

Why the Top 5-6 original Oil richest Arab countries as well as some fast moving cognitive skill nations should be treated as outliers in the regression analyses for the relationships between the economic growths vs. the cognitive skills.

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(Draft 1)

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### Abstract

In this short paper, I demonstrated that why the top 5-6 original oil richest countries need to be excluded from most of the socio-economic vs. cognitive skill regressions because they will remain as outliers far too much out to the otherwise very reliable and stable regression growth coefficients and explanation powers of the models involved. I included some simple linear regression charts where they are far out in North West corners of the regression lines; their GDP per capita had reached the top tier of the world by the 70s already with the minimal cognitive skills and education inputs; I provided their relative economic strength compared to the economic miracle powers from the Eastern Asia: 4 Asian Tigers and China so that you can see their super rapid rises were all due to their oil-based economies; their top 6 shares of the Natural Resource rents as percent of capita over the past 40 years. I believe that these 4 key factors may allow anyone serious about any serious regressions that involve the socio-economic regressions to exclude these 5-6 countries in their analysis. Finally I made a brief comment about the polar opposite to these countries with the poor economy with the rapid gains of the cognitive skills.

NOTE: this paper is provided for the various regressions that the author, Dongchan Lee, has been using for the online working paper series that Lee publishes in January of 2017. For the updated publications, you may frequently visit the web page.

Key words: Economic impacts of the oil, cross-country growth model, test score data, education policy, PISA, TIMSS, MMU1, and USL

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## The key summary:

The basic thesis of this paper about the top 5-6 original, oil richest Middle Eastern countries is summarized as follows.

- 1) **Natural Capital:** Before the international cognitive skill assessments like TIMSS or PISA started, the collective real GDP per capita of these top 5-6 oil-richest countries had been on the top of the world and had been mostly collapsing and barely recovering with few exceptions.<sup>1</sup>
- 2) **Low Human Capital:** Their mean school years were barely in the middle of the Primary school in average before these countries rose to the richest nations on earth by 1950s-60s.<sup>2</sup>
- 3) **Low Knowledge Capital:** as their earlier cycle of the PISA or TIMSS participations showed the very low scores in all 3 subjects of math and science.<sup>3</sup>
- 4) **North West corner of the PISA and TIMSS for in 2000s and at least till 2012 as the largest outliers:** If you look at either PISA or TIMSS math or science assessments of any given years for the past 15-20 years, all these top 4-5 oil richest countries (and Saudi has never participated and Bahrain barely as well) have been near the North West corners compared to the straight line regression lines where we see the expected Log of the real GDP per capita vs. these international assessment test scores, which have been normalized and standardized based on the growths of the STDEV (Standard Deviation) advancements of the math, reading, and science scores.<sup>4</sup>

As such, these hyper oil-richest and the fastly rising cognitive skill-based nations should be excluded from the regressions that deal with the socio-economic growths vs. the cognitive skill growths for now.

## The polar opposites to these low Human Capital, Low Knowledge Capital, and the top Physical Capital-based top oil-richest 5-6 countries

On the other hand, the opposite to these super rich oil richest - which have been mostly Arab countries - are some newly and rapidly rising North Eastern Asian countries like Vietnam, some provinces of China, and some from the South East corners of these regression analyses between the real GDP per capita vs. the normalized international scores. Either one of these two groups tend to completely kill the  $R^2$  (to destroy the reliability of the regressions) and the correlations coefficients (drastically lowering the slopes of the regressions).

Why is that so? To illustrate, here I will include a couple of the typical regression charts.

First for the outliers from the oil richest nations.

For TIMSS math

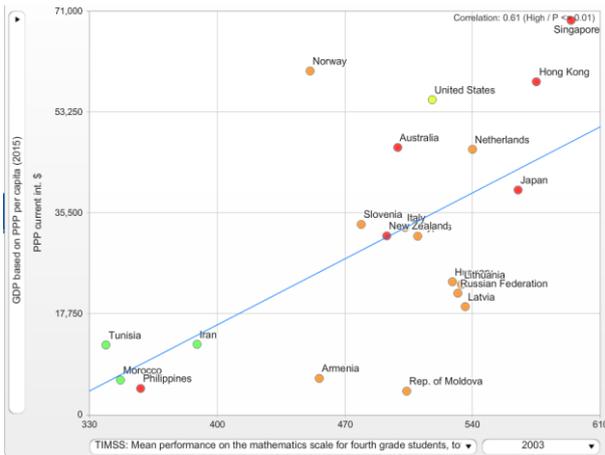
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<sup>1</sup> Brunei was at the same league, but Brunei seems to never have participated in any major international cognitive skill assessments. So we wouldn't consider Brunei.

