Exploration

Dwellings

Work in progress

Antiques and other valuable objects

Subsoils Assets: Proved Reserves

Subsoils Assets: Unproved Reserves

Other

Software and Databases

Non Residential Construction and Infrastructure

Finished Goods

Others

Non-Cultivated Biological Economic Resources

Non-Economic Biological Resources

Originals of literature and artistic works

Machinery and Equipment

Goods to resale

Enviromental Economic Resources

Non-Economic Enviromental Resources

R & D

ICT

Transport Equipment

Land

Other

Investment in Firm-Human Capital Formation

Cultivated Assets

Marketing Assets: purchase goodwill, brand equity, design and advertising, etc.

Durable Goods owned by Households

HUMAN CAPITAL

other

Goodwill (include expectations of future earnings, urban land market value and overlapping other intangible assets and human capital)

$$\text{NATIONAL WEALTH} = \text{NON FINANCIAL ASSETS} + \text{INTERNATIONAL INVESTMENT POSITION}$$

NET FINANCIAL ASSETS/LIABILITIES AMONG RESIDENTS = 0

Reserve Assets

Money and Deposits

Securities and Other Debt Holdings

Loans

Stocks and Investment Funds

Others

Monetary Gold
Currency

Money
Deposits

Short and Long Term

Short and Long Term

and other participations

Commercial Credits and advances
Insurance Technical Reserves

INTERNATIONAL INVESTMENT POSITION

EXTERNAL FINANCIAL ASSETS

EXTERNAL FINANCIAL LIABILITIES

BY INSTITUCIONAL SECTOR:

FINANCIAL CORPORATIONS
NON FINANCIAL CORP
HOUSEHOLDS
GOVERNMENT
REST OF THE WORLD

SNA08 BOUNDARY-ownership criteria

WELFARE AND SUSTAINABILITY BOUNDARY

NATIONAL WEALTH

Sequence of Estimation of National Wealth

					INTERNATIONAL INVESTMENT POSITION ***	NATIONAL WEALTH
			FARMING LAND (MV) SUBSOIL ASSETS (NPV)	NON-FINANCIAL ASSETS		
		HUMAN CAPITAL+OTHER INTANGIBLES	WEALTH PRODUCED CAPITAL STOCK MV			
URBAN LAND		TANGIBLE WEALTH PRODUCED CAPITAL STOCK MV				
NET PRODUCED CAPITAL STOCK		TANGIBLE NET PRODUCED CAPITAL STOCK				
Machinery and Equipment	RC					
Transport Vechicles	RC					
ICT	RC					
Residential Buildings	RC					
Non Residential Buildings	RC					
Infraestructure	RC					
Other agricultural construction	RC					
Capital Livestock	MV					
Agricultural cultivated assets	MV					
Inventories	MV					

RC: equivalent replacement cost

MV: Market Value

NPV: net present Value

*** IIP bonds, stocks and other securities at market value

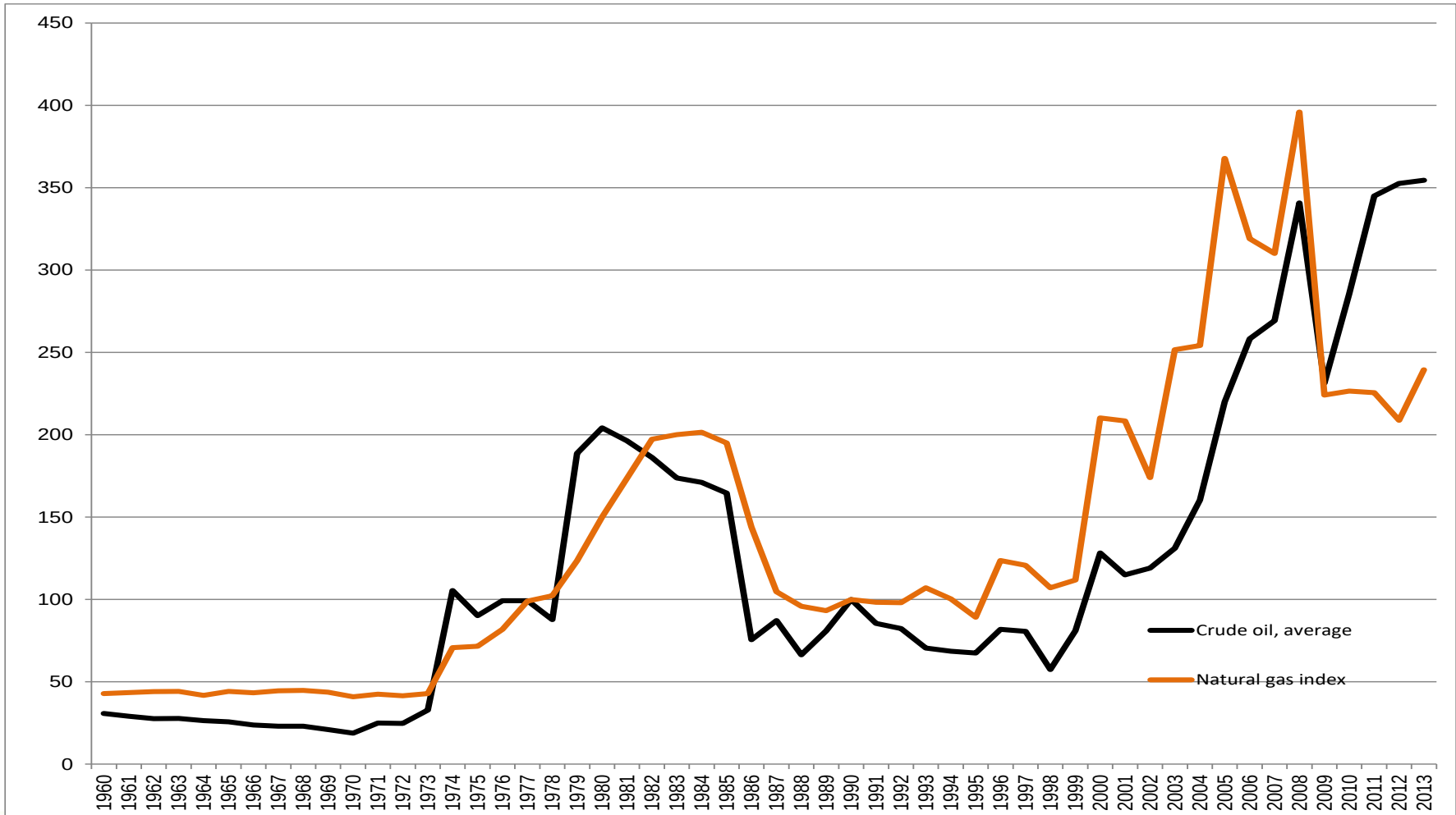
Consistent Metrics of Capital by Type and Concept: KLEMS+N approach