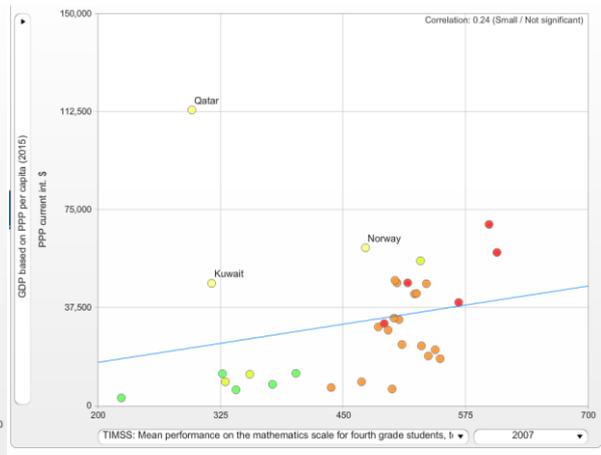
<sup>2</sup> I will provide the visual charts to show conclusively that there was no space or enough time for the Human capital could have contributed to their growths in an upcoming paper.

<sup>3</sup> The author will provide the concrete evidences in the upcoming papers. For Qatar and UAE between the mid-2000s by 2012 in PISA, their math or science scores were 300s or at best early 400s. For Kuwait and Bahrain, they could barely cross 400 in TIMSS by later 2000s.

<sup>4</sup> TIMSS had only Math and Reading tests while PISA has all three subjects.



In this 2003 TIMSS, only Norway (the richest western oil-rich countries) rise far above the regression line.

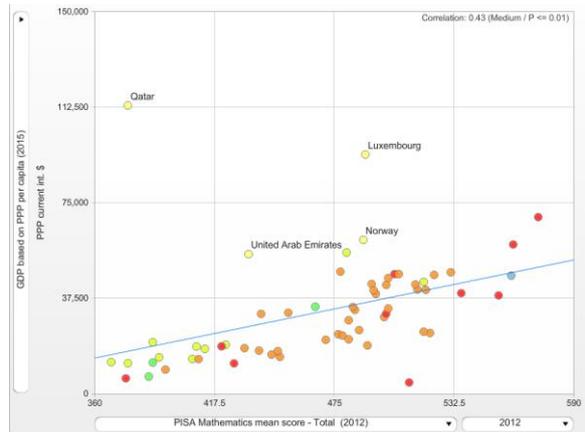
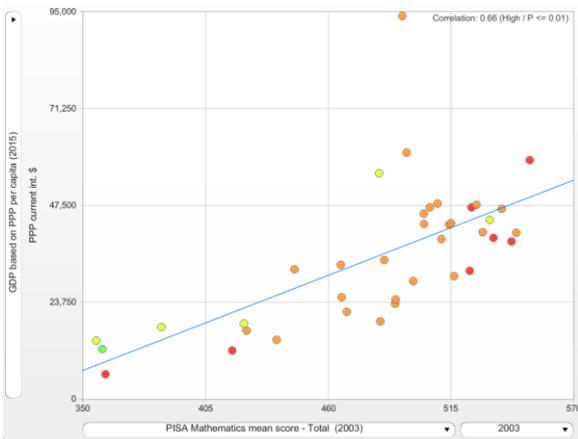


In 2007 TIMSS however, Qatar and Kuwait appeared in the North West of the regression line, completely dwarfing the Norway we saw on the left chart.

For PISA math

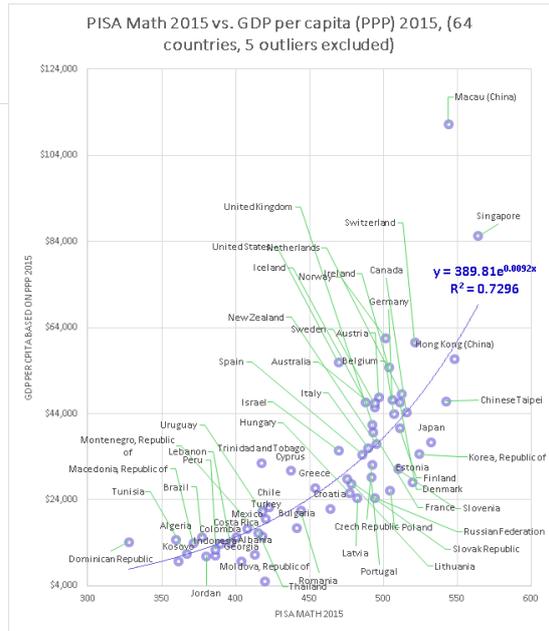
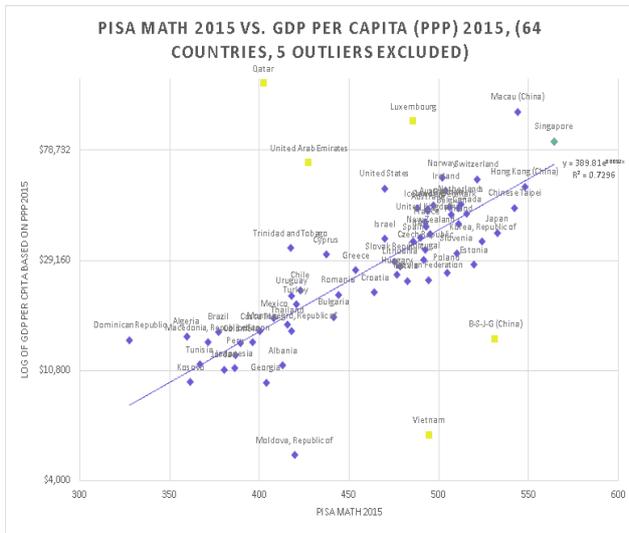
In 2003 without any of these oil richest Arab nations in PISA.

In 20012, 2 oil-richest Arab nations appeared. And the big outlier red dot in 2012 in the South East is Vietnam.



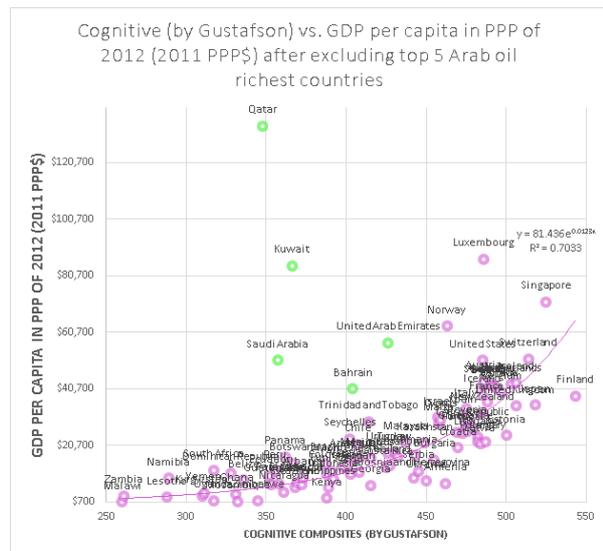
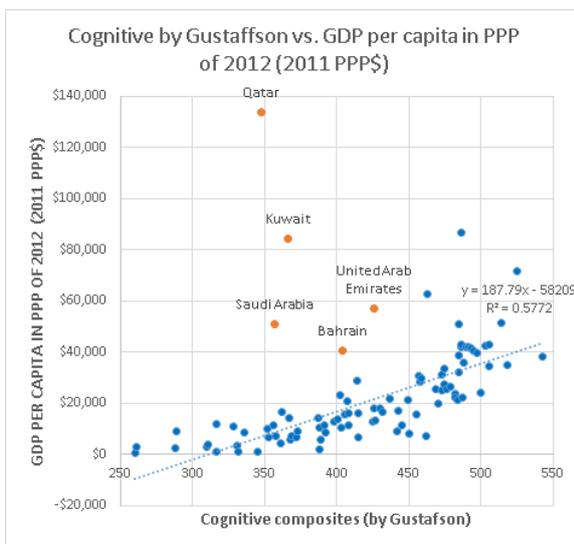
Source: Statsilk based on World Bank WDI data (access date of December 29<sup>th</sup>, 20160

The 5 outliers in the yellow colored squares. Actually this has 4 outliers, not 5 because B-S-J-G of China are 4 provinces, not the randomly selected entire China sub-population of students.