Table1: Capital Stocks by concept, type and methods

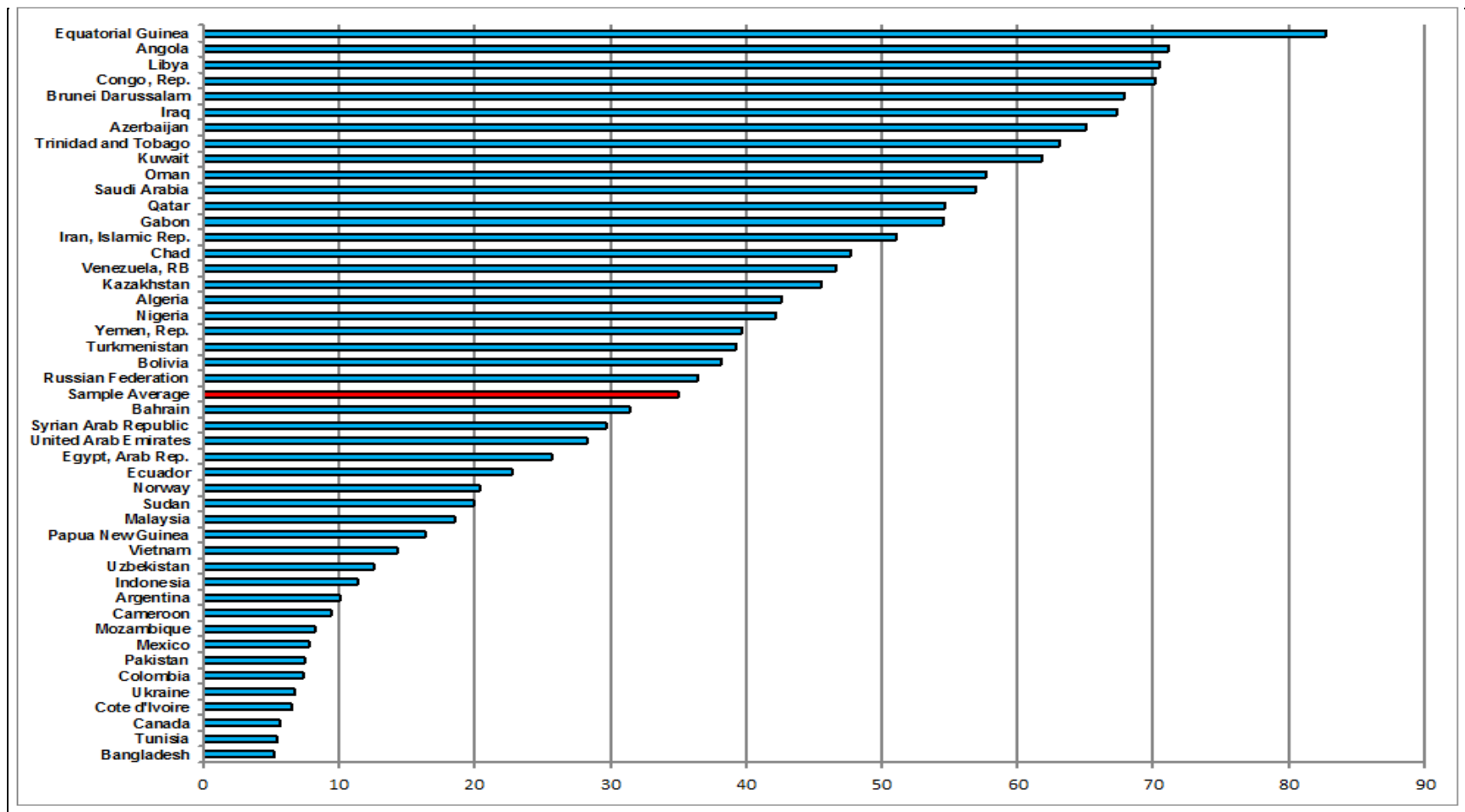
variables	Produced Capital	Human Capital	Natural Capital	Land	Subsoil Assets
TOTAL	KP	KH	KN	K _{land}	K _{subsoil}
WEALTH	Net Produced Capital at equivalent replacement costs adjusted by Urban Land	Lifetime per capita Income of Population at workage by Jorgenson-Fraumeni Approach	Natural Capital at market prices	Land at market prices by area	Subsoil Assets by Net Present Value of Future total rents
(1) $W = KP + KH + KN + IIP$	(2) $KP^W = KP_{\text{otherNonICT}}^{\text{net}} + KP_{\text{ICT}}^{\text{net}} + KP_B^{\text{net}} * \left(\frac{Pm}{Pc}\right)$	(4) $KH_t^W = \sum_{g,a,e} lli_{g,a,e,t} n_{g,a,e,t}$	(5) $KN^W = K_{Land}^W + K_{subsoil}^W$	(6) $K_{Land}^W = \sum_i p_i^{\text{land}} * ha_i$	(7) $K_{subsoil}^W = \sum_{n=t}^{t+T-1} \sum_i \frac{r_j^S q_j}{(1 + \rho_j^S)^{n-t}}$
SERVICES	Produced Capital value at user cost by type	Labor Composition Change	Natural Capital Services Inputs	Land Areas value by unit rents	Material Extracted value by unit rents
	(8) $\frac{K_t^P}{K_{t-1}^P} = \prod_{i=1}^n \left(\frac{K_{it}^P}{K_{it-1}^P} \right)^{\frac{1}{2}(v_{it} + v_{it-1})}$ $V_{i,t} = \frac{u_{i,t}^K K_{i,t}}{\sum_n^n u_{i,t}^K K_{i,t}}$ $u_i(t) = [r(t) + \delta_i - \rho_i(t)] \dot{P}_i^e(t)$	(9) (10) $\Delta \ln L = \sum_j \bar{s}_{j,t} \Delta \ln H_{j,t}$ $s_{j,t} = \frac{w_j H_{j,t}}{\sum_j w_j H_{j,t}}$ $\Delta \ln L^Q = \bar{\alpha}_L (\Delta \ln L - \Delta \ln H)$	$KN^S = K_{Land}^S + K_{subsoil}^S$	(11) $K_{Land}^S = \sum_i r_i^{\text{land}} * ha_i$	(12) $K_{subsoil}^S = \sum_j r_j^S q_j$
INCOME NNY	$Y - \delta_{KP^W} KP^W$	I_{KH^W}	$-\delta_{KN^W} KN^W$		
Genuine Savings Sg	$S - \delta_{KP^W} KP^W$	I_{KH^W}	$-\delta_{KN^W} KN^W$		

Are Oil and Gas Rich Economies rich?
Paradox: poor-low wellbeing
resource-exporting countries

Crude Oil average price and Natural Gas real price Index-2010 US dollars (1990=100)