Source: PISA 2015 math and the GDP per capita from World Bank WDI 2016 December

For the PISA 2015 or all other assessments, any province's partial participations shouldn't be allowed for the international level assessments. As such, Shanghai for the 2012 PISA or 4 provinces of China (B-S-J-G) where Shanghai was a part of them will be excluded from the regressions of this types for the international national comparisons because the provinces like Shanghai in China or Massachusetts in USA will be 0.5-1 Standard Deviation higher than the national average cognitive skill scores. For instance in B-S-J-G of China 2015 PISA is already about 0.9 Standard Deviation of PISA 2012 math results when only Shanghai participated. Furthermore when the regular randomly selected parts of China is included in the PISA math assessment, I estimate that the current Chinese average may be somewhere between 430-490 in PISA math.



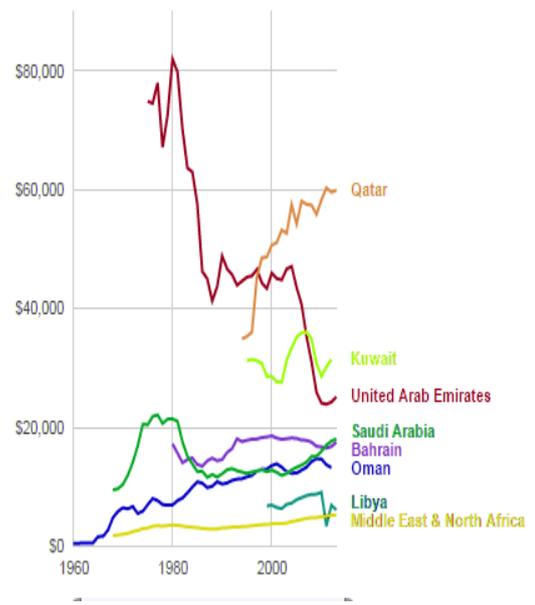
Source: Gustafsson's normalized composite cognitive skill estimations and the GDP per capita from World Bank WDI 2014

Both of these 2 polar opposite groups from the North West corner of South East corners of the regressions stay as huge outliers, destroying both of the regression growth coefficients and  $R^2$  because their distances are too far off because the oil richest 5-6 countries are very rich with the very low cognitive skills, especially the math. The fast movers from the South East have managed to advance their cognitive skills, especially the math, but they have grown so fast that their economic equivalent status may need 2-3-4 decades to have the commensurate levels that fit to the typical regression analysis.

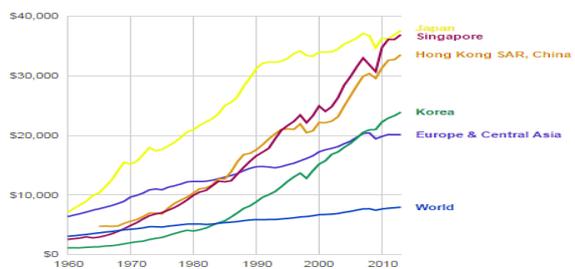
Real GDP per capita (international dollars) over 50-60 years of time span.

The 4 Asian Tiger countries rising very rapidly, but there were some others who got there much faster and earlier.

The original Oil rich Countries. Notice that they were far up earlier.



Notice that the rapidest rising 4 Asian Tigers in 40 years barely to the levels of the top 5 oil richest nations before the oil crisis of the 70s.

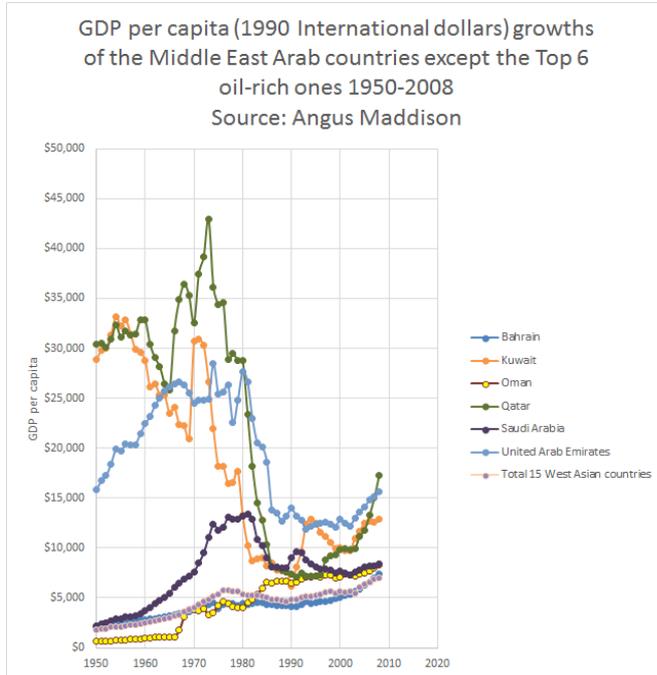


Source: Google data (retrieved in 2014)