Share of Oil and Gas Rents in Oil and Gas dependent countries GDP



Share of Oil and Gas Rents in Oil and Gas dependent countries GDP

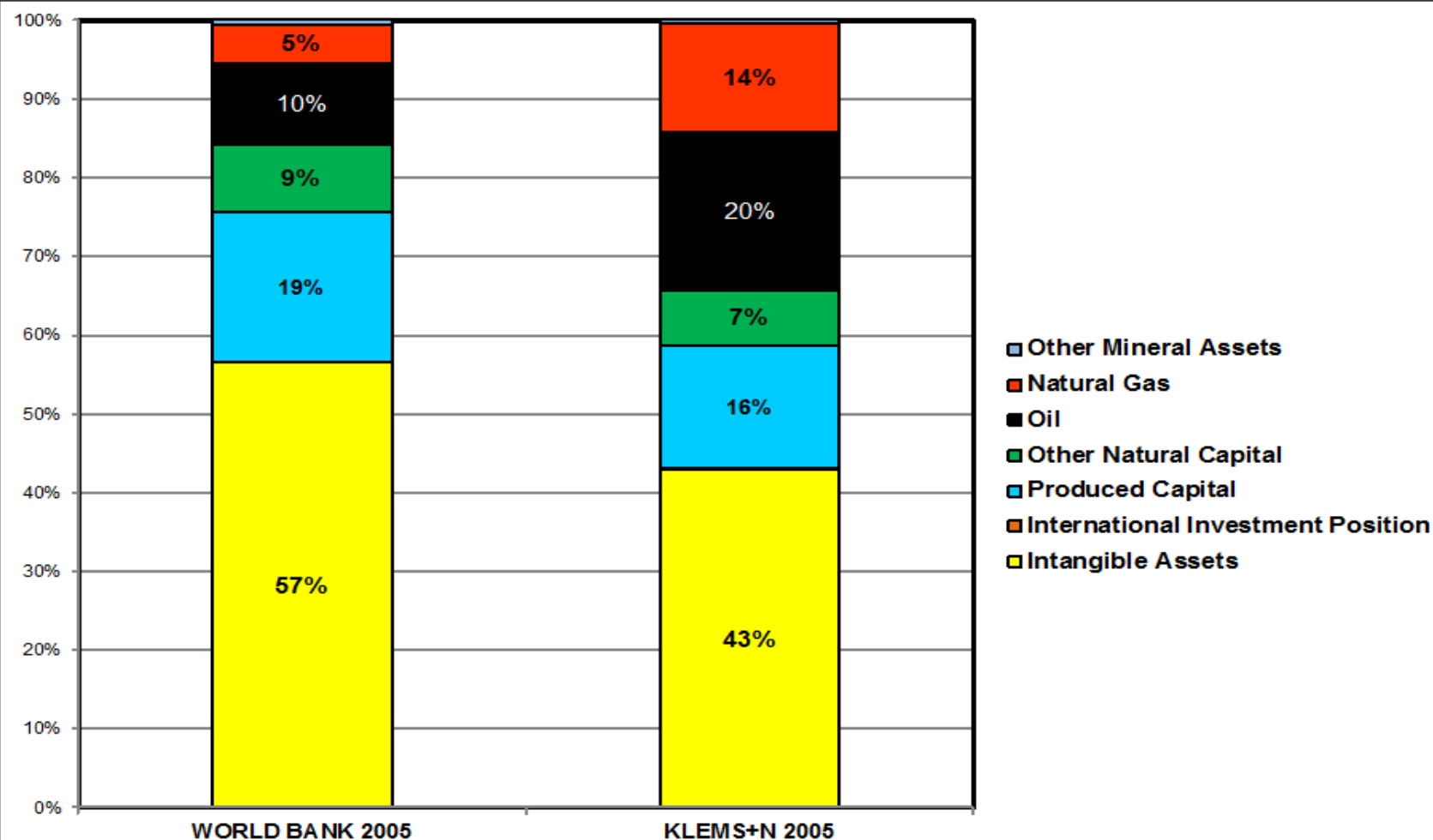
Table3: Wealth of Oil and Gas dependent countries group

Wealth	Level	Per Capita	W/GNI	GNI per Capita
	US\$ billions			
Oil and Gas countries	93.230	57.877	17,3	3.348
OECD	556.552	583.490	16,5	35.370
Low Income	4.452	6.441	16,3	396
Middle Income	143.410	32.617	15,7	2.076
High Income	574.904	567.802	16,6	34.237
World	786.519	128.927	17,8	7.254

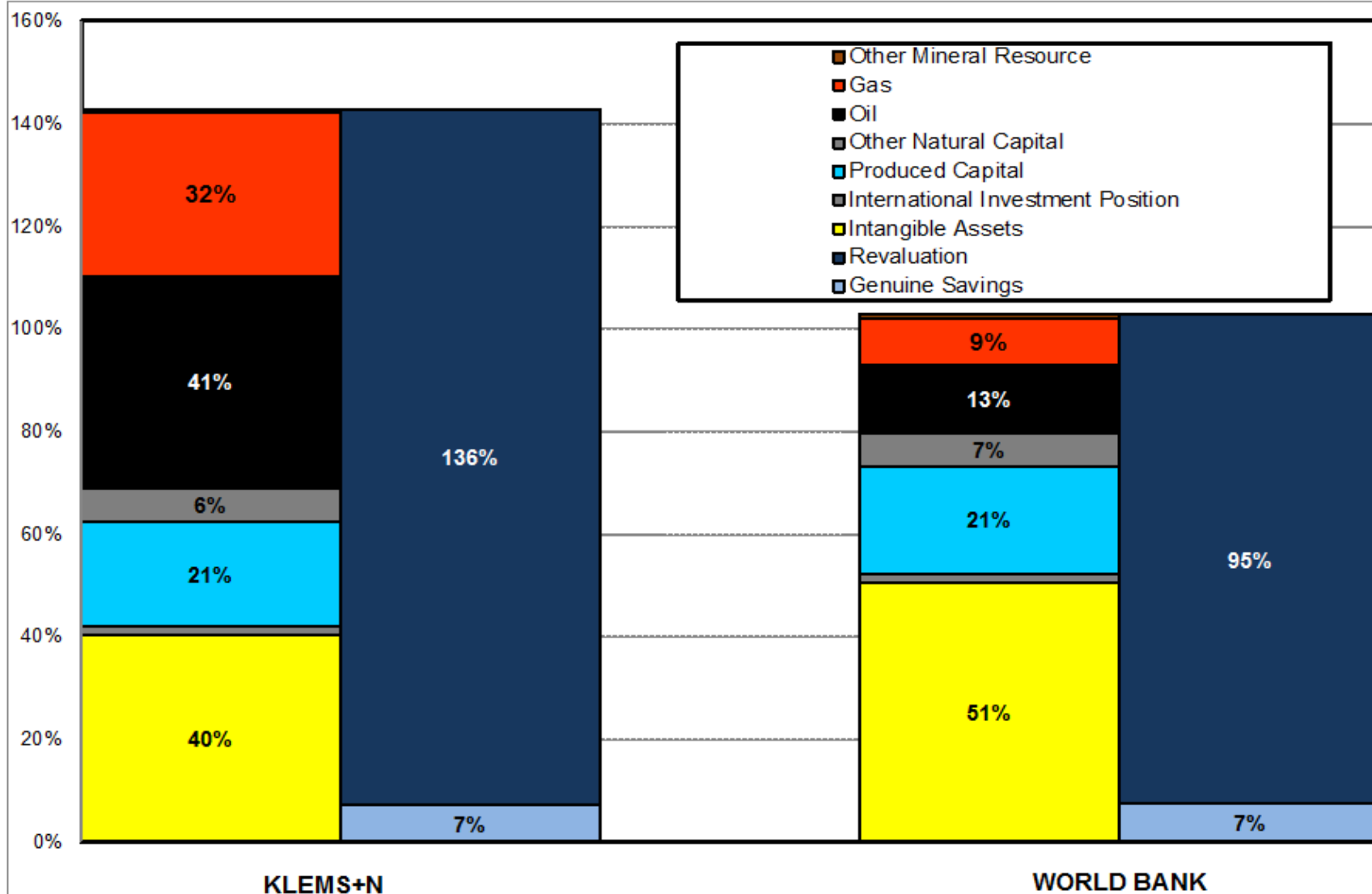
Table4
Oil and Gas Wealth of Oil and Gas dependent countries group
for 2005
-u\$ billions-