Note the massive economic collapses of these top 6 original oil richest Arab nations till the oil crisis rattled them to collapse reducing their GDP per capita to 1/2-1/3 of their previous GDP per capita in the mid-70s.

Source: Google data (retrieved in 2014)

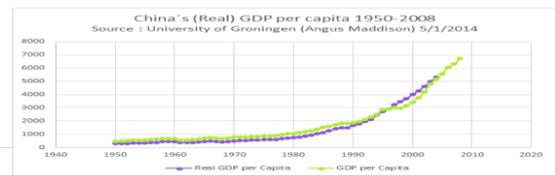
### Middle East Top 6 oil-rich countries



To give you more tangible perspective of how possibly these previously poor Arab countries were suddenly very rich by mid-20<sup>th</sup> century.

In comparison, the colossal economic rise (GDP per capita here) of China since the middle of 20<sup>th</sup> century looks like a total dwarf.

Source: data based on the data from Angus Maddison 2008



Source: data based on the data from Angus Maddison 2008

By 1950, most of the western nations' GDP per capita were below \$10-12,000 and they built their modern economy based on the knowledge and education-based economies. These top 6 oil-richest countries – especially the original top 4 without UAE and Oman had reached the GDP per capita over \$20,000 by 1960 and went up further before the oil crisis in the 70s made them collapse.

The original top 6 oil-rich countries - 5 of which were the Arab countries - grew their GDP per capita 30-50 times in just 10-35 years or so till the oil shock stopped their massive growths, which was never repeated ever since. Even the 4 Asian Tigers and China took about 50 years to increase their GDP per capita by about 20-25x.

### So how long did it take for the top 5 oil richest countries to get to the top of the world?

To see is to believe this. It looks as if it took only 10-30 years or so to ascend near the top of the world GDP per capita. What the USA took 80-90 years from about 10k USD to 40 k USD in real GDP per capita, these countries achieved in just 5-25 years!

### Top 5 original oil rich countries vs. the USA.

These original top 5-6 oil richest countries soared to the world's richest real GDP per capita in just 10-30 years of times frame, too short to build any much of mean school years or to raise the cognitive skills. To show the stark contrast, I put the USA in the yellow thick trajectory of the GDP per capita growth (in PPP). Compared to the yellow fat tracks by the USA, these top oil-richest ones

have risen steeply and fallen after the oil crisis, but still they have been afloat among the richest or very richer parts of the world.

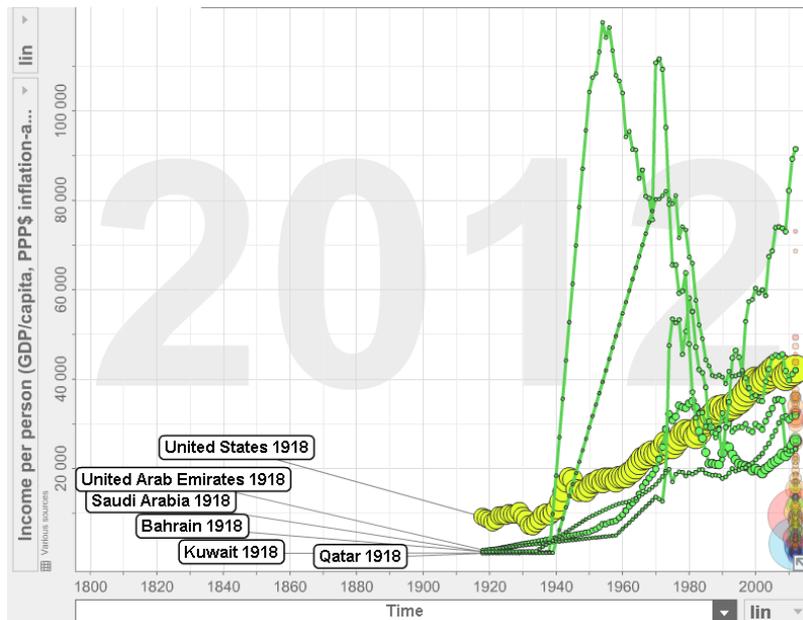
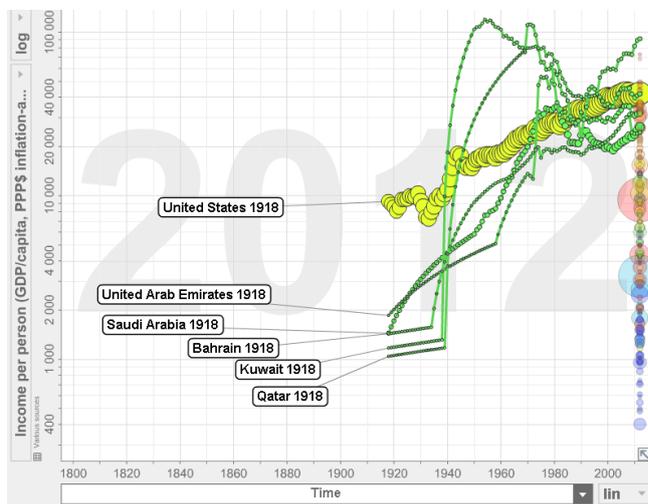