	Oil	Gas
WORLD BANK	8.273	3.900
KLEMS+N	19.449	13.475

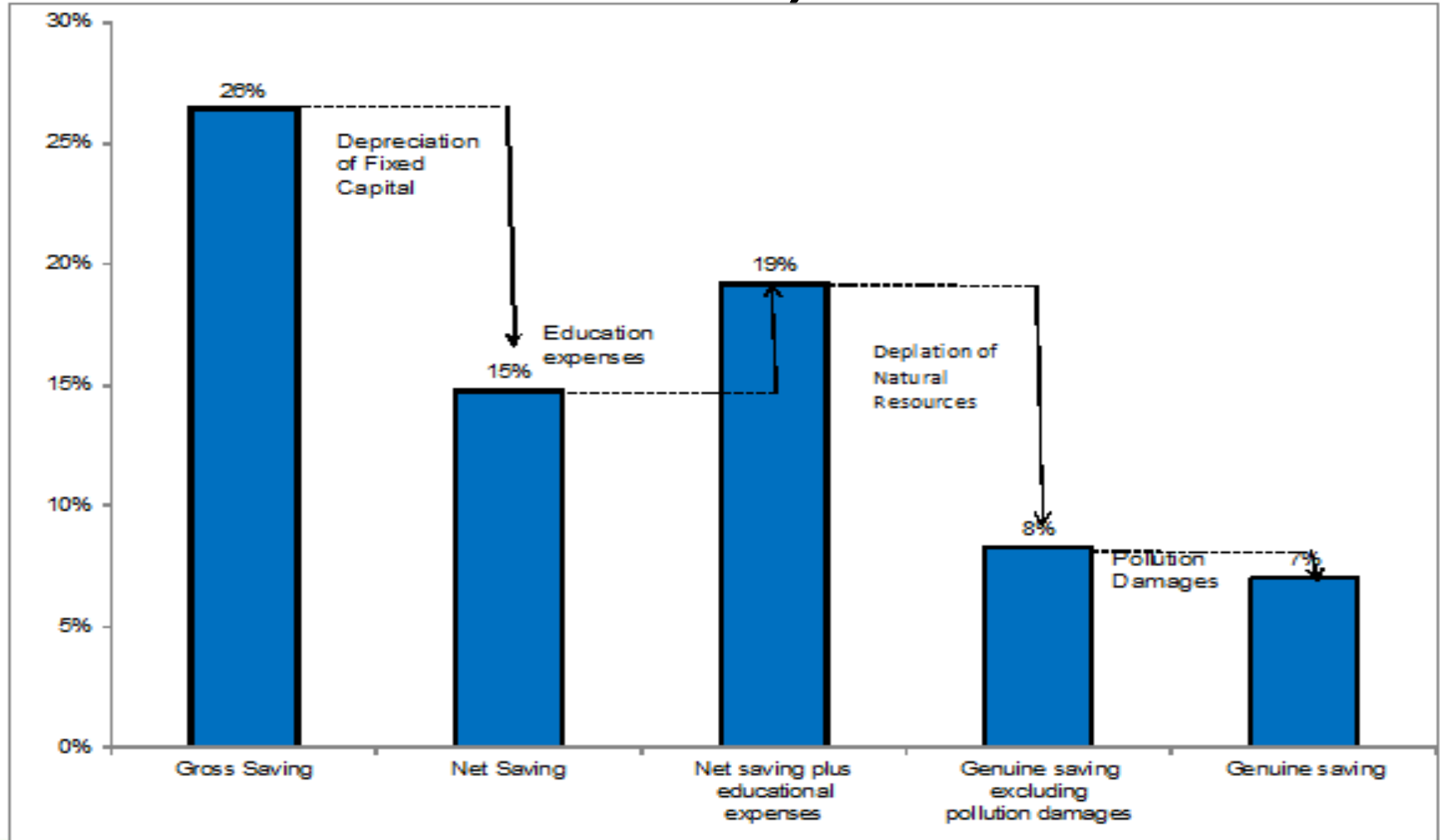
Wealth composition of Oil and Gas countries group 2005, World Bank and ARKLEMS estimation.