Photo credit: from Gapminder (retrieved in December, 2016)

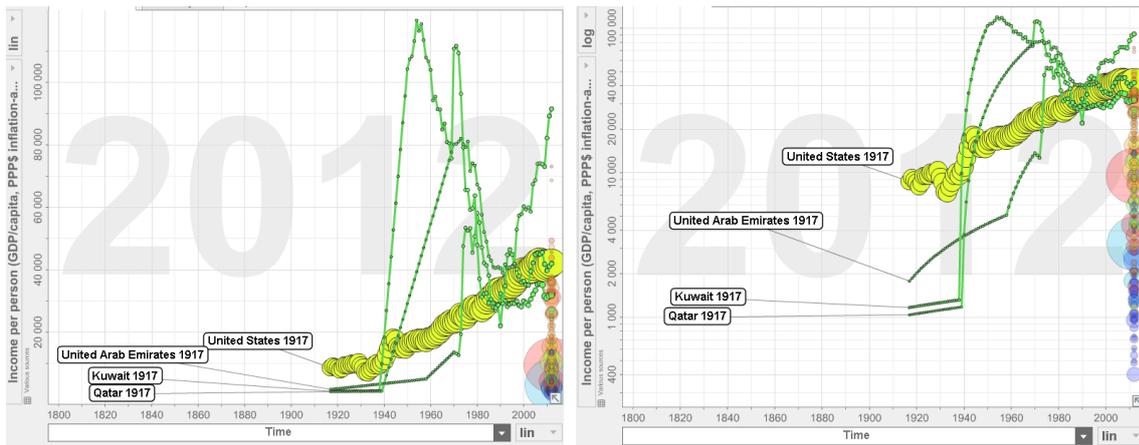
To make you see more clearly the difference between these top 6 original oil-rich Arab countries, I converted the above chart to have log scale on the vertical axis of the GDP per capita.



Source: Gapminder based on the data from Angus Maddison 2008

If these economic growth contrasts between the top 5 oil richest Arab countries compared to the 4 Asian tigers and China do not convince you, let's look at the contrast between the real GDP per capita growth trajectory of these 5 countries against the growth speed of the USA in the early mid-20<sup>th</sup> century.

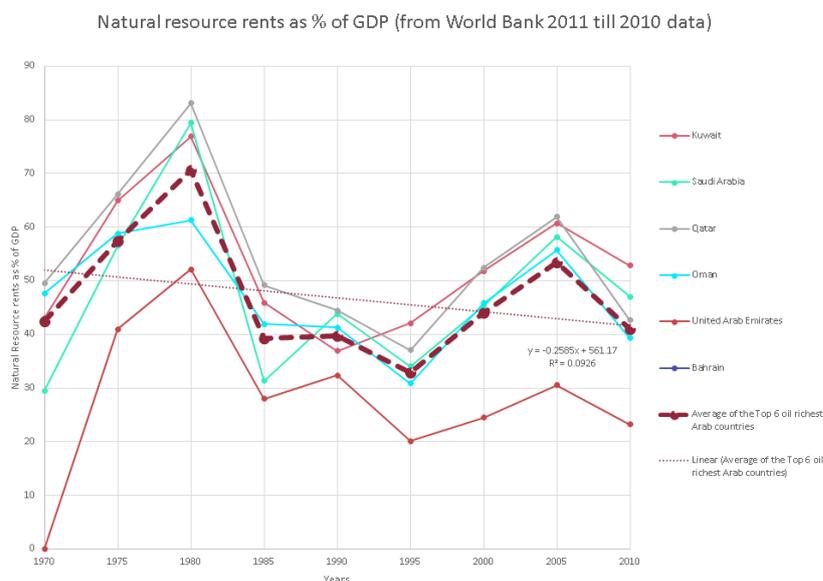
And now, let's focus especially on the Qatar, Kuwait, and UAE compared to the USA.