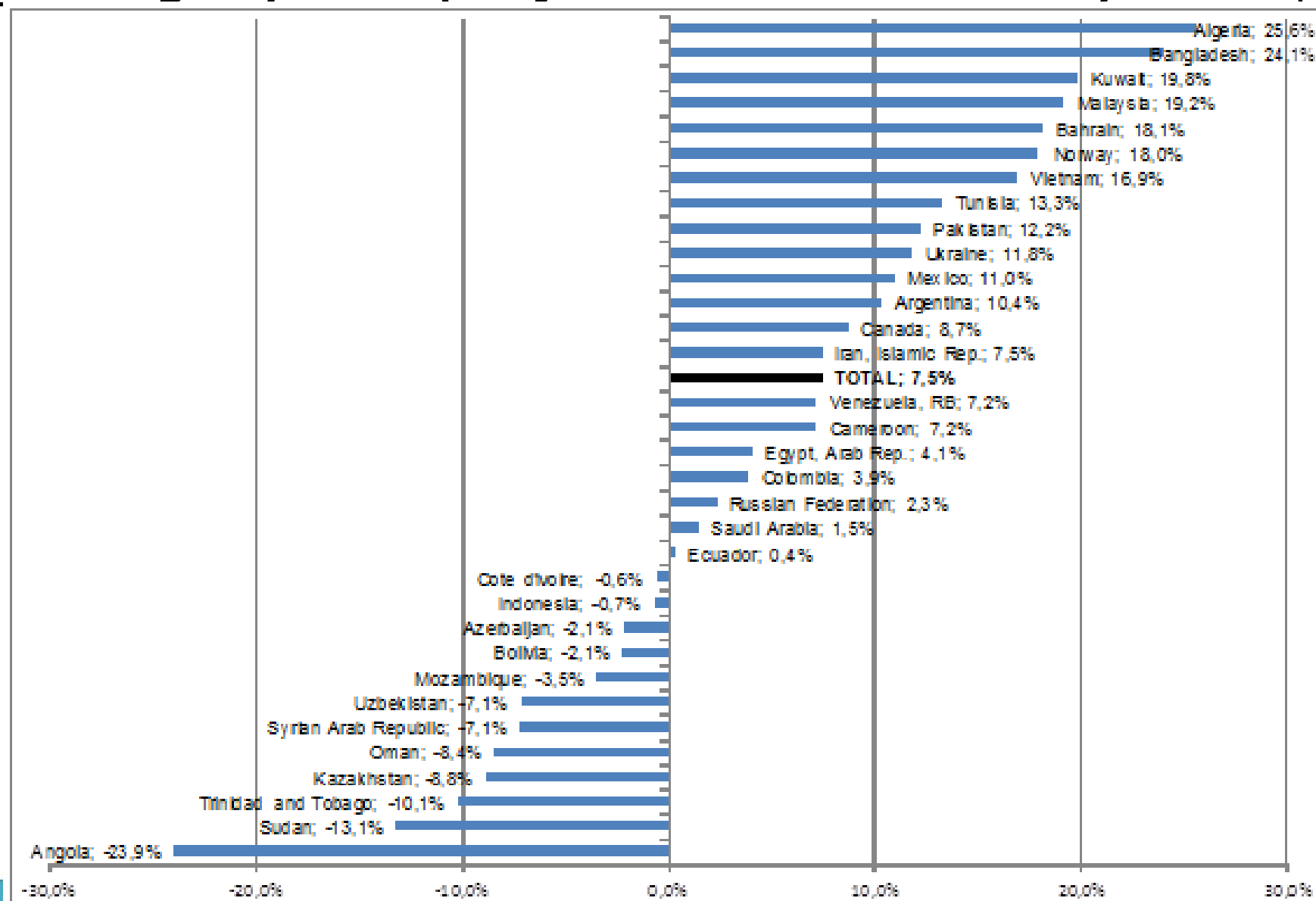
Wealth Change of Oil and Gas countries group 2005, World Bank and KLEMS+N estimation.



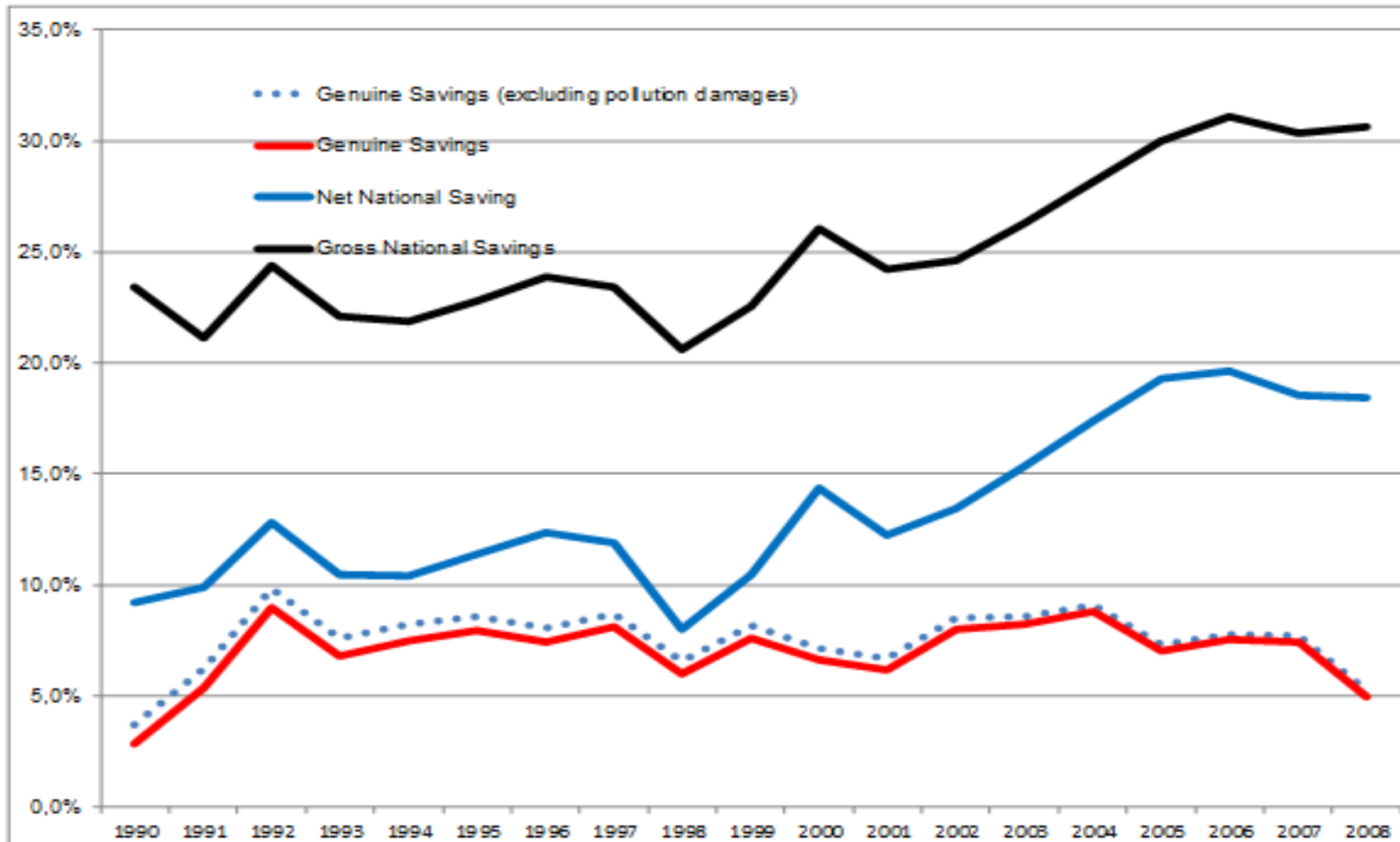
Components of Genuine Savings for Oil and Gas countries group 1990-2008 (% of Gross National Income).



Ranking of Genuine Savings for Oil and Gas countries group 2007 (% of Gross National Income).



Genuine Savings for Oil and Gas countries group 1990-2008. (% of Gross National Income).

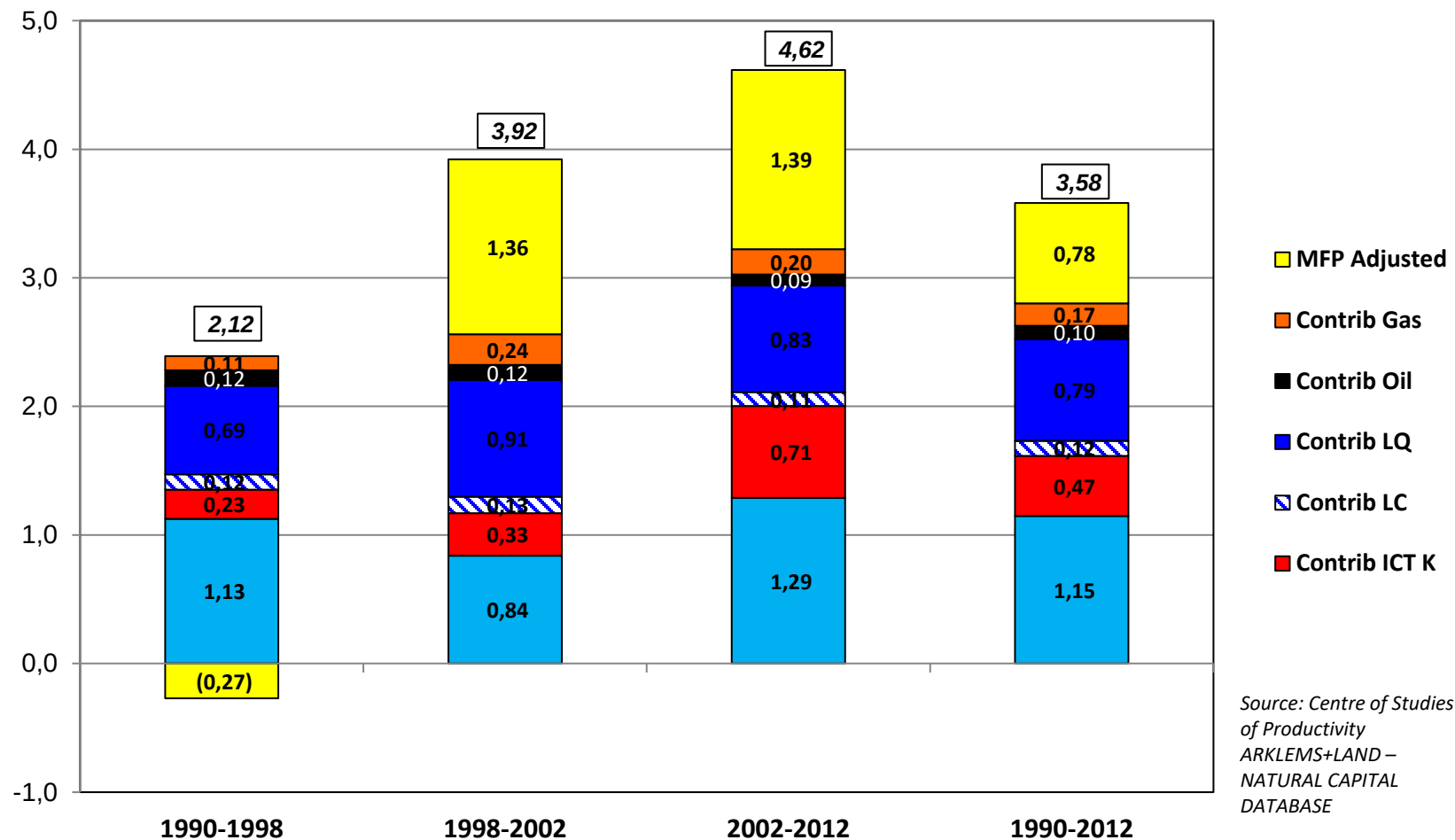


KLEMS+N Growth Accounting for Oil and Gas richer countries

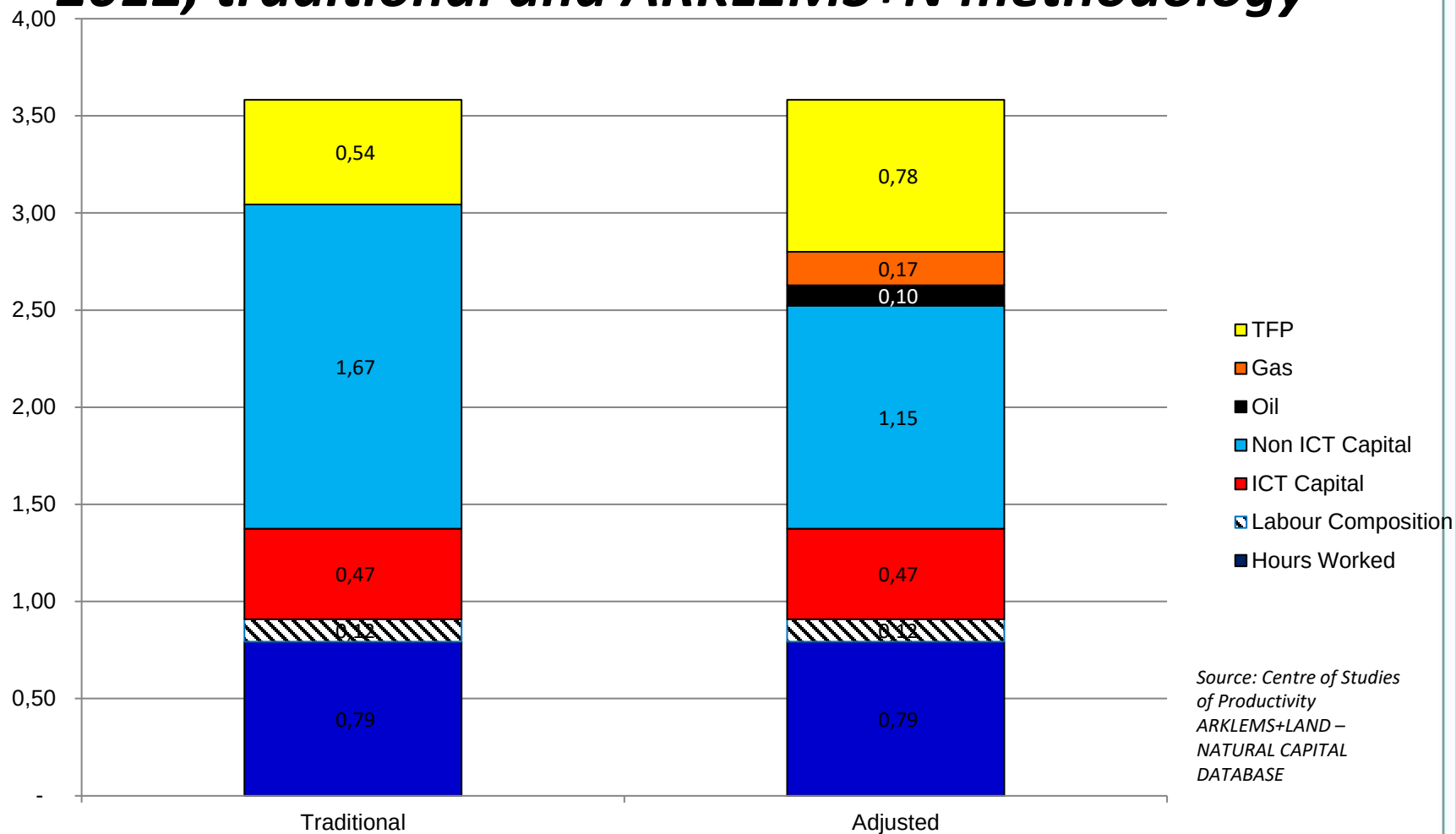
- $$\frac{d \ln MFP}{dt} = \frac{d \ln Y}{dt} - \sum_{i=1}^N \frac{u_i K_i}{C'} \frac{d \ln K_i}{dt} + \frac{wL}{C'} \frac{d \ln L}{dt}$$
- $$\frac{d \ln GMFP}{dt} = \frac{d \ln Y}{dt} - \sum_{i=1}^N \frac{u_i K_i}{C} \frac{d \ln K_i}{dt} + \sum_{j=1}^M \frac{u_N K_N^S}{C} \frac{d \ln K_N^S}{dt} + \frac{wL}{C} \frac{d \ln L}{dt}$$
- $$\frac{d \ln GMFP}{dt} = \frac{d \ln MFP}{dt} + \frac{u_N K_N^S}{C} \left(\frac{d \ln Z}{dt} - \frac{d \ln K_N^S}{dt} \right) \text{ exog. } u$$
- $$\frac{d \ln GMFP}{dt} = \frac{d \ln MFP}{dt} + \frac{u_N K_N^S}{p_Y Y} \left(\frac{d \ln K}{dt} - \frac{d \ln K_N^S}{dt} \right) \text{ endog. } u$$