### Total Natural Resources rents (% of GDP)

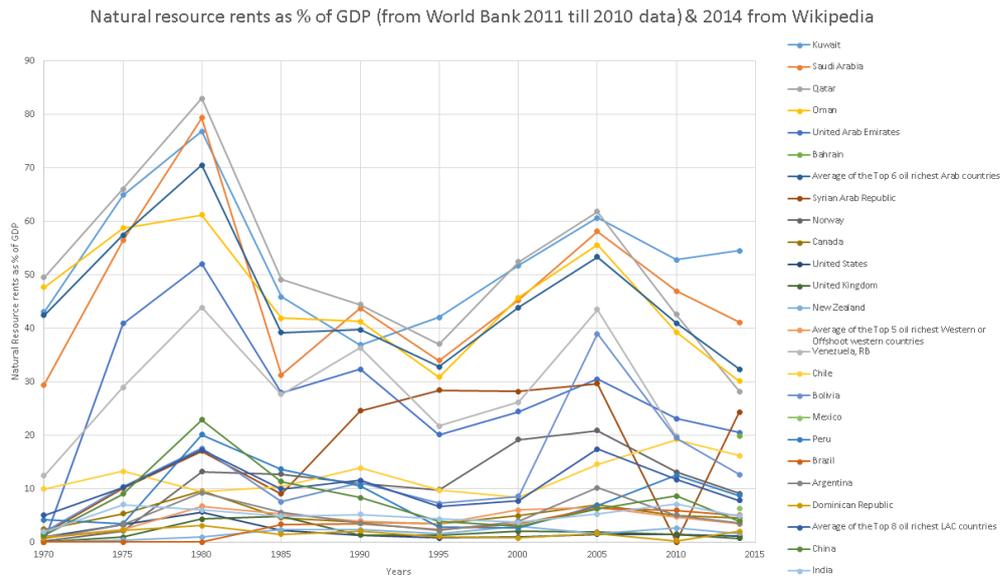
In the following Natural Resource rents visual data, notice that they tend to decrease over the several decades indicating that the countries that used to heavily rely on their natural resources tend to diversify and grow more internally as well.

Total Natural Resource Rents as % of GDP for these original richest Middle East nations:



Although their total Natural Resource rents have decreased over the past 4 decades, still these are far higher than the rest of the highest oil-producing nations for the GDP per capita shares.

Just look at the top 6 oil-richest nations. The rest of the highest oil-richer or rising nations completely pale in comparison.



## CONCLUSION

Because these top 5-6 oil richest Arab countries (along with few others) had been to the top of the world financially before the international math, science, and reading assessments started in the 1960s and by the 70s they started collapsing economically (except the late comer Oman in much minor scale of the oil prosperity) and all these oil richest countries still had the very low levels of mean school years (Human Capital) and the very presumably low levels of the Cognitive Capital as their earliest entries and results in the PISA and TIMSS showed the very low scores. Thus, till these countries sufficiently rise enough to reach their relative national average cognitive skill levels, which may take decades, they should be excluded from the regression analyses as outlier to obtain the reliable regression data. And the cognitive capital rich countries (near the frontline top nations of math and science) should be for now to be excluded for the regressions as their economic rise may take 20-30 years to the level compatible to the regression line averages.

## References

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World Bank WDI (for the data from the Gapminder)

Google data (GDP per capita over the years for the oil richest 5-6 Middle Eastern countries)

Gapminder (for the GDP per capita over the years)

Statsilk <http://www.statsilk.com/maps/world-stats-open-data?l=pisa%20mathematics%20mean%20score%20%20total>