- $$\frac{d \ln GMFP}{dt} = \frac{d \ln MFP}{dt} + \frac{u_N Q_N}{p_Y Y} \left(\frac{d \ln K_{nonICT}}{dt} - \frac{d \ln Q_N}{dt} \right)$$
- *I.* $d \ln K_{nonICT} < \frac{d \ln Q_N}{dt} \rightarrow \frac{d \ln GMFP}{dt} < \frac{d \ln MFP}{dt}$. If natural resource service growth rate is higher than the volume change of K_{nonICT} , traditional MFP was positive biased. Actually, GMFP is less dynamic.
- *II.* $d \ln K_{nonICT} > \frac{d \ln Q_N}{dt} \rightarrow \frac{d \ln GMFP}{dt} > \frac{d \ln MFP}{dt}$. The natural resource service growth rate is lower than the volume change of K_{nonICT} , MFP is negatively biased. So effective GMFP growth is higher.
- *III.* $d \ln K_{nonICT} \cong \frac{d \ln Q_N}{dt} \rightarrow \frac{d \ln GMFP}{dt} \approx \frac{d \ln MFP}{dt}$. If both included and non-included inputs grow at the same rate, there could be no bias in measured MFP.

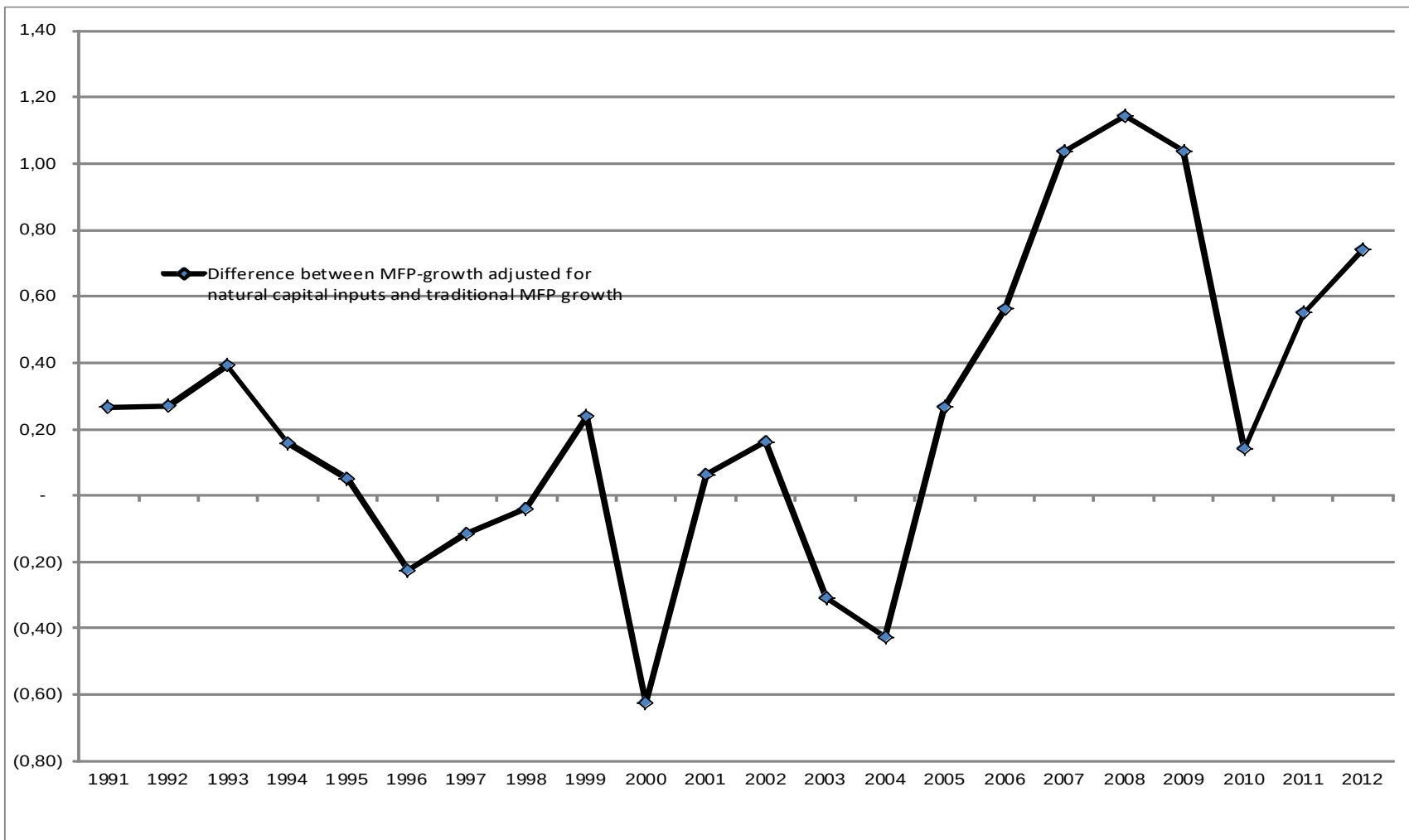
Oil and Gas Growth profile 1990-2012



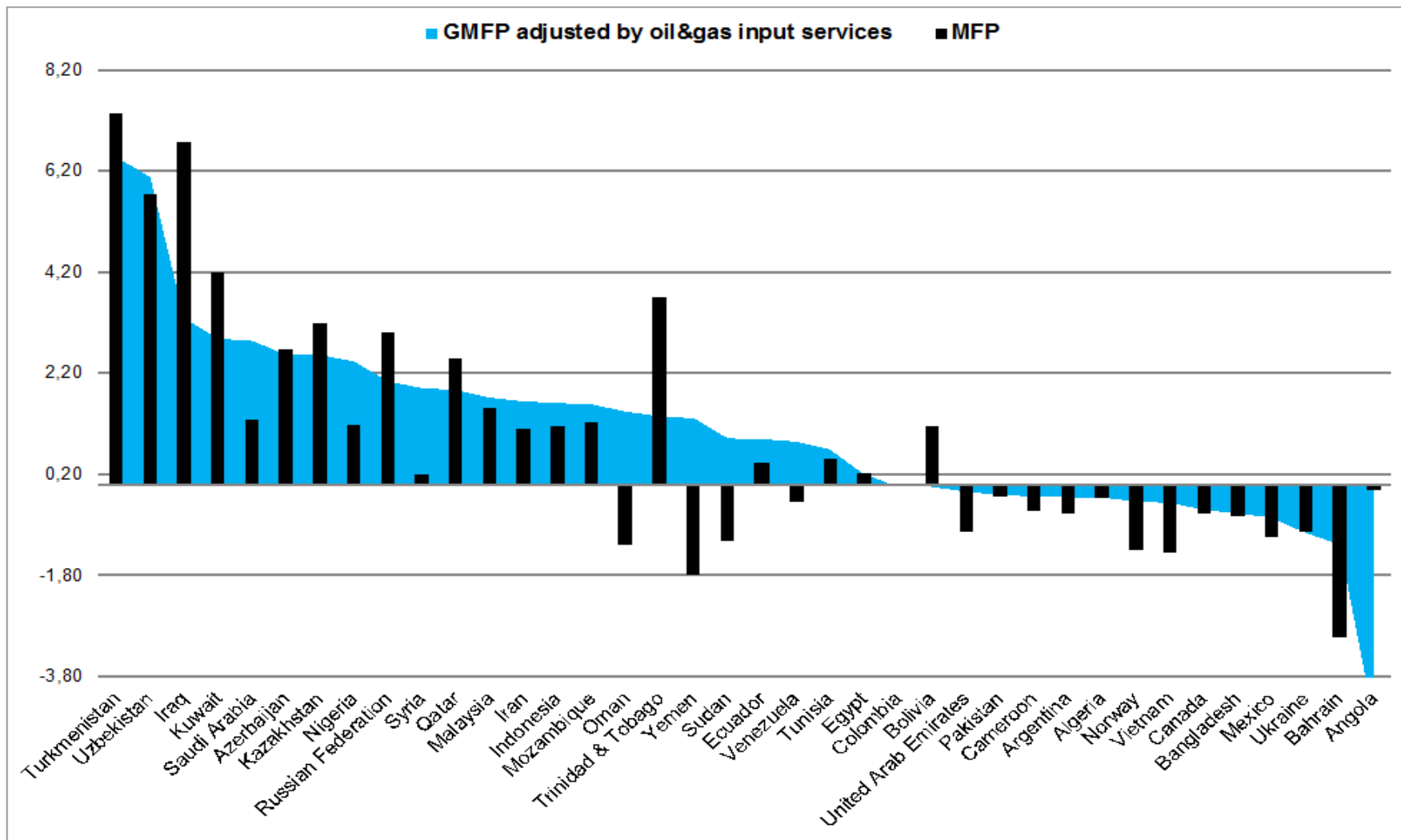
Growth Profile for Oil and Gas richer countries 1990-2012, traditional and ARKLEMS+N methodology



Difference between MFP and GMFP growth 1990-2012



GFMP and MFP annual growth in oil and gas dependent country (+China and USA) 1990-2012



- Traditional MFP is negative biased for the Oil&Gas group: adjustment is relevant. But heterogeneous between countries.
- $GMFP > MFP$ for Big Players Saudi Arabia, Nigeria, Iran, Indonesia, Ecuador, Venezuela, Mexico, United Arab Emirates, Algeria, Norway, Canada
- $GMFP < MFP$ Colombia, Bolivia, Ukraine and Angola; Iraq, Kuwait, Azerbaijan, Kazakhstan, Russian Federation, Qatar and Egypt.

CONCLUSION

- Oil and Gas Dependence range from 5% to >50% of the GDP: relevant issue
- Oil and Gas group National Wealth is $\cong$ 60% higher than Middle Income Group. W/GNI $\cong$
- Wealth Effects explains almost total Change of Wealth of Oil and Gas Dependent Countries. (55% by natural capital)

Some Signals of Resource Curse During Commodities Prices Boom

- Gross Savings grew from 23% to 30% of GDP
- Genuine Savings keep constant $\cong 7\%$ of GDP

But GDP accelerates during the Boom thanks of GMFP

- GDP accelerates from 2,1% (1990-1998) to 4,6 (1998-2012)
- Thanks of GMFP which changed from -0,3% to +1,4 (30% contribution), Oil&Gas services contribution decrease but factors contribution were nearly 70% of GDP growth
- MFP is negative biased for the Oil&Gas group: adjustment is relevant. But heterogeneous between countries.
- $GMFP > MFP$ for Big Players Saudi Arabia, Nigeria, Iran, Indonesia, Ecuador, Venezuela, Mexico, United Arab Emirates, Algeria, Norway, Canada
- $GMFP < MFP$ Colombia, Bolivia, Ukraine and Angola; Iraq, Kuwait, Azerbaijan, Kazakhstan, Russian Federation, Qatar and Egypt.

- **The methodology proposed is attainable to apply. This allows to consistent inclusion Welfare and Sustainability issues in the core of SNA as Stiglitz, Sen Fittousi concerns about overconsumption, welfare and development sustainability.**